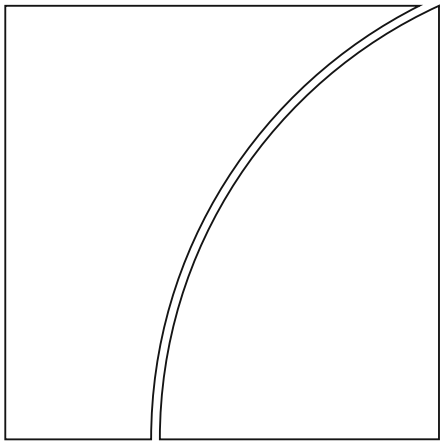


BIS Papers

No 157

How can central banks take account of differences across households and firms for monetary policy?

Monetary and Economic Department

June 2025

JEL classification: E52, E58, E2, C53, C8

Keywords: cross-sectional differences, heterogeneity, monetary policy, central banking, household inequality, between-firm inequality, informality, distributional effects, granular data, surveys, central bank communication

Papers in this volume were prepared for a meeting of emerging market Deputy Governors organised by the Bank for International Settlements on 17–18 March 2025. The views expressed are those of the authors and do not necessarily reflect the views of the BIS or the central banks represented at the meeting. Individual papers (or excerpts thereof) may be reproduced or translated with the authorisation of the authors concerned.

This publication is available on the BIS website (www.bis.org).

ISSN 1682-7651 (online)
ISBN 978-92-9259-857-0 (online)

Contents

BIS background paper

How can central banks take account of differences across households and firms for monetary policy?
Yingwei Dong, Tirupam Goel, Emanuel Kohlscheen and Philip Wooldridge 1

Contributed papers

Monetary Policy and Distribution: Insights from Argentina
Central Bank of Argentina 33

Firm and household heterogeneity at the Central Bank of Chile
Central Bank of Chile 45

Addressing heterogeneity via structural monetary policy: China's practices
People's Bank of China 63

Changes in the distribution of new loans by risk category throughout the post-pandemic credit cycle in Colombia
Central Bank of Colombia 73

Household and firm heterogeneity
Czech National Bank 103

Monetary policy decision-making: how are household and firm heterogeneity incorporated?
Hong Kong Monetary Authority 121

Monetary policy decision-making: how are household and firm heterogeneity incorporated in Hungary?
Magyar Nemzeti Bank 131

Monetary policy and heterogeneities – India
Reserve Bank of India 147

Bank Indonesia's approach to incorporating household and firm heterogeneity in monetary policy decision-making
Bank Indonesia 155

Monetary tightening at work: transmission and heterogeneity
Bank of Israel 161

Heterogeneity and monetary policy in Korea
Bank of Korea 171

Household and firm heterogeneity in monetary policy decision-making – Malaysia's perspective
Bank Negara Malaysia 183

Monetary policy transmission in Mexico: an overview and banking channels insights using granular data
Banco de México 195

Heterogeneity considerations in monetary policy design: the case of Peru
Central Reserve Bank of Peru 225

Monetary Policy and Degree of Heterogeneity in the Philippines
Bangko Sentral ng Pilipinas 243

Monetary policy and welfare redistribution in Poland
National Bank of Poland 257

Household and firm-level heterogeneity in monetary policy: the case of Saudi Arabia
Saudi Central Bank 271

The role of household and firm heterogeneity in the South African Reserve Bank's monetary policy deliberations
South African Reserve Bank 279

Monetary policy and household heterogeneity
Bank of Thailand 285

The heterogeneous impact of monetary policy announcements on firms' financial outcomes
Central Bank of the Republic of Türkiye 295

The Heterogeneity of Banks, Businesses and Households in the Monetary Policy Transmission Mechanism
State Bank of Vietnam 331

Survey questionnaire 337

How can central banks take account of differences across households and firms for monetary policy?

Yingwei Dong, Tirupam Goel, Emanuel Kohlscheen and Philip Wooldridge[1]

Abstract

This paper explores how differences among households and firms influence monetary policy. It draws on a novel survey about the role of these differences in the decision-making process of emerging market central banks. Cross-sectional data enhance policymakers' understanding of economic conditions as well as of monetary policy transmission given that different economic agents respond differently to policy actions. For households, factors like debt, income and wealth are key. For firms, size, leverage, sector and especially export-orientation are crucial. Cross sectional data about households and firms also shed light on the distributional effects of monetary policy. However, these effects are less important than the aggregate effects of monetary policy and thus central banks do not consider them when making policy decisions.

JEL classification: E52, E58, E2, C53, C8.

Keywords: cross-sectional differences, heterogeneity, monetary policy, central banking, household inequality, between-firm inequality, informality, distributional effects, granular data, surveys, central bank communication.

1. Introduction

Central banks have given increasing attention to the implications of cross-sectional differences across households and firms for the conduct of monetary policy. For example, starting in 2010, a rising proportion of central banks' speeches referred to such cross-sectional differences (Graph 1.A). One potential reason for this rising attention is that the transmission of monetary policy depends on such cross-sectional differences. The Covid-19 pandemic was a vivid reminder that households' and firms' exposure to shocks is not uniform. Such developments raised questions about whether monetary policy responses should take account of cross-sectional differences. In addition, improvements in the availability of granular data to analyse cross-sectional differences, as well methods to analyse such data, have facilitated central banks' interest. Research showing that differences across households and firms matter for monetary policy have also stimulated the interest of central banks.

[1] The views expressed in this paper are those of the authors and not necessarily those of the BIS. We thank Eduardo Amaral, Kevin Cheng, Gaston Gelos, Yi Huang, Benoit Mojon, Ilhyock Shim, Hyun Song Shin, Frank Smets, Christian Upper, Alexandre Tombini, James Yetman and Tao Zhang for useful comments. We are also thankful to Christina Manea for providing analytical inputs and to Berenice Martinez and Cecilia Franco for outstanding research assistance.

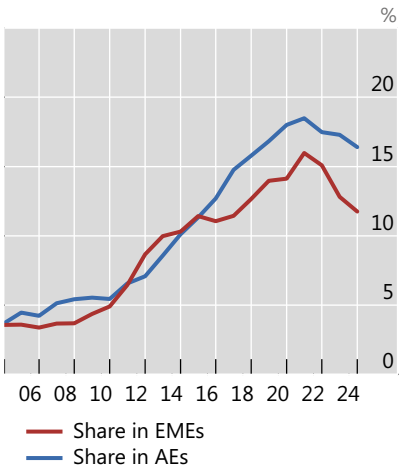
Motivated by this rising attention, this paper analyses three questions: the extent to which differences across households and firms matter for monetary policy, why they matter and how central banks can adjust their monetary policy approaches in response. The paper builds on a survey completed by central banks in 22 emerging market economies (EMEs) as well as papers contributed by these central banks explaining how they have taken cross-sectional differences into account in their monetary policy decisions.[2] These central bank inputs are combined with theoretical and empirical results from the rapidly expanding literature on the topic.

To maintain focus, this paper concentrates on households and non-financial firms. While central banks are also interested in differences across financial institutions, they have historically given less attention to differences across households and firms.

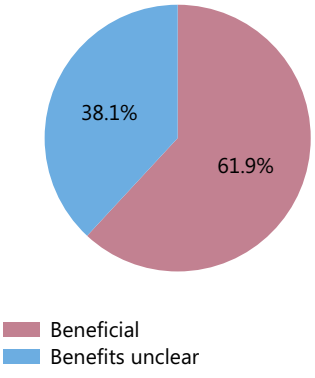
Further, the paper focuses on EMEs, even though the topic is of interest to central banks in all economies. In part, this focus is because the topic is particularly relevant for EMEs, where certain cross-sectional differences tend to be more pronounced than in advanced economies (AEs). For instance, financial inclusion tends to be lower in EMEs (Findex (2021)). In addition, income inequality is very high in some EMEs (Chancel and Piketty (2019)), and financing gaps between small enterprises and large corporates also tend to be larger in EMEs (Bruhn et al (2017)). Moreover, some EMEs have large informal sectors, resulting in a dual economy de facto.

Central bank interest in differences across households and firms is rising — Graph 1

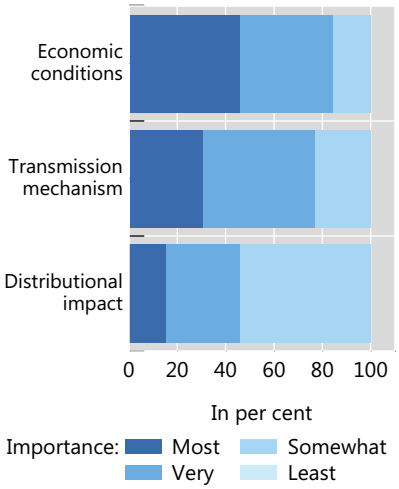
A. Speeches show rising interest in cross-sectional differences[1]



B. Is considering cross-sectional differences beneficial for monetary policy?



C. What are the most important areas where cross-sectional differences improve understanding?



[1] Speeches that contain the keywords: heterogeneity, heterogeneous, inequality, granular, HANK, distributional impact(s), distributional concern(s), distributional consequences or distributional consideration(s). Data across 30 AEs and 30 EMEs.

Sources: Central bank speeches; BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

[2] The survey questionnaire and the contributed papers were published together with this paper, in a *BIS Papers* volume on the BIS website (www.bis.org/bispapers/index.htm).

A key finding from the survey is that a majority of EME central banks deem it beneficial to consider household and firm differences when making monetary policy decisions (Graph 1.B). There are three areas in which data on cross-sectional differences can help to improve policymaking at central banks.

The most important use of information on these differences is to understand current economic conditions and how they might evolve (Graph 1.C). Any inputs that contribute to a more complete understanding of the pulse and outlook of the economy are helpful for forward-looking monetary policy decisions (eg the distribution of incomes and wealth matters for consumption growth and thus overall growth and inflation). Accounting for cross-sectional differences has also been found to improve the identification of vulnerabilities or financial stability risks that may, in turn, constrain monetary policy (eg a larger share of highly indebted households may justify more measured rate hikes).

The second benefit of cross-sectional information is that it can improve the understanding of monetary policy transmission. Different economic agents might react differently to the same monetary policy action depending on their circumstances (eg high or low levels of household debt). Understanding differences in these characteristics and the attendant reactions can help improve decision-making at central banks. In the case of households, central banks reported that the most relevant characteristics for monetary transmission include the level and type of debt, the level and source of income, and the level and liquidity of assets. The share of so-called hand-to-mouth households (those that hold little liquid wealth and largely consume their current income) matters in particular. In the case of firms, the most relevant characteristics are sector, size, currency exposure, the level and composition of debt, and export orientation. Monetary policy has a stronger impact on small, domestically oriented firms that tend to rely on domestic funding as compared to export-oriented or foreign-owned firms with access to diversified funding sources. In the case of both households and firms, informality further weakens transmission.

A third use for cross-sectional information – albeit a use that central banks deem less important in policy deliberations – is to understand the distributional consequences of monetary policy. While monetary policy can have distributional effects, central banks consider these effects to be less important than aggregate effects. When setting monetary policy, central banks focus on aggregate outcomes. Monetary policy is a blunt tool that is not well suited for influencing distributions in the population. Fiscal instruments are more easily targeted and thus more appropriate for this purpose. Moreover, vulnerable segments of society are best served when monetary policy focuses on the price stability mandate.

That said, central banks cannot ignore cross-sectional differences either. In part, this is because cross-sectional differences matter for policy transmission. Many EME central banks take complementary measures to mitigate certain cross-sectional disparities. For instance, financial inclusion and literacy programmes can improve transmission to households. Targeted lending programmes can help improve transmission to small, credit constrained firms. And macroprudential tools (eg sectoral stress tests or loan-to-value ratios) can help manage pockets of vulnerabilities that pose policy trade-offs. Furthermore, distributional effects might require adjustments to central bank communications (eg explaining to the public why

some distributional effects might be unavoidable when monetary policy is focused on meeting its primary objective of price stability).

While considering household and firm differences can help improve monetary policy, central banks face challenges on several fronts when incorporating these considerations into their decision-making processes.

For one, there are conceptual challenges. The value added of cross-sectional differences in monetary policy analysis can be state-dependent (eg more relevant in a crisis). Relatedly, knowing which specific cross-sectional differences are more relevant is not always obvious, and can vary across jurisdictions.

Then there are practical challenges. While granular data such as survey data are increasingly available – in part due to digitalisation – the potential for bias, lack of timeliness and privacy concerns can impede usage. Another issue is that the informal sector – which is large in some economies – is often underrepresented in surveys and administrative data. And while incorporating cross-sectional differences into existing empirical analyses and models can help extract more value from granular data, this can be technically complex. Some central banks, for instance, cited insufficient experience and confidence in such models.

Finally, there are communications-related challenges. Given the risks related to misinterpretation, most central banks rarely communicate about the interplay between cross-sectional differences and monetary policy, unless the situation clearly calls for it.

The rest of this paper is organised as follows. Section 2 reviews how considering cross-sectional differences can help improve economic monitoring and forecasting. Sections 3 and 4 discuss how monetary policy transmission is affected by differences across households and firms, respectively. Section 5 studies the distributional effects of monetary policy. Section 6 discusses the ultimate policy implications and communications challenges. Two boxes review, respectively, the challenges of using granular data and quantitative models that feature multiple types of agents.

2. Cross-sectional differences shed light on economic conditions

Central banks rely, in the first instance, on aggregate series for analysing and forecasting economic conditions. Only one fifth of EME central banks reported that information on cross-sectional differences is as important as aggregate series (Graph 2.A); an overwhelming majority attached greater importance to aggregate series. That said, central banks expect their use of cross-sectional data to increase over the next decade (Graph 2.B). The focus in this paper is on how cross-sectional information can provide additional insights on monetary policy matters.

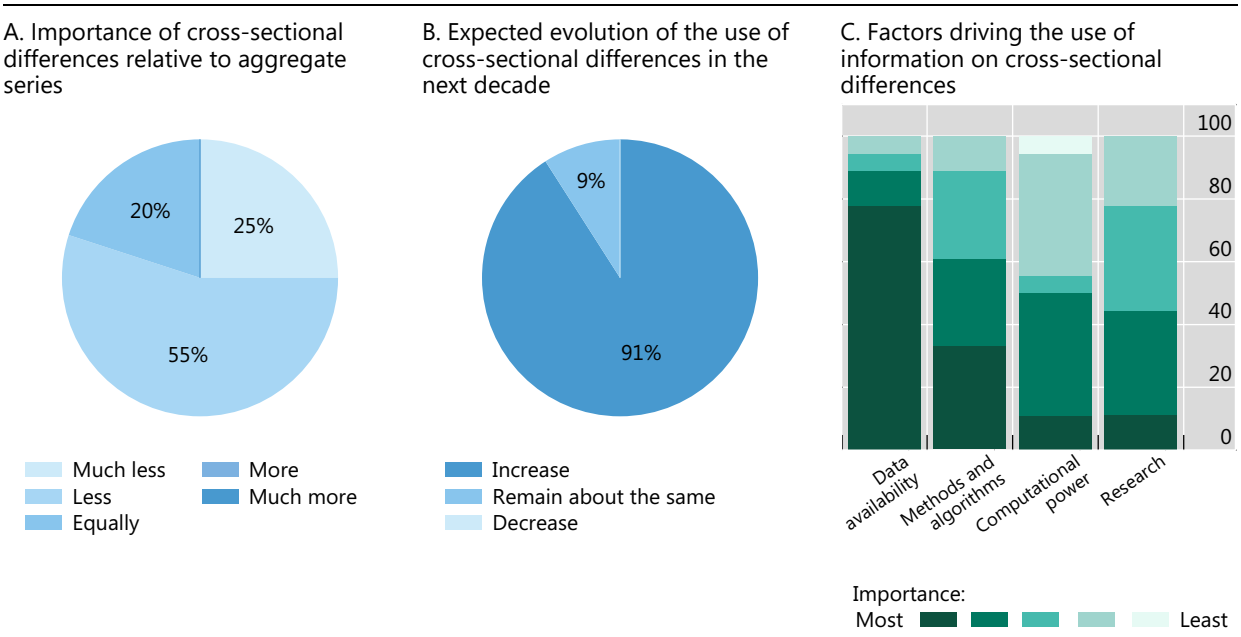
Several factors are motivating central banks' greater use of cross-sectional information in monetary policy analysis (Graph 2.C). For one, the digital revolution has improved the availability of granular data. For central banks, the most prominent sources of granular data are surveys, followed by administrative records and market data (Annex B). While surveys are less timely than alternative sources (such as

payments data or unaudited financial statements), they are more comprehensive and less noisy (Box A).

In addition, methods to process granular data have improved. To be sure, central banks have always used granular data to estimate aggregate statistics such as headline inflation and GDP. That said, advanced model solution and estimation methods have boosted the use of cross-sectional information – obtained from granular data – in economic analysis. Relatedly, more and cheaper computational power is available. A facilitator is cloud services that reduce the need for institutions to setup computational facilities themselves. A final factor motivating central banks' greater use of cross-sectional data is emerging research showing that differences across households and firms can be important for monetary policy.

Use of cross-sectional differences among EME central banks

Percentage of responses from EME central banks — Graph 2



Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

Information on cross-sectional differences can shed light on the current state of the economy and where it might be headed. Many EME central banks view this as the area in which such data add the most value (Graph 1.C). The Bank of Thailand noted that accounting for cross-sectional differences can make economic assessments more "inclusive, comprehensive and representative of the entire economy".

First, cross-sectional differences can help explain the drivers of past and current inflation and growth dynamics. For example, looking beyond aggregates can help identify the conditions under which relative price changes can morph into broader-based inflation due to unhinged expectations and wage-price spirals. This can help better understand the evolution of inflation, especially during periods of high inflation, such as in 2022 (BIS (2022)). Another application of cross-sectional information comes from Chile, where data on firm-level differences has been used to estimate sectoral output gaps. The gap was negative in goods-related sectors and

close to zero in services-related sectors in 2023, which helped explain the greater moderation in inflation in goods than in services. Relatedly, household payments data as well as firm-level data (eg aspects such as size, location and sector) can improve the real-time tracking of economic activity (eg Beck et al (2024), Chetty et al (2024)).

A second, more nascent use of information on cross-sectional differences is that it can sharpen understanding of the macroeconomic outlook, including projections. For instance, measures of disagreement – eg variance or skewness – in households' inflation expectations or perception can help improve the prediction of inflation, especially during periods of high inflation.[3] Likewise, the distribution of income can inform the outlook for consumption demand because rich and poor households face different unemployment risks, financial constraints, and marginal propensities to consume (eg Pereira da Silva et al (2022) and the paper contributed by the central bank of Malaysia). This underpins the variation in their consumption behaviours, which matters for aggregate consumption. Similarly, a higher share of heavily indebted households can dampen consumption demand (eg Lombardi et al (2017), Mian et al (2021)). In particular, the share of "zombie households" ie those subject to very high debt service burdens, can matter for consumption growth and thus help predict overall growth (eg Lee and Shim (2025)). Likewise, the share of "zombie firms" can help to improve understanding of the supply-side outlook.

Some central banks have incorporated these insights into their monetary policy analysis.[4] For example, motivated by the experience of the Great Financial Crisis and the empirical relevance of precautionary motives, the Hungarian central bank incorporated household leverage constraints in its main forecasting model. The Reserve Bank of India includes differences in wages across business sectors and varying cost conditions across firms in its projection models. Tellingly, the Czech National Bank compared inflation projections from two models – a standard New-Keynesian model and a two-agent New-Keynesian model. The difference in the inflation projections of these models can be as large as five percentage points, suggesting potentially very different implications for monetary policy. In Chile, the amended two-agent model has better inflation and growth forecasting capabilities than the representative model. It is also able to better explain past patterns (eg consumption during the Covid-19 pandemic). That said, there are a few studies that question the value added of data on cross-sectional differences for forecasting. For instance, models that incorporate differences across households to forecast consumption demand or inflation have been shown to be no more (or even less) accurate than representative household models.[5]

[3] This observation is made by several central banks (eg Peru) and is also supported in the literature (eg Reis (2022), Brandão-Marques et al (2023)).

[4] Typical forecasting models used by central banks include local projections (Jordà (2005)) and vector autoregressions. Cross-sectional differences can typically be incorporated in these models by including higher-order moments of the relevant distribution as endogenous, control or conditioning variables. Another approach is to use machine learning (ML) techniques that are more amenable to granular data. Indeed, incorporating ML has been shown to help improve the accuracy of growth and inflation forecasts (eg see the paper contributed by Bank Indonesia).

[5] See, for instance, Acharya et al (2023) who compare a standard New Keynesian model with a heterogeneous agent New Keynesian (HANK) model. Relatedly, Angeletos et al (2024) find that a benchmark HANK model with sufficiently slow fiscal adjustment predicts just as much inflation as the representative agent model. There may be an adverse selection problem in the literature too as non-

A third use of cross-sectional information is to identify financial vulnerabilities that may constrain monetary policy decisions. For instance, a higher share of heavily indebted households or firms might – from a financial stability perspective – inhibit the central bank from raising rates or keeping them high (which might otherwise be justified from a price stability perspective). Such considerations have recently featured in monetary policy deliberations in Thailand and Korea, among others. More generally, granular data can help understand correlations and concentrations of risk exposures across firms, and thus help identify potential systemic risks.

Box A

Challenges associated with using granular data

Despite the benefits, there are impediments and risks that limit the use of cross-sectional information in monetary policy analysis.

One is the absence or incompleteness of the data needed for monetary policy analysis. A related shortcoming is time series that are insufficiently long to draw time-tested insights. Such shortcomings can stem from the cost of carrying out surveys or the absence of institutional arrangements to collect such data regularly (eg a credit register). In some cases, legal hurdles can be prohibitive. For instance, administrative data collected by the tax authorities might not be available to the central bank. Even proprietary data (ie data collected by a firm in its course of business) might not be freely shareable with the central bank because of contractual requirements.①

A related issue is biased data. For example, online surveys exclude respondents who lack digital access or digital literacy. Digital surveys might also overrepresent certain population groups, such as those who are online more frequently (eg the young). Using such data without acknowledging bias and correcting for it can result in misleading conclusions.

Noise or measurement errors are another concern, which can create disincentives to use such data. This is more common in survey data (Brault et al (2024)). Even proprietary data (such as scanner transactions at supermarkets) can be prone to this issue due to limited quality control compared with official data sources (such as inflation statistics).

Timeliness can also be an issue. Monetary policy decisions are due every couple of months and require frequent and timely assessments of the economic situation. However, surveys and administrative data releases – two key sources of granular data for monetary analysis – are typically subject to lags due to the time needed to conduct compilation and/or accuracy checks.

Granular data often contain detailed information about individuals or entities, which can also lead to privacy-related constraints. For instance, there is a risk of re-identification even if survey data are anonymised, such as by combining auxiliary data sources using advanced technologies. This risk can induce survey respondents to curtail information or limit data-sharing rights.

① The central bank of the Philippines aims to narrow existing data gaps by operationalising its ability under the law to require any data from any person or entity – including government-related ones – for statistical and policy development purposes.

results – ie studies showing that cross-sectional information does not improve projections – tend to get published less often.

3. Monetary policy transmission and the impact of differences across households

Another key use of data on cross-sectional differences is to improve understanding of the transmission of monetary policy. This section focuses on how transmission channels are impacted by household heterogeneity. The subsequent section focuses on how they are impacted by firm heterogeneity.

Monetary policy impacts households through several transmission channels. First, it affects how households allocate consumption across time. That is, it affects consumption, saving and borrowing plans. We refer to this as the savings-investment channel. It can also affect their cost of servicing already existing debt (the cash flow channel) and the supply of credit that is available to households (the bank lending channel). Further, it impacts the value of their housing, bond, equity or foreign asset holdings (the balance sheet channel).[6] In smaller economies, or economies where foreign currency plays a large role – eg due to dollarisation or euroisation – monetary policy can also impact households' finances through the exchange rate. Last but not least, expectations about the future evolution of the economy and, in particular, inflation constitute a key mechanism through which it impacts behaviour (the expectations channel).[7]

The relative importance of the above-mentioned channels for households varies across countries owing to differences in income level and distribution, market characteristics, as well as monetary histories and frameworks. Among the central banks surveyed, Asian EMEs deem the savings-investment and the bank lending channels to be the most important monetary transmission channels for households (Graph 3.A). By contrast, central banks in Latin America and elsewhere point to the exchange rate as being the most important channel. This could partly be a legacy of past high-inflation episodes, when the exchange rate played a dominant role.

Cross-sectional variation in household-specific factors influence how each of the above-mentioned channels operate. This is because each household is exposed differently to the various transmission channels. Accordingly, the average of the policy impact across households might not be the same as the policy impact on the average (or representative) household. In such cases, the power of monetary policy might hinge not only on the average of a given factor in the economy, but also on its cross-sectional distribution across households.[8]

[6] Relatedly, it may also affect the appetite for taking on risk (the risk-taking channel). This channel is explained in greater detail in Adrian and Shin (2010), Borio and Zhu (2012) and Bruno and Shin (2015).

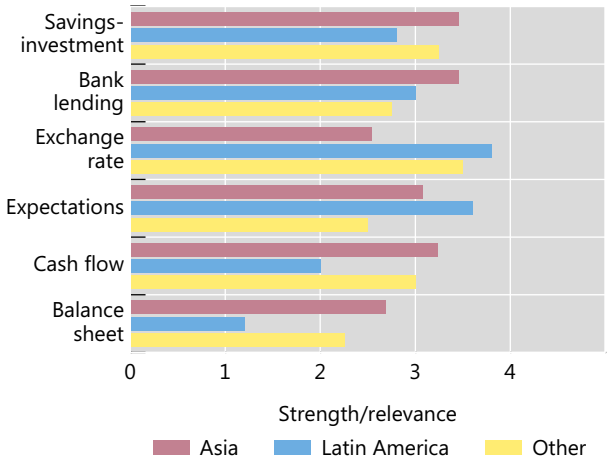
[7] A related channel is the sentiment channel. For instance, lower interest rates and increased liquidity can spur optimism among households and firms.

[8] Graph A1 in Annex A illustrates cross-sectional variation in selected household characteristics.

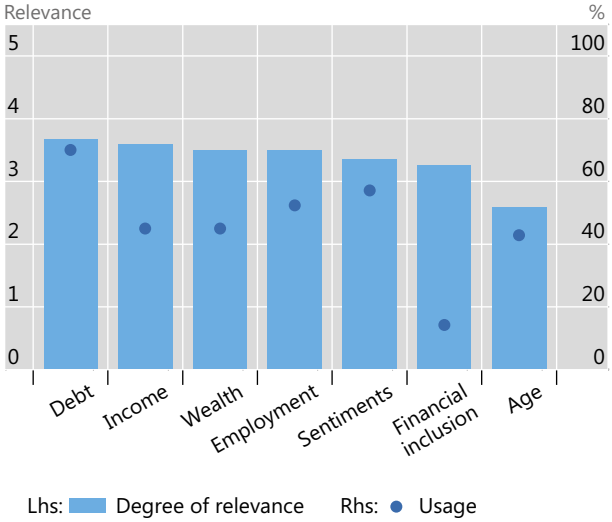
Household characteristics and monetary policy transmission[1]

Graph 3

A. Relative strength of transmission channels for households



B. Cross-sectional differences in the following household characteristics matter for monetary transmission



[1] Based on central bank responses on a scale of zero to five, with zero indicating not relevant and five indicating strong relevance. The graphs show the average across economies.

Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

Take for instance household debt. Transmission is typically more powerful when households are more indebted and their debts have adjustable rates. This is because, for such households, interest rate changes have a direct and larger impact on their disposable incomes – ie the cash flow channel becomes more prominent.[9] Yet, the effects of debt on transmission may not be linear. The response of a localised cohort of very highly indebted households to policy rate changes might be disproportionally strong, driving variation in the aggregates.[10] However, it might also be the case that highly indebted households are less stimulated by rate cuts if their balance sheets remain fragile (Mian et al (2021)). In either case, tracking the distribution of debt across households – and not only the average – is crucial. Currently, 70% of surveyed EME central banks report using information on household debt in their background analysis for monetary policy decisions (Graph 3.B).

Monetary policy's effectiveness might be reduced in countries where households hold substantial debt that is either denominated in or indexed to a foreign currency. This is because the currency depreciation that would normally be associated with a monetary easing could reduce rather than increase the spending power of households, as the nominal value of their debt effectively increases. More generally, debt can also affect how the bank lending channel of monetary policy plays out. High initial indebtedness might diminish policy effectiveness due to debt overhang, eg if

[9] For instance, mortgage borrowers are known to react more to policy rate changes than homeowners or renters (Cloyne et al (2020)). See also Voinea et al (2018), Ahn et al (2024) and CGFS (2024).

[10] Gelos et al (2024) find that more indebted and less liquid households show the strongest consumption response to monetary policy, and the share of such households in the United States has increased.

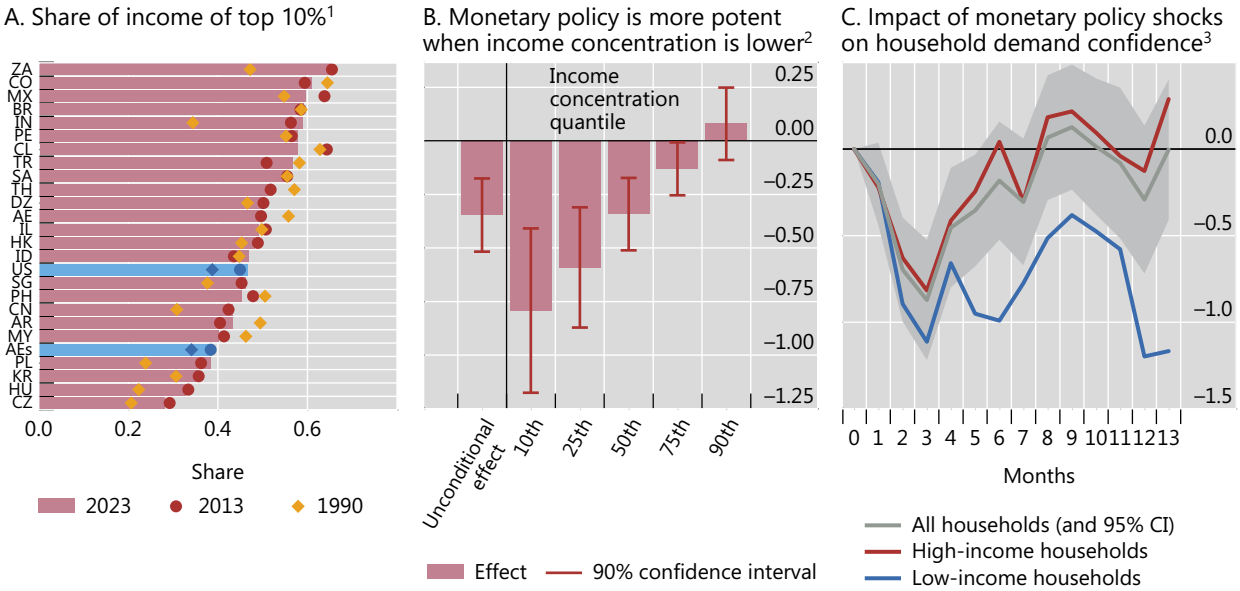
households are limited by banks in how much new borrowing they can take on given more favourable interest rates.

Beyond debt, central banks report that the income distribution – which tends to be highly skewed in most EMEs (Graph 4.A) – can also have a direct bearing on the power of monetary policy (Graph 3.B). Quantitative models support this experience. In a typical heterogeneous agent New Keynesian model, the short- to medium-term responses of poor hand-to-mouth agents to monetary policy are stronger than that of rich agents. Monetary policy affects aggregate demand and eventually labour demand and income. As a result, hand-to-mouth agents' consumption – which is driven by current rather than permanent income – reacts strongly. Thus, one would expect a stronger response to monetary policy induced changes where the overall weight of such agents in aggregate income is higher (Box B).

Empirical evidence shows that monetary policy is indeed stronger when income concentration at the top is lower. The impact on inflation of a surprise increase in the policy rate, based on a panel of medium and large EMEs, is presented in Graph 4.B. In the baseline case, disregarding income distribution, a surprise 25 basis point rate increase reduces inflation by 35 basis points within 12 quarters. When estimates are conditioned on the share of income of the top decile within a country, the effect on inflation is found to be more than twice as strong when such concentration is very

Monetary policy is more potent when income inequality is lower

Graph 4



[1] AEs = CA, FR, DE, IT, JP, GB, US, euro area. [2] Effect of a 25 basis point contractionary monetary policy shock on inflation within 12 quarters. Estimates based on linear projection models for CPI inflation 12 quarters ahead. In the conditional model, a monetary policy shock is interacted with the deviation of the aggregate income share of the top 10% from its country-specific mean. Monetary policy shocks are based on Checo et al (2024). Confidence intervals are based on Driscoll-Kraay standard errors. [3] Impact of monetary policy shocks on household confidence (as per a survey by IPSOS) in their ability to make major purchases currently and in the future using a pooled panel local projection analysis. Monetary policy shocks are based on Checo et al (2024).

Sources: Bloomberg; Checo et al (2024); Goldman Sachs; LSEG Refinitiv; HIS Markit; IPSOS; World Inequality Database; national data; BIS.

low.[11] Conversely, the effect of monetary policy weakens considerably when income concentration at the top reaches very high levels; that is, when the poor populations' share in aggregate income is very low. This positive effect of a more equitable distribution of income on the power of monetary policy is also evident throughout when conditioning on the state of the business cycle (Annex C).[12]

A separate exercise reveals that a contractionary monetary policy shock hurts demand confidence (ie the reported intention to make purchases). The impact is again more pronounced in the case of low-income individuals (who tend to be subject to greater employment risk and have higher marginal propensity to consume), reinforcing the message that cross-sectional differences matter (Graph 4.C).

A potential explanation for these findings is that when the share of income of the top decile is very high, the weight of households who are affected indirectly by income effects – and who typically have the highest marginal propensities to consume – is reduced. In such an economy, policy changes lead mostly to short-run changes in savings by the relatively rich cohorts, without causing large effects on short-run consumption expenditures or prices. The global long-term trend towards a larger concentration of income in the top decile could thus make aggregate demand management more challenging.[13, 14] Meanwhile, wealth inequality also affects the transmission of monetary policy (eg Matusche and Wacks (2023)).

The interaction between income, wealth and debt make the analysis of monetary transmission more complex. Different household characteristics can have opposing effects on transmission. Crucially, the relationship between characteristics differs from country to country. For instance, while high income households are the most indebted in the case of Korea, Poland and South Africa, debt burdens are highest among the poorer cohorts in Hungary and Hong Kong SAR.[15] In some cases such differences can stem from past policies to encourage credit uptake by the poorer cohorts (for instance through subsidised mortgage programmes).

Central banks report that differences between households along other dimensions can also matter for the transmission of monetary policy. One such dimension is demography. Policy rate hikes tend to have different effects on consumption by the young versus the old (eg see the paper contributed by Bank of

[11] More specifically, when the share of those in the top income decile in national income is at the 10th percentile of the distribution. Within the sample used for this exercise, the correlation between the share of income of the top decile and the income Gini coefficient is 0.991.

[12] This finding resonates with Voinea et al (2018) and, for advanced economies, BIS (2021).

[13] The World Inequality database shows a secular trend towards greater income concentration in many economies, eg between 1985 and 2023 in China the income share of the top 10% of earners increased from 30% to 44%, in India from 36% to 59% and in South Africa from 47% to 65%. This trend partly reflects the confluence of globalisation and skill-biased technical change (Acemoglu (2002), BIS (2021)).

[14] Greater concentration of income in the top decile is also associated with significantly larger contractions in aggregate consumption during economic downturns (Kohlscheen et al (2021)). This could be partly because stabilisation policies are less effective when income is highly concentrated in the segment of the population that has low propensities for immediate consumption.

[15] See Bazillier et al (2021) and the paper contributed by Hong Kong Monetary Authority. Also, as noted by South African Reserve Bank, the upper two deciles of income distribution account for almost all mortgage, vehicle and credit card lending, and are thus responsive to changes in the policy rate. By contrast, poorer South Africans are highly exposed to inflation.

Korea). These differences can stem from age-related differences in consumption behaviours (eg elderly's higher reliance on services) and incentives to save (eg weaker in the case of the old), but frequently also reflect the legacy of past house price increases and asset or debt trajectories. Differences in beliefs and expectations can also matter for the efficacy of monetary policy.[16] Another dimension is financial literacy. Urban households tend to be more financially aware, which facilitates a more sophisticated response to changes in interest rates and credit conditions (eg see the paper contributed by Saudi Central Bank). Yet another dimension is informality. The informal economy matters because policy rate changes may have a weaker transmission to informal financial contracts, while labour mobility between the formal and informal sectors may affect wage inflation and income dynamics.[17]

Box B

Advances in macroeconomic modelling

Incorporating cross-sectional differences into macroeconomic models has long been a goal of economic researchers.① Such efforts were revived by an influential article by Kaplan et al (2018), who analysed the effect of differences across households' incomes and wealth in an otherwise standard New Keynesian framework. Notably, they found that the response of aggregate consumption to policy rates is significantly stronger in a heterogeneous agent New-Keynesian (HANK) model, when compared with the standard representative agent New-Keynesian (RANK) model. The much larger effect of monetary policy is mostly due to an indirect effect, as explained below.

In a typical RANK model, monetary policy affects consumption exclusively via the intertemporal elasticity of consumption and savings. In a richer HANK model, which features non-Ricardian hand-to-mouth agents – ie agents with limited liquid wealth that largely consume all their income – these changes in consumption also affect employment and labour income, leading to further changes in consumption for all employed agents. This occurs because hand-to-mouth agents react strongly to current rather than permanent income.

Research on incorporating differences across households into models provides useful insights, but it is a rapidly growing and evolving field. For instance, whether incorporating differences across households has a substantial impact on macroeconomic aggregates can depend on modelling choices as well as the calibration strategy. Some studies have found substantial effects, partly because the majority of hand-to-mouth households are not poor, ie they are not in the bottom quintile of the long-run earnings distribution. Aguiar et al (2024) document and rationalise this and the fact that a high share of hand-to-mouth households have high debt in a model with persistent differences in discount factors across households. Tellingly, the much higher marginal propensity to consume of hand-to-mouth agents, together with their relevant weight based on income levels, causes these households to have sizeable macroeconomic effects even when 80% of households have standard preferences (a high degree of patience and low intertemporal substitution).

By contrast, other studies have found that hand-to-mouth consumers make little difference to business cycle fluctuations. For example, in Albonico et al (2024), the estimated fraction of hand-to-mouth consumers (for the US economy) was only 11% and they are modelled as being poor. As a result, such households carry very little weight in macroeconomic aggregates.

Meanwhile, the two-agent indebted demand model of Mian et al (2021) finds very important effects of heterogeneity on macroeconomic aggregates. They attain this result without resorting to hand-to-mouth agents. Instead, they focus on the savers-borrowers distinction, which they rationalise through different weights on bequest

[16] Flack et al (2021) show that when disagreement in inflation expectations is high, contractionary policy may lead to higher inflation, while when disagreement is low, the same policy leads to lower inflation.

[17] See Alberola and Urrutia (2020). While data on the informal sector may be harder to obtain due to the very nature of the sector (eg official records may not exist), sources such as household sentiments and supermarket scanner data can still help gauge trends in this sector.

motives. The differences in how much wealth each type of agent wants to pass on to their offspring generates different saving behaviours. In their model, even temporary policies that shift resources between borrowers and savers end up affecting overall indebtedness and can therefore have long-term effects. A monetary expansion, for instance, redistributes from savers to borrowers and leads to more debt accumulation. New lending boosts income in the short run. Later, when debt needs to be serviced, it acts as a drag on demand. With highly indebted demand, policy rates need to keep falling to avoid a recession, so that even the natural interest rate falls.

Even if substantial progress has recently been made in modelling heterogeneities, some areas still appear to deserve further exploration if the aim is to attain more realistic working models. For example, in several countries the richest households are also the ones with the highest debt-to-income ratios.② While there are efforts to address this observation, most HANK models do not yet rationalise such patterns.

Some central banks have been incorporating heterogeneous agents in their macroeconomic models in recent years. More common is incorporating two types of agents as opposed to adopting a fully heterogeneous model (Graph A4 in Annex A). For instance, in the central bank of Chile's model, 40% of the households cannot borrow or save and behave like hand-to-mouth households; the rest of the households have financial market access. The central bank of Peru allows firms of different sizes to have varied costs of credit. Monetary policy is found to be less potent in this case as compared to assuming a uniform cost of credit across firms.

Central banks acknowledge challenges or caveats in amending their workhorse models. These include modelling complexities, computational constraints and practical calibration challenges. Heterogeneity can also make it more difficult to fully grasp interactions in the model. For instance, Bank of Korea noted insufficient experience with and confidence in HANK models. Relatedly, Bank of Thailand faced calibration-related issues in implementing a HANK model. Consequently, satellite models or complementary studies are commonly used by central banks to understand the role of heterogeneity (eg in Colombia, Philippines and Poland).

① Krusell and Smith (1998) were among the first to study how differences across households affect economic dynamics. They found that differences across households had only a limited impact on the dynamics of the neoclassical growth model. ② See eg Bover et al (2016) who find that the odds of having secured debt increase with the level of household income.

4. Monetary policy transmission and the impact of differences across firms

Complementing the previous discussion on households, this section focuses on firms. It lays out the relevant monetary transmission channels in the case of firms and then discusses how these channels are impacted by firm heterogeneity.

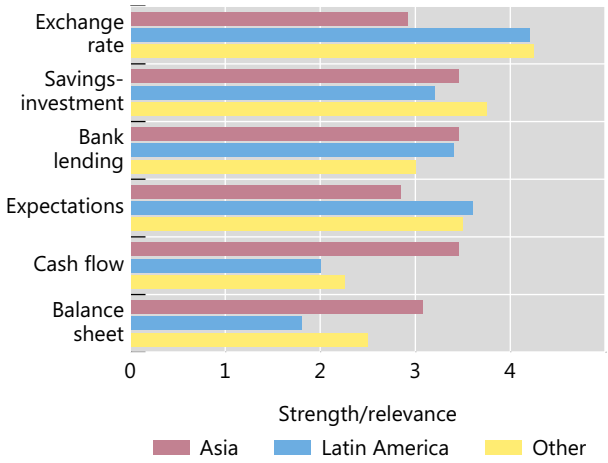
Monetary policy affects the opportunity cost of putting capital to productive uses because it impacts returns on firms' savings. It also alters firms' borrowing costs and thus cash flows.[18] Importantly, monetary policy affects the exchange rate and rebalances the prospective composition of domestic vs external demand, the cost of imported inputs and sometimes foreign exchange (FX) leverage, with possible reverberations for a firm's pricing decisions. It also affects the expectations of decision-makers at firms about future prices and business conditions.

[18] That said, the empirical evidence suggests that expected profits and low uncertainty are more important boosters of business investment than low interest rates, at least for firms facing less binding financing constraints (see eg Banerjee et al (2015) and Sharpe and Suarez (2021)).

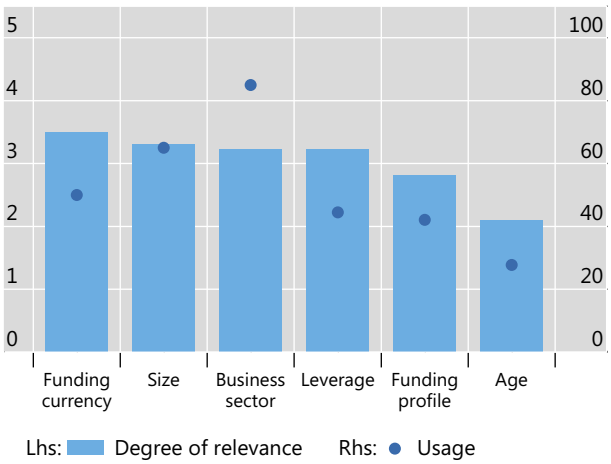
Surveyed central banks outside Asia indicated that the exchange rate channel was the most important, while those in Asia attached more importance to the savings-investment and bank lending channels (Graph 5.A). The cash flow and balance sheet channels were not considered important outside Asia but ranked more highly among Asian central banks.

Firm characteristics and monetary policy transmission[1] Graph 5

A. Strength of transmission channels



B. Relevance and use of firms' characteristics[2]



[1] Based on central bank responses on a scale of zero to five, with zero indicating not relevant and five indicating strong relevance. The graphs show simple averages across economies. [2] Funding currency means whether the funding is denominated in foreign or domestic currency. Funding profile can mean own funds, bank debt, bond funding or stock market financing.

Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

It is important to note that, particularly for very small businesses, the distinction between the household sector and business sector is blurred at best.[19] Debt to finance businesses is often incurred by households, sometimes even with the primary residence as collateral. This blurred dividing line between households and businesses is even more important in developing countries, particularly in the informal sector. While such small businesses may not always move the needle on aggregate investment volumes, they tend to be important in terms of employment. That said, what is clear is that business investments tend to follow a different rationale compared with decisions on household expenditures. Firms face much more complex decisions, as they need to make inferences about the strategies of competitors, their future price setting and ultimately their prospective profits – which tend to drive investments. And by their nature, differences between firms tend to be even starker than those between households, not least because they operate in different sectors and often follow different business models.

In terms of the specific characteristics that matter for transmission, the funding currency is seen as key (Graph 5.B), especially for the exchange rate channel. In several

[19] See, for example, the paper contributed by South African Reserve Bank, which stated that credit is more readily available to private individuals than to small businesses and entrepreneurs must sometimes rely on personal loans to finance their enterprises.

EMEs, a material share of corporate debt is denominated in foreign currency (Graph 6.A). For firms in the non-tradable sector whose receivables are in local currency this can lead to a currency mismatch. For instance, property developers that borrowed abroad can face sudden exchange rate induced changes in FX debt servicing costs, which reverberate on their investments plans. At the same time, exchange rate changes can cause banks to expand or retreat in sectors that are perceived as being riskier, altering their supply of loans to these market segments.[20] More generally, export-oriented or foreign-owned firms with access to more diversified sources of revenue or funding are less affected by domestic monetary policy shifts.

Which sector a business is in is also highly relevant. More than 80% of surveyed EME central banks reported using sectoral information about businesses in their background analysis for monetary policy decisions (Graph 5.B). Dynamics often differ substantially between the tradeable and the non-tradeable sectors, and between the commodity producing and manufacturing sectors. The central bank of Chile, for instance, highlighted that the mining sector is particularly relevant for understanding the response of aggregate investment in their economy. Meanwhile, a higher share of firms in the informal sector can weaken transmission.

Firm leverage also matters for monetary transmission. The interquartile range of the debt-to-asset ratio points to a very large dispersion in leverage across firms, particularly in the cases of Israel, Chile and India (Graph A.2 in Annex A). This suggests that monetary policy is likely to have more heterogeneous effects across firms in these countries. This is because the investment channel of monetary policy is stronger for firms with low debt burdens and high "distance to default", as these firms face a flatter marginal cost curve for financing investment (Ottonello and Winberry (2020)).

Another relevant characteristic is firm size and, relatedly, concentration among firms. Concentration in firm activity is prevalent across countries. In a majority of the EMEs, the top decile of firms accounts for more than 80% of aggregate firm assets, and in a few cases even above 90% (Graph 6.B). In some countries, a few large corporates (for instance commodity producers) tend to be the dominant players, often driving the variation in investment aggregates. Concentration can matter for policy effectiveness because it is related to the extent of financing constraints. Larger firms tend to have much more diversified sources of funding (including external ones) and may thus be less affected by monetary policy changes than small firms that tend to rely on banks only. This point is highlighted, for instance, in the paper contributed by the central bank of Malaysia, which says that small firms are much more exposed to the bank lending channel.

Relatedly, access to finance or financing constraints are also relevant factors. Many corporates, particularly in Latin America, identify access to finance as a significant constraint on their activity (Graph 6.C).[21] When this is the case, firms are often restricted to using their retained earnings as a source for financing expansion. It follows that firms will not be able to react to monetary policy changes as strongly

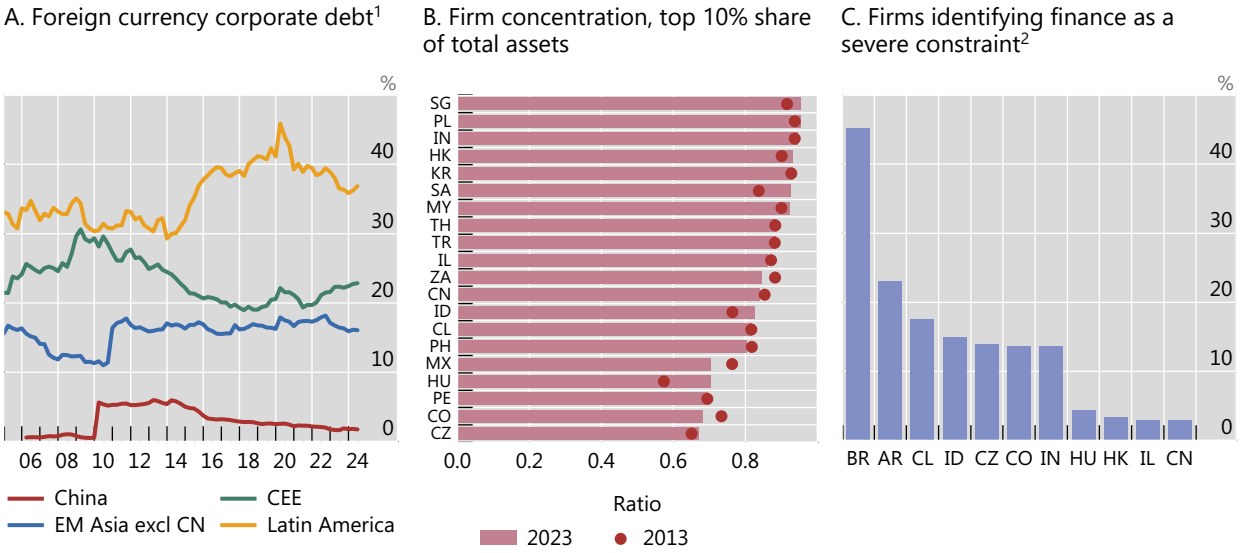
[20] See Pozo and Rojas (2020) for an analysis of the risk-taking channel in the case of Peru.

[21] This survey is based on an unweighted average of about 2,000 firms for the countries reported in Graph 6.C. More generally, one important caveat is the imperfect coverage of small firms in surveys. This issue is even more prevalent when the informal sector is large.

as in countries where access to finance at competitive rates is seamless.[22] At the same time, globalised firms that rely on longer global value chains typically need much more financing of working capital to bridge the timing mismatch between incurring costs and realising the cash flow from sales. As a result, their activity and exports are more sensitive to financing conditions (Kim and Shin (2023)).[23]

Varying FX exposure and heavy firm concentration

Graph 6



CEE = CZ, HU and PL; EM Asia excl CN = ID, IN, KR, MY, PH and TH; Latin America = AR, BR, CL, CO and MX.

[1] Share of debt. Simple average across countries in the region. Foreign currency and total debt of non-financial corporates are estimated from BIS data on bank lending and debt securities issuance. [2] Figures correspond to 2009 for BR; 2010 for CL; 2012 for CN; 2013 for IL; 2017 for AR; 2019 for CZ; 2022 for IN; and 2023 for CO, HK, HU and ID.

Sources: Dealogic; Euroclear; Refinitiv; TRAX; World Bank, Enterprise Surveys; S&P Capital IQ; BIS locational banking statistics; BIS.

At the current juncture, cross-sectional differences in leverage according to firm size may be particularly relevant for monetary policy. One indication of this emerges when one looks at a sample of the top 100 firms in each country – which tend to weigh more on economic aggregates. Debt servicing costs of medium and large enterprises have been impacted by recent changes in monetary conditions, after a prolonged period of low borrowing costs and abundant capital searching for yield globally (Graph 7). For instance, in China – where policy rates and bond yields have decreased – the ratio of interest expenses over earnings has been trending down. By contrast, in India and more recently also in Brazil interest costs for the top 100 companies increased after the pandemic. What is also evident is that this metric can vary substantially across different firm sizes.[24] Currently, the average interest burden is higher for the top 100 companies than for the top 10 companies in the majority of

[22] More generally, Banerjee and Manea (2025) show that even the output of unconstrained firms can react more strongly to monetary policy when there are fewer credit constrained firms in the economy than when a substantial share of firms are credit constrained. This is because effects on constrained firms spill over to unconstrained ones via input and output markets (Graph A3 in Annex A).

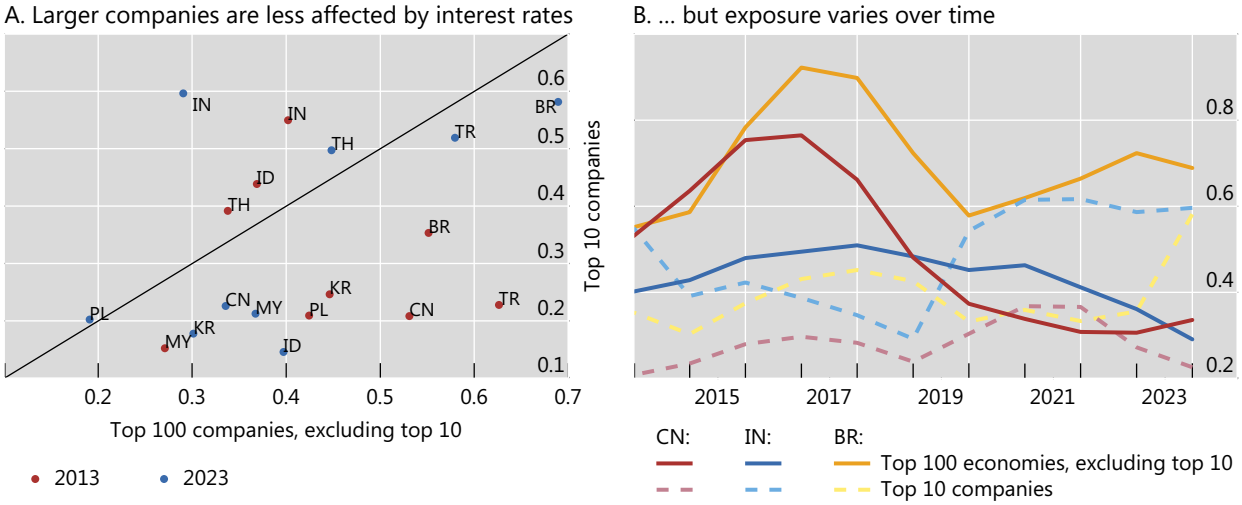
[23] As an appreciation of the US dollar against the local currency generally implies tighter financing conditions in EMEs, it affects production and export activity.

[24] This ratio also differs by sector of activity.

EMEs. This indicates that changes in monetary stances are likely to impact medium-size companies more strongly than the largest companies.[25]

Interest burden is typically lower for the largest companies[1]

Ratio of interest expenses to earnings before interest and taxes (EBIT) Graph 7



Graphs show three year moving unweighted averages. Only economies for which the average number of firms with available data was above 300 during the sample period are shown.

Sources: Capital IQ; BIS.

5. Distributional effects of monetary policy

A third area – in addition to the state of the economy and monetary transmission channels – where analysis of differences across households and firms can prove informative is the distributional effects of monetary policy. Growing public attention to inequality among households and differences in financing patterns across large and small firms have, in recent years, turned the spotlight on the potential contribution of monetary policy to distributional shifts.

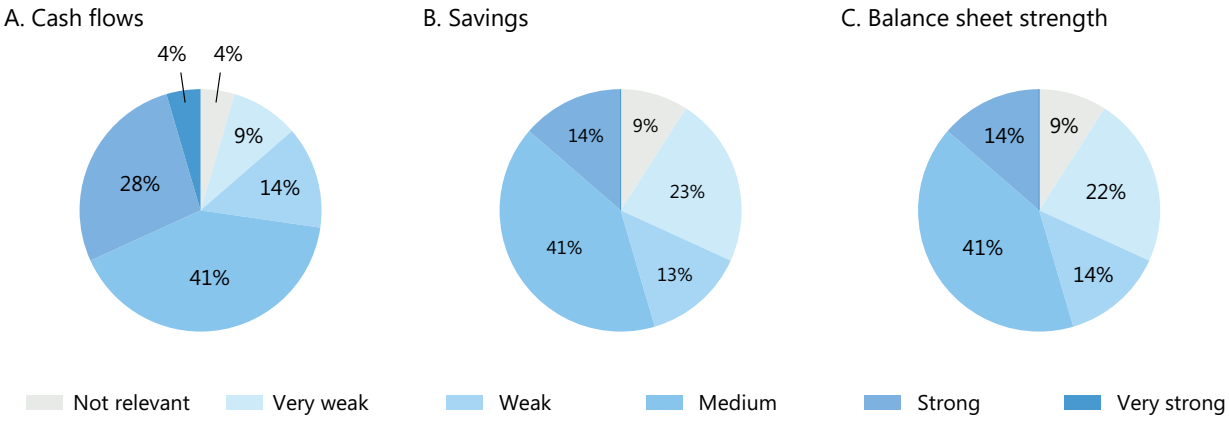
Central banks have a role in analysing and explaining the distributional consequences of their policies. However, as the primary mandate of monetary policy is price stability, when setting policy central banks focus on aggregate outcomes and do not consider distributional effects. Indeed, the most effective way for central banks to help reduce cross-sectional differences is by delivering on their price stability mandate and keeping inflation in check, as stressed in the papers contributed by several central banks (eg Bank of Korea and South African Reserve Bank). Moreover, monetary policy is a blunt tool that is not suited for achieving distributional outcomes (BIS (2021)). The policy rate applies to everyone, and while the impact may differ depending on household- and firm-specific factors, these factors are beyond the

[25] For instance, Durante et al (2022) find that monetary policy has a larger effect on investment by firms that are more leveraged.

control of central banks.[26] Fiscal and structural policies are more appropriate tools for addressing cross-sectional differences (eg Cox et al (2024)).[27] In recognition of central banks' limited role in this area, many do not attach high importance to the use of cross-sectional information for understanding distributional effects (Graph 1.C).

This section reviews the various channels through which monetary policy can redistribute attributes across households and firms (eg McKay and Wolf (2023)). As per central banks' survey responses, the impact of policy changes is strongest on households' cash flows (Graph 8.A). The direction of net impact, however, is unclear. Lower interest rates can hurt savers who earn less on their deposits, but benefit borrowers by reducing their debt servicing costs. Relatedly, lower rates can hurt the poor if inflation rises but benefit the unemployed or underemployed by improving their employment and wage prospects (eg Altavilla et al (2021)).

Monetary policy can affect the distribution of household attributes — Graph 8



Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

The net distributional impact in this case depends on the distribution of savers vs borrowers and poor vs rich in the first place, among other factors. What also matters is how different household characteristics are correlated with each other. For instance, if the rich tend to be more indebted (as in Korea), then higher rates can, ceteris paribus, hurt the rich due to higher debt servicing costs. In such cases, the equalising impact of tighter monetary policy can be outweighed by the dampening effect on overall demand (as opposed to when the rich tend to be savers, like in India).

A second effect of policy changes is on the distribution of the type and level of household savings (Graph 8.B). Lower rates can induce lower savings (and more consumption). Or they may induce a shift from one savings instrument to other assets, eg stocks, while keeping consumption constant. Lower rates might even induce more savings due to risk aversion or a desire to generate the same amount of interest income as before.

[26] The paper contributed by the central bank of Vietnam stressed that cross-sectional differences across firms (at least along some dimensions) is a natural economic feature that facilitates competition. Attempts by the central bank to address the same can undermine competitive mechanisms and capital allocation.

[27] The paper contributed by Saudi Central Bank provides various examples of such measures.

Monetary policy can also affect the relative strength of households' balance sheets (Graph 8.C). For instance, asset price inflation resulting from expansionary monetary policy – especially unconventional measures such as quantitative easing – can benefit those who own equities and real estate. Since the rich tend to own more of these assets, expansionary policy can strengthen their balance sheets and worsen wealth inequality. Relatedly, monetary expansions tend to benefit the young and hurt the old due to differential sources of income and asset holdings across these two groups (eg paper contributed by the central bank of Poland). The impact of policy changes can similarly transmit via the liability side of households' balance sheets.

It is worth noting that what ultimately matters is the effect through the monetary policy cycle. For instance, if contractionary policy undoes any redistributive effects of expansionary policy, then the "residual" impact through the cycle would be zero. One way in which monetary policy can have a residual impact is if contractions and expansions have asymmetric distributional effects, ie hysteresis. Another way is if the stance of monetary policy is biased in one direction over a period.

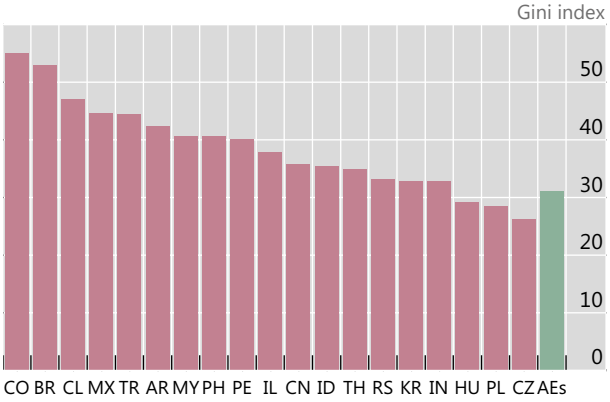
Distributional effects apply in the case of firms too. For instance, small firms tend to face greater financing constraints than large corporates, meaning that small firms benefit less from rate cuts or are constrained more by rate increases. Meanwhile, a low-interest rate environment could support the survival of non-viable firms or encourage entry by less productive firms, which can hurt resource allocation across firms. Relatedly, larger firms have greater bargaining power and tend to enjoy higher deposit rates (eg paper contributed by the central bank of Israel) while also having access to more diversified funding sources (eg paper contributed by the central bank of Malaysia). As a result, rate changes are likely to have an uneven impact on small versus large firms.

A recent but growing literature investigates some of these effects empirically, but the evidence is mixed. Some studies find that expansionary monetary policy can increase household income inequality or that contractionary policy that reduces credit supply to firms can lower wage inequality (eg Andersen et al (2023), Moser et al (2021)). Yet, other studies find that quantitative easing reduces income equality, contractionary monetary policy worsens income inequality, or that distributional effects are exacerbated under an active policy that reacts strongly to inflation. Some of these studies have further emphasised that the effect is asymmetric – that is, while contractionary policy tends to worsen inequality, expansionary policy does not necessarily alleviate inequality (eg Lenza and Slacalek (2024), Furceri et al (2018), Bobasu et al (2024)).

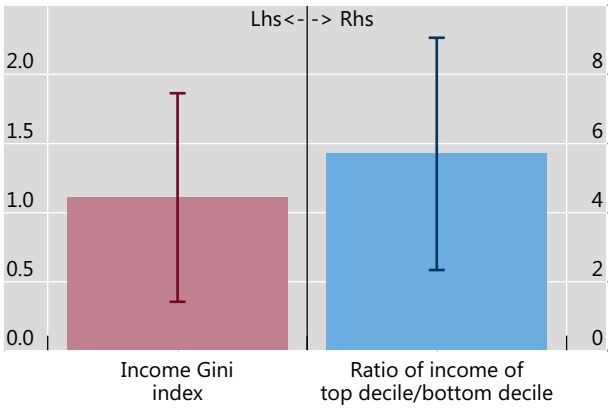
The lack of congruence in findings across studies likely reflects jurisdictional differences and the multiplicity of redistributive channels that may be acting in opposing directions. Against this backdrop, a large cross-country analysis lends support to the hypothesis that contractionary monetary policy can worsen household income inequality in EMEs, where it is already higher compared with AEs (Graph 9).

Interest rate hikes tend to increase income inequality Graph 9

A. Income inequality across EMEs[1]



B. Effects of contractionary monetary policy on income inequality[2]



[1] AEs consist of AU, AT, BE, CA, CH, DE, DK, ES, EE, FI, FR, GB, GR, HT, IE, IS, IT, JP, LT, LU, LV, MT, NL, NO, NZ, PT, SK, SI, SE and US. [2] Cumulative effect of a 100 bp contractionary monetary policy shock on inequality after 12 quarters. Estimates based on linear projection models for CPI inflation 12 quarters ahead, following Coibion et al (2017). Confidence intervals are based on Driscoll-Kraay standard errors. Average ratio of income of top decile/bottom decile is 22:1.

Sources: World Bank; BIS.

6. Towards policy decisions and communication

The previous sections explained why household and firm differences might matter for monetary policy. This section turns to the question of how, in practice, central banks have incorporated such differences into their policy decisions.

Surveyed central banks emphasised that their mandate focuses on price stability and consequently distributional effects were not explicitly considered when setting the policy rate. That said, data on household and firm differences still matter for policy transmission. As such, in many countries, such information is regularly collected and frequently informs policy discussions. For instance, in the Philippines, the central bank tracks inflation developments for the bottom 30 percent of households, in addition to monitoring overall inflation.

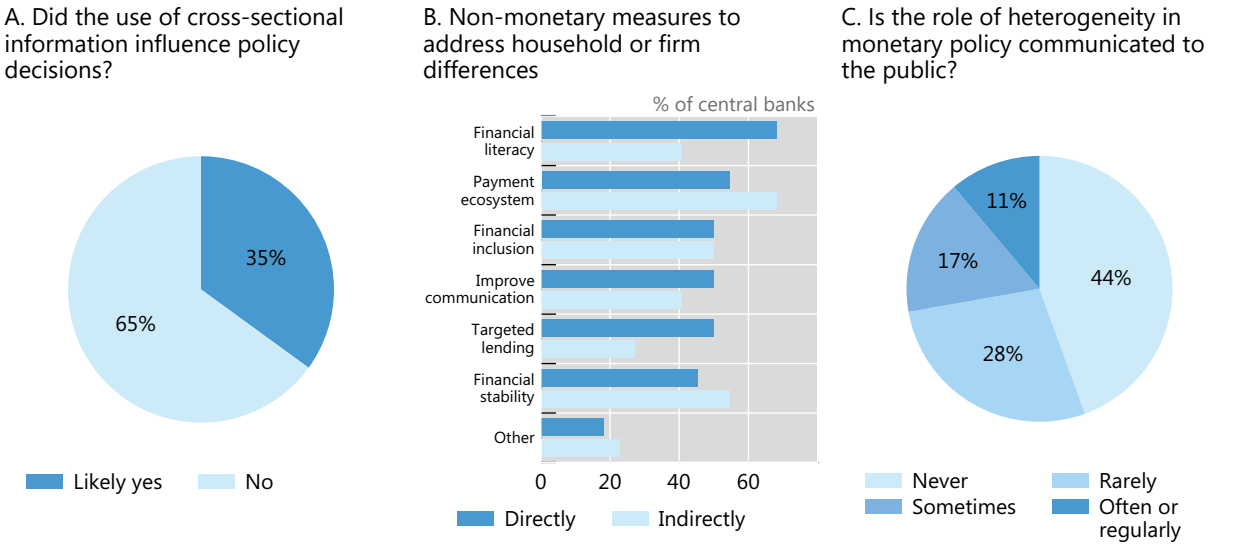
Incorporating cross-sectional differences in policy discussions influenced the ultimate decision for about a third of the surveyed central banks (Graph 10.A). For instance, in Malaysia granular data on households' balance sheet strength helped to establish that the impact of a negative income shock on private consumption would be small because much of the aggregate consumption is attributed to the rich, who can manage the shock and smooth consumption more easily. The analysis shaped the considerations that guided Malaysian monetary policy during 2024. In Thailand, household heterogeneity contributed to gradual and measured hikes after the Covid-19 pandemic, which made it more manageable for fragile groups to adapt to the increased interest burden. In Peru, the central bank regularly monitors relative prices and how they affect the inflation expectations of households differently. This enables

the central bank to identify any broadening of relative price pressures. In 2022–23, when large supply-induced relative price changes began to unhinge inflation expectations, the central bank decided to shift from an accommodative to a contractionary stance.

Some central banks explicitly seek to improve transmission by influencing cross-sectional differences. This is typically done via complementary non-price-based measures that are distinct from the primary interest rate or exchange rate tool. Also, non-price-based measures can be more easily targeted. While some of these measures seek to influence cross-sectional differences directly, others might only have an indirect impact.

Commonly used complementary measures include financial literacy programmes and payment system reforms (Graph 10.B). Among other benefits, financial literacy and inclusion have been shown to strengthen the effectiveness of monetary policy transmission (eg Brandão-Marques et al (2023)). A more efficient payment system can bolster the growth of small firms (eg see the paper contributed by Bank Indonesia). More generally, payments often serve as a point of entry into the formal financial system, meaning that payment reforms can also improve financial inclusion.

Policy decisions, non-monetary measures and communication — Graph 10



Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

Another common measure is special lending facilities that help address differentiated access to credit. For example, a bank-intermediated facility in Korea helps to partially offset varied access to finance among firms, especially small firms. The programme is flexible and was used to facilitate sectoral credit during the Covid-19 period. China has had a central bank lending programme for small businesses since 2014. In some other economies, such programmes were introduced temporarily during the Covid-19 period. In Chile, targeted measures were implemented for firms that were hit hardest. In Peru, while directing credit to specific sectors is prohibited, a guaranteed lending programme helped small firms navigate the economic challenges presented by the pandemic. Other measures that can help to reduce financing gaps

across firms include better data-sharing policies and well-regulated open banking (Caballero et al (2025)).

While targeted measures are useful for addressing cross-sectional differences, they present challenges for central banks. Measures that are meant to be temporary might become popular and difficult to discontinue. Furthermore, spillovers across tools means that central banks might face difficulties in fully controlling the effects of these tools or achieving desired results. In addition, the implementation of numerous measures aimed at addressing the needs of different groups is an operational burden for central banks and might lead to resource constraints (eg see the paper contributed by the central bank of Vietnam). A related challenge is identifying which groups to target, an issue that could run into political economy debates. Moreover, the overall complexity of the policy package can hamper communications efforts and reduce transparency.

Central bank communications about cross-sectional differences face similar trade-offs. On the one hand, transparency has benefits. By explaining the rationale behind policy decisions, communications can help improve policy acceptance among the public as well as the government and other policymakers. Moreover, if a perceived or real side effect of monetary policy decisions is higher inequality, then communication can help refocus the discussion on the central bank's role and mandate. In the absence of such communications, public or political pressure might mount on the central bank to act differently. In extreme cases, the government might even threaten to curtail the central bank's independence (Panetta (2015)). On the other hand, summarising the underlying rationale is not easy because there are several complex ways in which differences across agents can matter for policy decisions (and vice versa). This creates scope for misinterpretation.

Central banks balance these trade-offs differently depending on the circumstances in their country and thus diverge in their approach to communicating about cross-sectional differences. One aspect of their approach is the channel. While all central banks use traditional channels (eg central bank publications, press conferences), some have also used social media, including influencers, who tend to be good at simplifying complex arguments and reaching specific audiences like the young. Another aspect of their communication approach is its frequency. A majority of central banks reported that they rarely discussed heterogeneity in policy communications (Graph 10.C). Only a few do so regularly.

In general, in their communications central banks emphasise their primary mandate, roles and constraints. Several central banks highlighted the value of conveying to the public that central banks strive to protect the purchasing power of the public by stabilising prices, which especially helps the vulnerable. In Czechia, a recent example is when the deputy governor tried to explain the dilemma of higher-for-longer rates on public radio. She explained that higher rates were necessary to fend off inflation, especially a wage-price spiral, while acknowledging the pain that it caused to mortgage holders. Relatedly, when rate normalisation was criticised by some in Malaysia because of its negative impact on low-income households, the central bank intensified communications across channels and pointed to the availability of targeted programmes. The paper contributed by the central bank of Peru highlights the importance of tailoring communication strategies given the limitations of monetary policy in addressing food inflation, which hurts the poor

more. This can help to set realistic expectations about what monetary policy can achieve and the path of inflation.

References

Acemoglu, D (2002): "Technical change, inequality, and the labour market", *Journal of Economic Literature*, vol 40, no 1, pp 7–72.

Acharya, S, W Chen, M Del Negro, K Dogra, A Gleich, S Goyal, E Matlin, D Lee, R Sarfati and S Sengupta (2023): "Estimating HANK for central banks", *Federal Reserve Bank of New York Staff Report*, no 1071.

Adrian, T and H S Shin (2010): "Financial intermediaries and monetary economics" *Handbook of Monetary Economics*, vol 3, pp 601–50.

Ahn, S, S Galaasen and M Maehlum (2024): "The cash-flow channel of monetary policy – evidence from billions of transactions", *Norges Bank Working Paper*, no 20.

Alberola, E and C Urrutia (2020): "Does informality facilitate inflation stability?", *Journal of Development Economics*, vol 146, 102505.

Albonico, A, G Ascari and Q Haque (2024): "The (Ir) Relevance of Rule-of-Thumb Consumers for US Business Cycle Fluctuations", *Journal of Money, Credit and Banking*, 56(4), 769-804.

Altavilla, C, W Lemke, T Linzert, J Tapking and J von Landesberger (2021): "Assessing the efficacy, efficiency and potential side effects of the ECB's monetary policy instruments since 2014", *ECB Occasional Paper*, no 278.

Andersen, A, N Johannesen, M Jørgensen and J-L Peydró (2023): "Monetary policy and inequality", *The Journal of Finance*, vol 78, no 5, pp 2945–89.

Angeletos, G-M, C Lian and C Wolf (2024): "Deficits and inflation: HANK meets FTPL", *NBER Working Papers*, no 33102.

Banerjee, R, J Kearns and M Lombardi (2015): "(Why) Is investment weak?", *BIS Quarterly Review*, March, pp 67–82.

Banerjee and Manea (2025): "Firm heterogeneity, monetary policy and financial frictions", *BIS Working Paper*, *forthcoming*.

Bank for International Settlements (BIS) (2021): "The distributional footprint of monetary policy", *BIS Annual Economic Report*, June, Chapter II.

——— (2022): "Inflation: a look under the hood", *BIS Annual Economic Report*, June, Chapter II.

Bazillier, R, J Hericourt and S Ligonniere (2021): "Structure of income inequality and household leverage: cross-country causal evidence" *European Economic Review*, vol 132, 103629.

Beck, G, K Carstensen, J-O Menz, R Schnorrenberger and E Wieland (2024): "Nowcasting consumer price inflation using high-frequency scanner data: evidence from Germany", *ECB Working Papers*, no 2930.

Bobasu A, M Dobrew and A Repele (2024): "Heterogeneous effects of monetary tightening in response to energy price shocks", *ECB Research Bulletin*, no 123, October.

Borio, C and H Zhu (2012): "Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?", *Journal of Financial Stability*, vol 8, no 4, pp 236–51.

Bover, O, J Casado, S Costa, P Du Caju, Y McCarthy, E Sierminska, P Tzamourani, E Villanueva and T Zavadil (2016): "The distribution of debt across euro-area countries: the role of individual characteristics, institutions and credit conditions", *International Journal of Central Banking*, June, pp 71–128.

Brandão-Marques, L, G Gelos, D Hofman, J Otten, G Pasricha and Z Strauss (2023): "Do household expectations help predict inflation?", *IMF Working Papers*, no 224.

Brault, J, M Haghighi and B Tissot (2024): "Granular data: new horizons and challenges for central banks", *IFC Bulletin*, no 61, July.

Bruhn, M, M Hommes, M Khanna, S Singh, A Sorokina and J Seth (2017): *MSME finance gap: assessment of the shortfalls and opportunities in financing micro, small and medium enterprises in emerging markets*, World Bank.

Bruno, V and H S Shin (2015): "Capital flows and the risk-taking channel of monetary policy", *Journal of Monetary Economics*, vol 71, pp 119–32.

Caballero, J, S Doerr, A Mehrotra and F Zampolli (2025): "How far can digital innovation improve credit to small firms in emerging market economies?", *BIS Bulletin*, no 99, February.

Chancel, L and T Piketty (2019): "Indian income inequality, 1922–2015: from British Raj to billionaire Raj?", *Review of Income and Wealth*, vol 65, no S1.

Checo, A, F Grigoli and D Sandri (2024): "Monetary policy transmission in emerging markets: proverbial concerns, novel evidence", *BIS Working Papers*, no 1170.

Chetty, R, J Friedman, M Stepner and Opportunity Insights Team (2024): "The economic impacts of Covid-19: evidence from a new public database built using private sector data", *Quarterly Journal of Economics*, vol 139, no 2, pp 829–89.

Cloyne, J, C Ferreira and P Surico (2020): "Monetary policy when households have debt: new evidence on the transmission mechanism", *The Review of Economic Studies*, vol 87, no 1, pp 102–29.

Coibion, O, Y Gorodnichenko, L Kueng and J Silvia (2017): "Innocent bystanders? Monetary policy and inequality", *Journal of Monetary Economics*, vol 88, pp 70–89.

Committee on the Global Financial System (CGFS) (2024): "Interest rate risk exposures of non-financial corporates and households", *CGFS Papers*, no 70, November.

Cox, L, J Feng, G Müller, E Pastén, R Schoenle and M Weber (2024): "Optimal monetary and fiscal policies in disaggregated economies", *NBER Working Papers*, no 32914.

Durante, E, A Ferrando and P Vermeulen (2022): "Monetary policy, investment and firm heterogeneity", *European Economic Review*, vol 148.

Falck, E, M Hoffmann and P Hürtgen (2021): "Disagreement about inflation expectations and monetary policy transmission", *Journal of Monetary Economics*, vol 118, pp 15–31.

Findex (2021): *The Global Findex Database 2021*, World Bank.

Furceri, D, P Loungani and A Zdzienicka (2018): "The effects of monetary policy shocks on inequality", *Journal of International Money and Finance*, vol 85, pp 168–86.

Gelos, G, F Grinberg, S Khan, T Mancini-Griffoli, M Narita and U Rawat (2024): "Has higher household indebtedness weakened monetary policy transmission?", *International Journal of Central Banking*, vol 20, no 1, pp 325–71.

Jordà, Ò (2005): "Estimation and inference of impulse responses by local projections", *American Economic Review*, vol 95, no 1, pp 161–82.

Kaplan, G, B Moll and G Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743.

Kaplan, G and S Schulhofer-Wohl (2017): "Inflation at the household level", *Journal of Monetary Economics*, vol 91, pp 19–38.

Kim, S-J and H S Shin (2023): "Theory of supply chains: a working capital approach", *BIS Working Papers*, no 1070.

Kohlscheen, E, M Lombardi and E Zakrajšek (2021): "Income inequality and the depth of economic downturns", *Economics Letters,* vol 205, 109934.

Krusell, P and A Smith (1998): "Income and wealth heterogeneity in the macroeconomy", *Journal of political Economy* 106, no 5.

Lee, J and I Shim (2025): "Lending to vulnerable households and consumption: evidence from Korea", *BIS Working Papers*, forthcoming.

Lenza, M and J Slacalek (2024): "How does monetary policy affect income and wealth inequality? Evidence from quantitative easing in the euro area", *Journal of Applied Econometrics*, vol 39, no 5, pp 746–65.

Lombardi, M, M Mohanty and I Shim (2017): "The real effects of household debt in the short and long run", *BIS Working Papers*, no 607.

Matusche, A and J Wacks (2023): "Does wealth inequality affect the transmission of monetary policy?" *Journal of Macroeconomics*, vol 75, 103474.

McKay, A and C Wolf (2023): "Monetary policy and inequality", *Journal of Economic Perspectives*, vol 37, no 1, pp 121–44.

Mian, A, L Straub and A Sufi (2021): "Indebted demand", *Quarterly Journal of Economics*, vol 136, no 4, pp 2243–307.

Moser, C, F Saidi, B Wirth and S Wolter (2021): *Credit supply, firms and earnings inequality*, mimeo.

Ottonello, P and T Winberry (2020): "Financial heterogeneity and the investment channel of monetary policy", *Econometrica*, vol 88, no 6, pp 2473–502.

Panetta, F (2015): "The distributional consequences of monetary policy", remarks by at De Nederlandsche Bank, Amsterdam, 20 November.

Pereira da Silva, L, E Kharroubi, E Kohlscheen, M Lombardi and B Mojon (2022): *Inequality hysteresis and the effectiveness of macroeconomic stabilisation policies*, BIS.

Pozo, J and Y Rojas (2020): "The risk-taking channel of monetary policy: a new approach and evidence from Peru", *Central Reserve Bank of Peru Working Papers*, no 19.

Reis, R (2022): "The burst of high inflation in 2021–22: how and why did we get here?", *BIS Working Papers*, no 1060.

Sharpe, S and G Suarez (2021): "Why isn't business investment more sensitive to interest rates? Evidence from surveys", *Management Science*, vol 67, no 2, pp 720–41.

Voinea, L, H Lovin and A Cojocaru (2018): "The impact of inequality on the transmission of monetary policy", *Journal of International Money and Finance*, vol 85 pp 236–50.

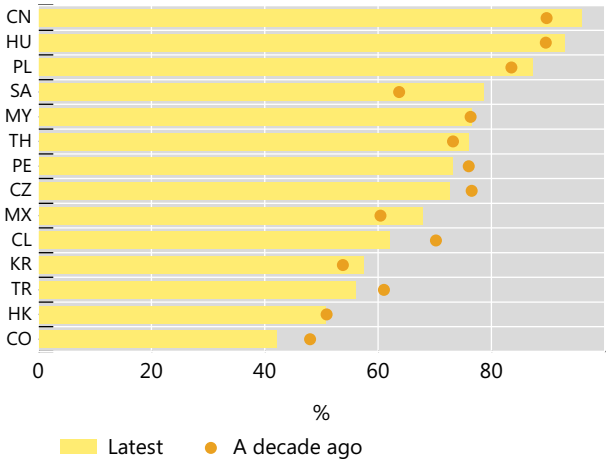
Annex A: Additional graphs

Large differences across households in EMEs

Graph A1

A. Share of households able to come up with emergency funds in 30 days[1]

B. Share of households that are homeowners[2]

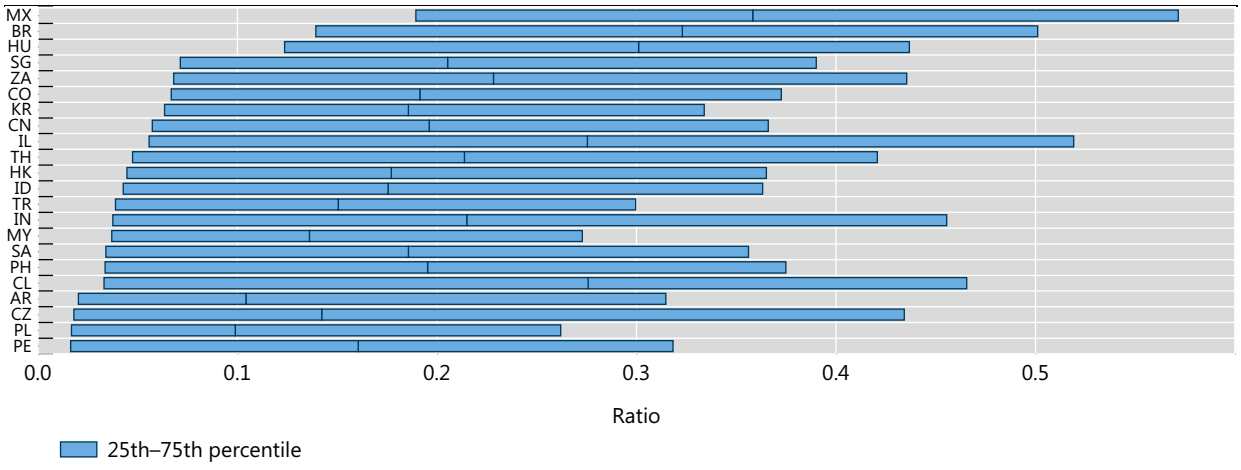


[1] Figures as of 2021, except VN as of 2022. [2] Latest corresponds to 2020 for MX; 2021 for CL; 2022 for HU, KR and MY; 2023 for CZ, TH, TR, SA, PL and PE; and 2024 for CN, CO and HK. A decade ago, corresponds to 2011 for CL, HU; 2012 for KR; 2013 for TH, TR and PE; 2014 for CN, CO, CZ, HK, MX and PL; and 2016 for MY.

Sources: World Bank, *World Development Indicators* and *Global Findex Database*; BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

Interquartile range of non-financial firms' debt-to-assets ratio[1]

Graph A2

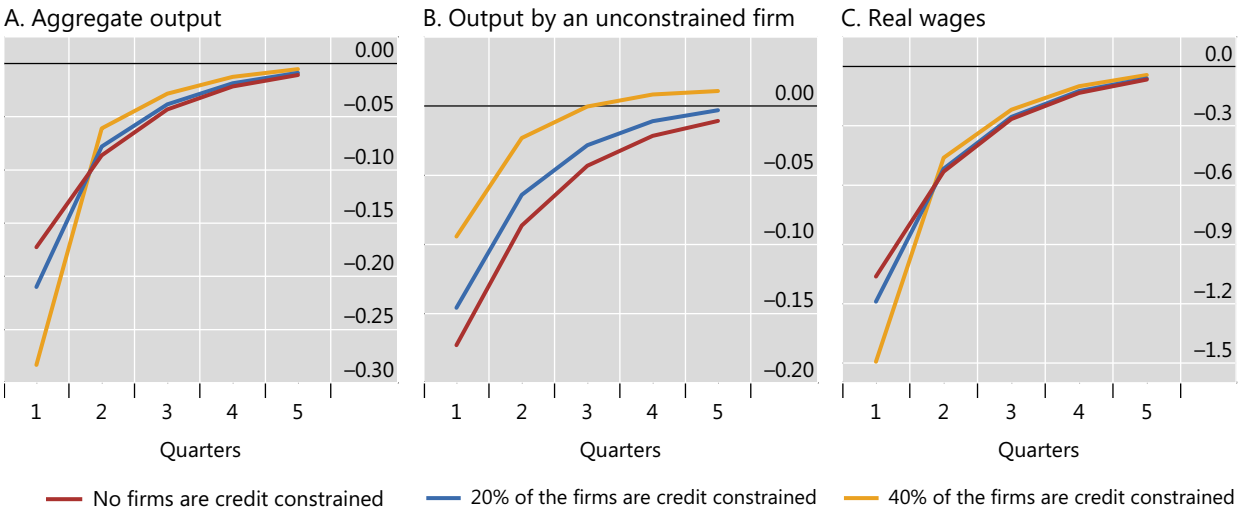


[1] Figures correspond to 2023.

Sources: World Bank, Enterprise Surveys; S&P Capital IQ.

Credit-constrained firms generate spillovers to unconstrained firms

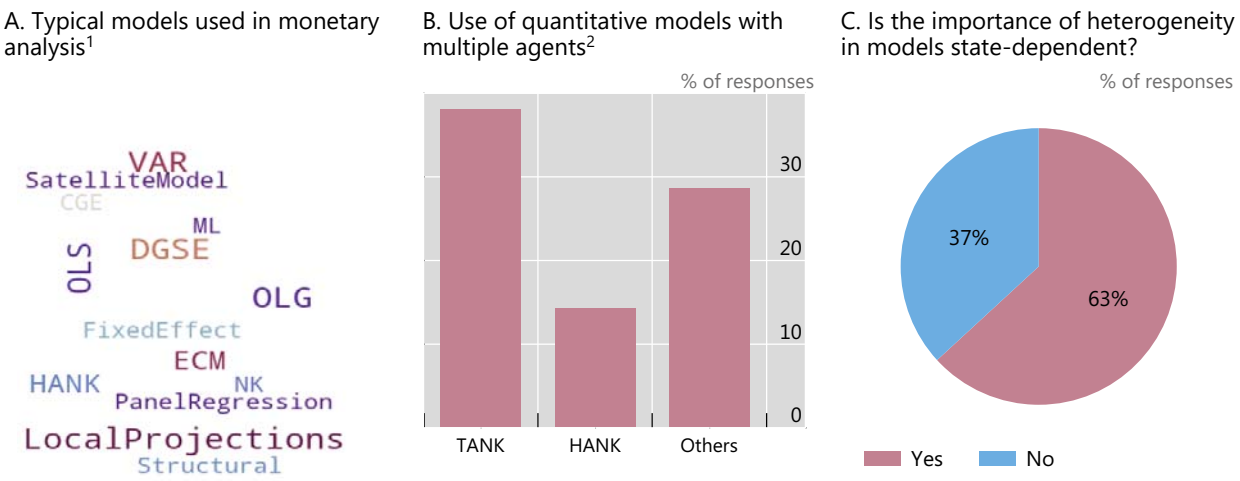
In per cent — Graph A3



Source: Banerjee and Manea (2025).

Macroeconomic models used by central banks

Graph A4



[1] Word cloud based on textual answers by central banks. CGE = computable general equilibrium; ECM = error correction model; HANK = heterogeneous agent New Keynesian model; ML = machine learning; OLS = ordinary least squares; OLG = overlapping generations model. [2] TANK = two-agent New Keynesian model; VAR = vector autoregressions.

Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

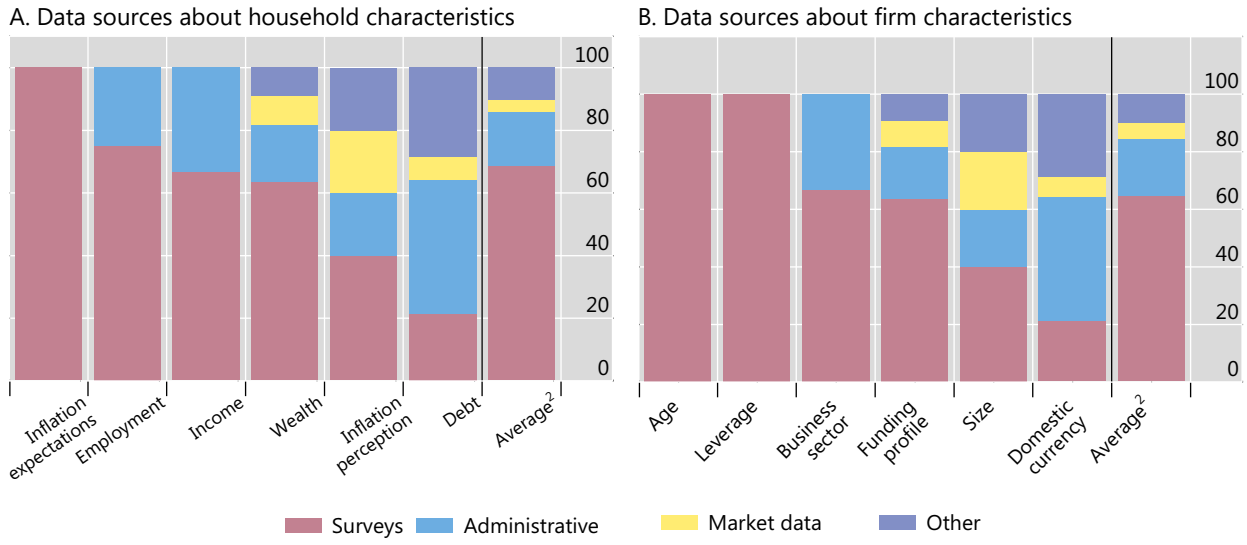
Annex B: Sources and features of granular data

Surveys are the most common source for granular data, administrative records are another frequent source, and in the case of some indicators market data are also a relevant source (Graph B1). Digitalisation has facilitated the use of each of these sources: conducting surveys has become easier due to online applications, sharing administrative data has become more efficient due to digital storage and more market data are generated because more transactions happen online. Such data also tend to be available for analysis more quickly or frequently, thus improving their potential to inform monetary policy analysis.

Among the beneficial aspects of granular data, central banks report that breadth (or representativeness) and depth (detail and comprehension) are most important (Graph B2.A). These attributes offer a window into cross-sectional differences, especially when heterogeneities exist along multiple dimensions. Another aspect is accuracy, which tends to be higher in the case of administrative sources. Moreover, unlike surveys, they often cover the whole target population. Another desirable attribute of granular data is the ability to follow the same entities over time – longitudinal data – as this facilitates panel regression analysis.

Primary data source by household and firm characteristics[1]

Percentage of responses — Graph B1



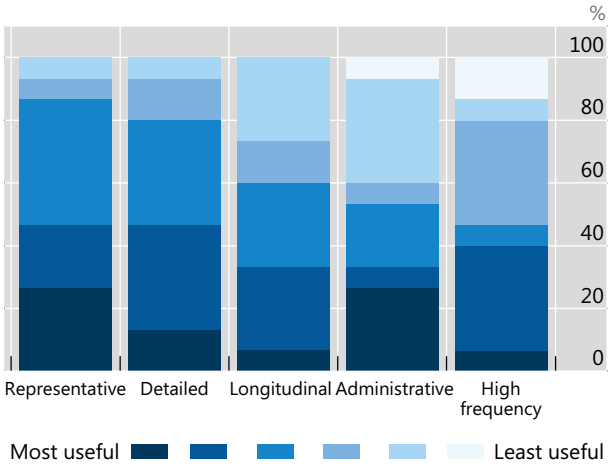
[1] For each household or firm characteristic, the stacked bar shows the share of primary data source across central banks. In the case of households, only the six most important characteristics are shown. [2] Average across all households or firm characteristics is shown.

Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

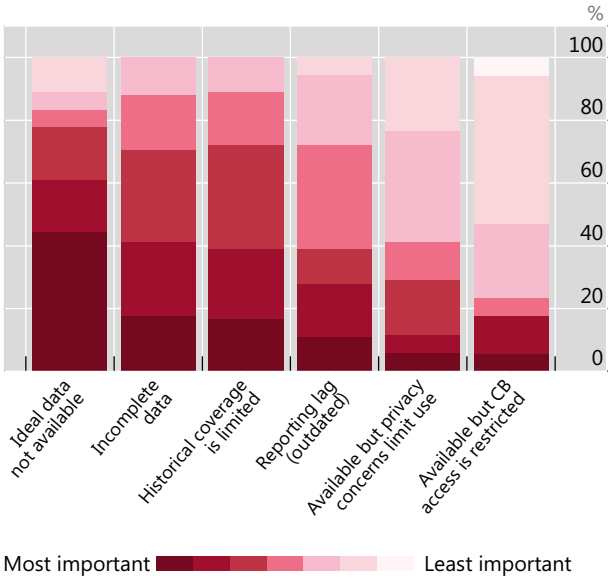
Benefits, risks and constraints of using granular data

Percentage of responses — Graph B2

A. Most useful attributes of granular data



B. Impediments or risks in the use of granular data



Sources: BIS survey for the 2025 Emerging Markets Deputy Governors meeting.

Annex C: Income concentration and monetary policy transmission

We empirically analyse the effects of income concentration on monetary policy transmission in two steps. First, the effects of monetary policy on aggregate real consumption growth are estimated with the following specification:

$$\Delta c_{i,t+h} = \alpha.\Delta c_{i,t} + \beta.IncShare_{i,t} + \gamma.mp_{shock_{i,t}}$$
$$+ \delta.[IncShare_{i,t}\ .\ mp\_shock_{i,t}] + \lambda.controls_{i,t} + \phi_i + \varepsilon_{i,t}$$

where $\Delta c_{i,t+h}$ denotes real consumption growth in country i in quarter $t+h$, $IncShare_{i,t}$ denotes the share of the top decile in aggregate income, $mp_{shock_{i,t}}$ the monetary shock, $controls_{i,t}$ is a vector containing other time-varying control variables, ϕ_i controls for unobserved fixed heterogeneity in consumption growth across countries and $\varepsilon_{i,t}$ is the error term. In what follows, we report the results when the private credit-to-GDP ratio is included as a control variable, capturing credit expansion and acting as a proxy for financial development.[28]

Second, the effects on consumer price inflation are estimated through the specification:

$$\pi_{i,t+j} = \alpha.\pi_{i,t} + \beta.IncShare_{i,t} + \gamma.mp_{shock_{i,t}}$$
$$+ \delta.[IncShare_{i,t}\ .\ mp\_shock_{i,t}] + \lambda.controls_{i,t} + \theta.ygap_{i,t} + \phi_i + \varepsilon_{i,t}$$

where $\pi_{i,t+j}$ denotes headline inflation in country i in quarter $t+j$, $ygap_{i,t}$ denotes the Hodrick-Prescott-based output gap and the remaining variables are as before.

Monetary policy shocks are calculated by Checo et al (2024) based on policy rate expectations collected from Bloomberg surveys, after removing any predictability based on macroeconomic and financial data that were available before monetary policy meetings. The sample is based on quarterly panel data for Brazil, Chile, Colombia, India, Mexico, the Philippines, Poland, Romania, South Africa and Thailand between 2000 and 2022.

Estimation results are shown in Graph C1. The unconditional effect of a surprise 25 basis points contraction is to reduce consumption growth by one percentage point within two years. When the specification is conditioned on the level of income inequality, it becomes clear that this effect is stronger when income concentration at the top is low and weaker when it is high (Graph C1.A).

Similarly, the unconditional effect of the same shock is to reduce inflation by 35 basis points within three years. Again, the effect is substantially stronger when income concentration is low (Graph C1.B). Further, the significant difference in effects holds irrespective of the level of economic slack (Graph C1.C).

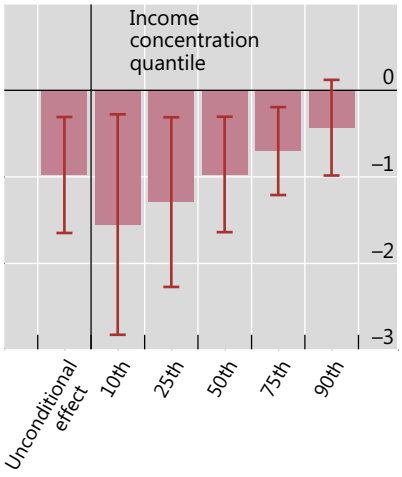
The results above are consistent with the notion that non-targeted stabilisation policies are less powerful when a very substantial portion of aggregate income is held by well-off agents, who tend to have a much lower propensity to consume than the average agent.

[28] Results are robust to the exclusion of the additional control variables in $controls_{i,t}$.

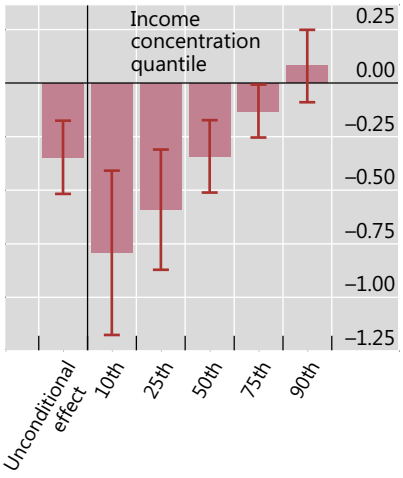
Effect of a 25 basis point contractionary monetary policy shock on consumption growth and inflation[1]

Graph C1

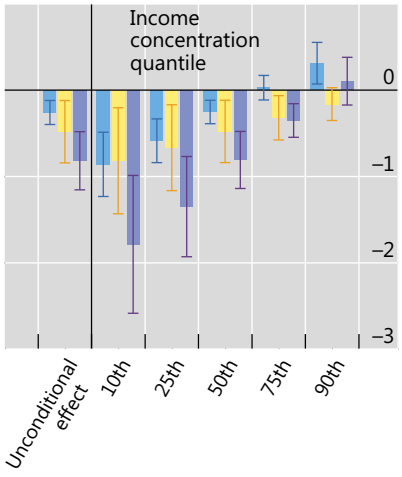
A. Effects on real consumption growth after eight quarters



B. Effects on inflation after 12 quarters



C. Effects on inflation by stage of business cycle



[1] Estimates based on linear projection models for real consumption growth eight quarters ahead and CPI inflation 12 quarters ahead. In the conditional model, the monetary policy shock is interacted with the deviation of the aggregate income share of the top 10% from its country-specific mean. Confidence intervals are based on Driscoll-Kraay standard errors.

Sources: Bloomberg; Checo et al (2024); Goldman Sachs; LSEG Refinitiv; HIS Markit; IPSOS; national data; BIS.

Monetary Policy and Distribution: Insights from Argentina[1]

Central Bank of Argentina

I. Introduction

Argentina's economic policy is aimed at restoring macroeconomic stability, by rebuilding sound fiscal and monetary policy frameworks. Price stability remains the focus of the Central Bank. This task requires overcoming the constraints on monetary policy which include shallow financial markets, limits to effectiveness of conventional policy tools, much reduced yet persistent FX controls and still limited hard currency liquidity. In parallel, the Central bank is reengineering domestic regulation that facilitates the transition of the banking system to "crowding in" of private sector credit while preserving financial stability.

In this note, we review the transmission channels for monetary policy in Argentina, highlighting how their impact is evolving as the economy moves from a high to a low inflation regime. The discussion requires an overview of the ongoing stabilization program as a general equilibrium approach emphasizes the complementary role that monetary policy plays alongside simultaneous adjustments through other economic policy levers. Distributional effects of reducing inflation in a sustainable manner are found to be significant. The main channels through which these distributional improvements take place include income, consumption, credit, and wealth channels. The distributional effects that work through these monetary policy channels are also intertwined with relative price adjustments driven by domestic and international trade and financial deregulation.

II. Fiscal dominance has blunted the transmission mechanism of monetary policy

In emerging markets and developing economies, the traditional channels through which monetary policy operates are distinct and less powerful than in advanced economies. This is often attributed to financial market underdevelopment, low credibility and –in some cases, like Argentina- pervasive currency substitution (BIS, 2008; Frankel, 2010).

Due to chronic fiscal dominance, Argentina financial markets have shallowed—reflecting financial repression and distortive subsidies, adoption of informal and

[1] Economic Research, Central Bank of Argentina. Note prepared for presentation at the meeting of BIS Emerging Market Deputy Governors on "Monetary policy decision-making: how are household and firm heterogeneity incorporated?", to be held on 17-18 March 2025 in Basel. Information is current as of March 2025 unless otherwise indicated.

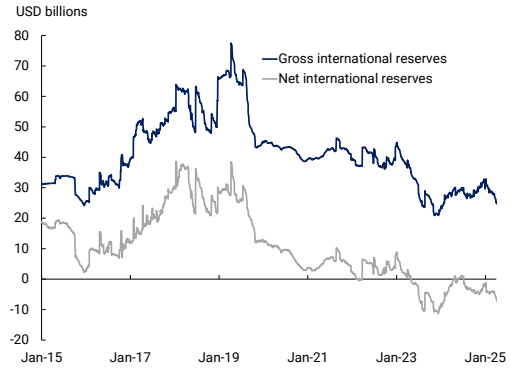
formal parallel markets, and the crowding out of credit for the private sector. A monetary regime with low credibility and an underdeveloped, largely transactional, banking system has reduced the effectiveness of the Central Bank's policy interest rate to influence aggregate demand and prices. Indeed, the interest rate channel, which typically works affecting borrowing, consumption and investment, has a very limited impact on prices.

In fact, the monetary overhang created by fiscal dominance through over-issuance of liabilities and its subsequent sterilization implied that the level of the policy rate adversely affected the size of the quasi-fiscal deficit. Argentina's central bank has faced difficulties in managing inflation through traditional tools like policy rate changes (IMF, 2015). Sterilization became ineffective and eventually counter-productive to anchor inflation expectations. As interest payments by the Central Bank were viewed as an additional source of money creation, money demand plummeted (Werning, 2024).

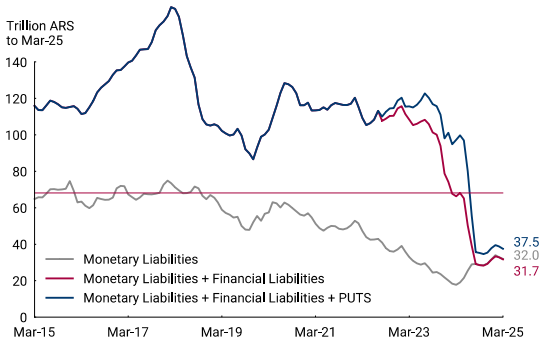
In parallel, fiscal dominance sharply eroded the asset side of the Central Bank's balance sheet as reserves were exchanged for illiquid Treasury IOUs. The financing fiscal deficits with money issuance plus the sale of international reserves to Treasury for the latter's IOUs reached a cumulative 60% of GDP over the past 20 years.

By late 2023 BCRA held too few liquid assets (net international reserves of about minus USD 11 billion) and too many liabilities (interest-bearing liabilities equivalent to about USD 59 billion) (Graphs 1 and 2). This resulting imbalance of the central bank balance sheet became unmanageable, triggering a pervasive relationship between devaluation risk and inflation expectations which intensified despite financial repression. The Argentine economy was extremely vulnerable, with no access to international financial markets, on the brink of a sovereign default and undergoing 3-digit annual (and accelerating) inflation.

Graph 1: BCRA's net international reserves



Graph 2: BCRA's liabilities



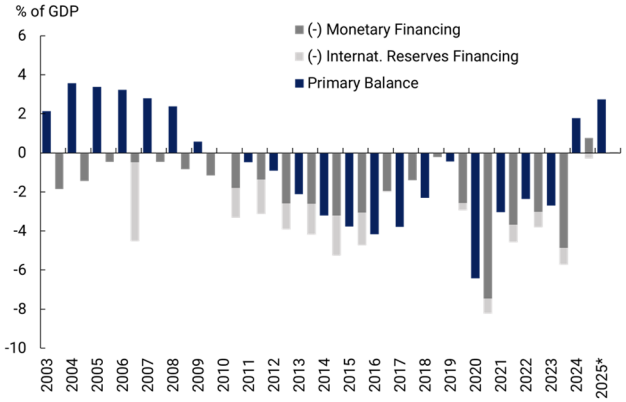
Source: based on data from BCRA.

III. The current stabilization program reestablishes monetary policy control

Since December 2023, a new administration has taken very significant steps to overturn this situation, implementing an economic program focusing on structural changes to first stabilize prices and then reverse economic stagnation (BCRA, 2023 and 2024). The stabilization plan required that monetary policy act rapidly in combination with fiscal and exchange rate policy to eliminate excess money.

The first pillar needed to regain macroeconomic stability was a reversal of fiscal policy. An unprecedented fiscal adjustment was carried out, reducing a headline deficit of 2.7% of GDP in 2023 to a headline surplus of 2.0% in 2024 (Graph 3). These "shock" measures immediately eliminated fiscal financing by way of money issuance. To protect vulnerable households, changes to income policy were made by fiscal authorities. The income policy was prioritized to reverse the prolonged erosion of real social spending, focusing on the Universal Child Allowance and the minimum pension.

Graph 3: Argentina: public sector balance and total BCRA financing of Treasury (Monetary and international reserves)

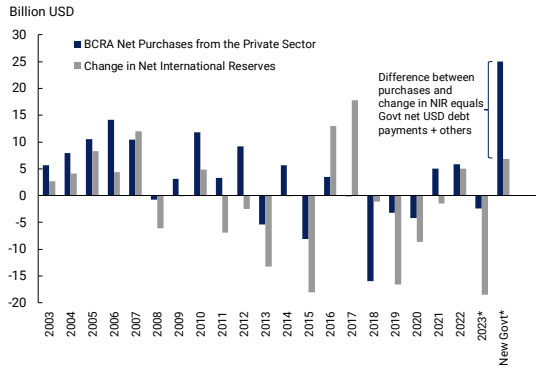


* Seasonally Adjusted Non-Financial National Public Sector primary balance up to Jan-25. Monetary and International Reserves financing up to Feb-25.

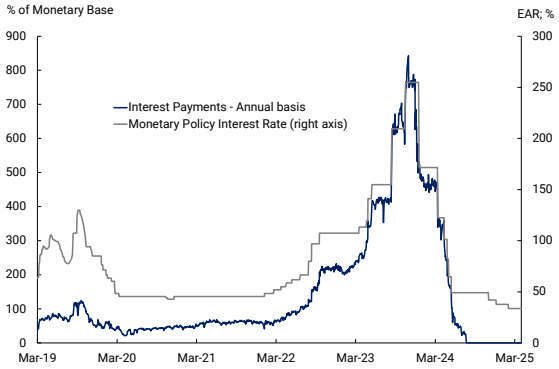
Source: based on data from BCRA and the Ministry of Economy.

The second pillar, the FX policy adjustment, included an initial depreciation (USD/AR$ went up by 118% in December) to correct the overvaluation of the peso and a subsequent 2% monthly crawling peg (subsequently reduced to 1% monthly in February 2025), to anchor inflation expectations. Voluntary FX swaps were offered in the form of securities to address a large backlog of FX claims from importing firms whose access to FX had collapsed to only 20% of imports. BCRA defined an incremental access schedule for import payments and offered the private sector the option of purchasing a foreign currency bond (BOPREAL) to settle their trade debts, effectively sterilizing large excess peso holdings. By the end of the first half of 2024, import payments in the official exchange market had returned to around 100% of monthly imports. These combined FX efforts allowed the Central Bank to purchase foreign currency in the FX market (Graph 4) and avoid sovereign debt default.

Graph 4: BCRA's interventions in the FX market



Graph 5: Policy interest rate and interest payments



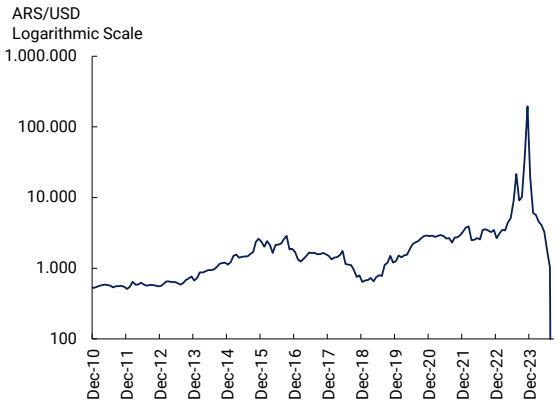
*2023 From Jan 1st to Dec 9th and New Govt from Dec 10th 2023 to Mar 11t h 2025.

Source: BCRA.

The third pillar involved a U-turn in monetary policy, aimed at eliminating endogenous money supply by defusing the "snowball" effect created by rising interest payments on BCRA's interest-bearing liabilities. This was carried out by lowering the policy rate (on reverse repos) from 133% nominal annual rate in December 2023 to 29% in March 2025 (Graph 5). A negative interest rate in real terms shrunk liabilities and reduced expected money growth. Subsequently, BCRA's interest-bearing liabilities were transferred to the Treasury which allowed the warehousing of residual liquidity without creating expectations of peso issuance. Over time, the issuance of *put* options on Treasury securities held by banks against the BCRA was halted and the stock of legacy put options were repurchased, eliminating yet another (contingent) source of money supply.

These crisis management solutions avoided hyperinflation, debt default, freezing of bank deposits and a broad banking crisis. The ratios of the BCRA's interest-bearing liabilities and imports relative to net international reserves decreased fast after reaching alarming highs at the end of the prior year (Graph 6). And the gap between the financial market exchange rate and the official exchange rate narrowed from164% at the end of 2023 to 15% in March 2025 (Graph 7).

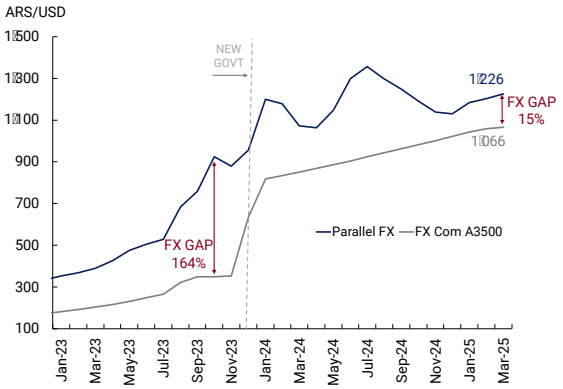
Graph 6: Ratios of remunerated liabilities international reserves



Note: Net international reserves are gross reserves less liabilities with foreign residents.

Source: based on data from BCRA.

Graph 7: FX gap (between paralle and official net to FX rates)



Source: based on data from BCRA.

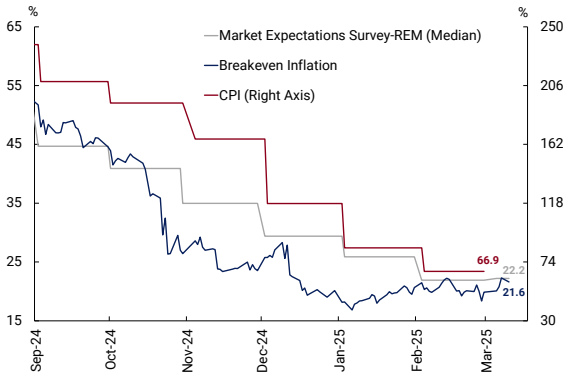
IV. Rapid disinflation sparks remonetization of the economy

As a result, both inflation and inflation expectations (as reflected in surveys and implied in the secondary bond market) have declined sharply. Actual inflation was around half of what market analysts forecasted at the end of the prior year. After reaching 25.5% monthly in December 2023, it fell to 3.7% monthly in March 2025. Meanwhile, annual inflation dropped from 289.4% in April 2024 to 55,9% in March 2025, with the market expecting 24.5% year-over-year over the next 12 months (Graph 8).

Money demand (M3 in local currency held by the private sector), recovered from its lows of early 2024, mainly driven by time deposits. Credit to the private sector growing substantially throughout the year as elimination of the fiscal deficit allowed for a "crowding in" process. Loans in pesos to the private sector grew from almost 4% of GDP at the beginning of 2024 to 7.9% of GDP in March 2025. Loans in foreign currency have grown by almost 300% in the same period (Graphs 9). This has also been enabled by a tax amnesty on external assets (*régimen de regularización de activos*), which led to deposits in USD doubling in volume in a few months.

Reestablishing macroeconomic equilibrium is not only reflected in a rapid disinflation process, a resurgence of bank and non-bank credit markets and a redirection of credit to the private sector. Intimately intertwined with these trends is a strong V-shaped recovery of economic activity. Thus, a key aspect of the stabilization program is that the anti-inflationary policy tightening underway is effectively imparting an expansionary effect on real activity and real money demand. Distributional effects of monetary policy are therefore simultaneously operating through direct (nominal) and (indirect) real channels.

Graph 8: Inflation and inflation expectations



Source: based on data from BCRA and INDEC.

Graph 9: Bank loans to the private sector

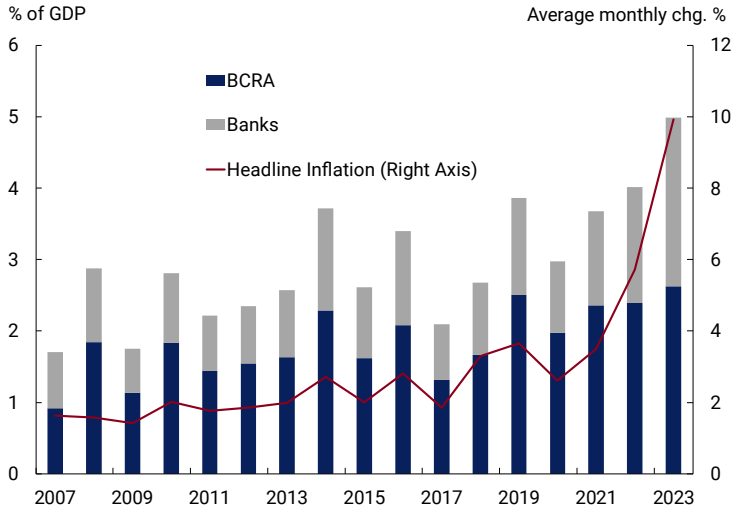
Source: based on data from BCRA.

V. Distributional effects of monetary policy following the stabilization effort

The stabilization program has generated distributive effects that are significant, widespread and beneficial. These effects surfacing through several channels.

Income channel: the reduction of the inflation tax previously captured by the public sector and banks is returning income to households and businesses. Graph 10 shows a recent perspective of the inflation tax collection on the transactional monetary aggregate (M2 private). This constitutes a key distributional aspect of the stabilization program.

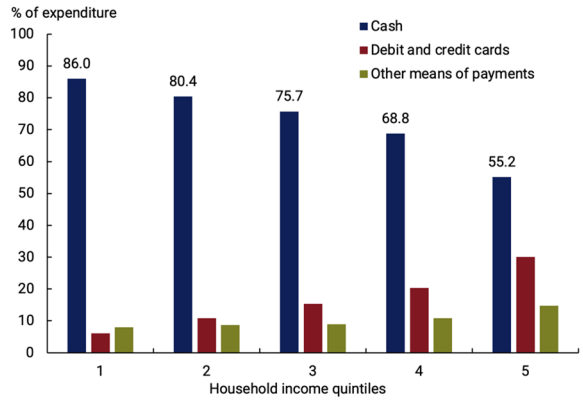
Graph 10: Argentina: inflation tax estimated on M2 (Transactional Private)



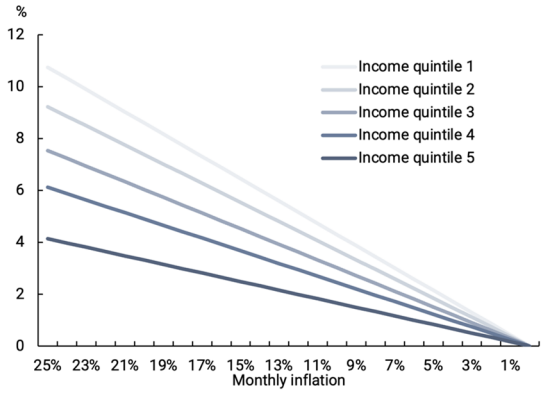
Source: based on data from BCRA and INDEC.

In addition to shifting income streams between certain sectors (public, banks) to others (private), changes in the inflation tax have significant distributional effects within the household sector. Inflation affects the poorest disproportionately, weighing more on households that cannot hedge against it (Easterly and Fischer, 2001). Poorer households tend to hold a larger share of their wealth in cash, which loses value as inflation rises (Graph 11). Our estimates for Argentina indicates that inflation tax incidence on poorer households, as a share of their income, is 2.6 times larger than that of wealthier households (Graph 12).[2] These estimates also suggest that as inflation decreases, poorer households gain between 9 and 10 percentage points of income in terms of lower inflation tax incidence.

Graph 11: Means of payment by income quintiles (% of family expenditure)



Graph 12: Incidence of inflationary tax by quintiles (% of average total family income)



Source: based on data from INDEC (Household Expenditure Survey 2017-18).

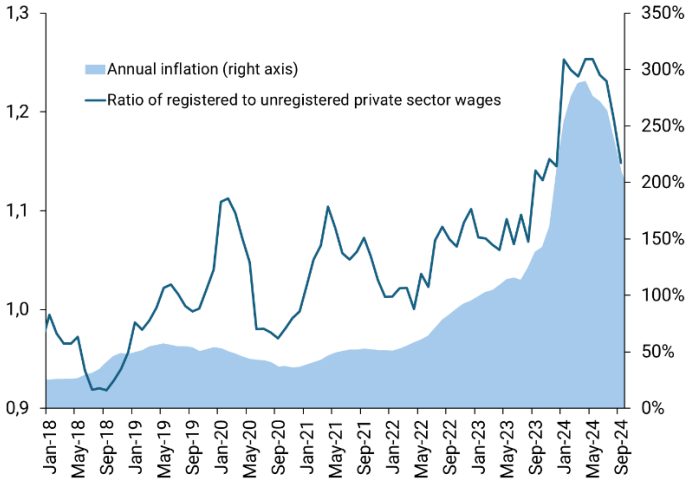
Additionally, poorer households tend to work more in the informal sector, whereas better off households tend to obtain work in the formal sector. Note that the ratio of registered to unregistered private sector wages is positively correlated to inflation (Graph 13). Hence, empirically in Argentina as inflation accelerates formal sector workers tend to obtain wage adjustments linked to labour unions' negotiations while informal sector wage earners adjustments lag and their real wage suffers relatively (a trend that reverses when inflation declines).

Consumption channel: Lower-income households benefited relatively more from the decline in inflation than higher-income households and poverty decreased, also helped by the recovery of economic activity and the increase in social programs. Inflation disproportionately affects households which have a higher share of tradable goods such as food in their consumption basket (Caisl et al., 2023). As the local currency depreciates, poorer households -with higher cash holdings- tend to lose more. Poverty has collapsed from its peak of 57,1% in the first quarter of 2024 to an estimated 33,6% in the first quarter of 2025 (Graph 14). This reflects the fact that food

[2] Household incomes are divided by quintiles using data from the INDEC's Permanent Household Survey of the second semester of 2024. Money holdings as % of income come from the Household Expenditure Survey 2017-18. For the methodology, see BCRA (2016).

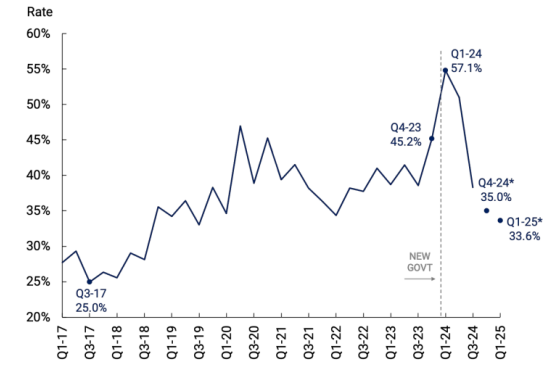
prices carry greater weight in the consumption basket of lower income households than in higher income households (Graph 15).

Graph 13: Ratio of registered to unregistered private sector wage and inflation



Source: based on data from INDEC.

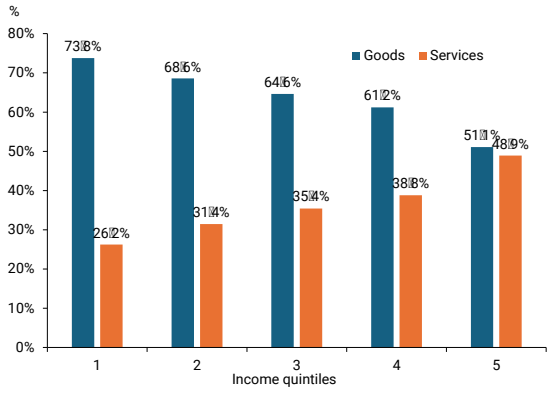
Graph 14: Poverty



*Q4-24 and Q1-25 are projected by G. Rozada (UTDT). Q1-25 is an average of Jan-25/Feb25.

Source: BCRA from INDEC data and G. Rozada (UTDT).

Graph 15: Percentage of household spending allocated to goods and services



Source: based on data from INDEC (Household Expenditure Survey 2017-18).

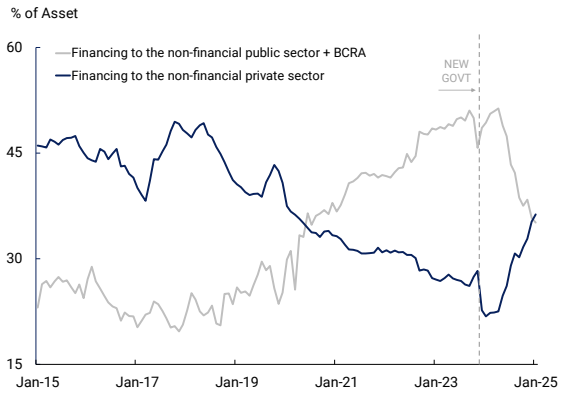
Credit channel: High inflation entails a shortening of planning horizons that weighs on financial markets, where terms are substantially reduced -hence curtailing longer term credit supply (Heymann and Leijonhufvud, 1995). As inflation mounts, financial decisions' horizons are shortened. This in turns weighs on credit supply. In contrast, disinflation facilitated credit price formation, bringing borrowers and banks closer together, while fiscal austerity supported credit expansion to the private sector.

By stabilizing inflation and improving the overall macroeconomic environment, monetary policy can also help "crowd in" private investment. When inflation

expectations are anchored, bank credit tends to increase, leading to greater access to credit for households, especially mortgage loans, and small enterprises (Graph 16).

Wealth channel: Disinflation (through monetary policy) together with USD purchases that ensured debt payments in foreign currency (FX policy) and fiscal austerity (fiscal policy) reduced the risk premia of sovereign and corporate debt, implying an increase in Argentine assets prices (Graph 17).

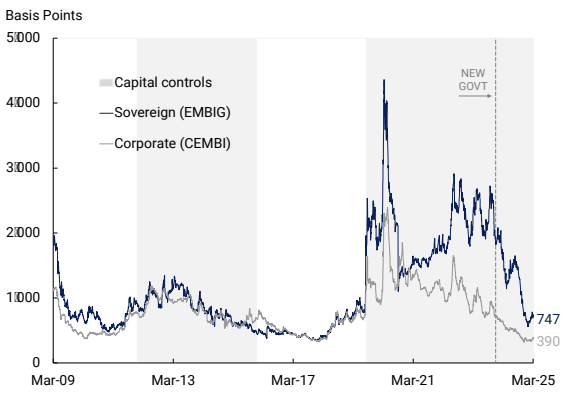
Graph 16: Bank financing to public and private sector (% of assets)



Financing to the non-financial public sector: Position in public securities + Loans to the public sector + LEFI. The public sector includes all jurisdictions.

Source: BCRA.

Graph 17: Risk premium: sovereign and corporates (Basis points)

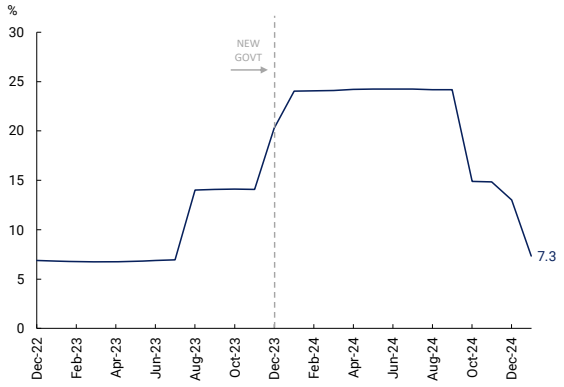


Source: BCRA from Bloomberg data.

VI. Distributional effects are also attributable to mandated relative price adjustments.

Relative price adjustments required under the stabilization program, although not directly attributable to monetary policy, also had significant distributional impacts. The reduction of import barriers (both tariff and non-tariff) is shifting income from importers/producers to consumers (Graph 18). Adjustments in regulated prices (such as public utilities) and those driven by deregulation in other sectors (such as rents) generate transfers that reflected market values (Graph 19). Finally, the narrower dispersion among multiple exchange rates that were reduced, resulted in income transfers from importers to exporters and consumers.

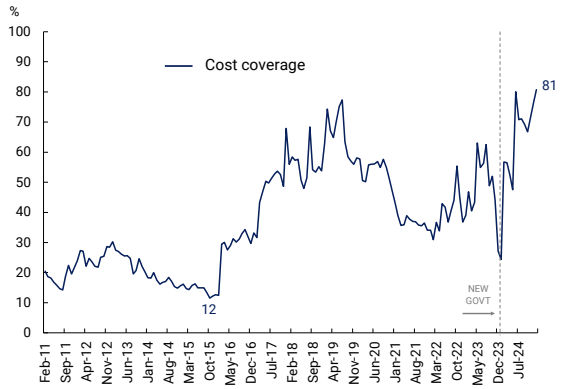
Graph 18: Taxes on imports of goods. Implicit rate



Includes average implicit tariff rate, statistic rate and PAIS tax rate.

Source: based on INDEC and Ministry of Economy data.

Graph 19: Electric utility tariffs. Cost of coverage



Source: BCRA.

VII. Concluding remarks

Argentina's current sound economic program is rapidly restoring macroeconomic stability and promoting a recovery in economic growth. In identifying the distributional effects of monetary policy in Argentina, context matters, and certain caveats are in order: First, monetary policy adjustments are working in combination with major fiscal and FX policy adjustments. Thus, distributional effects should be associated with the overall policy mix.

Second, conventional monetary policy transmission channels have been altered and subdued due to financial market underdevelopment which, in turn, is rooted in persistent macroeconomic imbalances that required deficit monetization and chronic high inflation.

Thus, when referring to monetary policy in Argentina it needs to be noted that the monetary policy toolkit does not conform to the conventional understanding (the FX anchor has played an outsized role) nor have monetary policy actions followed to the standard script (interest rate adjustments were engineered in the opposite direction of inflation risk).

Given that policy efforts have very sharply reduced the inflation tax the distributional effects of monetary policy are significant, widespread and beneficial (progressive). These distributional effects can be distinguished and accounted for through multiple channels of transmission of monetary policy: including income, consumption, credit and wealth channels.

References

BCRA (2016): "El impacto regresivo del impuesto inflacionario", apartado 4, Informe de Política Monetaria, October.

——— (2023): "Objetivos y planes respecto del desarrollo de las políticas monetaria, cambiaria, financiera y crediticia para el año 2024", December.

——— (2024): "El BCRA inauguró un marco monetario orientado a consolidar la estabilidad de precios", July.

BIS (2008): "Transmission mechanisms for monetary policy in emerging market economies", *BIS paper*, no 35, Monetary and Economic Department, January.

Caisl J, L Hermida, H Levy, and B Menyhért (2023): "The Uneven Impact of High Inflation", OCDE papers on well-being and inequalities, *OCDE Working Paper*, no 18, October.

Easterly W and S Fischer (2001): "Inflation and the Poor", *Journal of Money, Credit and Banking*, vol. 33, no 2, May, pp 160-178.

Frankel, J (2010): "Monetary Policy in Emerging Markets", *Handbook of Monetary Economics*, 3, pp 1439-1520.

Heymann, D and A Leijonhufvud (1995): *High Inflation*, Oxford University Press, New York, May.

IMF (2015): "Evolving Monetary Policy Frameworks in Low-Income and Other Developing Countries", *IMF Staff Report*, October.

Werning, V (2024): "Argentina: Un caso de fase terminal de dominancia fiscal sobre la política monetaria (en proceso de reversión)", presentation at BCRA Monetary and Banking Conference, October 15th.

Firm and household heterogeneity at the Central Bank of Chile

Stephany Griffith-Jones[1], Mario Giarda[2] and Jorge Arenas[3]
Central Bank of Chile

1. Introduction

The heterogeneity of economic agents is a central issue in modern macroeconomics. The asymmetric impacts of shocks in the context of the Covid-19 pandemic showed that data on specific characteristics of households and firms are important to understand the transmission of monetary policy. Several theoretical and methodological improvements have been developed in recent years which allow us to study macroeconomics at a very granular level with both statistical analysis and models.

Given the importance that the Central Bank of Chile (CBC) attaches to this topic and its implications, we organised our annual research conference in 2022 around this topic, leading to a resulting book (see Bauducco et al (eds) (2024)). In this note, we discuss how the CBC has incorporated heterogeneity into its economic analysis, and the current work to expand our main projection models in that direction. To do so, we present recent analyses in which the heterogeneity of firms or households was key to understanding the economic situation and supporting monetary policy decisions. We also discuss the current state of our main projection models, and how certain heterogeneities have been incorporated.

Considering heterogeneity both in macroeconomic analysis and in the expansion of models requires access to excellent micro data on the characteristics of firms and households, and at the CBC we have them. Through the sections of this note we discuss the micro data used in each area of work: Section 2 deals with firm heterogeneity, while Section 3 deals with household heterogeneity. Both sections discuss selected analyses and models. Finally, in Section 4 we note the policy implications of incorporating these heterogeneities into macro models, in relation to the distributional effects of monetary policy.

2. Firm heterogeneity

The CBC has made progress in incorporating firm heterogeneity into several aspects of economic analysis, taking advantage of good data availability. This heterogeneity

[1] Deputy Governor, Central Bank of Chile, sgriffith@bcentral.cl.

[2] Head of Economic Modelling, Central Bank of Chile, mgiarda@bcentral.cl.

[3] Economic Advisor to the Board, Central Bank of Chile, jarenasm@bcentral.cl.

has been present in macroeconomic analyses for preparing monetary policy meetings, most frequently in the wake of the Covid-19 pandemic. At the same time, we have developed complementary ("satellite") models to support policy decisions that consider firm heterogeneity. Through research, we are also studying how these differences affect certain monetary policy transmission mechanisms. This section begins with a brief mention of firm micro data, then describes the three aspects mentioned above, and finally presents a specific case where an exceptional policy measure, introduced as part of support to firms and households in the context of Covid-19, took firm heterogeneity into account.

2.1. Data

The data set available at the CBC covers a broad range of firm-level information, including transaction-level data between firms. This allows us to track prices, sales and purchases at both the firm and product level monthly. We can also classify firms by economic sector, size (based on sales or number of employees), geographic location and employment, among others. On the financial side, we have detailed data on commercial loans, including information on each contract between the firm and the financial institution. Most of these data come from three main administrative sources: the tax authority (Servicio de Impuestos Internos), the financial regulator (Comisión para el Mercado Financiero) and the pension system regulator (Superintendencia de Pensiones). We also conduct surveys on firms' expectations and on banks' perceptions of the credit market.

2.2 Selected work

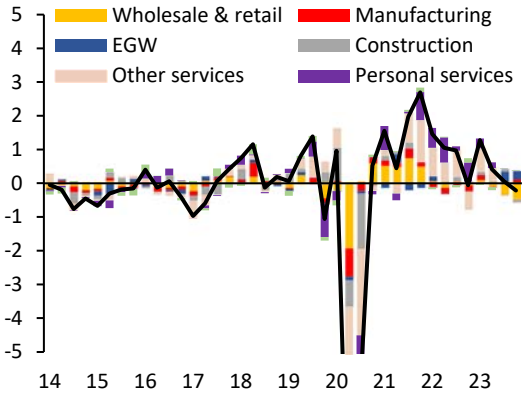
The CBC often uses boxes in its Monetary Policy Reports to present macroeconomic analyses of phenomena relevant to policy decisions. Even before the Covid-19 pandemic, some analyses considered firm heterogeneity, such as those on productivity estimation, production linkages, and investment dynamics in the mining sector (CBC (2012, 2018a,b)). Since 2020, these analyses have become more frequent. Below are some examples that highlight the importance of recognising firm-level differences.

Sectoral factors have been important for explaining recent inflation dynamics. In Chile and other economies, goods and services inflation have not followed similar trends. After excluding volatile items, goods inflation in Chile peaked at 14.9% in November 2022, while services inflation reached 8.5% in March 2023. Since then, goods inflation has declined faster, standing at 2.7% in November 2024, compared with 5.0% for services inflation in the same month. To understand these differences, Vivanco et al (2024) estimated sector-level output gaps and found negative gaps in goods-related sectors and gaps close to zero in services-related sectors (see Figure 1). These results are consistent with the observed inflation patterns. Considering heterogeneity in these gaps provided a more accurate view of costs, margins, etc and helped explain differences in relative prices across sectors.

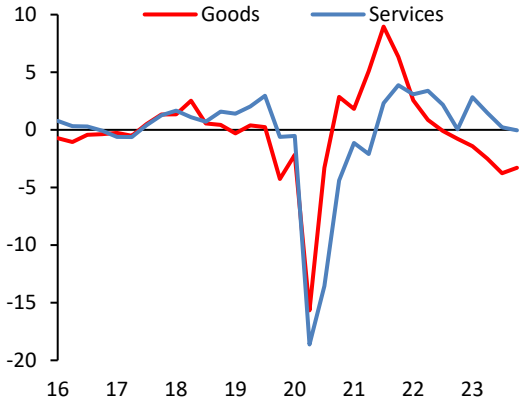
Sectoral output gaps

Figure 1

A. Sectors' contributions to non-mining GDP gap at factor costs (1) (percent of potential)



B. Goods and services gaps (2) (percent of potential)



Note: (1) Sector gaps estimated using median of 6 univariate filters. Sector aggregation based on nominal GDP weights. (2) Gaps using 6 univariate filters of activity subsectors related to consumption of goods and services, aggregated using weights from the input-output matrix.

Source: Vivanco et al (2024).

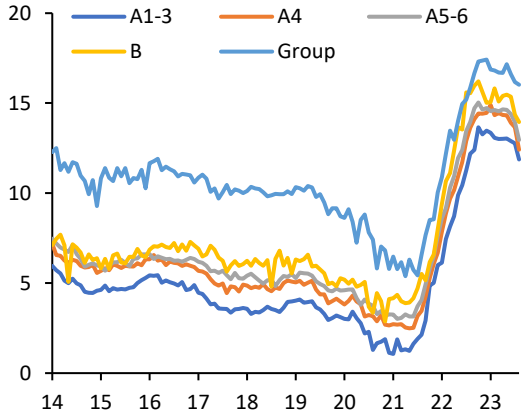
Another analysis that drew on firm heterogeneity examined the exchange rate pass-through (ERPT) according to firms' markups. In González et al (2024), monthly firm-level data were used to distinguish the ERPT based on firms' use of imported inputs and their markups. The results showed that the depreciation of the Chilean peso in the second half of 2023 (by 6.2% and 5.4% in the last two quarters, respectively) had a limited impact on prices. Firms more exposed to exchange rate fluctuations and with low markups passed on cost increases to sales prices more than firms with high markups. High markups allow firms to absorb cost increases, reducing pressure on prices. These findings align with the negative gaps observed in goods-producing sectors, where the effect of depreciation on prices was limited.

On the financial side, we have examined how credit conditions evolved for different types of firms following the start of cuts to the monetary policy rate (MPR) in July 2023. In the September 2023 *Monetary Policy Report*, we showed that commercial lending interest rates were falling as expected, indicating that one of the monetary policy transmission channels was working adequately (CBC (2023a)). By using micro data to characterise firms and their credit operations, it was possible to conclude that changes in average interest rates were mainly driven by the intensive margin; that is, by the average cost faced by firms depending on their risk level and other characteristics. Less risky firms borrowed at lower rates, and the gap between firms with different risk classifications narrowed (see Figure 2).

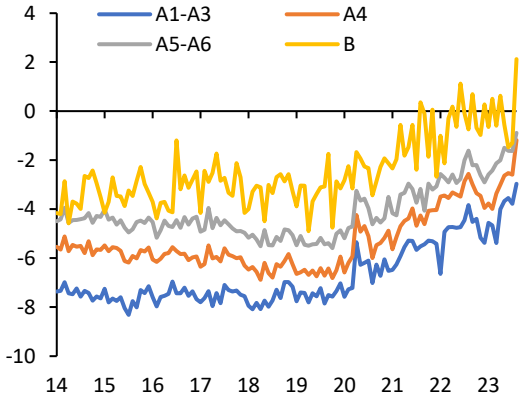
The banking sector had thus begun to pass on the monetary easing that had begun months earlier to the financing condition of firms, particularly to interest rates. Although the level of these interest rates is noted to depend on the credit rating or size of the firms, the evolution followed the usual patterns.

Behavior of interest rates according to risk rating Figure 2

A. Interest rate by risk rating (percent)



B. Average rate differential across firms according to risk rating (right, differential with respect to group portfolio, percent)



Note: For terms under 12 months. The left panel depicts the average interest rate perceived by firms for new loans they take within each risk rating, weighted by the share of firms belonging to a risk category in total credit. Operations with unusually low rates were eliminated. The right panel shows the average differential according to an econometric estimation between the rates charged by the same bank, for the same credit term and in the same month to firms with a given risk rating with respect to the rates charged to firms belonging to the group portfolio. Loans for a term of less than 0.1 months and firms with less than five employees are excluded. The results for August only consider the first days of the month. For the last months, preliminary risk rating data are used, which are subject to revision.

Sources: CBC (2023a).

The extensive data also facilitated firm-level productivity estimates. Aggregate data show a downward trend in productivity in Chile since 2011, with annual average growth of –0.4% between 2011 and 2019, well below the 2% average between 2000 and 2010 (Aguirre et al (2021)). To understand the microeconomic factors behind this decline, productivity was estimated using firm-level data. Three main findings emerged: (i) the firm-level data matched the aggregate productivity trend, with a sustained decline from 2011 onwards; (ii) the drop was mainly due to lower productivity in incumbent firms rather than changes in entry and exit dynamics; and (iii) two thirds of the productivity decline among incumbent firms related to changes within these firms, while the remainder stemmed from reallocation between firms. Sectors like transport, trade and manufacturing recorded positive productivity growth, while services, construction and agriculture saw declines. Smaller firms experienced greater productivity gains than larger firms (Aguirre et al (2021)). This analysis offered a more detailed perspective on Chile's productivity trends, showing the value of having firm-level data.

2.3 Modelling: satellite models

Although our main projection models, especially XMAS[4], do not incorporate much firm-level heterogeneity beyond the mining sector, we do have complementary

[4] XMAS: "Extended Model for Macroeconomic Analysis and Simulations". This is our medium-scale dynamic stochastic general equilibrium (DSGE) model, which we use for medium-run macroeconomic forecasts.

satellite models that include certain heterogeneities between firms. This section describes two such models: one for projecting the mining sector, and another for exploring conditional ERPT in tradable and non-tradable sectors.

Mining plays a key role in Chile's economy. It currently represents about 12% of GDP, though it exceeded 20% in 2006 and 2007, during the commodity price boom. Its investment dynamics depend primarily on global factors and the strategies of large mining companies, rather than domestic conditions. As a result, monetary policy has limited influence, justifying the separate treatment of this sector in projection models.

In XMAS, mining sector investment is modelled by assuming that mining firms take prices as given, and that production depends on past investment decisions. Investment is chosen to maximise returns, although it takes time to produce results (CBC (2020a)).

To complement the mining activity projections, a nowcasting model is used to estimate current production. For medium-term projections, time series models are used for each large mining firm. Medium-sized and small firms are grouped together and represented by a single model (CBC (2020a)).

The exchange rate channel is also relevant for a small, open economy like Chile. To understand how exchange rate movements affect inflation, García and García-Cicco (2020) developed a DSGE model with tradable and non-tradable sectors. They estimate the ERPT conditional on the type of shock that drives the exchange rate. The results show that the ERPT is high and persistent for shocks associated with uncovered interest rate parity (UIP), and lower with quicker pass-through for shocks related to external prices.

Differences in both magnitude and timing of the ERPT have important policy implications. It is well known that monetary policy acts with delay, so it cannot react to counteract a shock that has small and short-term effects, such as those on external prices. On the contrary, in the face of shocks to the UIP, which have large effects and take time to be passed on to domestic prices, monetary policy should react to reduce inflationary pressures (García and García-Cicco (2020)). For this reason, it is important to distinguish the sources that cause shocks in order to adjust the response of monetary policy.

2.4 Firm heterogeneity and monetary policy transmission

Ongoing research examines how different monetary policy transmission mechanisms depend on firm-level differences. Two studies are highlighted here. The first looks at the role of firms' access to finance in monetary policy transmission, and the second focuses on how firms' markups influence their response to monetary policy shocks.

Aruoba et al (2022) analyse the impact of monetary policy on Chilean firms' investment and employment decisions based on their access to credit markets. The authors use firm-level and credit contract data, as well as a series of monetary policy surprises. They consider firms' credit access, debt delinquency and leverage, controlling for their size and age.

They find that firms with access to credit respond significantly to monetary policy surprises, unlike those without access, which show no change in investment or employment. Among firms with credit access, payment capacity and debt levels also

affect how policy changes pass through. Firms with higher delinquency or more leverage respond less. Using these findings, they develop a partial equilibrium model in which credit access is endogenous and monetary policy transmission depends on firms' credit histories.

Giarda et al (2024) examine the cyclicality of Chilean firms' markups and its effects on monetary policy transmission. Using firm-level data, they find that markups are generally countercyclical, but vary widely. They also show that markup dispersion rises during recessions, possibly indicating less efficient resource allocation.

These two studies are part of a broader research agenda at the CBC, which takes advantage of detailed data to continue studying firm heterogeneity and its role in monetary policy transmission, and also considers how to integrate these differences into the models commonly used for projections.

2.5 Firm heterogeneity in the design of Covid-19 support policies

Finally, we describe how a specific form of heterogeneity among Chilean firms was considered in designing a support policy at the start of the Covid-19 pandemic.

Besides reducing the MPR to its technical minimum in April 2020 (0.5%), the CBC implemented other measures to meet the liquidity needs of firms most affected by the pandemic. One such measure was the Credit Facility Conditional on Increased Loans (FCIL), which gave banks access to CBC credit lines under favourable conditions (CBC (2020b)).

Since sharp declines in firms' sales were expected, especially for small and medium-sized firms, the FCIL's design directly considered this heterogeneity to ensure that the monetary stimulus was transmitted as intended. The initial unconditional credit line was set at 3% of the total commercial and consumer loan portfolio. An additional line, proportional to this base, depended on the increase in lending and on the share of resources allocated to smaller firms.[5] This additional line could be several times larger than the base line. The FCIL had three phases, amounting to loans totalling US$ 40 billion. Along with other support measures, this allowed financial institutions to grant more than US$ 20 billion in commercial loans (CBC (2023b)).

Again, the availability and frequency of firm-level data was crucial for designing the first stage of the FCIL and for monitoring the loans. Initially, estimates were made of how much additional bank credit would be needed to cover projected operational deficits. Surveys were also helpful in identifying firms' financing needs. Having access to these microeconomic data sources increased the precision and effectiveness of the policy's design, making it more likely to achieve its objectives.

[5] With annual sales of less than US$ 3.4 million.

3. Household heterogeneity

On the side of household heterogeneity, we have advanced in several dimensions that we will address in more detail below. First, we describe the available data and the possibilities raised by new sources that will be open to us soon. Second, we mention a selection of analyses we have conducted recently that consider heterogeneity at the centre of our policy work, including events during Covid-19. Finally, we briefly describe the heterogeneous agent New Keynesian (HANK) models we are developing, the DSGE model we use for forecasting, and how we extended the latter to account for features present in models with household heterogeneity.

3.1 Data

We use high-quality administrative databases. These databases allow us to evaluate the impact of aggregate phenomena on households in a much more granular way. The following is a list and description of a selection of databases.

We have access to administrative records on employer-employee databases, which we access from the tax authority and the pension regulator. These databases contain the formal employment history of the universe of employees in Chile. We also have access to demographic features of workers like education, age, gender and more. We can use these data to evaluate the role of firms in shaping employment and earnings fluctuations since we also have information on firm features. Moreover, these databases have monthly frequency, which is a rare feature. Monthly data allow us to study several relevant questions about the effects of business cycles and to track the economy at a higher frequency than before. Monthly frequency allows us to study the effects of different types of shocks more precisely too.

We also have data on credit and debit card transactions. These data are available at the transaction level daily and include the sector and location in which the transaction was made. They allow us to study high-frequency consumption by different types of goods purchased. However, these data do not include information on the individual who made the purchase. We can still learn about consumption heterogeneity by using location. We can study consumption at the municipal level. In Chile, municipalities are the smaller administrative units and, according to our analysis, broadly represent the income of their inhabitants well. One of the examples below (from a box in a Monetary Policy Report) uses these data to help us calibrate the effects of aggregate fluctuations on consumption in a more granular way.

3.2 Selected analysis

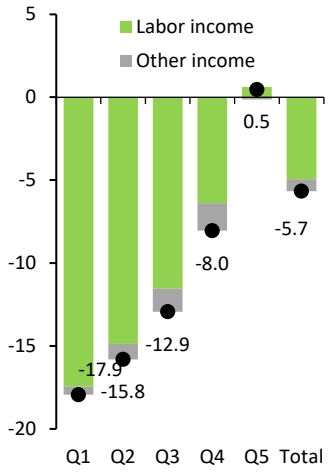
3.2.1 Income and consumption during 2020

In the December 2020 *Monetary Policy Report*, we analysed the fall in household income and the effect of support policies during Covid-19 (Barrero et al (2020)). In addition, we analysed households' marginal and average propensities to consume by quintile of income. This analysis was crucial to studying the macroeconomic impact of fiscal support given to households through its effects on consumption and savings.

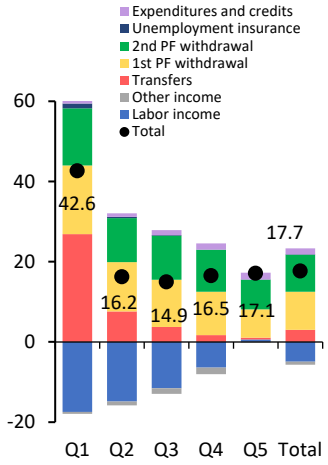
The first part of the analysis was focused on income. We showed that for two quarters (the second and third) of 2020, income fell by more than 10%, totalling a decrease of 5.7% in the year. This fall of 5.7% was highly heterogeneous, with the drop decreasing for higher incomes. We found that the fall in income of the first quintile (poorest) was 17.9%, that of the second quintile was 15.8%, and the income of the fifth quintile increased by 0.5% (see Figure 3.A).

Income changes, income support and propensity to consume by quintile in 2020 Figure 3

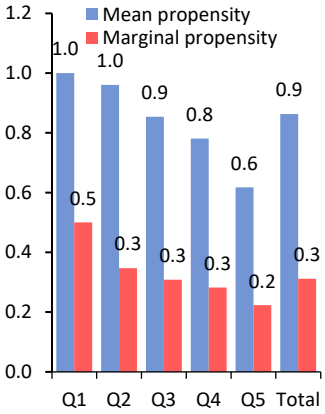
A. Income change (annual change, percent)



B. Income support (annual change, percent)



C. Mean and marginal propensities to consume (percentage of the available resources)



Source: Barrero et al (2020).

Like many countries, Chile approved several policies to aid individuals who were not allowed to work, and who, as the previous figure shows, had suffered a significant drop in income. Several measures were taken, but two stood out and were part of the analysis of the box: fiscal transfers and pension fund withdrawals. The former were stimulus cheques to households that were highly targeted but small at the beginning of the pandemic. The latter was part of a Congress initiative to allow workers to withdraw 10% of their pension fund. Figure 3.B shows a snapshot of the different kinds of help given to households of different quintiles. The lowest quintiles received fiscal transfers and withdrawals, while the highest received mainly withdrawals. In Figure 3.B, we can also see the significant increase in income for all quintiles in 2020. The increase was heterogeneous, with the lowest quintile having the largest rise (of 42.6%) despite the significant fall in labour income. On average, income increased by 17.7%.

An important question at this point is whether this significant rise in income, when most retail outlets and firms were closed, would generate a significant rise in inflation beyond supply pressures from lockdowns and foreign shocks like global value chain disruptions, which had started to develop at that time. To answer this question, the box provided additional evidence on the marginal and average propensities to consume. In this case, since the rise in income was tilted to the bottom

of the income distribution, it was crucial to estimate how much the different groups would spend out of that income.

Barrero et al (2020) describe these estimates. As explained above, we estimated the average propensity to consume (APC) and the marginal propensity to consume (MPC). The APC is the typical household consumption pattern corresponding to the average consumption share to income. The MPC is the rise in consumption after an increase of one unit of income or the consumption response to an income shock. The idea is to challenge the theory of permanent income which concludes that workers spend the annuity of their lifetime income in present value every period, and hence the MPC is very low. This is a consequence of having complete markets available for all households. We think – and know – that a large proportion of households in Chile do not have access to the financial market, so it is reasonable to think that households have a large MPC. We estimated the MPC to have an idea of the impact the different types of fiscal help had on the economy, and we did this by quintile of the income distribution to account for the previous fact that the changes in income (and help) were highly heterogeneous. Therefore, the consumption response to the extra income from household support is the average change in income weighted by the marginal (or average) propensity to consume.

To estimate these APC and MPC figures, we used the Family Budget Survey ("Encuesta de Presupuestos Familiares") carried out by the National Statistical Agency to define bundles in the consumer price index. This survey contains information on income, consumption of different goods and assets, and demographic characteristics. It gives a good snapshot of households' consumption and income patterns at a given time. The drawback of the survey is that it is carried out every five years, so it is impossible to conduct a time-varying analysis. With this survey, the APC is estimated using the average ratio of consumption to income. The MPC is identified using pseudo panels looking at the change in consumption after increases in income between the surveys in 2017, 2012 and 2007 for groups of workers who share the same characteristics and are from the same quintile.

Figure 3.C shows our estimated values for the APC and MPC. The APC is high in our sample, with values close to 1 from quintile 1 to quintile 3, while it is down to 0.6 for the fifth quintile. On the other hand, a more suitable estimate is the MPC, which we find is close to 0.3 on average. The MPC is high in the bottom quintile (0.5). It is somewhat lower in quintiles 2 to 4 (0.3) and, as expected, the lowest in quintile 5 (0.2). Naturally, we find a decreasing pattern of MPCs along the income distribution, which is a fact that is present in many studies in other economies (see Japelli and Pistaferri (2020)).

Finally, the box takes a stance on the expected increase in consumption due to the high support provided to households, with an estimated 2–4% of GDP of consumption in excess during 2020–21 due to household assistance. Notice that these estimates were given in late 2020, when we had significant uncertainty and did not have clarity on the policies that would be implemented next. The effects of these policies on inflation at that point were not analyzed. After this time (by 2021), several additional household assistance measures (that doubled the size and were untargeted with respect to previous policies) were taken. Afterwards, these policies most likely generated a significant rise in inflation. We will refer to this in the next section when we introduce models with heterogeneity to analyse this question and complement this with the measures taken in 2021.

3.2.2 Labour market heterogeneity and the recovery of employment

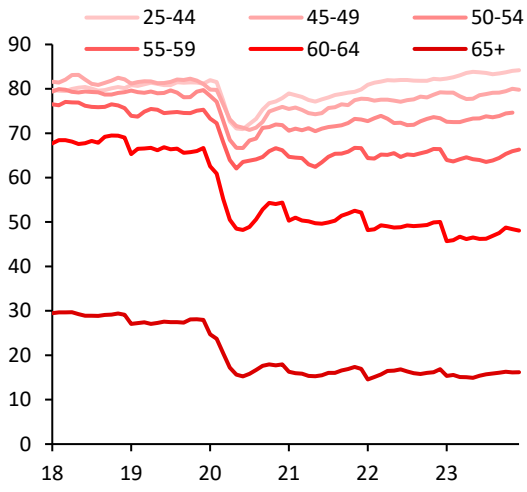
A second box we want to highlight was published recently in the *Monetary Policy Report* of March 2024 (Bauducco et al (2024)). We were very concerned about the slow recovery of employment after Covid-19, and one way to analyse this is by studying whether there were significant compositional effects on employment recovery. This box was about the labour market participation of older people. The question was why labour market participation did not recover in Chile as it did in comparable countries after Covid-19.

This box shows that the labour market participation of seniors (55 years or older) did not recover after Covid-19 and this mainly explains the slow recovery of labour market participation in Chile. Using data from the Employment Survey of the National Statistical Office (INE), we decompose labour market participation by age. We carried out the analysis from 2018 to 2024, and the main result is presented in Figure 4. Naturally, we find that labour market participation falls with age. Today, people aged 25–44 have the most significant participation rate of about 84%, while labour market participation of people aged 60–64 is about 48%.

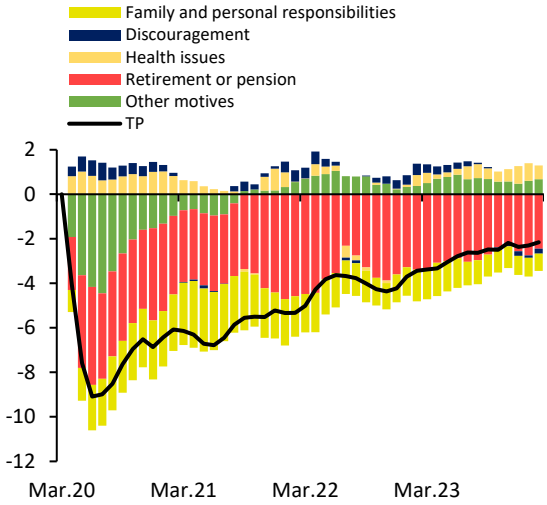
The most striking result of Figure 4.A is not that, but rather the evolution of participation rates by age. While participation rates among people at prime age (25–55) recovered almost wholly , the rate for people aged 55+ remained persistently low after the pandemic. The participation rate of workers aged 55–59 dropped by 10 points and remained at those levels until early 2024. The participation rate for individuals aged 60–64 fell dramatically by about 20 points and remained at those levels thereafter.

Labour participation and recovery of employment — Figure 4

A. Labour force participation by age in 2020 (percent)



B. Change in participation rate of individuals aged 55+ due to inactivity (1) (2) (difference w.r.t. March 2020, percentage points)



Note: (1) Internally deseasonalized levels using X13-ARIMA-SEATS. (2) Since the participation rate is equal to 1-(inactivity/working-age population), the participation rate can be decomposed into the different motives for inactivity. Source: own calculations based on data from the National Employment Survey (ENE) and Chile's Internal Revenue Service (SII). Source: Bauducco et al (2024).

All these results suggest that there was a structural change in labour markets around – or shortly after – Covid-19. To explore this, we analysed the reason why people aged 55+ remained inactive, as shown in Figure 4.B. This shows that the main reason people stayed out of the labour market was due to retirement.

This box suggests that to understand the dynamics and state of the labour market it is crucial to analyse the composition of the labour force and the reason why workers transition between different states. In this case, the age composition proved to be important in explaining the persistent decline in aggregate labour market participation rates, with a major reason being retirement, which implies this situation will be much longer-lasting than expected.

3.2.3 Consumption by quintile and class of goods

In the June 2023 *Monetary Policy Report*, we included a box in which we studied the heterogeneity in household consumption (García et al (2023b)). At that time, there was a concern about how aggregate demand was going to recover. As previous analysis shows, an important feature of the Covid-19 period and the aid provided was that they were highly heterogeneous, so in June 2023, with the economy converging to more normal levels in terms of the output gap and consumption, it was important to study this question.

The box analyses two dimensions of consumption: the income quintile of consumers and the class of goods. We used data from credit and debit card transactions and split them into quintiles and between goods and services. First, we show that the evolution of quintile consumption is highly heterogeneous. The evolution of the first and fifth quintiles went in opposite directions during 2020: the first quintile showed a significant increase, while the fifth quintile had a significant decrease. We posit that this is due to the heterogeneous MPCs of different households in combination with the type of goods the different households consume.

A recent working paper (García et al (2023a)) highlights that consumption bundles are heterogeneous and depend on income level. We show that consumption shares in services are increasing with income while food is decreasing, and they also fluctuate with income accordingly. This fact, in principle, explains why the consumption of the fifth quintile households fell by so much: we did not allow them to go to their favourite restaurants! Because of that, they cut consumption substantially. The case of the bottom quintiles is different; they received significant amounts of help that they spent on durables and food, which explains the relatively lower fall in goods we show.

This analysis helps us understand the impact of macro fluctuations on different types of households, allowing us to calibrate our macroeconomic policies more precisely.

Evolution of private consumption

Figure 5

A. By quintile (log deviation with respect to growth)

B. By sectors (lof deviation with respect to growth)

C. Changes in shares in consumer basket (percentage points)

Note: Panels (a) and (b) show the evolution of the (log)level of the respective consumption discounted from the average growth between 2015 and September 2019. Quintile decomposition considers only face-to-face purchases. Panel (c) shows change in share in the consumer basket of the goods and services sectors, in percentage points.

Source: García et al (2023b).

3.3 Modelling

Next, we will briefly refer to the models we are starting to use at the central bank that take into consideration household heterogeneity and the heterogeneous responses of income and consumption to different shocks. We start with a brief description of the HANK models we are developing and then describe the heterogeneity we include in the large-scale DSGE model we use and how we augment it to account for the main features HANK models have.

3.3.1 HANK models for Chile

Emerging economies have high inequality; their business cycles are significantly volatile. Because of that, their households are subject to significant income risk (through both real wage fluctuations and unemployment) and have low access to financial markets. An important question to answer when planning policy measures is that of the share of constrained households. To be able to analyse the channel through which monetary and fiscal policy operates, it is essential to get the shares of "Hand-to-Mouth" people correct.

To do so, García et al (2024) use the Encuesta Financiera de Hogares (the Chilean version of the Survey of Consumer Finances) to measure the share of households constrained in Chile – named as "Hand-to-Mouth" households (HtM). The authors identify rich HtM households as those who own illiquid assets but close to zero liquid assets (think about house owners with low income and credit card debt) and poor HtM households as those with no liquid or illiquid assets (following Kaplan et al

(2014)). They found that the percentage of HtM is stable at around 39–44%, whereas the poor and rich HtM are distributed around 10% and 32%.

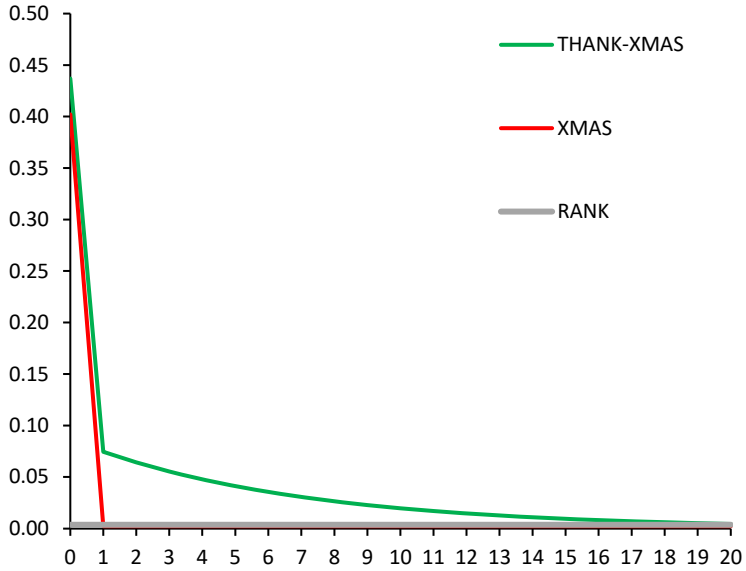
With these statistics, we could calibrate comparable models to study the differences produced in their transmission channels for monetary and fiscal policies. The authors built three HANK models. The first, considered the simplest, was a one-asset and sticky wages model (SW-OA from here on). The second model changed the sticky wages friction and added a simple search and matching mechanism (SAM-OA). Finally, we went back to the sticky wages simplification and added a second and illiquid asset (SW-TA).

The work proposes a transmission of a three-way channel decomposition. There is a direct effect, given by the partial equilibrium effect, through which the shock impacts consumption directly. The second component, named the average channel, corresponds to the average response of consumption to movements of the endogenous variables, representing the average general equilibrium component. Lastly, there is the cross-sectional channel, which involves all the evolution due to distributional/heterogeneous effects of the shock. The main findings can be summarised as follows: In SAM-OA, the transmission operates through average and direct effects, while in SW-OA, it is through cross-sectional effects. Assets also matter; the transmission in the SW-TA model has more substantial direct and average effects than SW-OA.

These models are useful because they give a more realistic response of consumption to fiscal transfers and rises in income. All models generate what Auclert et al (2024) call intertemporal MPC (iMPC), which corresponds to the intertemporal response of consumption to a one-time income shock. Auclert et al (2024) show that in HANK models, the iMPCs are persistent, and more persistent than in two-agent models (as in Galí et al (2007)), showing that this is a better match for the empirical findings in Fagereng et al (2021), who estimate the intertemporal response of consumption to winning the lottery in Norway. As Figure 6 shows, all models have iMPCs: the representative agent model (RANK) has a very low iMPC equal to the interest rate; the TANK model has a high MPC over the period of the shock and then goes on to be close to the interest rate; and the only model that gives a persistent response of consumption is HANK. In the next section we describe how we generate this in the large-scale model of the CBC.

In Garcia et al (2024), staff members published a study that followed the previous analysis. In this paper, they study the role of progressivity in shaping macroeconomic responses. The analysis had two parts. First, they studied the response of consumption to different types of policies classified as progressive and non-progressive. This distinction was crucial during Covid-19, since the most significant measures differed in that dimension. While fiscal transfers were highly targeted, pension fund withdrawals were mainly given to workers at the top of the income distribution, those who could save more before Covid-19. This paper follows up the analysis of these policies because by mid-2021, there was a third pension fund withdrawal, and fiscal transfers, starting in June 2021, were massive in amount and scope.

iMPCs under different model's assumptions (by quarters) Figure 6



Source: García et al (2024).

In this analysis, we show with micro data that consumption responses to progressive and non-progressive policies differ substantially. We found that municipalities that received more fiscal transfers consumed significantly more than municipalities with less help. We found that non-progressive transfers also positively affect consumption but are milder. This means that targeted transfers have stronger effects on consumption than non-targeted ones. In the paper, we also conduct a more quantitative assessment using a HANK model with labour market frictions. More targeted transfers can have a stronger effect on consumption, and not only is the iMPC the relevant channel, but the role of higher employment in boosting demand and better future perspectives. All these results also depend on policies: loose monetary policy is needed to complement the expansionary effects of transfers, and we need fiscal policy to be financed with debt. The last point is relevant because the Ricardian equivalence does not hold in these models. However, in the future these policies could become inflationary.

3.3.2 Augmented large-scale DSGE (XMAS)

The CBC has a large-scale New Keynesian model which we use as one of our forecasting tools. The model has a simple structure in terms of households, but it assumes there are two types of consumers in the spirit of the Gali et al (2007) and Bilbiie (2008) two-agent New Keynesian model (TANK). A fraction of households have perfect access to financial markets and behave like Ricardian households (R). Thus, they follow a Euler equation. The remainder fraction is out of the financial market and cannot borrow or save; we refer to these households as Non-Ricardian (NR).

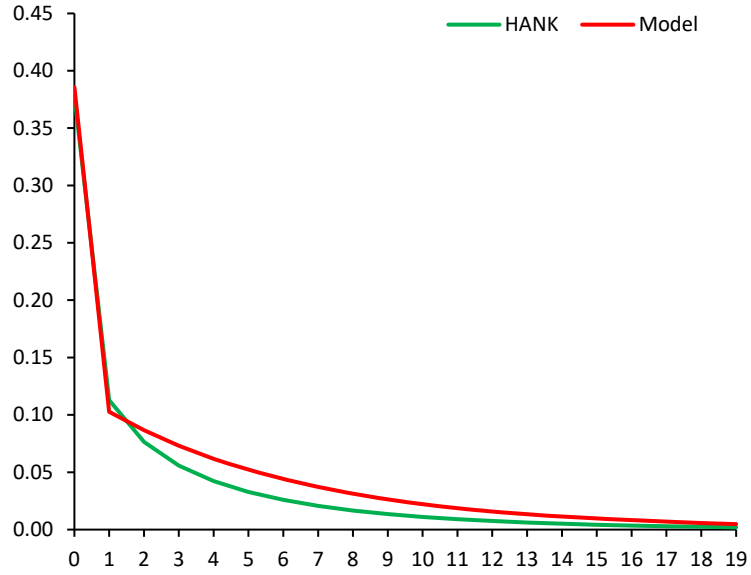
Thus, we assume heterogeneity in the model, with a fraction of "HtM" consumers. This generates a role of disposable income (from labour, fiscal transfers and others) in consumption fluctuations. XMAS delivers high MPCs out of contemporaneous

income fluctuations and then allows us to estimate the effects of transfers to households and introduce these effects to the macroeconomic scenario.

Having a share of HtM consumers delivers a high MPC, which is close to the share of HtM. This number is 0.5 in the original XMAS model. However high the number, the assumption of having a two-agent model is somewhat restrictive since all the effects are contemporaneous in TANK, as we explained above.

To augment the XMAS model with a more realistic response of consumption to income shocks that persist over more periods, we follow Bilbiie et al (2024), who introduce a probability of transitioning between Ricardian and Non-Ricardian states. This element delivers a more persistent response of consumption to a one-time increase in income, with the effects more front-loaded than in TANK, which is only present in the period of the income increase. In a forthcoming working paper, we include this assumption in XMAS and by adjusting the transition probabilities, we match the iMPCs we have for our HANK model (see Figure 7). We show that this assumption allows for the improvement of the model's forecasting ability, enhancing its performance in forecasting consumption, non-mining GDP and core inflation. This model also improves the understanding of fluctuations during Covid-19, giving more prominence to fiscal transfer shocks to explain consumption fluctuations during this period than a model without this feature.

iMPCs in adjusted XMAS and in HANK (by quarters) Figure 7



4. Concluding remarks and policy implications

The rise of the inclusion of heterogeneity in macroeconomic analyses and models has been beneficial primarily in improving the understanding of monetary policy transmission mechanisms. The rich microdata available in the CBC has allowed us to

analyse various heterogeneities of firms and households, which was considered in adjusting monetary policy response during the Covid-19 pandemic.

There are important considerations regarding the implications of models with heterogeneity for monetary policy. These models make the distributional effects of monetary policy explicit. As Violante (2022) argues, several channels of heterogeneity are important in analyzing the transmission of monetary policy, namely wealth levels, portfolio distribution, income, and income risk. Inflation also plays a key role in determining aggregate demand through real income, which, in these models, is a key driver of aggregates. Inflation has distributional effects through real wages if households at the bottom of the distribution rely on labor income more than households at the top, but also in their spending patterns. This generates a trade-off between employment and inflation stabilization at the household level that these models help to understand. Firm heterogeneity also has implications for monetary policy transmission. Ottonello and Winberry (2020) show that firm investment responds to monetary policy depending on leverage and asset holdings. This note explored some of these facts for Chile, noting that the CBC takes these dimensions seriously.

These findings imply that heterogeneity may be an important dimension for the design of policies. For example, the trade-off between inflation and employment stabilization has more implications in models with heterogeneity than in models with a representative agent. When considering heterogeneity, authorities must take into account that inflation may affect different households differently (through heterogeneity in bundles and differential wage adjustment processes) along with unemployment having a different incidence on different groups of households. These facts may have significant aggregate effects due to MPCs which are most likely high for poor households. Thus, as Sargent (2024) mentions, the dichotomy between stabilization and redistribution disappears, possibly changing optimal monetary policy and the relationship between monetary policy and other policies.

Policy coordination becomes crucial in this environment, and with fiscal policy in particular. Violante (2022) points out that fiscal policy has some advantages in resolving unwanted distributional effects, since it has many instruments. However, making redistribution the exclusive responsibility of this policy can be limited, as it acts with a delay and depends largely on political negotiations. Even if the central bank has a unique mandate, as heterogeneity plays an important role in the distribution of resources in the economy, the monetary authority should monitor and understand distributional effects and the feedback with its policy decisions. Finally, central banks can also implement targeted policies in exceptional circumstances like the ones described in this note.

References

Aguirre, Á, R Aldunate, A Arias, J Azócar, M Canales, D Coble, G Contreras, A Fernández, J Fornero, I Gallardo, B García, C Gómez, J Guerra-Salas, D Guzmán, F Huneeus, B López- Martín, M Solorza and M Taboada (2021): "Estimation of structural parameters for the Chilean economy", minutes cited in *Monetary Policy Report*, March, Central Bank of Chile.

Aguirre, Á, L Bertinatto, M Bouteille, I Díaz, F Guzmán and C Levenier (2024): "Inflation of goods and services and sectoral gaps", minutes cited in *Monetary Policy Report*, March, Central Bank of Chile.

Alves, F and G Violante (2024): "From micro to macro hysteresis: long-run effects of monetary policy", Working Paper, Princeton University.

Aruoba, B, A Fernandez, B Lopez-Martin, W Lu and F Saffie (2022): "Monetary policy and firm dynamics: the financial channel", working paper.

Auclert, A (2019): "Monetary policy and the redistribution channel", *American Economic Review*, vol 109, no 6, pp 2333-2367.

Auclert, A, M Rognlie and L Straub (2024): "The intertemporal Keynesian cross", *Journal of Political Economy*, vol 132, no 12, December, pp 4068–121.

Barrero, A, M Kirchner, C Pérez and A Sansone (2020): "Estimación del impacto del Covid-19 en los ingresos de hogares, medidas de apoyo y efectos en el consume", minutes cited in *Monetary Policy Report*, December, Central Bank of Chile.

Bauducco, S, A Castillo and M Tapia (2024): "Participación laboral de personas mayores en el período post-covid", minutes cited in *Monetary Policy Report*, March, Central Bank of Chile.

Bauducco, S, A Fernandez and G Violante (eds, 2024): "Heterogeneity in macroeconomics: implications for monetary policy", *Series on Central Banking Analysis and Economic Policies*, no 30, Central Bank of Chile.

Bilbiie, F (2008): "Limited asset markets participation, monetary policy and (inverted) aggregate demand logic", *Journal of Economic Theory*, vol 140, no 1, May, pp 162–96.

——— (2024): "Monetary policy and heterogeneity: an analytical framework", *The Review of Economic Studies*, https://doi.org/10.1093/restud/rdae066.

Bilbiie, F, T Monacelli and R Perotti (2024): "Stabilization vs. redistribution: the optimal monetary–fiscal mix", *Journal of Monetary Economics*, vol 147, Supplement, October.

Bilbiie, F, G Primiceri and A Tambalotti (2023): "Inequality and business cycles", *NBER Working Papers*, no 31729, September.

Central Bank of Chile (2012): "Implications of the mining sector boom", in *Monetary Policy Report*, June, Box III.1.

——— (2018a): "Mining productivity in Chile", in *Monetary Policy Report*, March, Box III.1.

——— (2018b): "Mining investment" in *Monetary Policy Report*, December, Box III.2.

——— (2020a): *Use of macroeconomic models at the Central Bank of Chile*.

——— (2020b): "Measures by the Central Bank of Chile to combat COVID-19", in *Monetary Policy Report*, March, Box II.1.

——— (2023a): "Credit conditions for firms: evolution and heterogeneity", in *Monetary Policy Report*, September, Box I.3.

——— (2023b): *Chilean companies during the COVID-19 crisis,* March.

Fagereng, A, M Holm and G Natvik (2021): "MPC heterogeneity and household balance sheets", *American Economic Journal: Macroeconomics*, vol 13, no 4, pp 1–54.

Galí, J, D López-Salido and J Vallés (2007): "Understanding the effects of government spending on consumption", *Journal of the European Economic Association*, vol 5, no 1, pp 227–70.

García, M and J García-Cicco (2020): "A TNT DSGE model for Chile: explaining the ERPT", *Working Papers*, no 868, Central Bank of Chile.

García, B, M Giarda, C Lizama and I Rojas (2024): "Transmission mechanisms in HANK: an application to Chile", *Latin American Journal of Central Banking*, vol 5, no 3, September.

García, B, M Giarda, C Lizama and D Romero (2023a): "Time-varying expenditure shares and macroeconomic dynamics", *Working Papers*, no 1000, Central Bank of Chile.

García, B, M Giarda and I Rojas (2023b): "Evolución reciente del consumo privado", minutes cited in *Monetary Policy Report*, June, Central Bank of Chile.

Giarda, M, W Lu and A Martner (2024): "Monthly heterogeneous markup cyclicality and inflation dynamics", working paper.

González, G, D Kohn and J Rishmawi (2024): "Heterogeneous effects of exchange rate pass-through on prices in Chile: an empirical analysis with microdata", minutes cited in *Monetary Policy Report*, March, Central Bank of Chile.

Jappelli, T and L Pistaferri (2020): "Reported MPC and unobserved heterogeneity", *American Economic Journal: Economic Policy*, vol 12, no 4, pp 275–97.

Kaplan, G, G Violante and J Weidner (2014): "The wealthy hand-to-mouth", *Brookings Papers on Economic Activity 2014*, vol 1, pp 77–138.

Ottonello, P, and T Winberry (2020): "Financial heterogeneity and the investment channel of monetary policy", Econometrica, vol 88, no 6, pp 2473 – 2502.

Sargent, T. (2024): "HAOK and HANK models", in Bauducco, S, A Fernández and G.L Violante, editors, "Heterogeneity in Macroeconomics: implications for monetary policy", *Series on Central Banking Analysis and Economic Policies*, no 30, Central Bank of Chile.

Violante, G (2022): "What have we learned from HANK models, thus far?" In *Beyond the Pandemic: the Future of Monetary Policy*. ECB Forum on Central Banking 2021, European Central Bank, Frankfurt, Germany.

Vivanco, D, L Bertinatto, M Bouteille, I Díaz, F Guzmán and C Levenier (2024): "Inflation of goods and services and sectoral gaps", minutes cited in *Monetary Policy Report*, March, Central Bank of Chile.

Addressing heterogeneity via structural monetary policy: China's practices

People's Bank of China

Central banks have been increasingly attentive to how heterogeneity across economic entities impacts monetary policy. On the household side, the changes in a broad range of indicators, such as an ageing population, declining fertility, population mobility, income and wealth, and employment, all affect monetary policy transmission. On the business side, heterogeneity in firm sizes, industries and regions poses challenges for the effectiveness of monetary policy.

China is a vast and culturally diverse country with a huge population, and its economy is at the critical stage of high-quality development and transition. The growing prominence and continuous evolvement of heterogeneity across households and firms may affect its monetary policy transmission and trigger market distortions and resource mismatches. To address this, the People's Bank of China (PBOC) has innovatively launched a series of monetary policy tools to adjust and optimise economic structure (structural monetary policy).[1] By smoothing the monetary policy transmission mechanism and giving full play to the role of structural monetary policies in providing liquidity in a targeted manner, the PBOC aims to channel liquidity to the important yet weak links in the national economy, and fosters a favourable monetary and financial environment, which enriches the global monetary policy framework with China's theoretical and empirical experiences in addressing the challenges of heterogeneity.

1. The evolving features of heterogeneity for Chinese households and firms

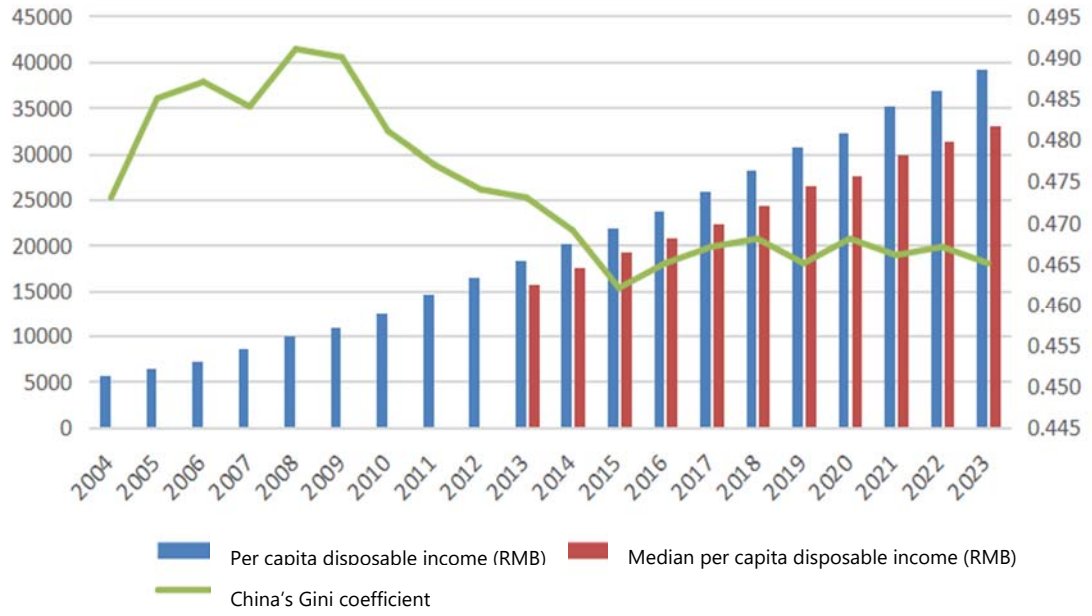
1.1 Growing prominence of household heterogeneity

First, population ageing is accelerating while fertility intentions are declining. As of end-2023, China is a deeply ageing society, with 15.4% of its population aged 65 years or above. Meanwhile, declining fertility has become even more pronounced. In 2023, China's birth rate registered 6.39‰, with a natural growth rate of –1.48‰.

[1] The PBOC defines "structural monetary policy" as "monetary policy that channels fund flows to specific areas of the economy based on market-oriented resource allocation through an appropriate incentive mechanism". Structural monetary policy not only adjusts economic structure, but is accompanied by a carefully designed incentive-compatible mechanism to link the incentive funds of the PBOC with targeted credit support to specific areas by the financial institutions, thereby delivering targeted and direct support. In addition, structural monetary policy also impacts monetary aggregates through the injection of base money to maintain banking liquidity at a reasonable and adequate level and to support the steady growth of credit.

Second, household income continues to grow while the Gini coefficient is moving sideways. As of end-2020, China had reached its poverty alleviation target for the new era on schedule and eradicated absolute poverty. With respect to household disposable incomes,[2] both the average and median per capita disposable incomes have grown significantly, and incomes across the five groups have continued to grow. The income of the low-income group is growing at a faster pace, and the income ratio between the lowest and highest earners has picked up from 9.3:100 to 9.7:100. This narrowed gap is reflected in the coefficient's overall decline amid fluctuations as it first rose, then fell and then started to move sideways, lingering above the international warning line of 0.4.

Yearly per capita disposable income and Gini coefficient in China — Graph 1



Per capita disposable income of Chinese households — Table 1

Per capita disposable income (RMB)	Year 2023	Year-on-year growth in 2023	Year 2014	Year-on-year growth in 2014
Low	9,215	7.14%	4,747	7.84%
Lower-middle	20,442	5.90%	10,887	12.77%
Middle	32,195	5.22%	17,631	12.31%
Upper-middle	50,220	5.96%	26,937	10.57%
High	95,055	5.48%	50,968	7.40%

[2] Chinese households under survey are evenly classified into five income groups (each group accounts for 20%), based on the average disposable income per capita: low, lower-middle, middle, upper-middle and high income.

1.2 Firm heterogeneity in sizes, industries and regions

First, size heterogeneity is becoming strikingly apparent. Chinese firms are enormous in number, and vary greatly in size. On the one hand, large firms are growing steadily in size and number. In 2023, the total assets of Chinese companies on the Fortune Global 500 list reached RMB 399.77 trillion, and the number of companies whose revenues exceeded RMB 100 billion rose to 254, a net increase of 10. On the other hand, micro, small and medium-sized enterprises (MSMEs) remain an important support for employment growth and economic development. At end-2018, assets of MSMEs registered RMB 402.6 trillion. As of end-2022, the number of MSMEs in China exceeded 52 million, representing an increase of 23,800 on a daily basis.

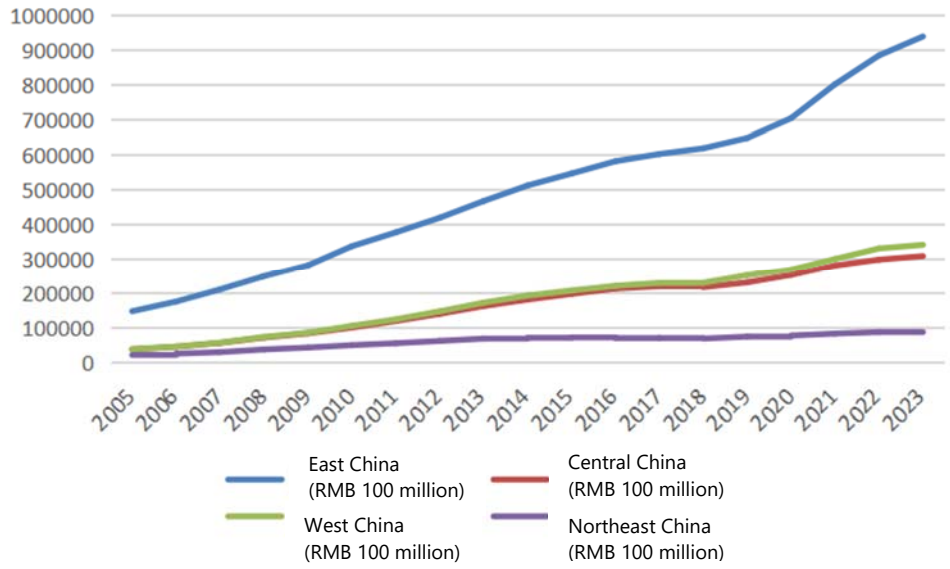
Second, industry heterogeneity is growing amid fluctuations over economic cycles. According to the United Nations' standards, China has the most complete industrial categories and the most comprehensive supporting system.[3] Against the ongoing innovation-driven development of China's key industries, the problem of unbalanced and inadequate development across industries is gradually arising. Especially in the context of increased fluctuations over economic cycles, the difference and divergence between asset-heavy industries such as the real estate and emerging tech industries have gained prominence, profoundly affecting the implementation and transmission of monetary policy.

Third, regional heterogeneity is evolving and gaining prominence. Over the past 40 years of reform and opening-up, the Chinese economy has developed significantly across different regions, with the coastal areas developing first and the interior picking up over time. Nevertheless, imbalance has emerged in productivity, market orientation, financial development and industrial structure, among others. Affected by supply chain clustering, transport cost and other factors, inter-region divergence among firms has become all the more striking. This has become one of the key considerations in the formulation and implementation of monetary policy.

[3] According to the *Industrial Classification for National Economic Activities GB/T 4754-2017*, China's industries basically cover all categories of the United Nations' *International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4.*

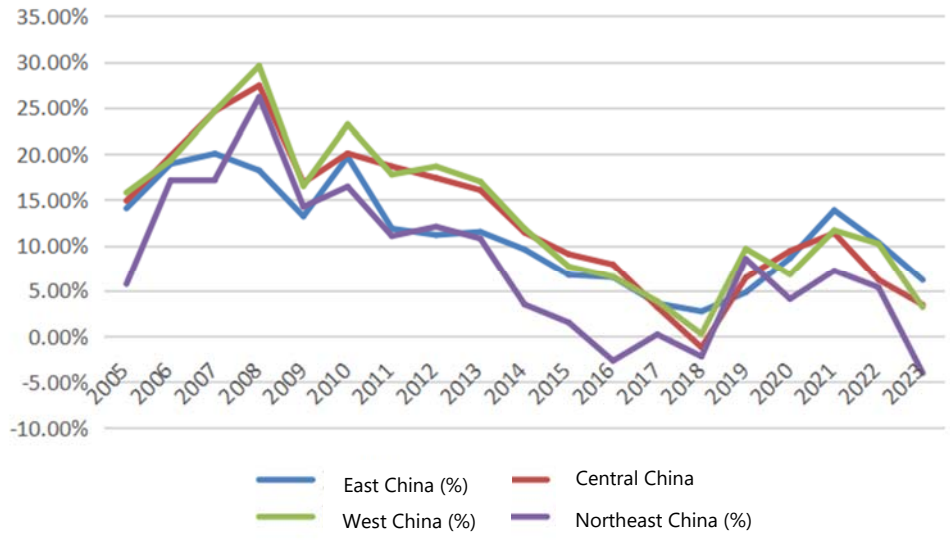
Regional breakdown of total assets of China's industrial firms above designated size

Graph 2



Regional breakdown of asset growth of China's industrial firms above designated size

Graph 3



2. Practices and achievements of China's structural monetary policy in addressing the challenges of heterogeneity

In the process of making monetary policy decisions, China has increasingly taken into account the implications of household and firm heterogeneity, explored relevant theories and practices, and established structural monetary policy tools tailored to the heterogeneous characteristics of important industries.

China's earliest structural monetary policy tools trace back to central bank lending,[4] which was established initially to support inclusive finance. Subsequently, the PBOC established structural monetary policy tools such as central bank discount (established in 1986 and taking on a structural role from 2008), central bank lending for the agricultural sector (1999), central bank lending for small businesses (2014) and pledged supplementary lending (2014), mobilising capital flows to key areas and weak links in the national economy such as agriculture, rural areas and farmers (the "three rural issues"), micro and small businesses (MSBs) and private firms.

Recent years have witnessed further innovations in China's structural monetary policy, with a richer toolkit of policies. **On the one hand**, the areas supported by policies have been expanded. Besides inclusive finance, they now also include fields related to new development concepts, such as green transformation, scientific and technological innovation, inclusive elderly care, etc. The Central Financial Work Conference in October 2023 emphasised the need to "make significant efforts in five key areas: scientific and technology finance, green finance, inclusive finance, elderly care finance, and digital finance". Currently, structural monetary policy has basically covered these areas. **On the other hand**, transaction methods have been innovated, with the PBOC optimising the credit structure through transactions with commercial banks. Agreements have been signed on top of central bank lending. After commercial banks fulfil the obligations stipulated in the agreements (for instance, an increase in outstanding inclusive MSB loans), the PBOC provides funding support to them.

As of end-Q3 2024, the PBOC had established 18 structural monetary policy tools with a balance of RMB 6.7 trillion, or 14.63% of its total assets, among them 10 current and eight expired tools, respectively. These tools have played targeted and direct roles in addressing the challenges of heterogeneity by mainly supporting inclusive finance, elderly care finance, green development, scientific and technological innovation, and the steady and healthy development of the real estate industry, thus achieving a basic coverage of the "five key areas".

First, structural monetary policy supports households in eradicating poverty. In 2016, the central bank lending facility for poverty alleviation started to provide low-cost funds for locally incorporated institutions in poverty-stricken areas, guiding them to scale up lending there. Since the launch of the battle against poverty,

[4] Central bank lending, ie loans issued by the PBOC to commercial banks, is a time-honoured and traditional tool that has been used for many years, tracing back to the central bank's inception. Initially serving as an aggregate tool and as the most important channel for the PBOC to inject and withdraw base money, central bank lending has shifted to play a structural role.

a total of RMB 668.8 billion of central bank loans have been issued under this lending facility, and RMB 45.8 billion of central bank loans have been issued under the special central bank lending facility for deeply poverty-stricken areas in the "Three Regions and Three Prefectures",[5] ensuring financial support for poverty alleviation. In 2020, China secured a comprehensive victory in this battle.

Second, structural monetary policy has proved effective in helping counter the impact of the Covid-19 pandemic. In view of the severe challenges posed by the pandemic, the PBOC launched a series of innovative new tools. In addition to cutting the reserve requirement ratio to keep the liquidity of financial institutions reasonably adequate, it introduced two monetary policy tools providing direct support for the real economy, ie the facility for deferred repayments on inclusive MSB loans and the support scheme for inclusive unsecured MSB loans. Moreover, the quotas were increased for the central bank discount facility and the central bank lending facilities for the agricultural sector and small businesses. The PBOC also launched new facilities, such as central bank lending for sci-tech innovation. Based on the characteristics of different bank types, it offered different guidance to banks for the issuance of loans at preferential interest rates, so that more support was extended to MSMEs in line with market-oriented principles and the rule of law to help them resume production. These measures worked out effectively and were highly appraised by market entities.

Third, structural monetary policy is helping foster an inclusive domestic elderly care market. The PBOC, together with the National Development and Reform Commission (NDRC), kicked off the pilot central bank lending programme for inclusive elderly care services in April 2022, with a view to encouraging financial institutions to offer preferential loans to elderly care service providers, helping foster inclusive elderly care models, and delivering a quick response to an ageing population. As of end-Q3 2024, central bank lending for inclusive elderly care outstanding was RMB 2.1 billion.

Fourth, structural monetary policy supports scientific and technological innovation and the development of the digital economy. In response to the strategy of building a "scientific and technological powerhouse" and to promote scientific and technological advances, the PBOC established a central bank lending facility for sci-tech innovations in April 2022, guiding financial institutions to ramp up credit support to tech firms. It established a central bank lending facility for equipment upgrading and renovation in September 2022, guiding financial institutions to grant loans to support equipment upgrading in manufacturing, social services and MSMEs and by self-employed individuals. Continuous efforts have been made to incentivise financial institutions to scale up credit support for science and technology. As of end-Q3 2023, the outstanding amount of the aforementioned facilities stood at RMB 86.5 billion (sci-tech innovations) and RMB 155.7 (equipment upgrading) respectively. A total of 262,100 technology-based small and medium-sized enterprises (SMEs) have received loan support nationwide, with the loan

[5] "Three Regions" refers to the Xizang Autonomous Region, the Zang nationality areas of Qinghai, Sichuan, Gansu and Yunnan provinces, as well as Hetian, Aksu, Kashi and Kizilsu Kyrgyz in the south of the Xinjiang Uygur Autonomous Region. "Three Prefectures" refers to Liangshan prefecture in Sichuan, Nujiang prefecture in Yunnan and Linxia prefecture in Gansu.

granting ratio rising by 0.1 percentage points year on year to 46.8% and outstanding loans increasing by 20.8% year on year to RMB 3.19 trillion.

Fifth, structural monetary policy is helpful in advancing the green transformation of economic and social development. To help achieve the goals of carbon peaking and carbon neutrality and the steady transformation of the energy structure, in November 2021 the PBOC launched the carbon emissions reduction facility (CERF) and the special central bank lending facility for clean and efficient coal use, which provided funding support equivalent to 60% and 100% of the principal of eligible loans for the respective areas. As of end-Q3 2024, the CERF posted an outstanding balance of RMB 535.1 billion, having incentivised the issuance of over RMB 1.2 trillion in carbon emissions reduction loans for the relevant key technological areas. The special central bank lending facility for clean and efficient coal use, which registered RMB 211.6 billion outstanding, had supported the issuance of RMB 262.4 billion of loans by financial institutions. With the support of structural tools, green loans have seen rapid growth. As of end-Q3 2024, China's green loans outstanding registered a year-on-year increase of 25.1% and stood at RMB 36.8 trillion, 66.8% of which were loans for projects that directly or indirectly reduce carbon emissions.

Sixth, structural monetary policy is supportive of the development of long-term mechanisms for the provision of inclusive financial services. As the PBOC's long-standing instruments for inclusive finance, the central bank lending facilities for the agricultural sector and small businesses and the central bank discount facility have supported the development of long-term mechanisms for the provision of inclusive financial services. In recent years, the PBOC has been stepping up the use of structural monetary policy to support agriculture, rural areas, farmers, MSBs and other areas of inclusive finance. Apart from expanding the quotas for the central bank discount facility and the central bank lending facilities for the agricultural sector and small businesses, it launched short-term instruments, such as the inclusive MSB lending facility and the facility for interest rate reductions on inclusive MSB loans. As of end-Q3 2024, the central bank lending facilities for the agricultural sector and small businesses and the central bank discount facility recorded a total outstanding balance of RMB 2.9 trillion; the pledged supplementary lending posted RMB 2.6 trillion outstanding; and the funds provided as incentives via the inclusive MSB lending facility reached RMB 67.4 billion, leading to a cumulative increase of RMB 4.5 trillion in inclusive MSB loans issued by locally incorporated financial institutions. Additionally, a total of RMB 26.9 billion was provided via the short-term facility for interest rate reductions on inclusive MSB loans. With the support of structural tools, inclusive financial services have witnessed higher volumes, wider coverage and lower costs. As of end-Q3 2024, China's inclusive MSB loans recorded a year-on-year increase of 14.5% and an outstanding amount of RMB 32.9 trillion, extending support to 62.03 million MSBs, up by 1.6% year on year. The interest rates on inclusive MSB loans issued across the country over the first three quarters of 2024 averaged 4.42%, down by 0.35 percentage points from 2023.

Seventh, structural monetary policy provides support for the sound development of the property market. Four relevant facilities have been put in place: the loan support scheme for timely deliveries of presold housing projects; the loan support scheme for rental housing, which aims to support the development of the rental housing market in pilot cities; the special central bank lending facility for easing the difficulties facing property developers through mergers and acquisitions of

relevant projects; and the facility for bond financing of private firms (Phase II), which supports bond financing of private firms in the property sector.

Eighth, structural monetary policy provides support for the stable development of the capital market. In collaboration with the China Securities Regulatory Commission, the PBOC has established the securities, funds and insurance companies swap facility (SFISF) and the central bank lending facility for share buybacks and shareholding increases, with the aim of motivating long-term capital inflows and supporting the stable development of the stock market. Designed to be totally market-oriented and based on successful international practices, these two facilities showcase the efforts of the PBOC to expand and explore the central bank mandate of maintaining financial stability.

3. Policy suggestions

In recent years, there have been many discussions internationally on how to use monetary policy to address heterogeneity. Below are some policy suggestions based on China's theoretical and empirical experiences in this field.

1. **In terms of function, structural monetary policy is complementary to conventional monetary policy.** The role of conventional monetary policy mainly lies in adjusting short-term aggregate demand. Based on national circumstances and multiple constraints, the PBOC has adhered to an accommodative monetary policy stance while winding down its focus on quantitative targets and taking into consideration aggregates, structure and prices in a coordinated manner. In coping with heterogeneity issues, structural monetary policy stands as a useful complement to aggregate monetary policy. Its main function is to channel funds reasonably to different entities that need to be supported and to help optimise the credit structure. Moreover, also having an effect on aggregates, structural monetary policy is instrumental in creating a favourable monetary environment.

2. **In terms of transmission, market-oriented resource allocation should play a decisive role.** Structural monetary policy tools mainly consist of central bank lending facilities, for which market-oriented operation is fundamental. By providing funds at preferential interest rates via its lending facilities, the central bank incentivises banks to readily allocate credit resources to targeted areas. In the process, banks select projects and issue loans according to their own professional judgment and bear the credit risks on their own, thus allocating financial resources effectively to the highly efficient sectors or firms. That means structural monetary policy tools don't subsidise firms directly in addressing heterogeneity, so as to avoid rent-seeking and achieve effective policy transmission.

3. **In terms of policy coordination, structural monetary policy should join forces with fiscal and industrial policies to achieve synergy.** In addressing heterogeneity issues in economic development, structural monetary policy is subject to the influence of various factors. To achieve better and quicker effects, work needs to be done to coordinate structural monetary policy, aggregate credit policy, and various reform measures such as those on market development

and financial reform. Once having delivered the intended effect, structural monetary policy should exit in a timely manner, as the establishment of long-term mechanisms supporting different firms and households should count on credit policy and reform measures. In particular, structural monetary policy should focus primarily on improving the credit structure. It should join forces with fiscal and industrial policies, whose support needs to be ramped up for different firms and households on the financing side, thereby promoting transformation and upgrading of the economic structure and advancing high-quality economic development.

Box 1

Using structural monetary policy tools to support pandemic relief efforts: China's practices and their effects

In coping with the crisis caused by the Covid-19 pandemic, monetary authorities of the major economies reached broad consensus on using structural monetary policy tools for targeted liquidity injections into the financial system and the real economy. In China, structural monetary policy tools have played a significant role in providing direct financial support for the real economy to bolster key fields and weak links in national economic development. They represent important monetary policy practices to address heterogeneity.

The establishment of an incentive-compatible mechanism brought into play the unique advantages of structural monetary policy tools in providing targeted support for the real economy. Following the outbreak of Covid-19, the PBOC launched a series of innovative structural monetary policy tools. In 2020, it rolled out policies on central bank lending for the agricultural sector and small businesses and on central bank discounts as well, with a total quota of RMB 1.8 trillion. It also launched two monetary policy tools that provided direct support for the real economy. In 2021, these two monetary policy tools were converted into other forms.[6] In 2022, apart from supportive measures for inclusive finance, the PBOC stepped up support, via central bank lending and discount facilities, for the industries hit hard by the pandemic, such as retail, wholesale, hospitality, catering, logistics, transport, culture and tourism.

Embedded in all of these structural monetary policy tools was an incentive-compatible mechanism, which had been thoughtfully designed so that the funds issued by the PBOC were linked directly and quantitatively with the targeted credit support provided by financial institutions. Such an internal drive enabled quick and effective implementation of these tools. As a result, fund flows were directed precisely to the weak links in economic development, and differentiated financial support was provided for the industries heavily affected by the pandemic. In this way, financial resources were channelled to the vital areas of the economy. In practice, structural monetary policy tools proved effective in increasing the volume of inclusive MSB loans, expanding their coverage, and reducing their costs. As of end-2022, China's inclusive MSB loans posted a year-on-year increase of 24% and an outstanding amount of RMB 24 trillion, which gave credit support to 56.52 million MSBs, up by 26.8% year on year. China's loans to enterprises recorded a weighted average interest rate of 4.17% for 2022, a low level historically, down by 34 basis points year on year.

At the same time, structural monetary policy tools were helpful in keeping liquidity in the banking system adequate at a reasonable level to support credit growth. With the orderly implementation of structural monetary policy tools, base money was injected continuously into the financial system. From the beginning of 2020 to end-Q1 2022, injections of base money via structural monetary policy tools totalled RMB 2.3 trillion, which was conducive to keeping liquidity in the banking system adequate at a reasonable level so as to support generally stable growth in credit. Structural monetary policy tools have duly played their role in "moving a thousand pounds with four ounces" and provided effective support for economic recovery.

[6] The facility for deferred repayments on inclusive MSB loans was converted into the inclusive MSB lending facility, with incentives provided in an amount equivalent to 1% of the increase in inclusive MSB loans outstanding. The support scheme for inclusive unsecured MSB loans was incorporated into the central bank lending facilities for the agricultural sector and small businesses.

Changes in the distribution of new loans by risk category throughout the post-pandemic credit cycle in Colombia

Camilo Gómez, Carlos Quicazán-Moreno and Hernando Vargas-Herrera[1]
Central Bank of Colombia

1. Introduction

In the aftermath of the pandemic, financial system loans grew significantly in real terms in Colombia, especially in the consumer loan segment. This was followed by a deceleration that started in late 2022, marking a pronounced credit cycle (Graph 1). Accordingly, banks' credit standards were loose after the pandemic, supporting loan supply, but were gradually tightened from the second quarter of 2022 (Graph 2). This note takes advantage of granular data on individual loans to examine how financial intermediaries changed the credit risk composition of their new loan portfolio throughout the cycle. This adds to the understanding of bank behaviour in these episodes and provides information on the dynamics of loan supply by risk category that may enrich the evaluation of domestic financial conditions.

Moreover, the expansion phase of the credit cycle coincided with the tightening phase of a monetary policy cycle aimed at reducing inflation (Graph 3). It has been noticed that average lending rates reacted more than one on one to policy interest rate (MPR) changes throughout the tightening and easing phases of the monetary policy response in the 2021–24 period (Graph 4).[2] Any assessment of this observation must acknowledge that average lending rate changes involve possible shifts in the composition of new loans by risk categories arising from the monetary policy changes themselves or from other factors affecting the loan market. Thus, rising average lending interest rates may reflect policy rate hikes or greater importance of riskier borrowers (paying higher interest rates) in new loans. Conversely, declining average lending interest rates may include the effects of policy rate cuts or the decreasing importance of riskier borrowers in new loans.[3] Hence, the second part of this note

[1] Economist in the Financial Stability Department, Director of the Financial Stability Department and Technical Deputy Governor of the Central Bank of Colombia, respectively. We are grateful to Deicy Cristiano, Eliana González, Juan Carlos Mendoza, Andrés Murcia, Gloria Sarmiento, Roberto Steiner, Leonardo Villar and Mauricio Villamizar for their helpful comments and suggestions. The opinions and ideas expressed in this document are our own and do not necessarily reflect those of the Central Bank of Colombia or its Board of Directors.

[2] In Graph 4, commercial loan interest rates are compared with the monetary policy rate (MPR) because around 60% of new loan disbursements are tied to it. By contrast, almost all new consumer loan disbursements correspond to fixed rate contracts. Hence, consumer loan interest rates are compared with the OIS rate with similar maturity.

[3] The transmission of monetary policy shifts to lending interest rates in Colombia has traditionally been evaluated using aggregate (average) rates on new loans, by loan term and loan category (eg

explores the influence that loan composition shifts had on the transmission of actual and expected monetary policy movements to average lending rates in the 2021–24 credit and monetary policy cycles in Colombia.

The analysis of loan distributions by "risk category" suggests that credit establishments[4] shifted their new loan portfolios towards riskier borrowers from the second quarter of 2022, especially in the consumer credit segment, and relapsed into safer portfolios in 2024. In addition, changes in loan composition by "risk category" affected the dynamics of average lending interest rates. Specifically, composition effects increased the observed transmission of actual and expected policy rates to average lending interest rates. This was particularly the case for consumer loan interest rates. The results presented in this document show the importance of examining the dynamics of the credit cycle and loan market conditions when assessing the transmission of monetary policy. This note is also illustrative of the usefulness of disaggregated data in macro and monetary policy analysis.

The rest of this document continues as follows. Section 2 presents the procedure followed to define "risk categories" and describes the credit risk-taking dynamics in the 2021–24 period. Based on the defined "risk categories", Section 3 presents a simple accounting framework to identify the effects of shifts in loan composition on the behaviour of average lending rates. Sections 4 and 5 discuss the results and conclude.

2. The distribution of new loans by risk categories

For risk-neutral banks, the spread between an individual loan interest rate and the MPR or the corresponding maturity OIS rate may reflect: (i) the riskiness of the borrower; (ii) the operational cost of the loan; (iii) overall bank liquidity constraints that affect all loans; and (iv) the market power of banks in the loan market (see Appendix 1). Hence, assuming that there are no significant changes in operational costs, liquidity constraints[5] or banks' market power[6], movements of the distribution

commercial, consumer, mortgages, etc). See, for example, Galindo and Steiner (2022), Cristiano-Botia et al (2017), Chavarro-Sánchez et al (2015), Gomez-Gonzalez et al (2016), Holmes et al (2015), González et al (2010) and Vargas-Herrera et al (2010). The coincidence of different phases in the loan market and monetary policy cycles can also affect the assessment of the bank lending channel of monetary policy. See, for instance, Apergis and Christou (2015).

[4] Credit establishments in Colombia include all credit institutions, comprising commercial banks, investment banks, financial cooperatives and financing companies.

[5] There were important changes in the liquidity of several banks in the period considered, mostly related to the application of Net Stable Funding Ratio (NSFR) regulation and the concentration of maturities of certificates of deposit. However, as discussed below, the results of the exercise presented here are still suggestive of significant shifts in the distribution of loans across risk categories.

[6] Large changes in banks' market power are unlikely to have occurred between 2021 and 2024. Panzar and Rosse's (1987) indicator shows no statistically significant variations in the degree of competition for Colombian credit establishments in that period (see *Informe especial de concentración y competencia en los mercados de crédito y depósitos de septiembre de 2024*). However, as shown in Appendix 1, even when market power remains unchanged, lending interest rate spreads may move

of individual loans across spreads are indicative of shifts of bank loan portfolios across risk categories.[7] This idea is used to explore those shifts using granular data.

Individual borrower information on loan amounts and interest rates is available in a quarterly annex reported by credit establishments to the Financial Superintendence of Colombia. Based on this annex, it is possible to identify granular data on new commercial and consumer loans.[8] The average lending interest rates calculated from these data are close to the aggregate lending rates (comprising all new loans) reported weekly by banks to the Financial Superintendence (Graph 5). This suggests that the results obtained from the analysis of the granular sample could be representative of the Colombian financial system as a whole.[9]

With the individual loan interest rate data, the following procedure was applied to define "risk categories" in the Q1 2021–Q2 2024 credit cycle:

(i) A spread, $s^m_{j,k,t} \equiv i^m_{j,t} - ipol^m_t$, was computed for new loan j of type k in quarter t with maturity m. In this expression, k refers to commercial or consumer loans.[10]
Also, $m = \text{six months}, 12 \text{ months}, 18 \text{ months}, \text{two years}, \text{five years}$ for commercial loans, whereas $m = \text{one year}, \text{two years}, \text{four years}, \text{five years}$ for consumer loans.[11] $i^m_{j,t}$ is the individual new loan interest rate. $ipol^m_t$ corresponds to the MPR in the case of commercial loan interest rates and

with the policy rate without any variation in banks' risk appetite. Nevertheless, as discussed below, the behaviour of loan quantities and other indicators suggest the relevance of shifts in risk appetite as a determinant of banks' loan portfolios.

7 With risk-averse lenders, shifts in the spreads between lending interest rates and policy rates may also reflect changing degrees of risk aversion through time. For example, a reduction in risk aversion would probably cut spreads. Interestingly, this implies that the spread on a given loan would be similar to the spread applied to safer loans previously. Hence, an observed increase in the share of loans with a high spread could actually indicate greater exposure of the banks to borrowers with higher default probabilities than those previously included in the same spread group.

8 This data set ("Annex 341") contains the information on loans granted by credit establishments. It includes, among others, loan amounts, interest rates, maturities and disbursement dates. Credit operations are aggregated by various characteristics (such as credit ratings) for each credit institution-debtor-quarter combination, making it difficult to measure new loans, especially disbursement interest rates. To address this issue, we identified new loans as those with disbursement dates occurring in each quarter. For each credit establishment, we take debtors without loans in the previous quarter. These criteria ensure that observed interest rates are not contaminated by previously disbursed operations, which are aggregated in the annex. The analysis excludes credit card loans from consumer loans, since their maturity usually reflects the card's expiration date. The resulting quarterly data set spans from Q1 2021 to Q4 2024 and has 463,000 observations in the commercial loan portfolio and 14 million in the consumer loan portfolio.

9 The observed differences between the interest rate measures arise from the assumptions made to derive new loans from the granular data (see footnote 8) and from the differences in maturity aggregations. In particular, loan maturities can be observed precisely in the granular data, whereas the weekly averages aggregate disbursements by wide maturity intervals.

10 Small and medium-sized enterprise (SME) and large firm loans in the commercial portfolio, as well as vehicle and other credits in consumer loans, are studied later. Other credits include payroll loans and free-destination loans, among others. For the study of each segment, the methodology is replicated with the corresponding data subset.

11 To increase the sample coverage, each maturity group m includes credits with an initial credit term equal to $m \pm \text{one month}$.

to the OIS_t^m rate in the case of consumer loan interest rates.[12] The reason for this distinction is that almost all new consumer loans are linked to fixed rate contracts, while around 60% of new commercial loans involve variable rate contracts tied to the MPR.

(ii) A histogram of $s_{j,k,t}^m$ was constructed using Sturges' (1926) rule for each loan type.[13] The bins of these histograms are defined as "risk categories" (Graph 6). The use of the whole credit cycle sample ensures that all relevant risk categories are included in the resulting histograms. Loans falling in a particular bin are assumed to be comparable across time in terms of their riskiness.

(iii) Using the risk categories identified in the previous step, a distribution of new loans by type and maturity is produced for every quarter. Graph 7 shows heatmaps that illustrate the dynamics of these distributions for loans of different types and maturities throughout the credit cycle.

For every quarter in the sample period, the heatmaps show the risk categories (from the lowest to the highest risk) and the share of the value of loans that fall into each category.[14] A more intense red colour indicates a larger fraction of loans belonging to a particular category. For example, the distribution of five-year consumer loans in Graph 7 is concentrated in risk categories 5 to 10 in 2021 and the first half of 2022. It then becomes more concentrated in categories 15 to 20 until the second quarter of 2023, to finally cluster in categories 10 to 15 in the last part of the period.

The distributions calculated generally indicate a move towards riskier loans since mid-2022, near the peak of the credit cycle, with a correction between the end of 2023 and the beginning of 2024. This pattern is especially clear for consumer loans with maturities of two years or longer. It is worth noticing that, in this context, the Colombian financial regulator tightened credit-loss provision schemes for consumer loans to penalise credits with high maturities and prevent excessive risk-taking by credit establishments.[15] Within consumer loans, the pattern is also noticeable for both car and other loans (Appendix 2). By firm size (commercial loans), the composition towards riskier categories is more evident for SME loans (Appendix 2).

[12] The correspondence between OIS and loan maturities was set as follows: 12-month OIS for $m =$ one year, two-year OIS for $m =$ two years, three-year OIS for $m =$ three years, four-year OIS for $m =$ four years, and five-year OIS for $m =$ five years.

[13] Sturges' rule defines the bin size as $R/\left(1 + 3.322 \log_{10} N\right)$, where R is the data range and N the number of observations.

[14] In Graph 7, the bins of the interest rate spread histogram are translated into an integer scale of risk categories ranging from one to the total number of bins. Thus, risk category one contains loans in the first spread bin and is supposed to reflect the lowest credit risk level, whereas the last risk category includes loans in the highest spread bin and is supposed to represent the highest level of credit risk.

[15] See López et al (2014), Jiménez et al (2017), Gómez et al (2020), Morais et al (2021) and Cabrera et al (2022) for references on how credit provisions can reduce credit growth.

3. Composition effects in the dynamics of average lending interest rates

To identify the effects of shifts in loan composition on the behaviour of average lending rates, the following procedure was followed for each loan type (eg commercial, consumer, etc) and maturity, based on the distributions computed in the foregoing section:

(i) Let D be the set of all risk categories (bins) in the credit cycle.

(ii) Let $D_t \subseteq D$ be the set of risk categories present in period t.

(iii) Let $\widetilde{D}_t \subseteq D$ be the set of risk categories that *do not appear* in period t.

(iv) Then, the average lending rate in period t can be defined as:

$$i_t = \sum_{h \in D_t} \alpha_{ht} i_{ht},$$

where α_{ht} is the share of loans in risk category h in period t, and i_{ht} is the weighted average of the interest rate on all loans included in category h in period t. Notice that $\alpha_{ht} = 0$ for $h \in \widetilde{D}_t$.

(v) Therefore, the first difference of the average lending rate can be expressed as:

$$\Delta i_t = \sum_{h \in D_t \cap D_{t-1}} (\alpha_{ht-1} \Delta i_{ht} + i_{ht} \Delta \alpha_{ht}) + \sum_{h \in D_t \cap \widetilde{D}_{t-1}} i_{ht} \alpha_{ht} - \sum_{h \in \widetilde{D}_t \cap D_{t-1}} \alpha_{ht-1} i_{ht-1}.$$

(vi) The component $\sum_{h \in D_t \cap D_{t-1}} \alpha_{ht-1} \Delta i_{ht}$ is defined as the "*pure interest rate effect*".

(vii) The component $\sum_{h \in D_t \cap D_{t-1}} i_{ht} \Delta \alpha_{ht}$ is defined as the "*composition effect*".

(viii) The component $\sum_{h \in D_t \cap \widetilde{D}_{t-1}} i_{ht} \alpha_{ht} - \sum_{h \in \widetilde{D}_t \cap D_{t-1}} \alpha_{ht-1} i_{ht-1}$ is defined as the "*net emerging risk category effect*".

The "*pure interest rate effect*" filters composition shift effects. By construction, it closely tracks the movements in the MPR (in the case of commercial loan rates) or the OIS (in the case of consumer loan rates). This is so because the individual loan interest rates falling within a risk category in every quarter have similar spreads with respect to the relevant policy interest rate (MPR or OIS). Thus, their variation in time mostly reflects the movement in the policy rate.

The "*composition effect*" and the "*net emerging risk category effect*" pick up the impact of changes in the distribution of loans by risk categories. If riskier borrowers gain importance in the new loan portfolio, then the average lending interest rates will increase ("*composition effect*"). Likewise, if riskier borrowers were absent in past new loan portfolios and are included in the current one, then, ceteris paribus, the average lending rate will increase. If these borrowers are then excluded from future new loan portfolios, the average lending interest rate will fall ("*net emerging risk category effect*"). The composition and net emerging risk category effects may or may not be a consequence of movements in the policy interest rate. However, they influence the dynamics of average lending interest rates.

Graph 8 shows that the "*composition*" and "*net emerging risk category*" effects are important determinants of the changes in average lending rates, especially for consumer loans. In particular, positive "*composition*" effects are sizeable between Q2 2022 and Q1 2023, while the disappearance of riskier loan categories (negative "*net emerging risk category*" effect) partly explains the fall in several consumer credit interest rates in 2023 and 2024. These effects reflect the aforementioned shifts in the distribution of new loans towards riskier ones from Q2 2022 and their subsequent reversal. For commercial loans, "*composition*" and "*net emerging risk category*" effects tend to be more volatile at the end of the period. The conclusions above generally hold for interest rates on SME and large firm loans, and for car and other consumer loans (Appendices 3 and 4).

4. Discussion

The expansion phase of the 2021–24 credit cycle was characterised by: (i) fast-growing credit volumes, especially in the consumer loan segment; (ii) a shift of the composition of new loans towards riskier ones; (iii) rising policy interest rates; and (iv) faster increases in average lending interest rates explained by loan composition effects. How can these observations be interpreted simultaneously? At least four possible (and not mutually exclusive) "stories" could be compatible with these observations.

First, from a simple microeconomic perspective, a hike in policy interest rates should raise the lending interest rate of a borrower with a given probability of default by more than one on one.[16] Something similar occurs when bank market power is present, since it makes the lending interest rate spreads dependent on the policy rate, even if market power itself remains constant (see Appendix 1). In terms of the risk categories defined previously, this means that a borrower with an unchanged default probability will automatically move to a higher risk category (a larger spread between the lending and the policy rates) after an increase in the monetary policy rate. In this case, banks' risk appetite remains constant, but the change in the policy rate may alter credit spreads and the observed distribution of loans across them.

A problem with this "story" is that, in the face of higher spreads and interest rates, credit demand and loan volumes should fall, unlike the large expansion observed. To simultaneously explain higher prices and quantities, an increase in loan demand could be posited as a second "story". This was clearly a possibility, in view of the strong

[16] Take, for example, the lending interest rate decision of a risk-neutral bank that can lend to a borrower with a given probability of default, p, charging her an interest rate, i_L, or can invest in a risk-free alternative (eg a central bank deposit facility) with an interest rate, i. Assuming that there are no operational costs and that the bank cannot recover anything in the event of a default, the following non-arbitrage condition must be met:

$$(1-p)(1+i_L) = (1+i) \;\; or \;\; (1+i_L) = (1+i)/(1-p).$$

Hence, any hike in i will produce a larger increase in i_L. The rise in the lending rate must be enough to ensure that the expected value of the return on the loan matches the increase of the opportunity cost. A more general illustration of this point is presented in Appendix 1. This effect is reinforced if the policy rate hike raises the probability of default. See, for instance, Martinez-Miera and Repullo (2010) for a model where default probabilities are endogenous to interest rates.

output growth of the Colombian economy in 2021 and 2022 (10.7% and 7.3%, respectively). However, a larger credit demand by itself does not necessarily imply a shift towards riskier loans in banks' portfolios.

A third "story" would explain the movement of the new loan distribution towards higher lending interest rate spreads by the liquidity stress undergone by several banks between Q2 2022 and Q3 2023, when NSFR regulation was applied and there were large concentrations of certificate of deposit (CD) maturities. Graph 9 shows substantial increases in the spreads between CD and OIS interest rates, indicating the presence of liquidity pressures.[17] These pressures would increase lending interest rate spreads equally for all loans of a given type and maturity, shifting the whole loan distribution upwards, without necessarily reflecting a change in risk appetite. Nevertheless, this effect would be similar for all types of loans (especially of longer maturities) since liquidity constraints would apply likewise across them. Graph 7 suggests that, at least visually, this is not the case and that there is variation in the shifts observed in the distribution of loans of different types and maturities.[18]

Hence, a fourth "story" regarding banks' risk appetite could be suitable. Greater risk appetite (as reflected in the relatively loose credit standards shown in Graph 2) could have relaxed lending policies and expanded loan supply to riskier borrowers. Three observations lend support to this "story". First, the share of loans disbursed to new borrowers increased from 4.4% on average in 2017–19 to 4.8% in 2021 and 7.9% in 2022.[19] Second, the "*net emerging risk category*" effects presented in the foregoing section are explanatory factors in the rise and subsequent fall of average lending interest rates of four- to five-year consumer loans, and two- to five-year commercial loans. This means that previously absent risk categories appeared and then disappeared from some, but not all, new loan portfolios. Third, losses from the realisation of credit risk in consumer loans (stemming from credit loss provisions) mounted between May 2022 and June 2023, even as unemployment stood at or below estimates of NAIRU and real wages remained stable, indicating exceedingly easy past lending conditions. Moreover, greater bank risk appetite would be likely to reduce lending interest rate spreads for all borrowers; consequently, increases in the share of loans belonging to a high spread category probably involve borrowers that are even riskier than before.

5. Conclusion

This note contributes to the understanding of banks' behaviour in Colombia during the 2021–24 credit cycle. Using disaggregated borrower information, it is found that,

[17] Appendix 1 explains that, in the presence of binding liquidity constraints, the spreads of deposit and lending rates with respect to policy rates rise.

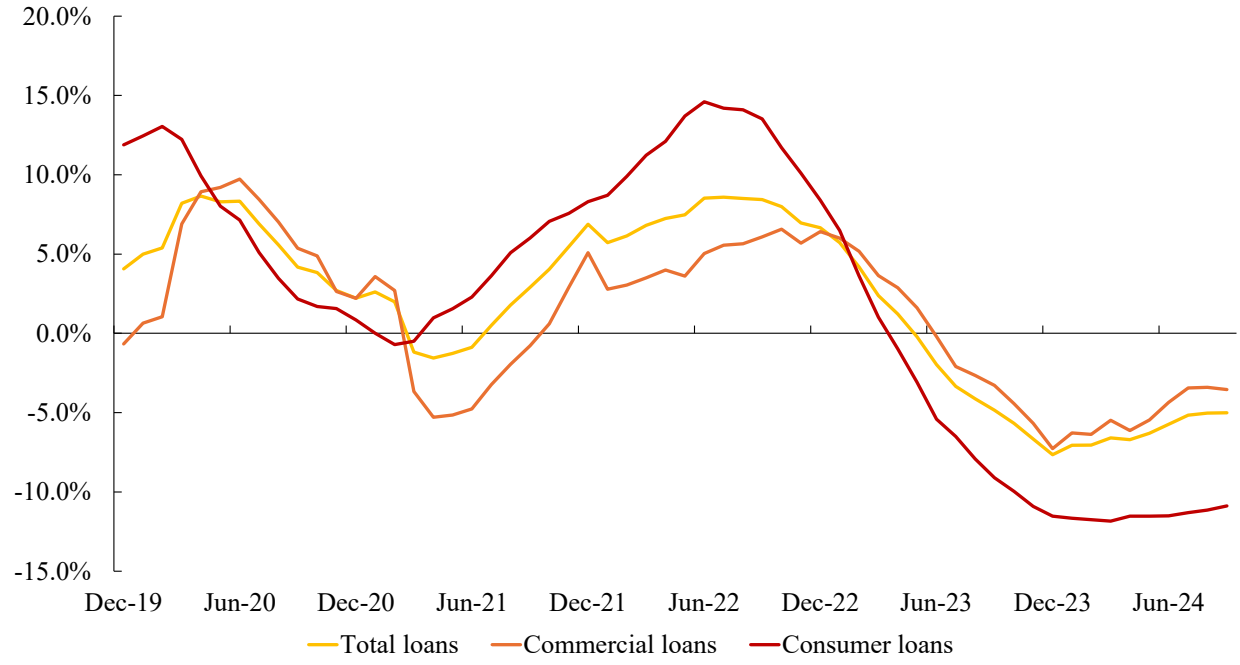
[18] Moreover, the stringency of liquidity constraints is endogenous and may respond to changes in credit risk appetite. Shifts of banks' asset portfolios towards loans (typically illiquid assets) may make liquidity constraints binding.

[19] In each quarter, new borrowers are defined as debtors that do not have outstanding loans in the previous four years. During 2021–22 there is also an increasing trend in the number of new borrowers in the consumer loan portfolio and a correction in the following years. For more details, see *Informe Especial de Riesgo de Crédito de Septiembre de 2024*.

as credit establishments rapidly expanded loans, they increased their exposure to riskier borrowers. Afterwards, they reduced loans and concentrated their new loan portfolio in safer borrowers. This was particularly noticeable in the consumer loan segment. Interestingly, increased risk-taking occurred as the monetary policy stance was being swiftly tightened, while de-risking of new loan portfolios coincided with the relaxation of monetary policy. Consequently, average lending interest rates rose faster than actual or expected policy rates, as the weight of riskier loans in the average grew. By the same token, average lending rates fell faster than policy rates in the easing phase of the monetary policy cycle, as new loan portfolios turned safer. These results point to the importance of examining the dynamics of the credit cycle and loan market conditions when assessing the transmission of monetary policy. The results are also illustrative of the usefulness of disaggregated data in macro and monetary policy analysis.

Real annual growth of loan portfolio

Graph 1



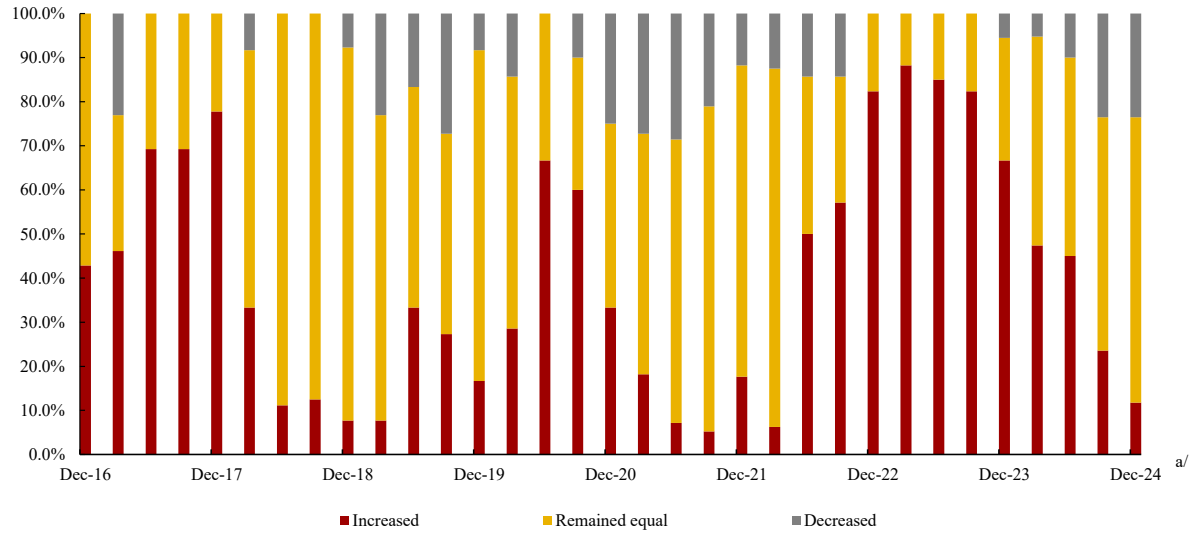
Real growth calculated with the consumer price index excluding food.

Sources: Central Bank of Colombia; Financial Superintendence of Colombia.

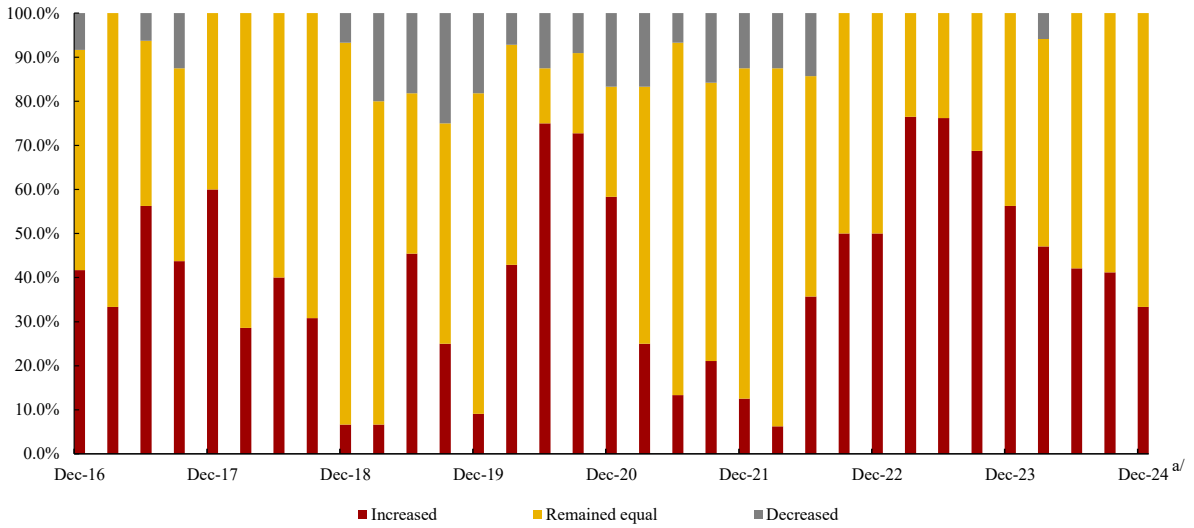
Change in requirements for allocating new loans (banks)

Graph 2

A. Consumer loans



B. Commercial loans

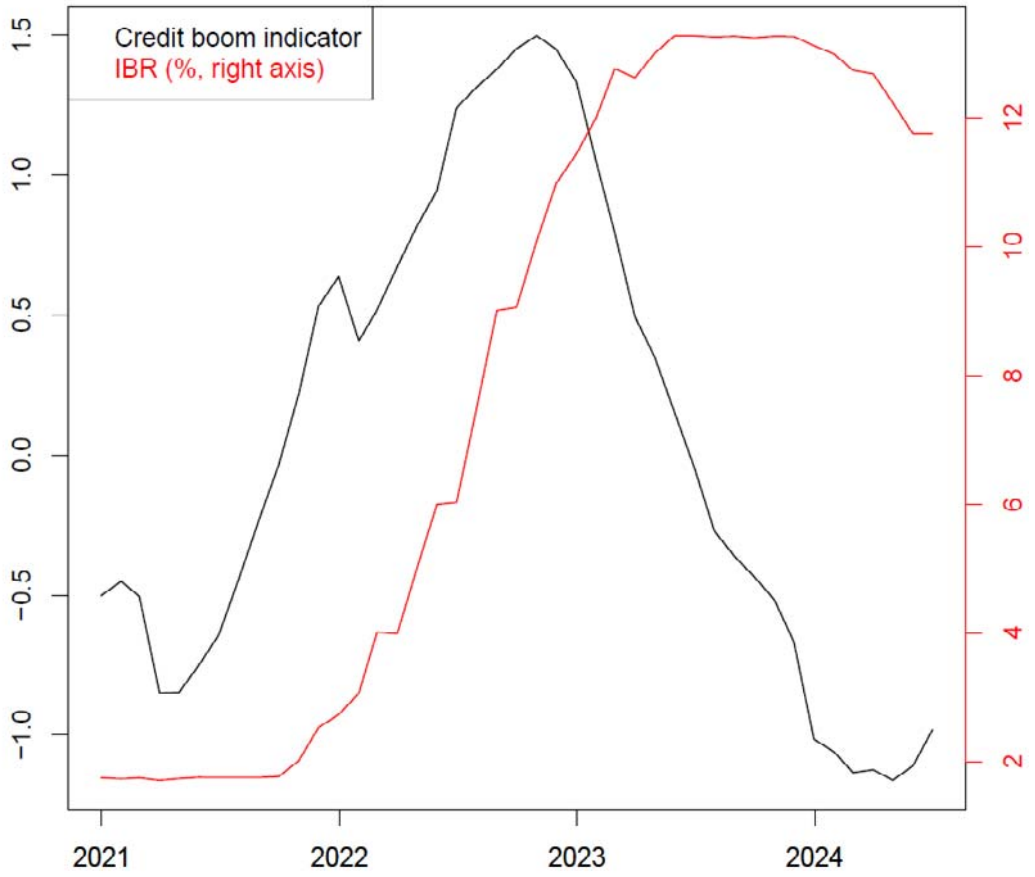


a/ Next quarter expectations. Percentage of responses.

Source: Central Bank of Colombia (2024).

Credit and monetary policy cycles

Graph 3



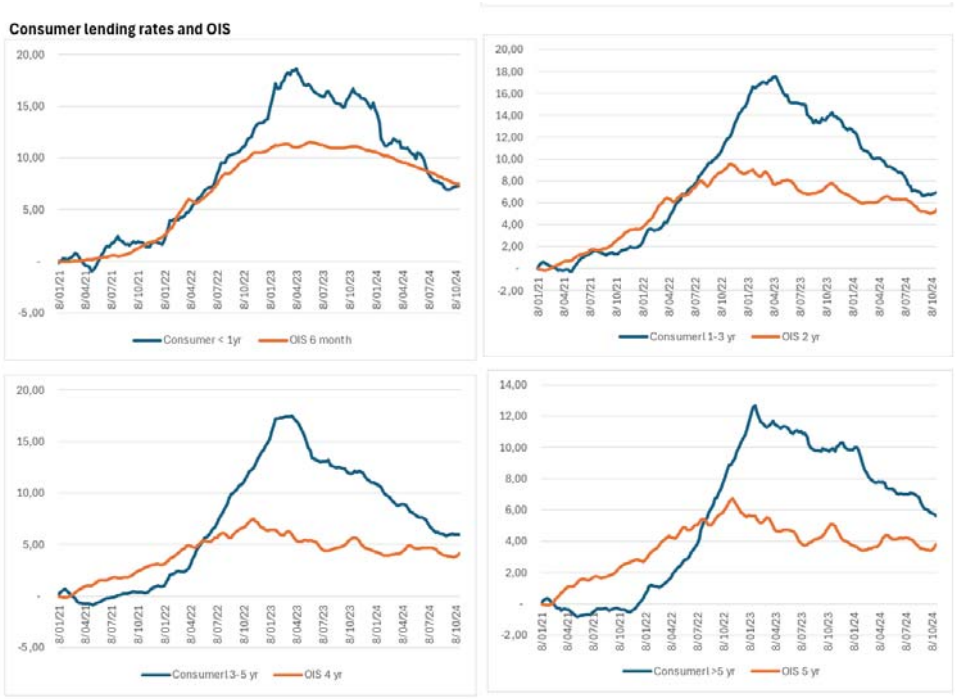
Credit "boom" indicator constructed for total loans as the sum of the cyclical components of the per capita portfolio and its growth using a Hodrick-Prescott filter. IBR is the overnight interbank loan interest rate. Quarterly data.

Sources: Central Bank of Colombia; Financial Superintendence of Colombia.

Credit and monetary policy cycles

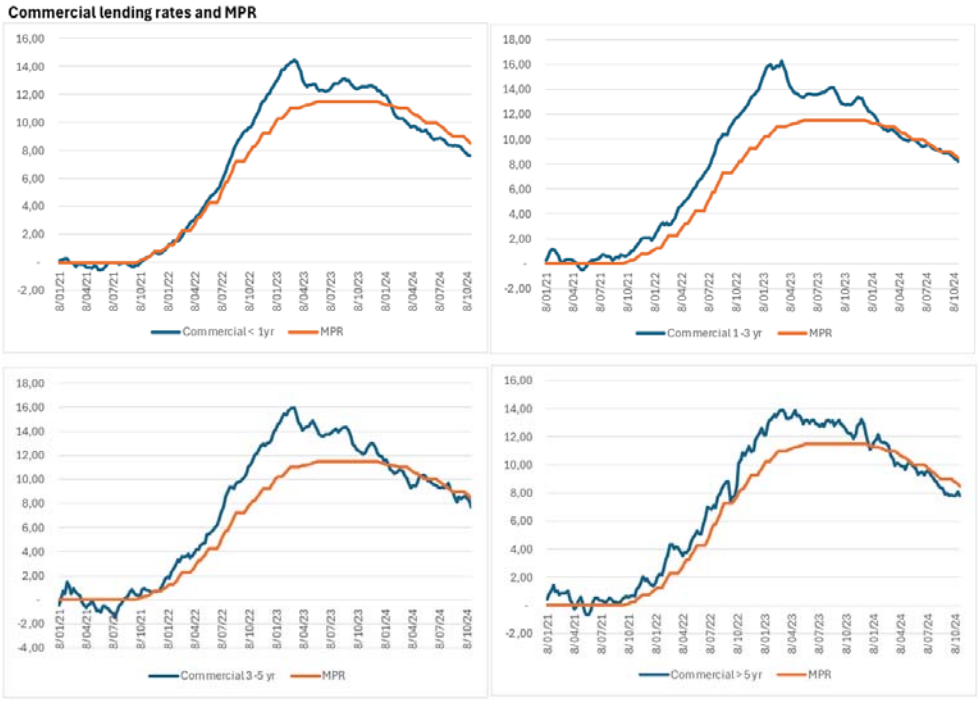
Graph 4

A. Cumulative variation of consumer loan and OIS rates since 1 January 2021



Sources: Central Bank of Colombia; Financial Superintendence of Colombia

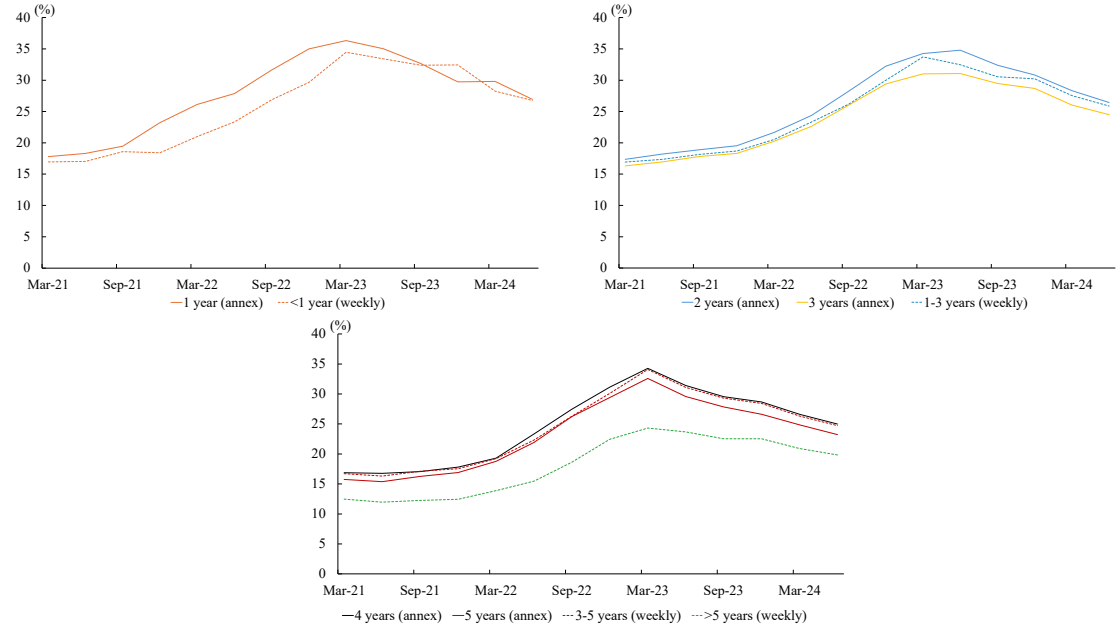
B. Cumulative variation of commercial loan and monetary policy interest rates since 1 January 2021



Sources: Central Bank of Colombia; Financial Superintendence of Colombia

Average lending rates calculated from individual borrower information (annex) vs aggregated lending rates comprising all new loans (weekly) Graph 5

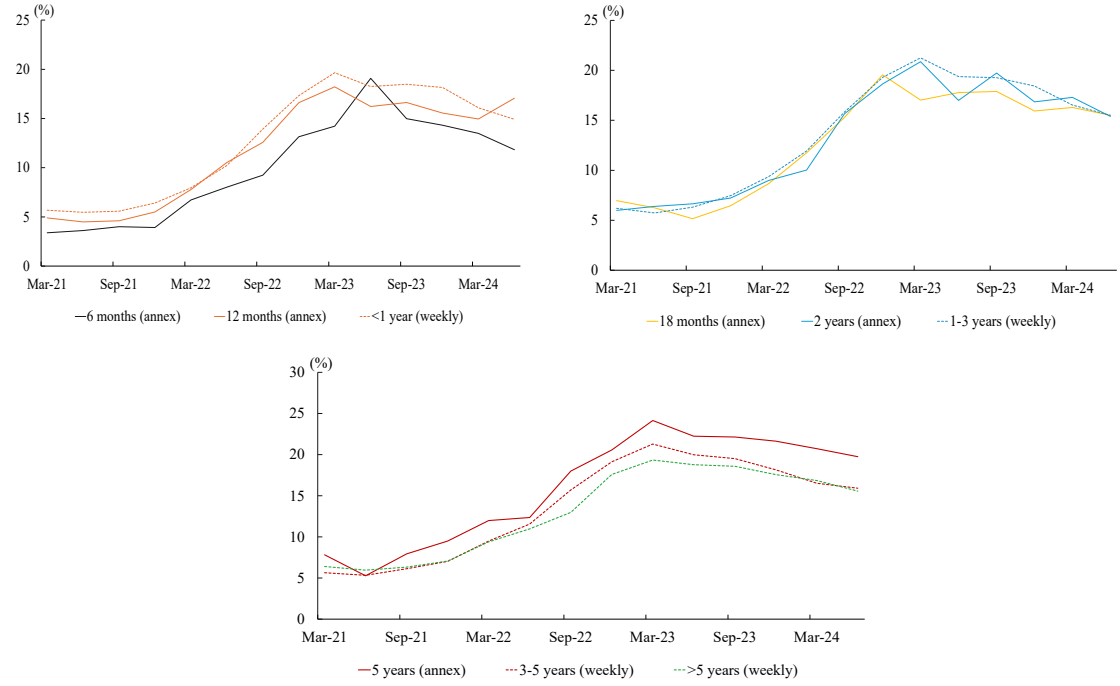
A. Consumer loans



Quarterly data. The weekly data are aggregated through weighted averages in which the weights are based on the value of the disbursements.

Source: Financial Superintendence of Colombia.

B. Commercial loans

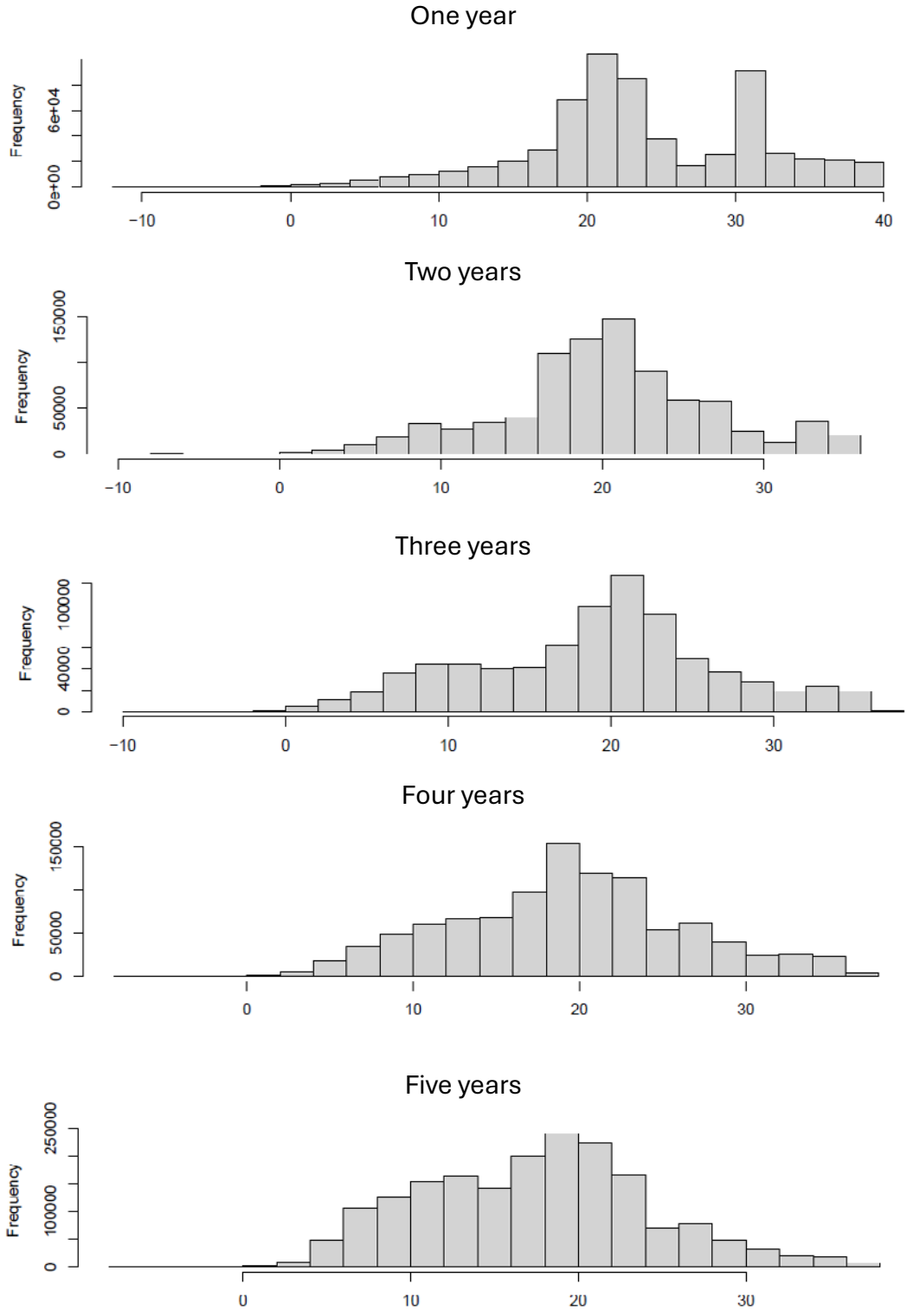


Quarterly data. The weekly data are aggregated through weighted averages in which the weights are based on the value of the disbursements.

Source: Financial Superintendence of Colombia.

Spread histograms and risk categories for each loan type and maturity Graph 6

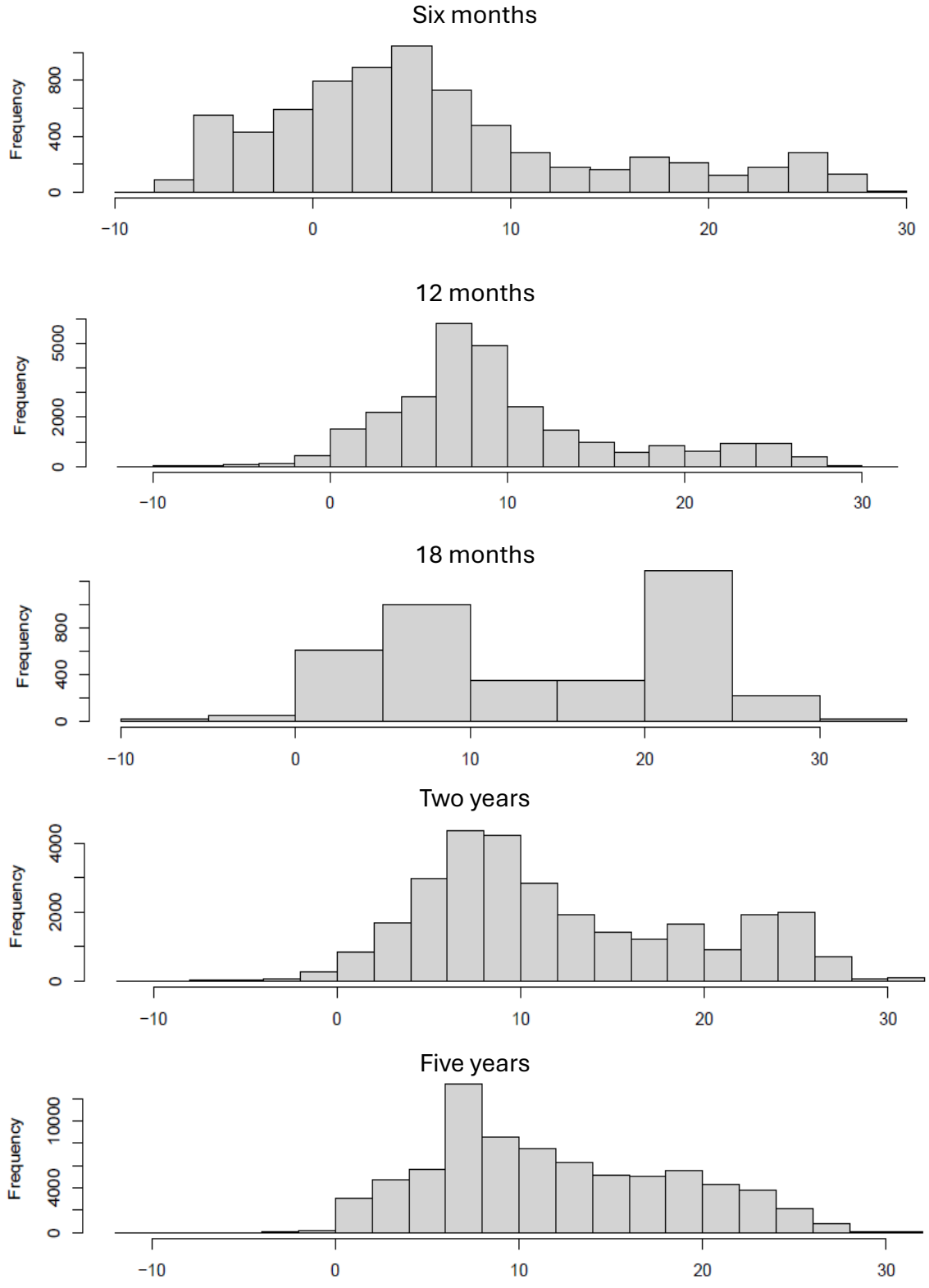
A. Consumer loans



Sources: Financial Superintendence of Colombia; authors' calculations.

Spread histograms and risk categories for each loan type and maturity Graph 6

B. Commercial loans

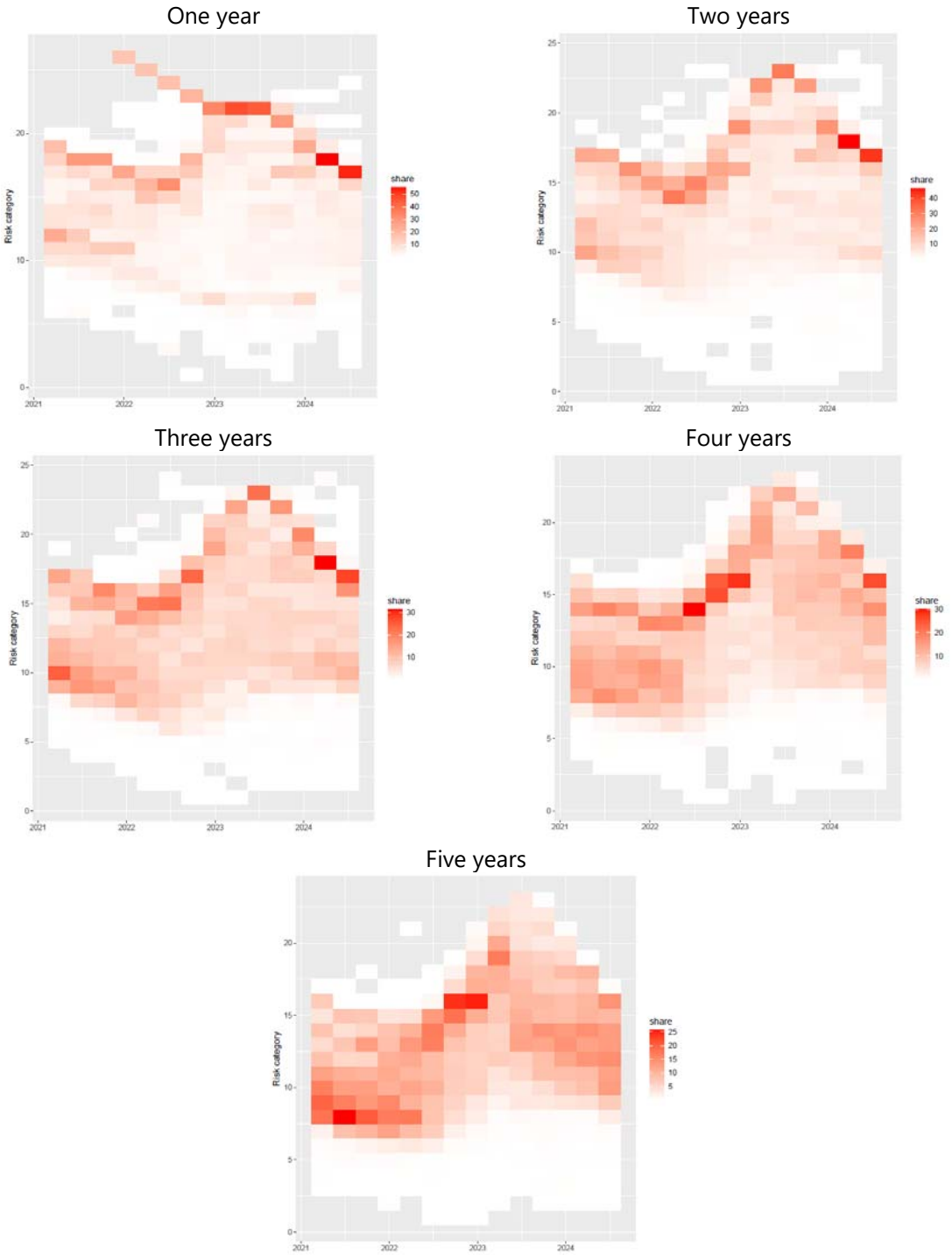


Sources: Financial Superintendence of Colombia; authors' calculations.

Heatmaps of the distribution of new loans through time by risk categories

as a percentage of new loans Graph 7

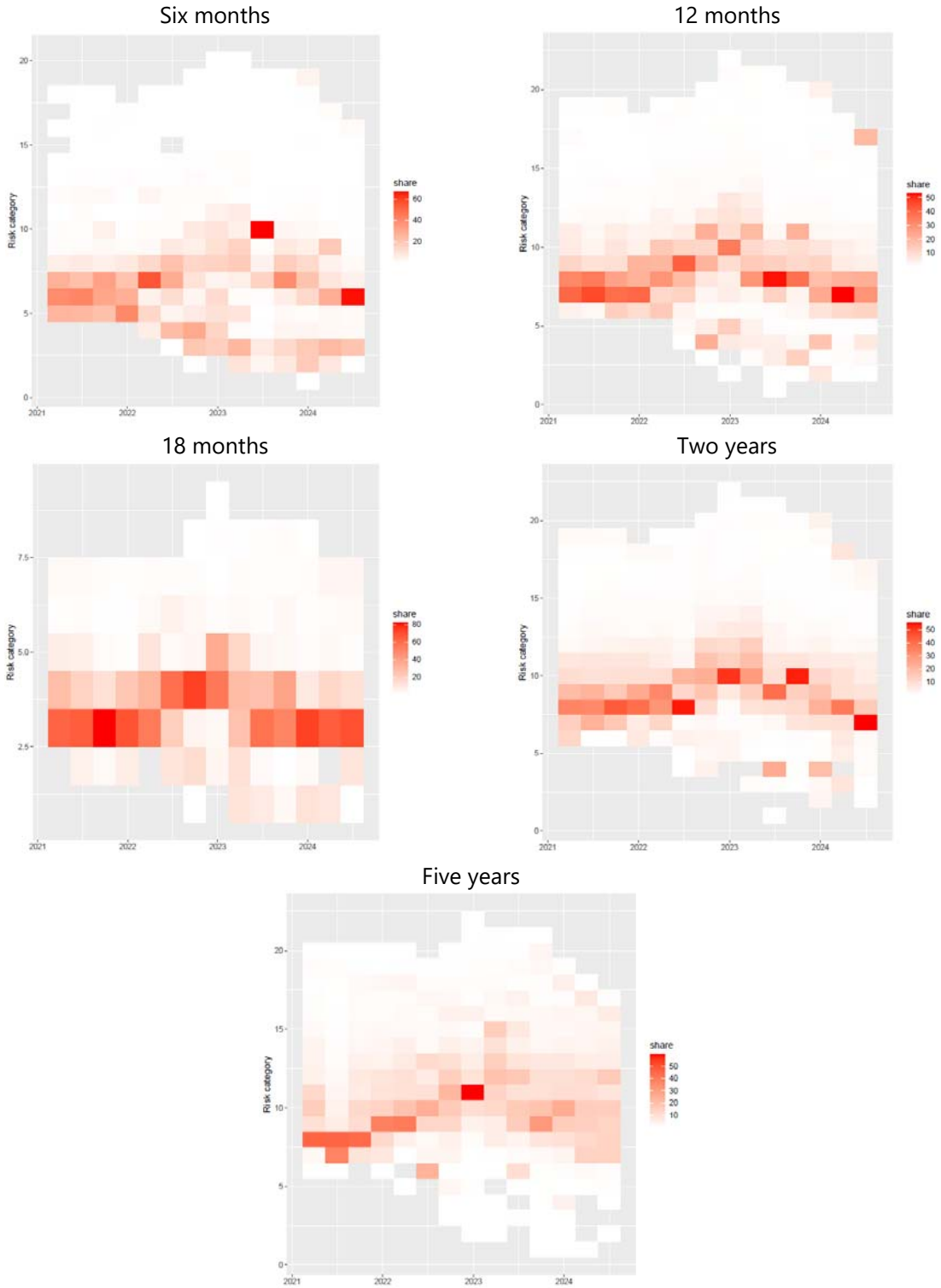
A. Consumer loans



The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.

Sources: Financial Superintendence of Colombia; authors' calculations.

B. Commercial loans



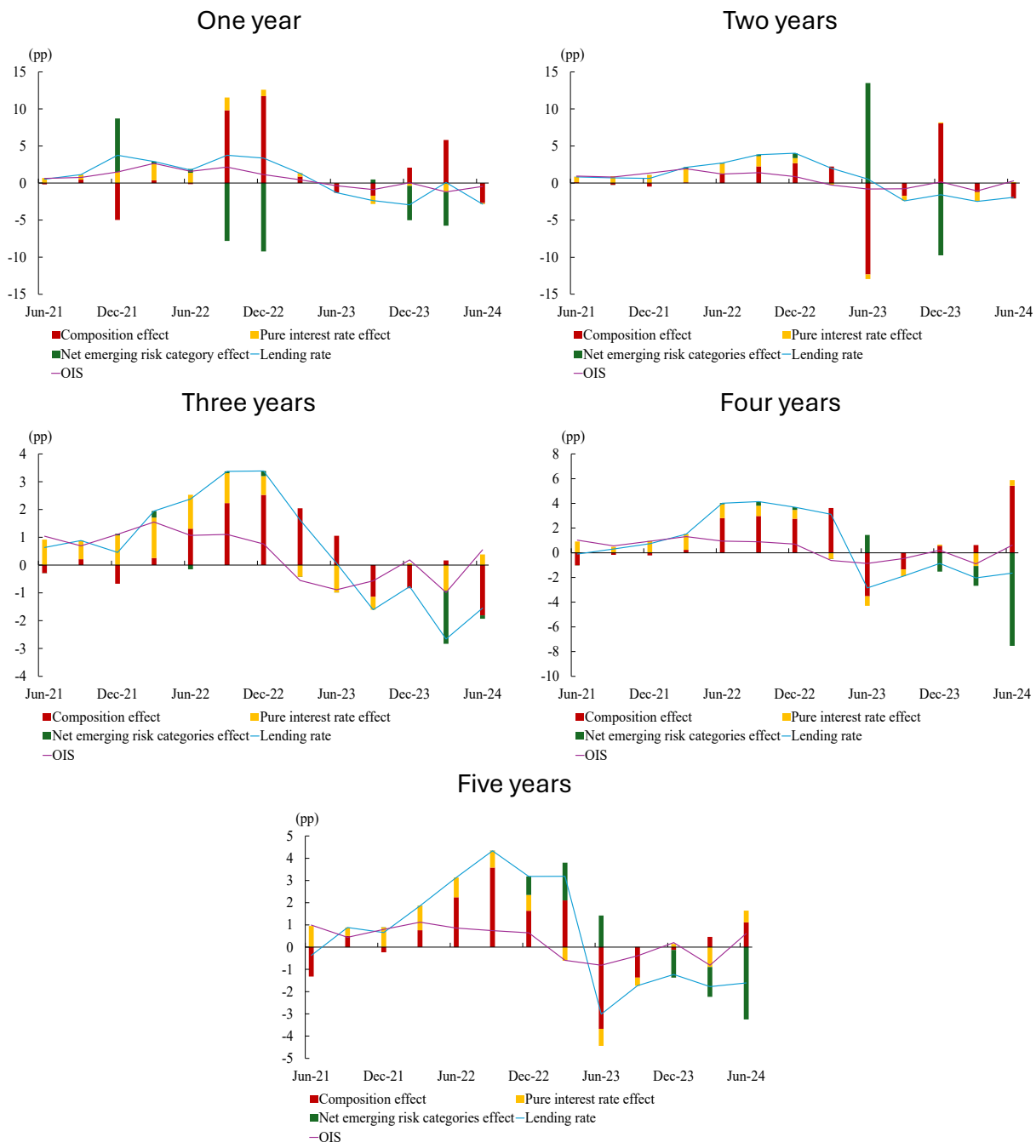
The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.

Sources: Financial Superintendence of Colombia; authors' calculations.

Decomposition of quarterly change of lending rates by pure interest rate effect, composition effect and net emerging risk category effect

Graph 8

A. Consumer loans

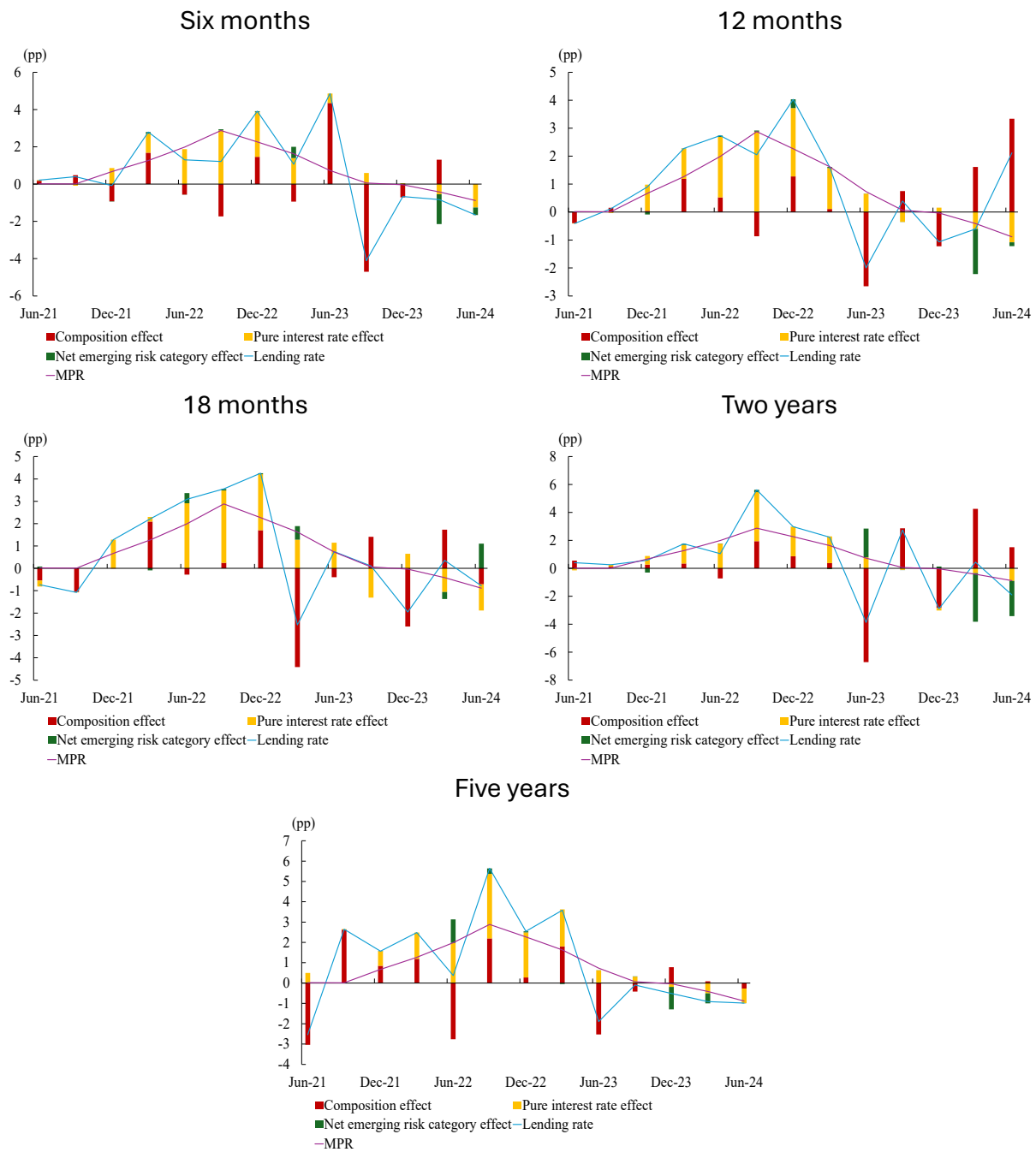


Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

Decomposition of quarterly change of lending rates by pure interest rate effect, composition effect and net emerging risk category effect

Graph 8

B. Commercial loans



Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

CD and OIS interest rates

Graph 9

Sources: Central Bank of Colombia; DECEVAL.

References

Apergis, N and C Christou (2015): "The behavior of the bank lending channel when interest rates approach the zero lower bound: evidence from quantile regressions", *Economic Modelling*, vol 49, pp 296–307.

Cabrera, W, S Gamba, C Gómez and M Villamizar-Villegas (2022): "Examining macroprudential policy through a microprudential lens", *Borradores de Economía*, no 1212, Central Bank of Colombia.

Central Bank of Colombia (2024): *Survey of the credit situation in Colombia*, September.

Chavarro-Sánchez, X, D Cristiano-Botia, J Gómez-González, E González-Molano and C Huertas-Campos (2015): "Evaluación de la transmisión de la tasa de interés de referencia a las tasas de interés del sistema financiero", *Borradores de Economía*, no 874, Central Bank of Colombia.

Cristiano-Botia, D, E González-Molano and C Huertas-Campos (2017): "Evaluación de la transmisión de la tasa de interés de referencia a las tasas de interés del sistema financiero considerando las expectativas de los agentes", *Borradores de Economía*, no 988, Central Bank of Colombia.

Galindo, A and R Steiner (2022): "Asymmetric interest rate transmission in an inflation-targeting framework: the case of Colombia", *Latin American Journal of Central Banking*, vol 3, no 3, 100069.

Gomez-Gonzalez, J, E González-Molano, C Huertas-Campos, D Cristiano-Botia and X Chavarro-Sánchez (2016): "An evaluation of the transmission of the policy interest rate to the financial system's interest rates in Colombia", *Ecos de Economía*, vol 20, no 42, pp 19–45.

Gómez, E, A Murcia, A Lizarazo and J Mendoza (2020): "Evaluating the impact of macroprudential policies on credit growth in Colombia", in "Macroprudential policies in the Americas", *Journal of Financial Intermediation*, vol 42, April, 100843.

González, A, F Hamann and H Vargas (2010): "Efectos de la política monetaria sobre las tasas de interés de los créditos hipotecario", *Desarrollo y Sociedad*, vol 66, pp 45-64.

Holmes, M, A Iregui and J Otero (2015): "Interest rate pass through and asymmetries in retail deposit and lending rates: an analysis using data from Colombian banks", *Economic Modelling*, vol 49, pp 270–77.

Jiménez, G, J Ongena, J-L Peydró and J Saurina (2017): "Macroprudential policy, countercyclical bank capital buffers, and credit supply: evidence from the Spanish dynamic provisioning experiments", *Journal of Political Economy*, vol 125, no 6, pp 2126–77.

López, M, F Tenjo and H Zárate (2014): "Credit cycles, credit risk and countercyclical loan provisions", *Ensayos sobre Política Económica*, vol 32, no 74, pp 9–17.

Martinez-Miera, D and R Repullo (2010): "Does competition reduce the risk of bank failure?", *The Review of Financial Studies*, vol 23, no 10, pp 3638–64.

Morais, B, G Ormazabal, J-L Peydró, M Roa and M Sarmiento (2021): "Forward looking loan provisions: credit supply and risk-taking", *Borradores de Economia*, no 1159, Central Bank of Colombia.

Panzar, J and J Rosse (1987): "Testing for 'monopoly' equilibrium", *Journal of Industrial Economics*, vol 35, no 4, pp 443–56.

Sturges, H (1926): "The choice of a class interval", *Journal of the American Statistical Association*, vol 21, no 153, pp 65–6.

Vargas-Herrera, H, Y Betancourt-García, C Varela and N Rodríguez-Niño (2010): "Effects of reserve requirements in an inflation targeting regime: the case of Colombia", in "The global crisis and financial intermediation in emerging market economies", *BIS Papers*, no 54, December, pp 133–69.

Appendix 1

Interpretation of lending interest rate spreads

To interpret the spread between lending interest rates and the MPR or the corresponding maturity OIS, consider the decision of a competitive, risk-neutral bank that receives deposits from the public, D, and can invest in central bank liabilities, B, or make loans, L, with probability of default, p. The optimisation problem of the bank is as follows:

$$\begin{aligned} Max \quad & i_l L + i\, B - i_d D - c_l L - c_d D - pL \\ s.t. \quad & L + B = D \\ & L \leq zD \end{aligned}$$

$i_l, i,$ and i_d are the lending, policy (MPR or OIS) and deposit interest rates, respectively. c_l and c_d are the constant unit operational costs of loans and deposits, respectively. $L \leq zD$ is a "liquidity" constraint that limits the amount of (presumably illiquid) loans to a fraction of deposits. Notice that, in case of a default, the bank is able to collect the interest revenue on the loan, although it loses the principal. This optimisation problem can be expressed as:

$$Max \quad i_l L + i\,(D - L) - i_d D - c_l L - c_d D - pL + q(zD - L)$$

where q is the the Lagrange multiplier that represents how stringent the liquidity constraint is. The bank chooses D and L to solve this problem. The first-order optimisation conditions imply:

$$\begin{aligned} i_l - i &= p + c_l + q \\ i_d - i &= qz - c_d \end{aligned}$$

Thus, the spread between the lending and the policy (or OIS) rates reflects the riskiness of the borrowers (their probability of default), the operational cost of the loan and the stringency of the liquidity constraint. Likewise, the spread between deposit and policy rates reflects operational costs of deposits and the stringency of the liquidity constraint.

If the default event includes the interest payments in addition to the loan principal, the above result on lending rates will hold in the following form:

$$i_l - i = p(1 + i_l) + c_l + q$$

Notice that in this case, the lending interest rate spread will change with the value of the lending interest rate. The implications of this feature are considered in the discussion of the results.

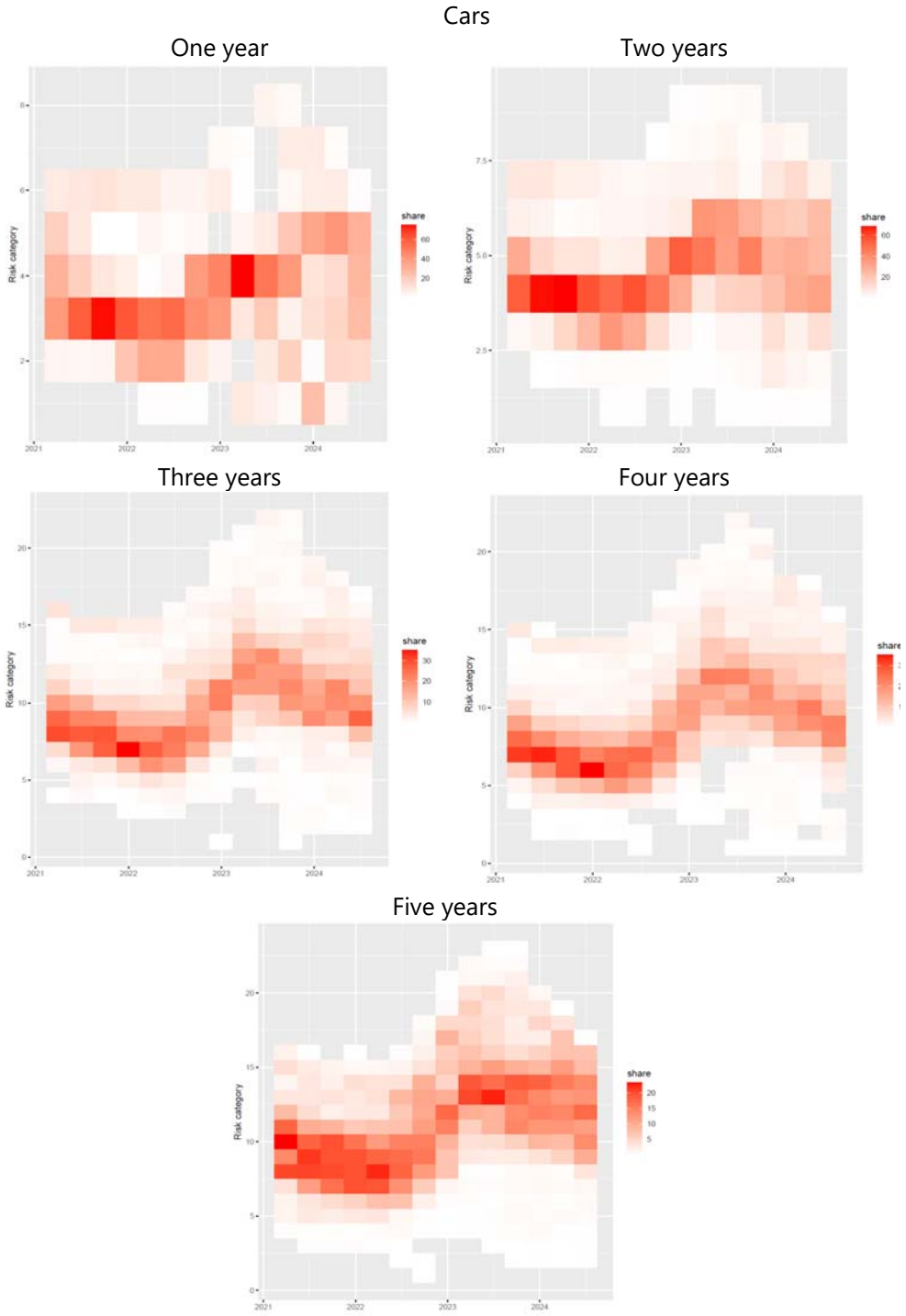
Assuming now a monopolistic bank, it can be shown that the expression for the lending interest rate spread when the default applies only to the principal of the loan becomes:

$$i_l - i = \frac{i}{e-1} + \frac{e}{e-1}(p + c_l + q)$$

where e is the price elasticity of loan demand. Hence, given a value for this elasticity, the lending interest rate spread will change with the policy rate. The implications of this feature are also considered in the discussion of the results.

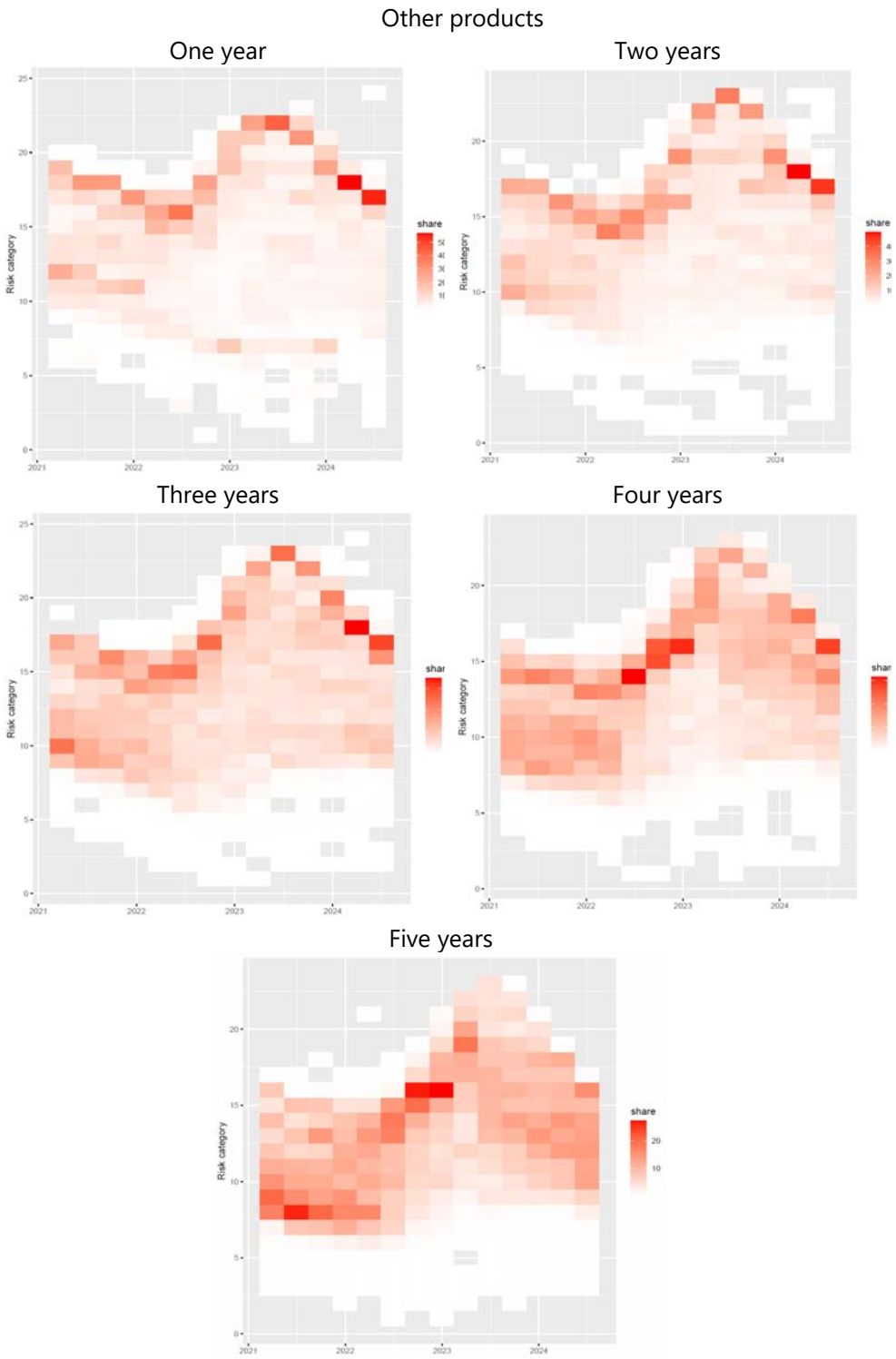
Appendix 2

Heatmaps of the distribution of new loans through time by risk categories (as a percentage of new loans). Consumer loans by product



The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.

Sources: Financial Superintendence of Colombia; authors' calculations.

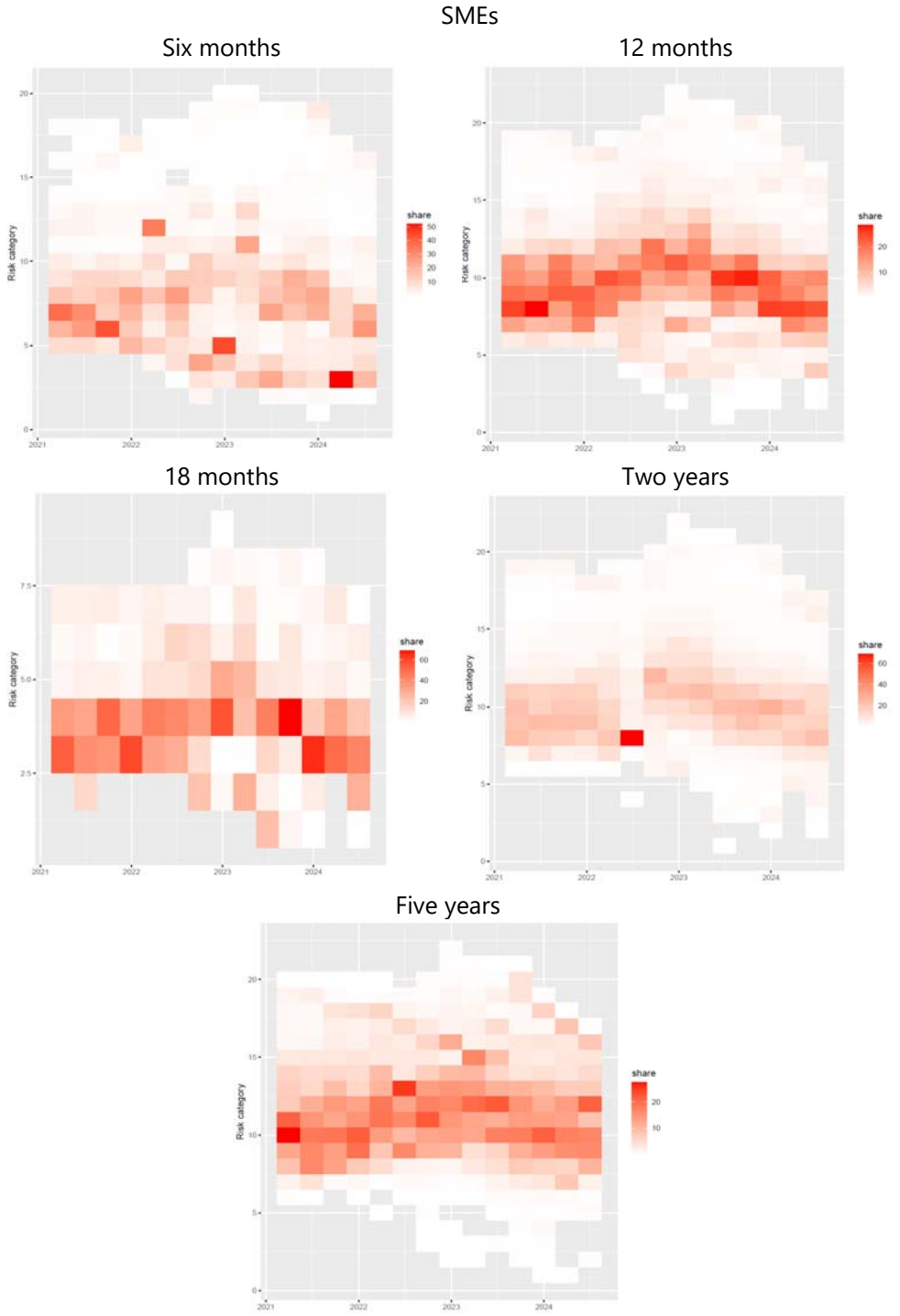


The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.

Sources: Financial Superintendence of Colombia; authors' calculations.

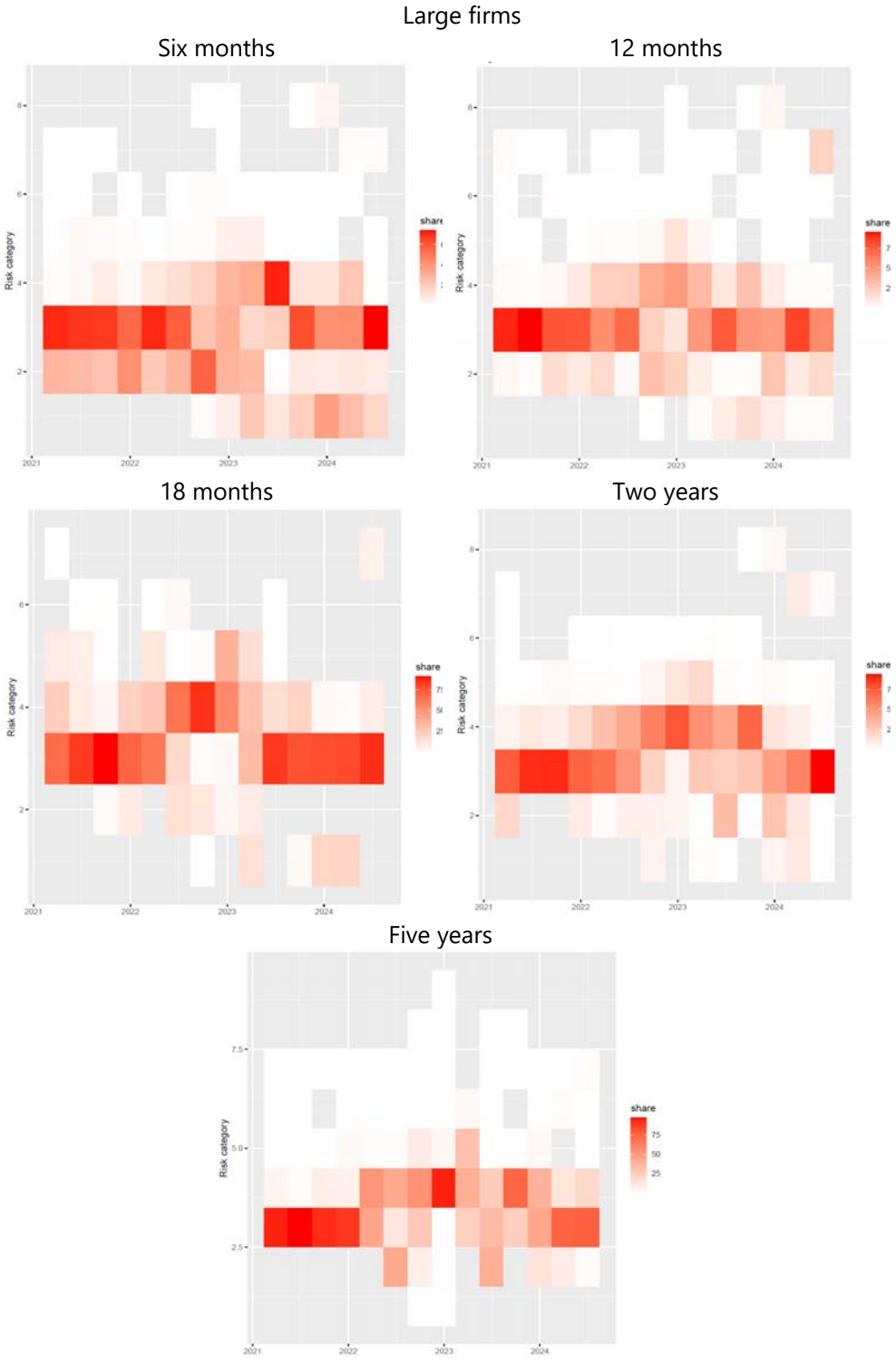
Appendix 2

Heatmaps of the distribution of new loans through time by risk categories (as a percentage of new loans). Commercial loans by firm size



The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.

Sources: Financial Superintendence of Colombia; authors' calculations.

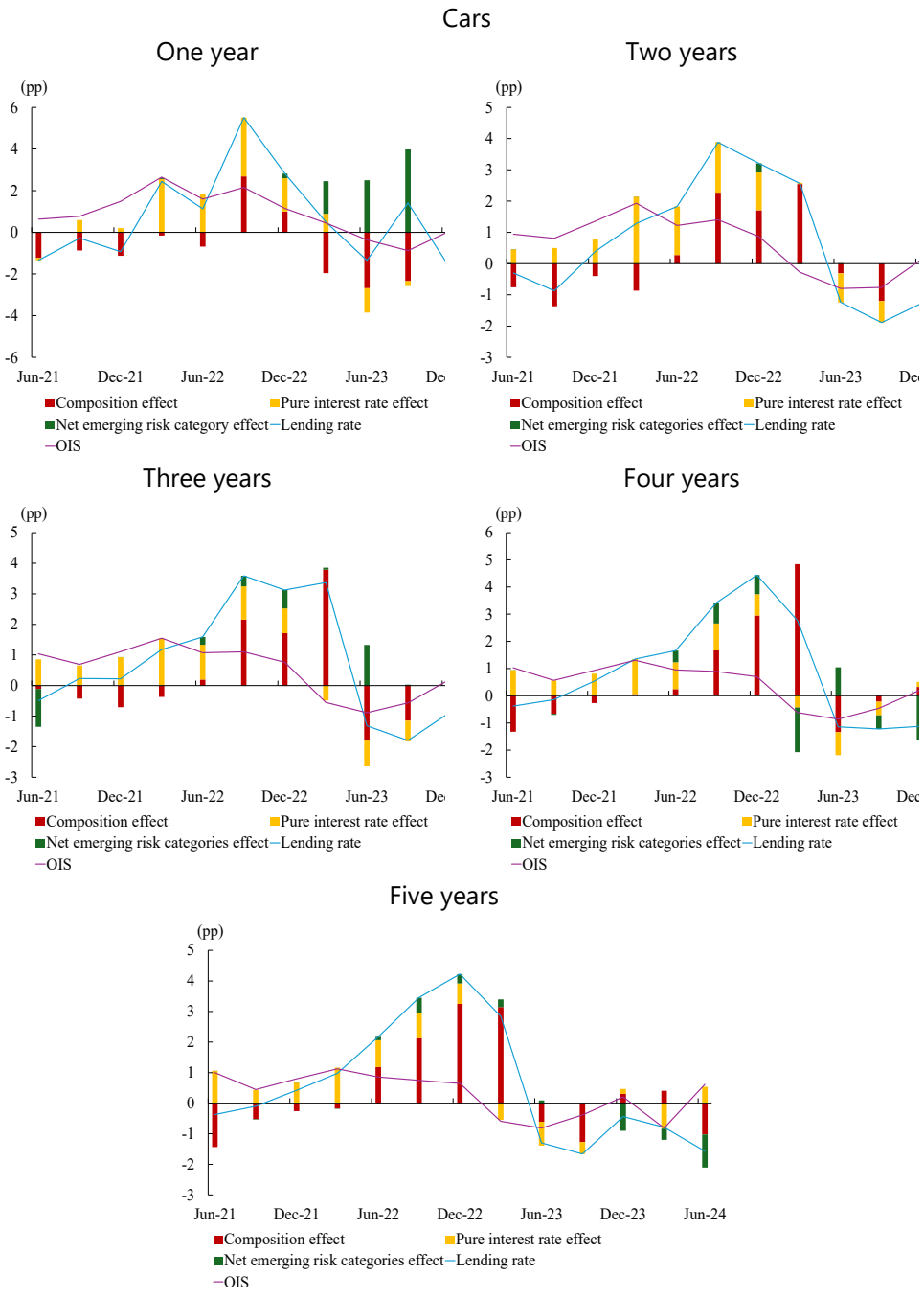


The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.

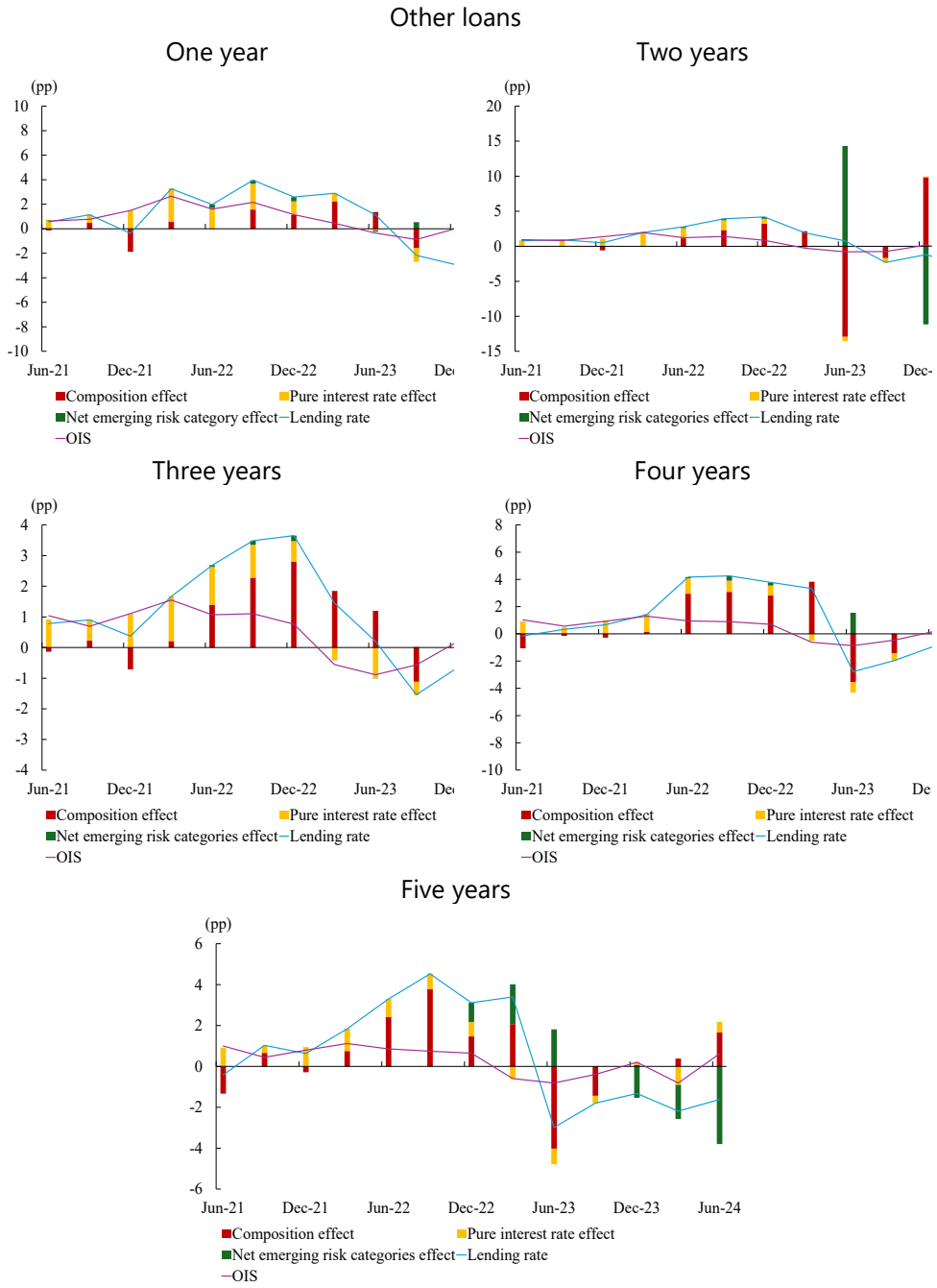
Sources: Financial Superintendence of Colombia; authors' calculations.

Appendix 3

Decomposition of quarterly changes of lending rates by pure interest rate, composition and net emerging risk category effects. Consumer loans by product



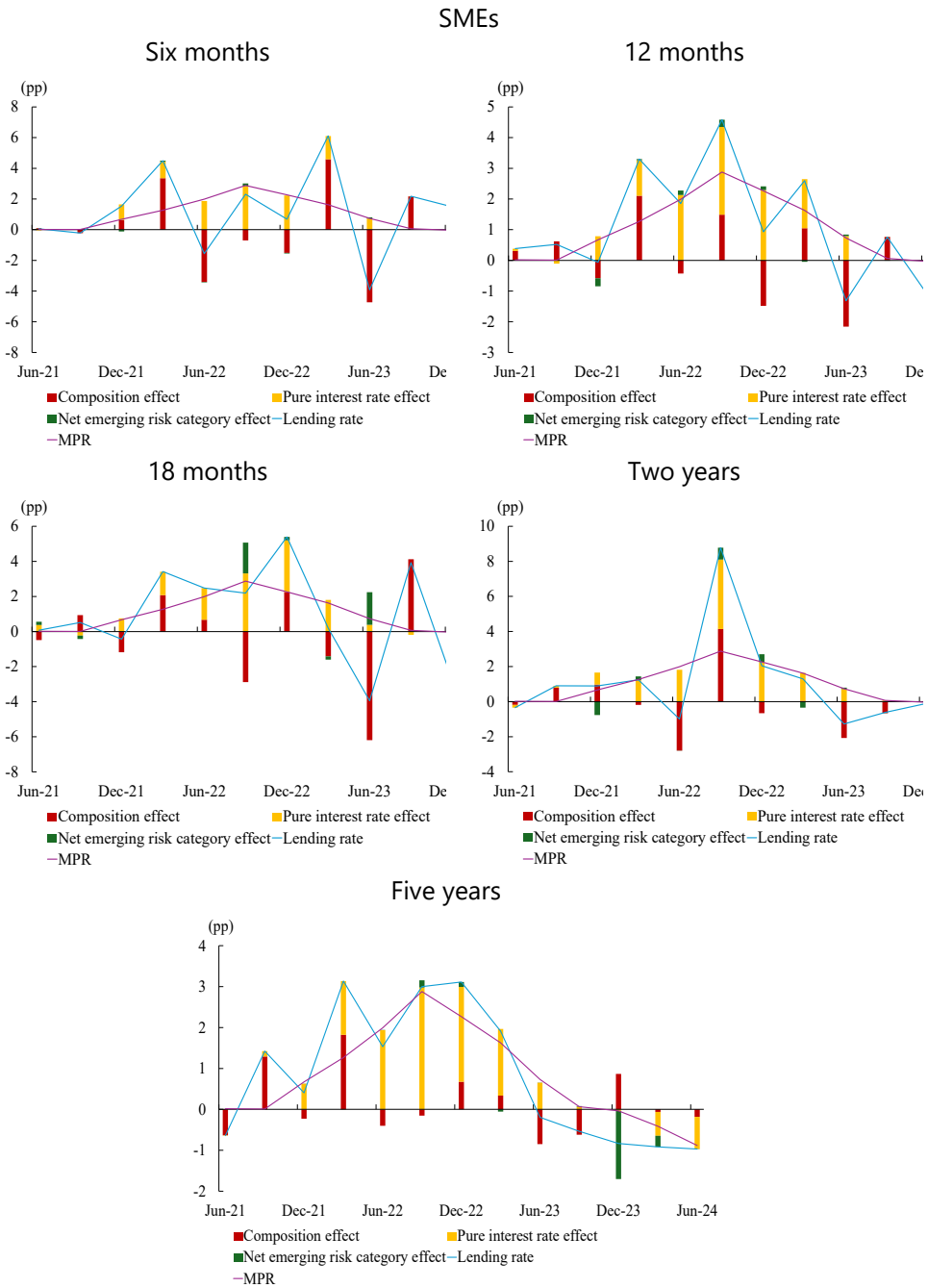
Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.



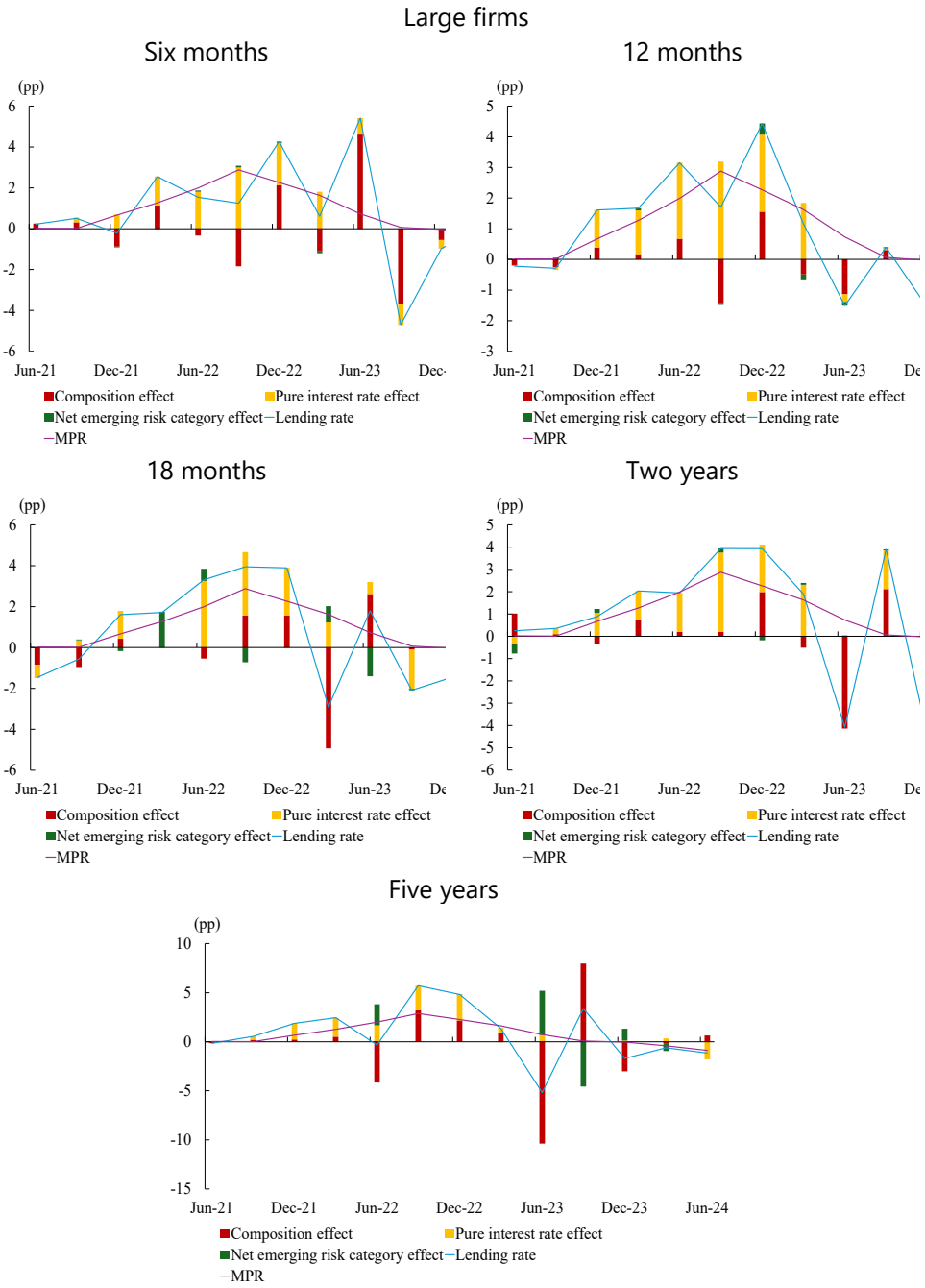
Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

Appendix 4

Decomposition of quarterly changes of lending rates by pure interest rate, composition and net emerging risk category effects. Commercial loans by firm size



Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.



Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations

Household and firm heterogeneity

Czech National Bank

This note responds to BIS questions regarding the process of monetary policy decision-making in the Czech National Bank (CNB). It specifically addresses how household and firm heterogeneity are incorporated. The first section describes the most important monetary policy transmission channels in the Czech economy. The transmission within each channel is affected by the actions of heterogeneous economic agents and the CNB uses various means to analyse the behaviour of important subpopulation groups of agents. The second and third sections document such analyses for household and firm heterogeneity, respectively, and present a selection of analytical work produced by the CNB over the last few years. The fourth section clarifies how this heterogeneity is linked to monetary policy decisions. The fifth discusses the distributional effects of Czech monetary policy. The sixth section presents the CNB's measures to address heterogeneity.

I. Monetary policy transmission channels

The Czech National Bank (CNB) takes into consideration all standard transmission channels of monetary policy when deciding on tightening or loosening monetary conditions. All of the channels directly or indirectly affect behaviour of agents to various extents and, thus, are important factors to analyse. Three transmission channels play a particularly important role in the Czech economy: the exchange rate channel, the interest rate and credit channel, and finally the asset price channel.[1] Within all of the transmission channels, the transmission effects are not homogeneous but rather heterogeneous, varying depending on individual and firm-level characteristics as well as other factors. The CNB carefully considers these heterogeneous effects in its analyses to better understand the overall effects on the economy. Examples of such analyses are presented in the subsequent sections of this note.

The exchange rate channel works both directly and indirectly. An increase in interest rates results in a higher demand for assets denominated in the Czech currency (the koruna), which is reflected in higher demand for the koruna and its appreciation against other currencies. The appreciation leads to lower prices of imported goods intended for consumption and subsequent production. This slows growth in domestic consumer prices. Along with this direct price effect, domestic and external demand for domestic products declines in favour of foreign products due to an increase in the price of the former relative to the latter ("intratemporal substitution"). This leads to lower growth in domestic economic activity and a cooling of the labour market, which also acts in the desired anti-inflationary direction. In a

[1] A complex analysis of Czech transmission channels, including the speed of transmission and the strength of individual channels, is presented in Babecká Kucharčuková et al (2013).

small open economy such as the Czech Republic, both the direct and indirect exchange rate channels play an important role in the transmission mechanism.

The interest rate and **credit channel** works owing to the interconnectedness of the CNB's monetary policy rates and market and client interest rates via the central bank's monetary policy operations, which affect the interbank money market. A rise in CNB monetary policy rates increases the price of money in the economy, which generally leads to a preference for future consumption over current consumption ("intertemporal substitution").[2] In practice, this means, among other things, that growth in monetary policy interest rates will be reflected in higher bank client rates on loans and deposits. In such conditions, firms revise their investment plans due to a decline in the profitability of the most risky and financially controversial projects. Their debt management costs will also rise. Thus, there is a decrease in corporate demand for investment and investment-financing loans. This will be reflected in lower production by domestic producers of capital goods. When the cost of money (ie client interest rates on deposits) increases, households start to favour saving over immediate consumption. At the same time, consumer credit becomes more expensive, which also results in lower demand for debt-financed consumption of goods and services. This further dampens economic activity and leads to a slowdown in wage growth and the taming of inflation.

The asset price channel acts through changes in the pricing of financial and non-financial assets such as securities and property. Other things being equal, a rise in interest rates causes asset prices to fall, because the higher interest rates reduce the expected rate of return. Assets therefore become less attractive than better remunerated bank deposits. The fall in current market asset prices represents a decline in households' perceived wealth, which will be reflected in a reduction in their consumption. Firms engage in more prudent investment activity. Overall, this leads to slower growth in economic activity due to lower demand and thus again to a slowing of excessive inflation.

There is a limited amount of literature that includes in-depth analysis of the Czech transmission mechanism.[3] The majority of research articles agree that the most important transmission channels are the exchange rate and credit channels. The relative strength of monetary policy transmission channels changes slightly over time based on current economic conditions but the importance of the two main transmission channels remains consistent.

[2] The pass-through from reference to client interest rates is documented in Hromádková et al (2023). They show that the pass-through from the reference rate to short-term client rates is almost immediate and fully transmitted.

[3] See, for example, Franta et al (2011), Babecká Kucharčuková et al (2013), Hromádková et al (2023), or Babeckáet al (2017).

II. Role of household heterogeneity in monetary policy transmission

The CNB considers household heterogeneity when preparing materials for informed decisions about setting monetary policy. The materials related to household heterogeneity and its role in monetary policy transmission are distributed both internally and for public use. The internal materials include presentations and various analytical documents that aim to communicate relevant information from the monetary department to the CNB Board. Household heterogeneity and its role in monetary policy transmission are discussed irregularly in periodical publications such as the Monetary Policy Reports (MPRs, previously Inflation Reports), Analyses of the Czech Republic's Current Economic Alignment with the Euro Area, Financial Stability Reports, and other outputs.[4]

The main dimensions of household heterogeneity are the following:

Household type: The CNB's core forecasting model, g3+ (see Brázdik et al (2020)), distinguishes between Ricardian and non-Ricardian households, often referred to as rule-of-thumb or hand-to-mouth households. This type of household heterogeneity is also used in the CNB's satellite analyses of the effects of fiscal policy and fiscal-monetary interactions (Ambriško et al (2015); Babecký et al (2018)).

Household income and wealth: Differences in income create variation in spending sensitivity to interest rate changes and inflation. Lower-income households are often more liquidity-constrained, impacting their ability to save and increasing their sensitivity to price fluctuations. Analyses supporting policymaking increasingly break down households by income and, more recently, by wealth groups as micro data on household finances become available. Household income and wealth data could also be employed in both empirical and semi-structural modelling frameworks to conduct stress tests and calibrate the CNB's borrower-based regulation, which helps to quantify the impact of monetary and macroprudential policies on different groups of households (Gregor (2024); Ehrenbergerová et al (2024)). Another recent CNB working paper (Junicke et al (2023)) investigates the heterogeneity in the effects of monetary policy shocks depending on household wage income using unique contract-level data from the Czech labour market. The results suggest that low-wage groups are hit more profoundly by monetary policy shocks than high-wage groups, and the effect of restrictive shocks is stronger in the manufacturing sector than in any other. Exploring other dimensions of the data offers insights into the heterogeneity of the the impact of monetary policy on different demographic groups. The paper shows that less educated and also young workers are more affected by monetary policy shocks.

Household age group, real and financial asset ownership, indebtedness: Other aspects of household heterogeneity include age groups, types and level of indebtedness, and real and financial asset ownership. Households with higher debt

[4] Full texts of the Monetary Policy Reports are accessible from: www.cnb.cz/en/monetary-policy/monetary-policy-reports/; Inflation Reports from: www.cnb.cz/en/monetary-policy/inflation-reports/; Financial stability reports from: www.cnb.cz/en/financial-stability/publications-on-financial-stability/.

levels, especially variable rate debt, are more affected by interest rate changes, which can lead to significant shifts in disposable income and consumption behaviour. These dimensions help assess both household resilience to unexpected shocks (CNB (2024)) and the general financial vulnerability of households (Babecký et al (2024)).

Household energy intensity in consumption: Audzei and Sutóris (2024) explore a new feature of household heterogeneity related to energy intensity in consumption. The authors employ a stylised heterogeneous agent New Keynesian model, calibrated with household finance and consumption data, to contribute to the debate on whether monetary policy influences the energy intensity of household consumption.

Household expectations: Brázdik et al (2024) extend the CNB's g3+ core projection model by incorporating endogenous expectation premiums that reflect elevated inflation expectations. The simulations underscore the importance and relevance of accounting for heterogeneity in inflation expectations across different groups such as households, firms and professional forecasters. On the empirical side, evidence suggests that households experience varying inflation rates depending on their consumption preferences, income levels and other characteristics (Sutóris (2023)). A related aspect of household heterogeneity – variation in perceptions or sentiment – is an important factor to account for when modelling consumer loans and, more broadly, in understanding the rational versus irrational motives underlying households' consumption and borrowing decisions (Gric et al (2022)).

Heterogeneity among households is increasingly being considered in the background analysis for monetary policy. The examples below show typical materials produced by the CNB that consider household heterogeneity.

Consumption, savings and wealth heterogeneity

From the viewpoint of monetary policy, a particular focus is put on heterogeneous **household consumption** and **saving** behavioural patterns. For example, the a box in the Summer 2023 *MPR*[5] describes the motives behind the surge in savings, the savings structure by income groups of the population, and the factors that can lead the saving rate to return close to its long-run average. The analysis shows that until 2019, the four lowest income quintiles together accounted for just 10–20% of total savings, with the poorest (first) quintile not saving at all (Chart 1).

Classifying households according to their income is fairly standard in materials provided by the CNB. A box in the Autumn 2023 *MPR*[6] presents some views on households' balance sheets from the perspective of the different degrees of asset liquidity and the distribution of assets by income group. The ratio of consumer expenditure to income (the propensity to consume) fell in 2022 relative to 2021, mainly in the case of food and non-alcoholic beverages, doing so across most income groups. By contrast, the ratio of housing expenditure to income rose among households in the first to third quintiles. The ratios of spending on transport and in restaurants also increased, although least of all for higher-income households.

[5] See Box 1 ("Reasons for households' current increased propensity to save") in the Summer 2023 *MPR*.

[6] See Box 2 ("Household savings, net wealth and consumption") in the Autumn 2023 *MPR*.

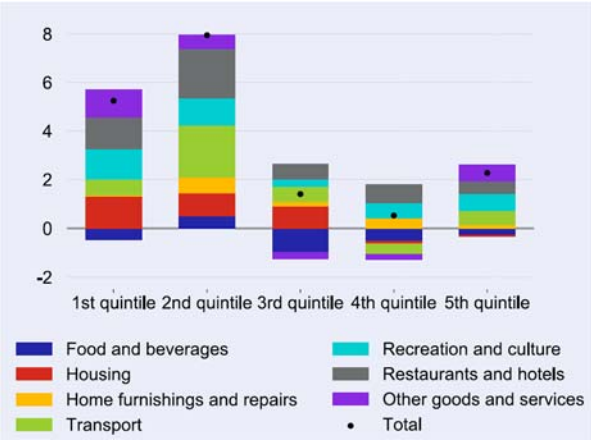
Overall, the propensity to consume is lowest among high-income households (see Chart 2).

High-income households are maintaining the highest saving rate; it did not change much even during the Covid lockdowns

Saving rate by income quintile in % — Chart 1

The propensity to consume fell mainly in the case of food and rose in the case of housing in 2022

Comparison of ratio of consumer expenditure to net money income between 2022 and 2021; differences in pp; CNB calculation based on data from Household Budget and Living Conditions Survey (CZSO) — Chart 2



Other CNB work dealing with heterogenous household consumption focuses on the period of high energy prices. A box in the Winter 2022 *MPR*[7] studies the heterogeneity in household consumption expenditures over time. The surge in

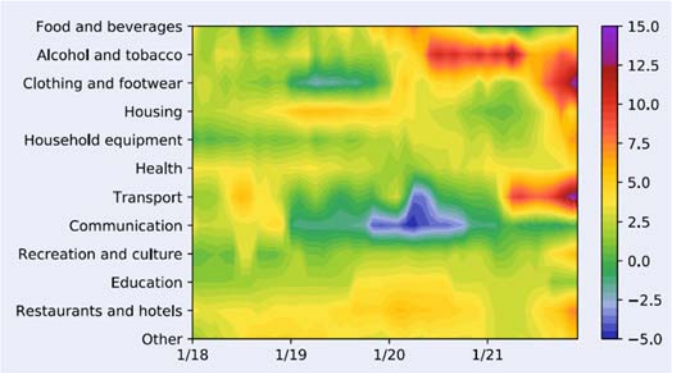
[7] See Box 2 ("How will the high energy prices affect household consumption?") in the Winter 2022 *MPR*.

housing-related energy prices had a significant impact on real household consumption in 2022. This analysis shows that a 20% increase in electricity, gas and heat prices implies a negative whole-year impact on real household consumption of almost 2.5%. According to PAQ Research, the absolute growth in housing expenditure was similar across all households. Therefore, low-income households were hardest hit. The share of housing costs in their total expenditure rose from 55% to 63%. Household consumption heterogeneity is also considered in relation to prices.

A box in the Winter 2022 *MPR*[8] shows inflation heterogeneity in the consumer basket. It concludes that the 2021–22 wave of price growth was not driven by just a few items but was broad-based and relatively intense. Chart 3 depicts the year-on-year price increases of the main categories of the consumer basket in the individual months of 2018–21. With the exception of the alcohol and tobacco category, which reflects a rise in excise duties on cigarettes, the price of the consumer basket increased at a moderate pace until the first quarter of 2021. Subsequently, however, inflation began to gather momentum across all categories except telecommunications. This was particularly evident in transport and in clothing and footwear.

Inflation rose significantly across consumer basket categories in the second half of last year

Annual inflation in %; the colour scale indicates the intensity of annual inflation — Chart 3



Mortgages

CNB analytical materials use individual-level data to analyse mortgage loans to households, which make up the largest part of households' debt burden. This is crucial because a substantial part of monetary policy transmission in the household segment takes place via the effect of interest rates on the volume of genuinely new loans for house purchase. An example of such material is provided in a box in the Summer 2023 *MPR*.[9] As the period since the CNB's policy rates (and subsequently also client

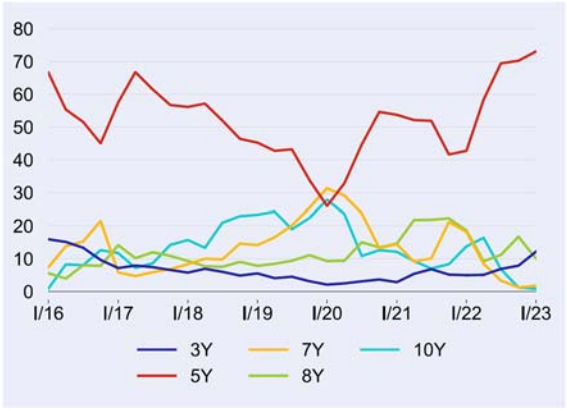
[8] See Box 4 ("Two phenomena of the current high inflation – intense and broad-based price growth") in the Winter 2022 *MPR*.

[9] See Box 2 ("Refixation and refinancing of mortgages and their effects on household expenditure") in the Summer 2023 *MPR*.

rates) went up increased in length, another channel was gaining in importance – the impact of the increased rates on current loan instalments, which are refinanced over time. According to the data from the *Survey of new loans secured by residential property*, the most popular fixed rate period is five years. It was agreed for 53% of total mortgage loans in the whole period under review (see Chart 4). However, the volume of loans with longer fixed rate periods rose significantly in 2019 – the share of 10-year fixes reached 28% and that of seven-year fixes 31%. This led to an increase in the average fixed rate period to 7.6 years. This can be explained by a decrease in banks' cost of funds at the time (see the five-year IRS rate in Chart 5) and an easing of banks' credit standards applied to loans for house purchase compared to 2017 and 2018.

Clients most frequently agreed a five-year fixed-rate period

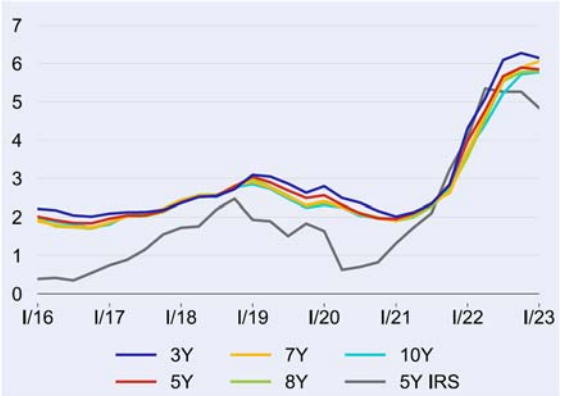
Share of loans by fixed-rate period; in % Chart 4



Note: The chart shows the five fixed-rate periods with the largest mortgage volumes. The rest of the fixed-rate periods account for 3% of all mortgage agreements on average.

Interest rates on new mortgages rose sharply for all fixed-rate periods in 2022

Interest rate on new mortgagesY IRS rate in %; by fixed-rate period Chart 5

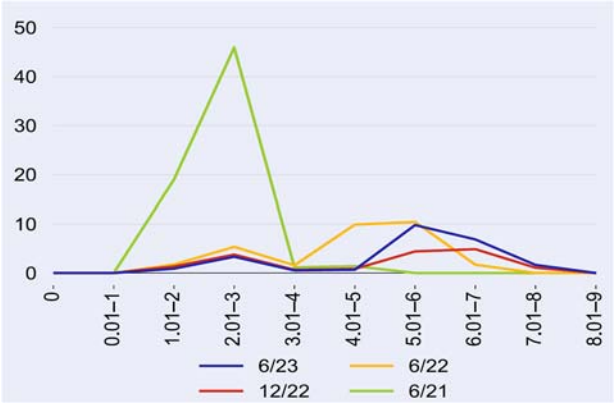


Deposit rates

The CNB regularly focuses on the distribution of household interest rates on loans and deposits (ie the heterogeneity in household rates). A box in the Summer 2023 *MPR*[10] shows how loan and deposit rates changed for Czech firms and households between the end of June 2021 and the end of June 2023. In mid-2021, the CNB started to raise its 2W repo rate from 0.25%. In the space of about one year, the rate increased to 7%, where it has stayed ever since (Charts 6 and 7).

Interest rates on new loans for house purchase are distinctly higher than in the past; volumes have fallen sharply

x-axis: interest rate band in %; y-axis: volumes in CZK billions; new loans — Chart 6



By actively seeking out higher interest rates, a large proportion of household deposits have been able to move to bands with a rate of over 5%

x-axis: interest rate band in %; y-axis: volumes in CZK billions; stocks of deposits — Chart 7

[10] See Box 3 ("How client interest rates on loans and deposits have changed over the last two years") in the Summer 2023 *MPR*.

The main sources of granular household data available in the CNB are the following:

Survey on income and leaving conditions (EU-SILC), Household Budget Survey (HBS), European Commission Business and Consumer Survey (BCS).

Household Finance and Consumption Survey (HFCS): This relatively new survey provides unique data on household finances, including assets, liabilities and net wealth. The survey does not include data on the wealthiest households, so the results must be interpreted with this limitation in mind.

IPSOS CZ and other specialised surveys: The CNB's pilot survey with IPSOS CZ, conducted from January to June 2024, captures household inflation expectations, providing insight into the heterogeneity of economic outlooks and sentiments. Previously, the CNB conducted several ad hoc surveys with STEM focused on evaluating monetary policy communication, with included questions on inflation perceptions and expectations.

III. Role of non-financial firm heterogeneity in monetary policy transmission

The CNB considers non-financial firm heterogeneity when preparing materials for informed decisions about setting monetary policy interest rates. Non-financial firm heterogeneity and its role in monetary policy transmission are discussed irregularly in periodical publications such as the MPRs), Analyses of the Czech Republic's Current Economic Alignment with the Euro Area, Financial Stability Reports and other outputs.[11]

The Czech Republic is a small open economy with heavy industry and a large share of exporting firms especially in the automotive industry. Apart from standard characteristics used to classify firms such as industry, firm size, new/old firm, non-/exporting firms, etc, an important aspect is whether a non-financial firm has access to loans denominated in euros. Primarily the exchange rate and credit channel in the transmission mechanism have potential to respond to non-financial firm heterogeneity to the largest extent.

Similarly to the case of households, the CNB monitors the evolution of firms' client interest rates. See Chart 8 for the distributions of interest rates on koruna-denominated loans in time and Chart 9 for the corresponding deposit rates.[12]

A standard characteristic to study firm heterogeneity – industry – is discussed, for example, in a box in *Inflation Report-IV 2018*[13]. This work discusses labour

[11] See, for example, Babecký et al (2017).

[12] For more details, see Box 3 ("How client interest rates on loans and deposits have changed over the last two years") in the Summer 2023 *MPR*.

[13] See Box 2 ("The effect of corporate investment on productivity") in *IR-IV 2018*. See also Galuščák and Sutóris (2016).

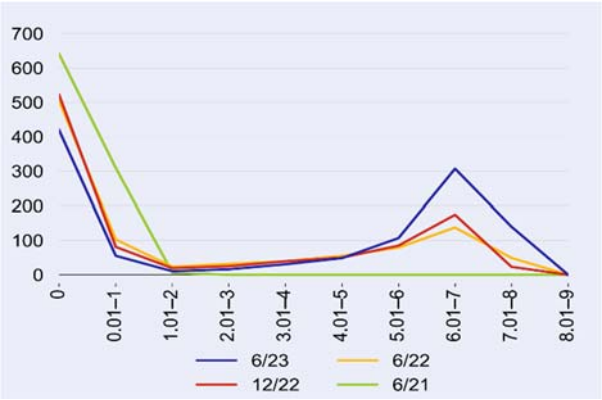
productivity and investment in the manufacturing sector as well as among large firms and is based on CZSO data on more than 800 large firms in this sector.

Interest rates on koruna-denominated loans to non-financial corporations respond almost immediately to monetary policy rates

x-axis: interest rate band in %; y-axis: volumes in CZK billions; stocks of koruna denominated loans — Chart 8

Firms are capable of attaining deposit rates close to the repo rate

x-axis: interest rate band in %; y-axis: volumes in CZK billions; stocks of deposits — Chart 9



Sectoral heterogeneity is for example studied in a box in *Inflation Report-II 2020*,[14] which focuses on how Covid-19 measures affected gross value added in different sectors, unsurprisingly with the strongest effect on services, especially tourism.

A CNB box in the Autumn 2023 *MPR*[15] uses firm-level and macro data to disentangle the Czech Republic's foreign trade relations and shows not only

[14] See Box 2 ("Direct impacts of the Covid-19 pandemic on the Czech economy") in *IR-II 2020*.

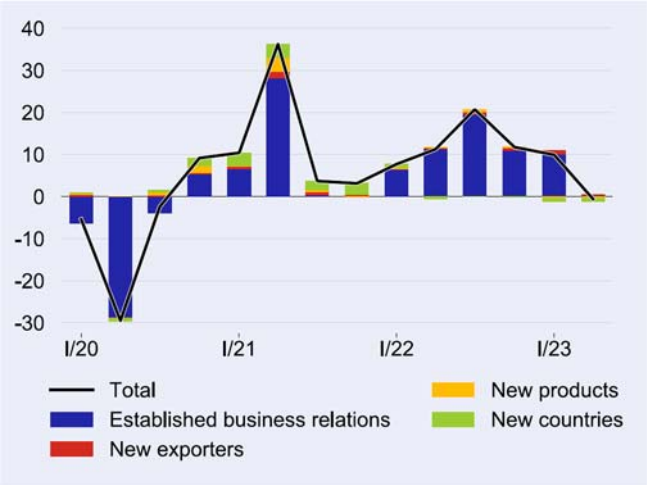
[15] See Box 1 ("The dependence of Czech exports on Germany") in the Autumn 2023 *MPR*.

Germany's importance to our economy, but also the specific nature of Czech exports in general. Czech goods exports are dominated by intermediate products such as metal products and machinery parts. An interesting characteristic to classify the heterogeneity among Czech non-financial firms is the existence of established business relationships. Chart 10 shows how much exports rise thanks to established business relations and how much thanks to new opportunities – due either to new firms becoming involved or to existing firms exporting new products or finding new markets for their goods.

Established business relations largely determine the dynamics of Czech exports

Annual growth rate of Czech exports and net contributions; CZSO firm-level data from residents on movements of goods; CNB calculations

Chart 10



Note: Weighted averages of year-on-year changes in exports at firm level, at product level under the six-digit classification of goods codes (Harmonized System) and at destination country level. Average exports in both periods are in the denominator.

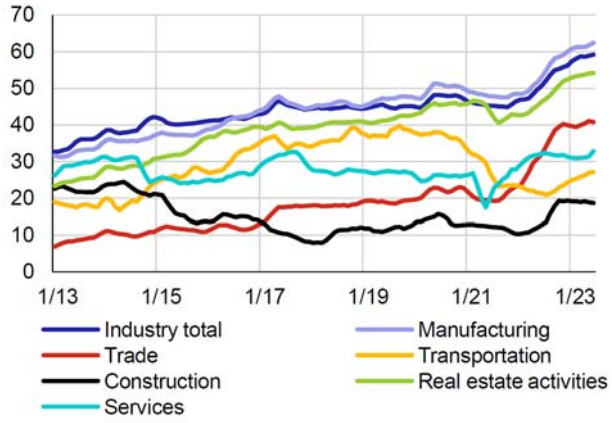
The CNB uses a standard set of granular firm-level data collected in the EU. For example, the Structure of Earnings Survey or Amadeus data are used on a regular basis. The CNB, however, uses other data sources for ad hoc analyses. A prominent example of such a data source is the AnaCredit data set, which collects information on all bank loans to non-financial corporations provided in the Czech Republic and is used in many analyses. A thematic chapter ("Euro financing of Czech firms"[16]) in an *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area* report studies a situation when an increase in the differential between domestic and foreign interest rates due to a tightening of monetary policy by the CNB has been accompanied by a rise in the share of foreign currency (mostly euro-denominated) financing of Czech corporations. A higher share of foreign currency financing in the economy, ceteris paribus, weakens the monetary policy transmission mechanism. Using the administrative data from the AnaCredit database, the chapter examines the currency structure of corporate financing by domestic banks and from abroad, the

[16] Full text available in Analyses of the Czech Republic's Current Economic Alignment with the Euro Area 2023.

relationship between the share of euro-denominated loans and the interest rate differential, and the euroisation of the Czech economy (Charts 11 and 12).

Share of euro-denominated loans in selected sectors

% Chart 11

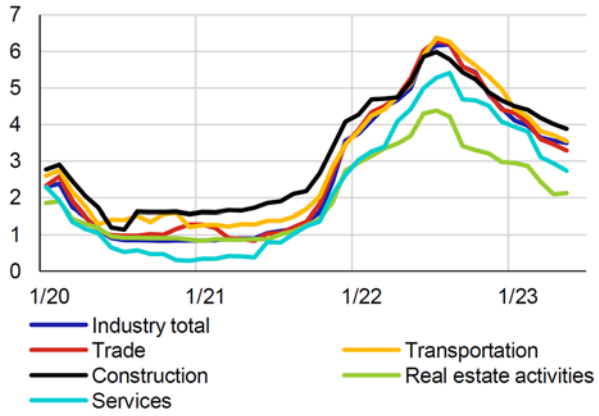


Note: 3M moving averages.

Source: CNB, CNB calculations.

Interest rate differential in selected sectors

From interest rates on koruna and euro-denominated loans; percentage points Chart 12



Source: CNB AnaCredit, CNB calculations.

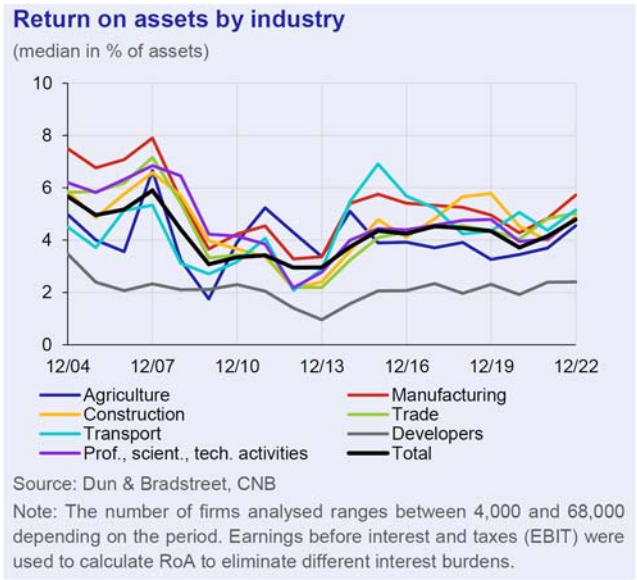
The CNB also uses data on balance sheets, covering up to 280,000 non-financial corporations operating in the Czech Republic.[17] The Spring 2024 *Financial Stability Report* box "Financial analysis of non-financial corporations"[18] analyses the situation in the corporate sector across industries and firm sizes, which is a novelty compared

[17] The data source is Dun & Bradstreet Czech Republic.

[18] For details, see Financial Stability Report Spring 2024, Box 2.

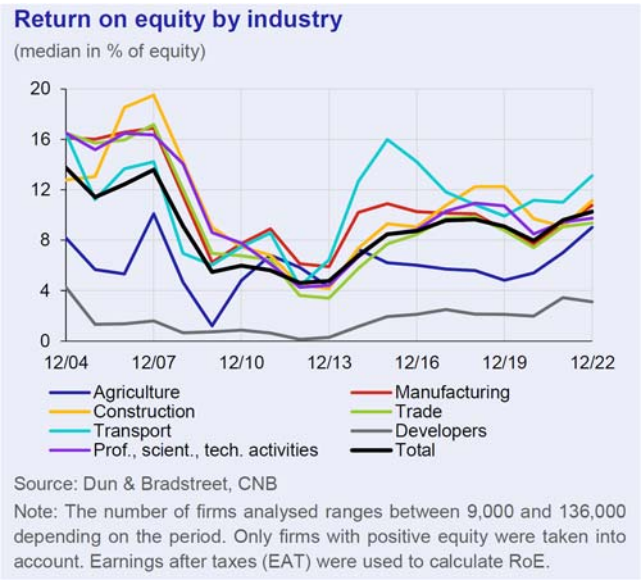
to the data sources used previously. The aim of this box was to introduce the key indicators monitored at the level of individual non-financial corporations. Knowledge of these indicators for a broad sample of firms will also allow the financial stability department to refine the stress testing of the non-financial corporations sector in the future (Chart 13).

Chart 13



Source: Dun & Bradstreet, CNB

Note: The number of firms analysed ranges between 4,000 and 68,000 depending on the period. Earnings before interest and taxes (EBIT) were used to calculate RoA to eliminate different interest burdens.



Source: Dun & Bradstreet, CNB

Note: The number of firms analysed ranges between 9,000 and 136,000 depending on the period. Only firms with positive equity were taken into account. Earnings after taxes (EAT) were used to calculate RoE.

IV. The link from heterogeneity to monetary policy decisions

The CNB implements heterogeneity of agents mainly in the form of expert judgments. These are applied mostly in ad hoc situations (eg increases in the minimum wage). Heterogeneous effects are judged based on the subpopulation distributions and their impacts are subsequently included in the core prediction model g3+. The model itself includes only two types of agents (agents with the possibility to save and hand-to-mouth agents) and, thus, the direct heterogeneity implementation is limited.

Qualitative inputs are much less involved in the prediction process and in supporting materials compared to quantitative inputs. Nevertheless, the CNB uses qualitative data occasionally. A prominent example is the European Commission Business and Consumer Survey, which focuses on inflation expectations. The qualitative answers are converted to one overarching index, which is further used for the sake of its simplicity.

Occasionally, the CNB initiates its own surveys on topics of interest. One recent example is a 2022 STEM survey that collected public opinion about trust in the CNB, the financial situation of households, and inflation expectations.

The CNB does not communicate heterogeneous effects on a regular basis. CNB Board members communicate the relevance of data on heterogeneity in specific situations, usually if some economic shock or event has a heterogeneous effect on non-financial firms or households. One example was during a high-inflation period, when CNB Board members repeatedly warned that high monetary policy interest rates disproportionally affect those non-financial firms that operate in korunas, as opposed to firms with access to financing in euros. For that reason, the CNB Board members stressed the importance of influencing the Czech economy through the exchange rate monetary policy channel.

In summer 2022, the share of business loans denominated in foreign currency (mostly euros) amounted to 55%. Loans denominated in euros were much cheaper than loans denominated in korunas. The reason behind this difference was the interest rate differential between the monetary policy rates, amounting to 6.5 pp in August 2022. Large companies and foreign-controlled companies benefited from cheaper EUR loans, while SMEs were hit hard by the tight monetary policy. Instead of tightening monetary policy rates further, the Bank Board decided to use the FX channel to tame inflation that peaked at 18% y/y in September 2022. The two-week repo rate (2W repo rate) was raised to 7% at the end of June 2022 and was expected to be raised further by some analysts. According to the Bank Board, further hikes would have only hit small and medium-sized companies hard, while large companies with access to EUR loans would have remained untouched. The question was: How to achieve a level playing field for all heterogenous agents? Instead of raising rates further, a kind of forward guidance has been used to support a strong CZK/EUR and thus to tame inflation. This strategy has proven to be successful, with the inflation target of 2% being achieved at the beginning of 2024.

V. Distributional effects of monetary policy

Under the Constitution of the Czech Republic and in accordance with primary EU law, the CNB's primary objective, which is also enshrined in the Act on the CNB, is to maintain price stability. In pursuing this objective, the CNB uses inflation targeting, which is based on a publicly announced inflation target of 2% and open communication by the central bank. By maintaining inflation close to the 2% target, the CNB creates an environment conducive to the development of business activity and growth in household living standards. Therefore, the CNB considers distributional effects of monetary policy on households and firms. However, this cannot lead to a deviation from the primary goal of maintaining price stability.

The Act on the CNB does not explicitly state that distributional effects should be considered in addition to the focus on aggregate targets. If its primary objective is not compromised, the CNB supports the government's general economic policy aimed at sustainable economic growth.

Distributional effects have been mentioned in past policy communications.[19] For example:

Board member J Procházka on the DTSI indicator, which is dependent on the client's age: "…the DSTI indicator, which relates debt service to the client's income (determining the maximum size of the monthly payment relative to their net monthly income – editor's note), is indeed a topic of discussion. The question remains whether these indicators, which constrained the market during periods of low rates, function the same way when rates are high, especially since high rates themselves are a barrier. We review these criteria every six months, but we are currently trying to act in an anti-inflationary manner, and it doesn't make sense for us to relax mortgage regulations at this time".[20]

Vice Governor J Frait on foreign exchange interventions: "We indeed abolished the intervention regime because it is an unconventional step that potentially offers some protection to certain investors…".[21]

Vice Governor E Zamrazilová comments on heterogeneous financing of Czech non-financial firms: "The financing of the domestic corporate sector reflects a relatively high level of spontaneous euroization in the economy. At the end of 2022, less than half (44%) of the total debt of the domestic corporate sector was denominated in the local currency, while 56% of loans were denominated in foreign currency, predominantly in euros….".[22]

Vice Governor E Zamrazilová on the mortgage market: "Property prices in our country have more than doubled since 2015, with the growth being the second highest in Europe. This was truly not a healthy growth. It has caused significant social challenges that will persist, especially for young families who want to acquire their own homes, making housing unaffordable for them. At the beginning of all this were very low interest rates combined with active permitting".[23]

[19] A full overview of the communication of the CNB and CNB Board members can be found at www.cnb.cz/cs/verejnost/servis-pro-media.

[20] Full text available at: www.cnb.cz/cs/verejnost/servis-pro-media/autorske-clanky-rozhovory-s-predstaviteli-cnb/Pokud-mzdy-porostou-moc-rychle-sazby-muzeme-zvednout-uz-v-kvetnu/ .

[21] Full text available at: www.cnb.cz/cs/verejnost/servis-pro-media/autorske-clanky-rozhovory-s-predstaviteli-cnb/Jan-Frait-vysvetluje-menovepoliticke-rozhodnuti-pro-Ceskou-televizi/

[22] Full text available at: www.cnb.cz/cs/verejnost/servis-pro-media/autorske-clanky-rozhovory-s-predstaviteli-cnb/Struktura-financovani-firem-a-transmise-menove-politiky-CNB/.

[23] Full text available at: www.cnb.cz/cs/verejnost/servis-pro-media/autorske-clanky-rozhovory-s-predstaviteli-cnb/Vyvoj-inflace-je-rozkolisany.-Snizovani-sazeb-muze-pokracovat-ale-obezretne/.

VI. Measures to address heterogeneity

The CNB uses certain policies that have heterogeneous impacts on firms and households. These are mainly policies that relate to financial stability and macroprudential measures.[24]

An example of such a macroprudential measure is the LTV (loan-to-value) indicator. The CNB can set or recommend a cap on this credit indicator for providers of consumer loans secured by residential property. The current cap on the LTV indicator is 80% (90% for applicants under 36 years old purchasing their own housing). Above this threshold, banks can grant loans only by exception. Similar age-specific heterogeneity holds for the DSTI (debt service-to-income and) and DTI (debt-to-income) indicators.[25] Currently, there is no mandatory upper limit set for the DSTI and DTI.

The CNB has recently introduced the SyRB (systemic risk buffer; a capital reserve for covering possible systemic risk), which is used to strengthen resilience against identified but harder-to-measure long-term structural risks. In the case of these risks, there are very limited comparable historical experiences regarding their materialisation, and as a result, these risks are more difficult to quantify and require a significant degree of expert assessment. The CNB can set the SyRB broadly for the entire banking sector and for all types of exposures (so-called broad SyRB) or sectorally for a defined subset (eg exposures related to loans in the real estate sector) based on the nature of the identified systemic structural risks.

The duration of the above-mentioned measures is usually not limited by a defined time frame, but their parameters can be changed or they can be cancelled based on the decision of the CNB Board.

[24] More about the financial stability department and macroprudential policies carried out by the CNB can be found at: www.cnb.cz/cs/financni-stabilita/.

[25] More details about the credit indicators can be found at: www.cnb.cz/cs/financni-stabilita/makroobezretnostni-politika/stanoveni-horni-hranice-uverovych-ukazatelu/.

References:

Ambriško, R, J Babecký, J Ryšánek and V Valenta (2015): "Assessing the impact of fiscal measures on the Czech economy", *Economic Modelling*, vol 44, pp 350–57, www.sciencedirect.com/science/article/pii/S0264999314002764.

Audzei, V and I Sutóris (2024): "A heterogeneous agent model of energy consumption and energy conservation", *Czech National Bank Working Papers*, no 4/2024, www.cnb.cz/en/economic-research/research-publications/cnb-working-paper-series/A-Heterogeneous-Agent-Model-of-Energy-Consumption-and-Energy-Conservation-00001/.

Babecká Kucharčuková, O, M Franta, D Hájková, P Král, I Kubicová, A Podpiera and B Saxa (2013): "What we know about monetary policy transmission in the Czech Republic: collection of empirical results", *Czech National Bank Research and Policy Notes*, no 1/2013, October, www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/research_publications/irpn/download/rpn_1_2013.pdf.

Babecká Kucharčuková, O and R Pašaličová (2017): "Firm investment, financial constraints and monetary transmission: an investigation with Czech firm-level data", *Czech National Bank Working Papers*, no 16/2017, www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/research_publications/cnb_wp/cnbwp_2017_16.pdf.

Babecký, J, J Brůha and I Sutóris (2024): "Financial situation of Czech households: results and applications", Czech National Bank, mimeo.

Babecký, J, M Franta and J Ryšánek (2018): "Fiscal policy within the DSGE-VAR framework", *Economic Modelling*, vol 75, pp 23–37, www.sciencedirect.com/science/article/pii/S0264999317319077.

Babecký, J, K Galuščák and D Žigraiová (2017): "Wage dynamics and financial performance: evidence from Czech firms", *Czech National Bank Working Papers*, no 14/2017, https://www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/research_publications/cnb_wp/cnbwp_2017_14.pdf.

Brázdik, F, T Hlédik, Z Humplová, I Martonosi, K Musil, J Ryšánek and J Žáček (2020): "The g3+ model: an upgrade of the Czech National Bank's core forecasting framework", *Czech National Bank Working Papers*, no 7/2020, www.cnb.cz/en/economic-research/research-publications/cnb-working-paper-series/The-g3-Model-An-Upgrade-of-the-Czech-National-Banks-Core-Forecasting-Framework-00001/.

Brázdik, F, T Keseliová, K Musil, R Šnobl, J Šolc, S Tvrz and J Zacek (2024): "Understanding inflation expectations: data, drivers and policy implications", *Czech National Bank Working Papers*, no 3/2024, www.cnb.cz/en/economic-research/research-publications/cnb-working-paper-series/Understanding-Inflation-Expectations-Data-Drivers-and-Policy-Implications-00001/.

Czech National Bank (2024): *Financial Stability Report – Spring 2024*, www.cnb.cz/export/sites/cnb/en/financial-stability/.galleries/fs_reports/fsr_2024_spring/fsr_2024_spring.pdf.

Ehrenbergerová, D, Z Gric and S Malovaná (2024): "Distributional effects of borrower-based macroprudential measures", Czech National Bank, mimeo.

Franta, M, R Horváth and M Rusnák (2011): "Evaluating changes LQWKH monetary transmission mechanism in the Czech Republic", *Czech National Bank Working Papers*, no 13/2011, www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/research_publications/cnb_wp/cnbwp_2011_13.pdf.

Galuščák, K and I Sutóris (2016): "Margins of trade: Czech firms before, during and after the crisis", *Czech National Bank Working Papers*, no 14/2017, www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/research_publications/cnb_wp/cnbwp_2016_12.pdf.

Gregor, J (2024): "A stress test approach to the calibration of borrower-based measures: a case study of the Czech Republic", *Czech National Bank Working Papers*, no 2/2024, www.cnb.cz/en/economic-research/research-publications/cnb-working-paper-series/A-Stress-Test-Approach-to-the-Calibration-of-Borrower-Based-Measures-A-Case-Study-of-the-Czech-Republic/.

Gric, Z, D Ehrenbergerova and M Hodula (2022): "The power of sentiment: irrational beliefs of households and consumer loan dynamics", *Journal of Financial Stability*, vol 59, 100973, pp 1–16, www.sciencedirect.com/science/article/pii/S157230892200002X.

Hromádková, E, I Kubicová and B Saxa (2023): "How does interest rate pass-through change over time? Rolling windows and the role of the credit risk premium in the pricing of Czech loans", *Czech National Bank Research and Policy Notes*, no 2/2023, www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/research_publications/irpn/download/rpn_2_2023.pdf.

Junicke, M, J Matějů, H Mumtaz and A Theophilopoulou (2023): "Distributional effects of monetary policy shocks on wage and hours worked: evidence from the Czech labor market", *Czech National Bank Working Papers*, no 4/2023, www.cnb.cz/en/economic-research/research-publications/cnb-working-paper-series/Distributional-Effects-of-Monetary-Policy-Shocks-on-Wage-and-Hours-Worked-Evidence-from-the-Czech-Labor-Market/.

Sutóris, I (2023): "Individual inflation of Czech households: price rises hit mainly the poorer ones" (in Czech), *cnBlog*, 14 July, Czech National Bank, www.cnb.cz/cs/o_cnb/cnblog/Individualni-inflace-ceskych-domacnosti-Rust-cen-dopadl-hlavne-na-ty-chudsi/.

Monetary policy decision-making: how are household and firm heterogeneity incorporated?

Transmission of high interest rates to households and firms: perspectives from Hong Kong SAR

Hong Kong Monetary Authority

Abstract

Hong Kong SAR implements the Linked Exchange Rate System, which restricts the Hong Kong Monetary Authority's discretion on matters of monetary policy. Nevertheless, the Hong Kong economy is subject to monetary policy shocks from the United States. This note discusses the main interest rate transmission channels that impact households and non-financial firms. It highlights several factors driving uneven interest rate responses for Hong Kong, including income and outstanding residential mortgage loans for the household sector, and access to external finance and the interest rate structure for non-financial firms. The note further presents some measures undertaken in Hong Kong to mitigate heterogeneity.

JEL Classification: D22, E21, E52, E58, F41.

Keywords: monetary policy, Linked Exchange Rate System, residential mortgage, small and medium-sized enterprises.

1. Introduction

Monetary policy, typically implemented through interest rates and money supply adjustments, is widely used to stabilise the economy. However, the effects of monetary policy are not uniform across different segments of the population and industries, leading to heterogeneous outcomes.

In the case of Hong Kong SAR, even though it follows the Linked Exchange Rate System (LERS), which restricts the Hong Kong Monetary Authority's (HKMA's) discretion on matters of monetary policy, the Hong Kong economy remains subject to monetary policy shocks from the United States. In light of the monetary regime in Hong Kong, this note presents our views and experiences regarding the relevance and strength of various channels through which US interest rates are transmitted to households and non-financial firms in Hong Kong. The interest rate transmission does not imply that Hong Kong has an active monetary policy.

The rest of this note is organised as follows. The next two sections explain the LERS and discuss the main interest rate transmission channels through which a US interest rate hike impacts households and non-financial firms in Hong Kong. Drawing

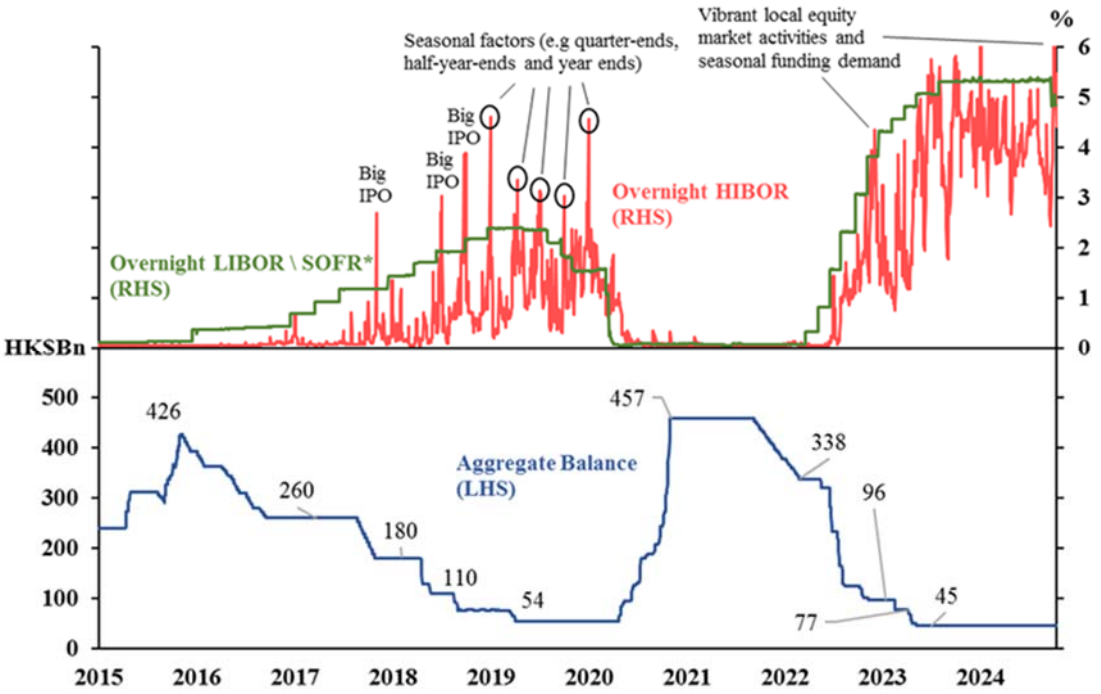
on HKMA studies and granular data, Sections IV and V illustrate the ways in which various dimensions of differences across households and firms matter for interest rate transmission. On the household side, Section IV highlights the roles of household income and outstanding residential mortgage loans in driving uneven responses, as well as the use of countercyclical macroprudential measures and the Mortgage Insurance Programme as mitigating factors. In Section V, access to external finance and the interest rate structure are identified as two sources of heterogeneity among non-financial firms. Section V also shares our experience in supporting small and medium-sized enterprises (SMEs) through countercyclical capital buffers and the SME Financing Guarantee Scheme (SFGS).

2. Interest rate transmission in Hong Kong

Hong Kong follows the LERS, which keeps the Hong Kong dollar (HKD) trading within the Convertibility Zone of HKD 7.75–7.85 to 1 US dollar. Importantly, the LERS is characterised by the Currency Board arrangement, which restricts the HKMA's discretion on matters of monetary policy.

In accordance with the LERS and through an automatic interest rate adjustment mechanism, HKD interbank interest rates generally track their USD counterparts. As an example, during the last US rate hike cycle, which began in March 2022, the Hong Kong dollar eased on widened interest rate spreads to the rising US interest rate. With funds flowing out from the HKD system, the weak-side Convertibility Undertaking was triggered 49 times, and the Aggregate Balance (ie the sum of the balances in the clearing accounts kept with the HKMA) contracted from over HKD 450 billion in 2021 to around HKD 45 billion in 2023. Tighter liquidity conditions drove the HKD interbank rates to gradually rise and track the USD interbank rates (Chart 1). In practice, HKD long-dated interest rates would track the US rates more closely, while short-dated interest rates would also respond to local supply and demand for the Hong Kong dollar.

Aggregate balance and overnight interest rates Chart 1



The USD London interbank offered rate (Libor) has been discontinued since 1 July 2023 and replaced by the secured overnight financing rate (SOFR) as its alternative reference rate.

Source: HKMA

The interbank interest rates are transmitted to the retail interest rates as banks adjust their deposit and lending rates taking into account the level of interbank rates (as well as their own funding cost structures).

3. Aggregate interest rate transmission channels

Changes in interest rates have the usual aggregate effects on the Hong Kong economy, through influencing aggregate demand and supply. On the demand side, a rise in interest rates induces households to substitute current consumption with saving in return for raising future spending. Consumption is also negatively impacted due to wealth and collateral effects. On the supply side, higher interest rates increase firms' cost of borrowing and lower collateral values. This section elaborates on these channels based on empirical studies by the HKMA and others.

On the demand side, Cutler (2004) found that a 100 basis point (bp) increase in the real interest rate would reduce the level of consumption by 0.39% in the short run, which is similar to the estimates for some other countries such as the United Kingdom. Recent literature, however, suggests that the substitution effect associated with a rising interest rate could be mitigated in economies with a well developed financial market, as this provides households with greater access to financial

instruments, thereby reducing their need for precautionary saving (Aizenman et al (2019)). This finding suggests that the direct impact of the interest rate on private consumption might have been weakened in Hong Kong along with the development of the local financial market over the past 20 years.

With mortgages accounting for the major portion of household loans in Hong Kong, higher interest rates could negatively affect private consumption through their impact on mortgagees' debt service burden and thereby households' expendable income. The magnitude of such an impact is also expected to increase with the size of the outstanding mortgage loans. By constructing a quarterly indicator on the outstanding mortgage debt servicing ratio (DSR) of households in Hong Kong, Chan et al (2017) find that a higher mortgage debt service burden would act as a drag on private consumption, with a 1 percentage point increase in the indicator reducing household consumption by 0.76% in the long run.

Higher interest rates could also lead to a reduction in consumption through their dampening effect on equity and property prices, resulting in negative wealth and collateral effects. Among different types of assets, property assets serve as the key transmission channel in Hong Kong, as residential property constitutes the major portion of household assets. According to the estimation by Lo (2019), a 10% increase in real property wealth at an aggregate level would lead to around a 1.1–1.2% boost in private consumption, whereas a 10% increase in stock market wealth would boost private consumption by a smaller extent of around 0.5%. These estimates are consistent with the findings of our analysis (HKMA (2016)), in which interest rate transmission works through the property price channel with a time lag, and the property price channel would eventually exert a strong drag on private consumption. In contrast, transmission through the equity price channel was found to be very limited.

On the supply side, rises in interest rates would act as a drag on firms' capital investments, both directly through an increase in the cost of borrowing, and indirectly through a reduction in the collateral value of their assets. In addition, changes in interest rates may also indirectly affect the pricing decision of property developers through their impact on housing prices. In particular, financially distressed developers, characterised by high leverage and low liquidity, may be particularly vulnerable to interest rate increases and may have to resort to fire sales of their units in order to meet their liquidity demand [under an adverse scenario]. The resulting price cut in the primary market by distressed developers would also exert downward pressure on secondary market prices and undermine overall market activities.

4. Household heterogeneity

Recent advances in the heterogeneous agent New Keynesian (HANK) model literature have demonstrated that households with positive and negative liquid wealth holdings have differentiated consumption responses to interest rate adjustments.[1] Moreover,

[1] See Kaplan et al (2018) and Holm et al (2021) for details.

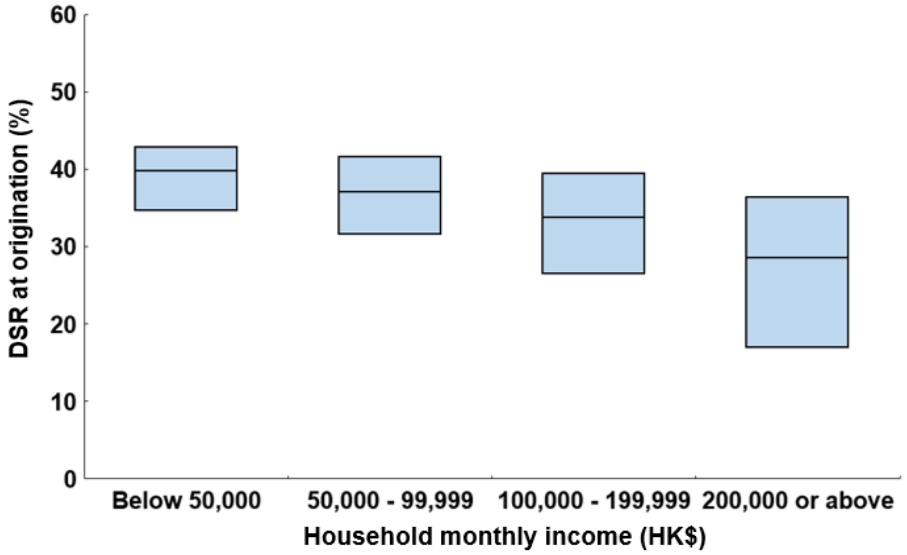
households with limited liquid wealth have large indirect effects because they have high marginal propensity to consume out of a fall in their income.

These findings suggest that, for Hong Kong, low-income households and households whose wealth is largely locked up in their residential properties (such as liquidity-constrained first-time homebuyers with low savings for down payments) could be more exposed to interest rate risks.[2] Furthermore, young households, which, according to life-cycle theories, tend to be credit-constrained and exhibit hand-to-mouth consumption behaviour, may be more susceptible to the adverse impact of an interest rate hike.

Our data indeed show such a relationship between household income and interest rate risks. Using granular data on outstanding residential mortgage loans (RMLs) reported by Authorized Institutions,[3] we find evidence that household exposure to interest rate risks in Hong Kong is skewed towards the lower- and medium-income households. In particular, these granular data reveal that households in the lowest income group have a median DSR at origination of around 40%, which is much higher than that of the households in the highest income group, at 29% (Chart 2). This implies that lower-income households with an outstanding RML in Hong Kong could be more vulnerable to interest rate shocks, especially given the fact that over 90% of the RMLs in Hong Kong are floating rate mortgages.

DSR at origination by income group

Chart 2



The length of the box plot shows the interquartile range of the DSR at origination, with the upper, middle and lower bars of each box representing the 75th percentile, the median, and the 25th percentile respectively.

Source: HKMA staff estimates based on granular data on RMLs.

[2] A study using US and UK data finds that mortgagors, but not owners and renters, adjust their expenditure strongly to interest rate changes (Cloyne et al (2020)).

[3] The HKMA initiated the Granular Data Reporting (GDR) programme in April 2019, under which Authorized Institutions are required to report transaction-level RML data to the HKMA on a monthly basis. As of July 2024, the GDR data set contained over 615,000 outstanding RMLs associated with around 650,000 borrowers/guarantors.

While aiming to strengthen banks' risk management and resilience to a possible downturn in the local housing market, the countercyclical macroprudential measures for property mortgage loans may also indirectly address the difference in the transmission of interest rate shocks arising from such heterogeneity. The measures were introduced partly due to the fact that RMLs have always accounted for more than 20% of the banking sector's lending for use in Hong Kong. The HKMA implemented a total of eight rounds of macroprudential tightening measures between 2009 and 2017. These tightening measures included, but were not limited to: (i) lowering caps on the loan-to-value (LTV) ratio and limits on the DSR for mortgage loans; and (ii) applying stress testing on mortgage borrowers with respect to changes in the mortgage interest rate. By adjusting the caps on the LTV ratio and the limits on DSR, these macroprudential tightening measures helped restrain the mortgage debt service burden across all individuals, thereby indirectly mitigating the difference in the impact of interest rate shocks on households at different income levels. In addition, these measures also restrained the growth in mortgage debt service burden in the event of an interest rate hike, helping alleviate the potential headwinds to private consumption.

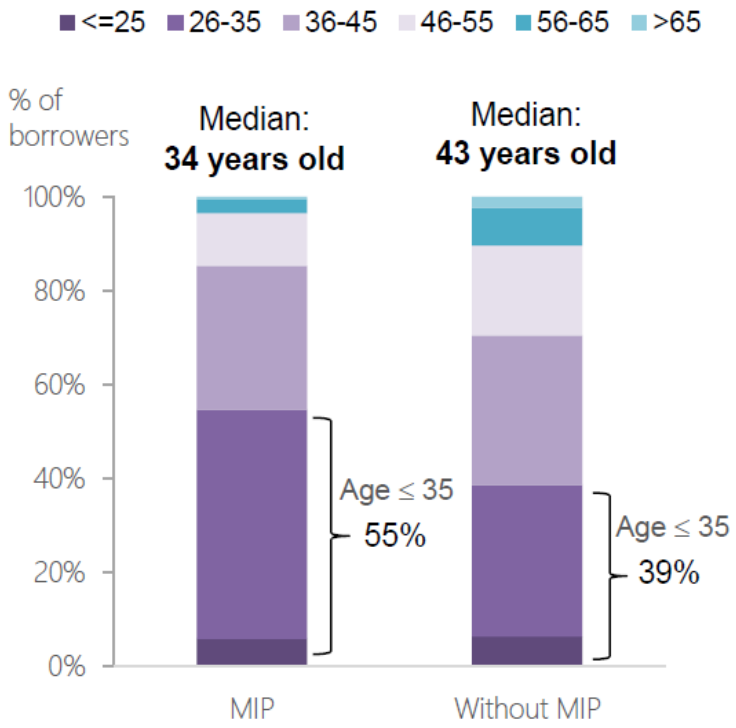
The Mortgage Insurance Programme (MIP) has served as a complement to the countercyclical macroprudential measures by alleviating the liquidity constraints on first-time homebuyers, particularly those with lower savings for down payments. The MIP was launched by the Hong Kong Mortgage Corporation (HKMC)[4] in 1999 to promote wider home ownership in Hong Kong by reducing the down payment required for financially sound first-time homebuyers to purchase their self-occupied properties.[5] Through several rounds of amendments to the MIP between 2019 and 2024, our granular data on RMLs revealed that the median age of new mortgage borrowers using the MIP was 34, in contrast to 43 years old among the non-MIP borrowers (Chart 3). This suggests that the MIP advanced home purchases by about nine years on average. Meanwhile, empirical evidence also shows that the MIP can enhance banking stability without undermining the effectiveness of the macroprudential tools.[6] Indeed, reflecting the prudent underwriting criteria and high mortgage loan quality under the MIP, the delinquency ratio of these loans remained at a very low level of 0.02% in 2023, even lower than the 0.08% delinquency ratio of all the outstanding RMLs of the Hong Kong banking sector at end-December 2023.

[4] The HKMC was established in 1997 and is owned by the Hong Kong SAR government. Its primary missions include: (i) to enhance the stability of the banking sector by offering a reliable source of liquidity, thereby reducing the concentration and liquidity risk of mortgage lending by banks; (ii) to promote wider home ownership in Hong Kong; and (iii) to facilitate the growth and development of the debt securities and mortgage-backed securities markets in Hong Kong.

[5] The MIP is designed to protect banks from credit losses on the portion of loans over the threshold set by the macroprudential measures in the event of mortgage default. Under the MIP, mortgage loans of up to 90% of the LTV ratio are available for eligible homebuyers.

[6] See Wong et al (2011).

Age distribution of mortgage borrowers by MIP usage Chart 3



Source: HKMA staff estimates based on granular data on RMLs.

5. Firm heterogeneity

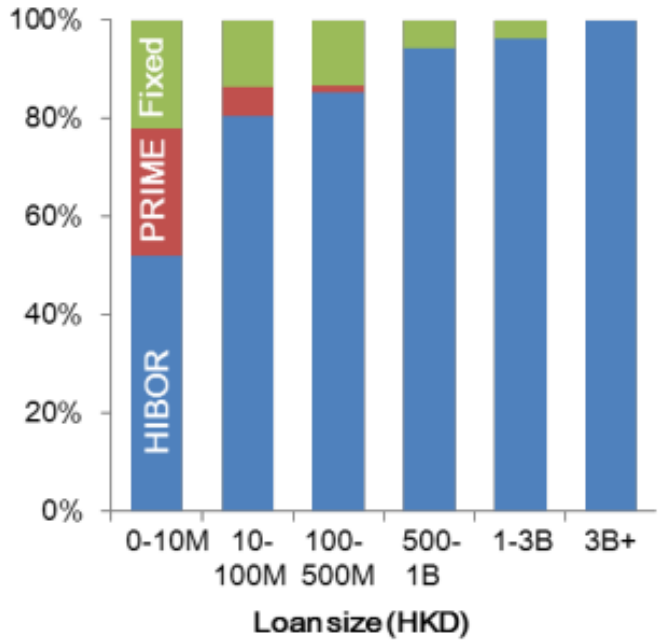
An interest rate hike also has heterogeneous impacts on firms, along several dimensions. We highlight two of these. First, firms may have differentiated interest rate structures. Heterogeneity in the reliance on floating rate debt and in the type of reference interest rate would affect the transmission of interest rate shocks to firms. Second, it is well known that large firms in general have better access to external financing than smaller firms.[7] The heterogeneity may stem from market frictions and imperfections.

In terms of the interest rate structure of the firms in Hong Kong, the majority of corporate loans extended by banks have a floating rate structure (Chart 4). Loans to large corporates are mainly priced with reference to the Hong Kong interbank offered rates (HIBORs) or USD market interest rates, whereas smaller corporates like SMEs are more reliant on loans priced with reference to the prime lending rate (Wu and Liu (2020)). Since HIBORs track the USD market interest rates while the adjustment of the prime rate tends to lag behind, firms with loans priced with reference to HIBORs could be more susceptible to interest rate changes. In fact, during the US interest rate hike

[7] See Beck et al (2008), for example.

cycle in 2022–23, the one-month HIBOR rose markedly, by about 500 bp, while the prime rate was raised by only 87.5 bp. This suggests that the transmission of higher interest rates was more apparent for large corporates during this rate hike cycle.

Distribution of loan reference rate by loan size — Chart 4



HKD loans only. Data as of end-August 2019. Percentage share of loans based on outstanding amount of sample banks.

Sources: Wu and Liu (2020); HKMA.

On the one hand, the smaller and slower upward adjustment in the prime rate may mean a more moderate transmission through interest rate changes to SME loans, which are mainly prime-based. On the other hand, the availability of credit for SMEs is also an important aspect to consider. In view of the concerns over credit availability and the challenges facing SMEs amid uncertainties in the external and local environment over the past couple of years, the HKMA has worked with the banking sector to roll out a series of measures to support the financing needs of SMEs (eg more flexible repayment arrangements, credit products and services to assist SMEs' transformation), subject to prudent risk management principles, and set up a joint Taskforce on SME Lending. In October 2024, the HKMA also lowered the countercyclical capital buffer (CCyB) ratio from 1% to 0.5% to release bank capital to facilitate lending. In addition, the Hong Kong government has extended and enhanced the SFGS.[8]

Experience during the pandemic suggests that the release of the CCyB and SFGS were effective in supporting lending in times of stress, and these policy measures

[8] In October 2024, the Hong Kong government announced that for both existing and new loans, borrowing enterprises under the SFGS will be allowed to apply for principal moratorium for up to 12 months, while the maximum loan guarantee periods of the 80% and 90% guarantee products will be extended to 10 years and eight years respectively. In addition, the partial principal repayment options will be offered for new loans under the two guarantee products.

were complementary. An HKMA study finds that banks deployed their extra capital headroom from the release of the CCyB to support mainly less risky corporate loans (those less hit by the pandemic), while credit flows to hard-hit sectors were well supported by the SFGS (Wong et al (2022)). Using granular data from the GDR programme and a deep neural network model, a follow-up HKMA study on the SFGS reaches a similar conclusion – the scheme has been particularly effective in supporting those SMEs operating in vulnerable industries or seeking loans for uncertain purposes during the pandemic (Poon et al (2024)). It further shows that the scheme has a stabilising effect on the perceived creditworthiness of the borrowers.

With the various policy measures, it is expected that banks will continue to be supportive of SME financing. Indeed, according to our regular survey on SMEs' credit conditions, the share of respondents reporting tightening of banks' credit approval stance remained broadly steady in recent quarters. This result suggests that transmission to SMEs through the credit availability channel may not be strong.

References

Aizenman, J, Y-W Cheung and H Ito (2019): "The interest rate effect on private saving: alternative perspectives", *Journal of International Commerce, Economics and Policy*, vol 10, no 1, pp 1–37.

Beck, T, A Demirgüç-Kunt and V Maksimovic (2008): "Financing patterns around the world: are small firms different?", *Journal of Financial Economics*, vol 89, no 3, pp 467-87.

Chan, S, A Fu and M Cheng (2017): "Measuring the effect of mortgage debt service burden on private consumption", *Hong Kong Monetary Authority Research Memorandum*, no 16/2017.

Cloyne, J, C Ferreira and P Surico (2020): "Monetary policy when households have debt: new evidence on the transmission mechanism", *Review of Economic Studies*, vol 87, no 1, pp 102–29.

Cutler, J (2004): "The relationship between consumption, income and wealth in Hong Kong", *HKIMR Working Papers*, no 01/2004, January.

Holm, M, P Paul and A Tischbirek (2021): "The transmission of monetary policy under the microscope", *Journal of Political Economy*, vol 129, no 10, pp 2861–904.

Hong Kong Monetary Authority (2016): "Box 3: Examining the impact of interest rate hikes on Hong Kong's private consumption", *Half-Yearly Monetary and Financial Stability Report*, March.

Kaplan, G, B Moll and G Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743.

Lo, S (2019): "Quantitative analysis of wealth effects on private consumption expenditure in Hong Kong", *Office of the Government Economist of the Hong Kong Special Administrative Region Economic Letters*, no 2019/05, May.

Poon, M, O So and M Kwong (2024): "Assessing the effectiveness of SME Financing Guarantee Scheme using granular data", *Hong Kong Monetary Authority Research Memorandum*, no 04/2024, March.

Wong, E, T Fong, K-f Li and H Choi (2011): "Loan-to-value ratio as a macro-prudential tool – Hong Kong's experience and cross-country evidence", *Working Papers*, no 01/2011, Hong Kong Monetary Authority, February.

Wong, E, K Ho, A Wong and V Lo (2022): "The effects of COVID-19 support measures on bank lending: lessons from the release of the Countercyclical Capital Buffer and Loan Guarantee Schemes in Hong Kong", *HKIMR Working Papers*, no 21/2022, December.

Wu, M and Z Liu (2020): "Corporate loan pricing and collateral decision in Hong Kong: evidence from granular transaction-level data", *Hong Kong Monetary Authority Research Memorandum*, no 02/2020, May.

Monetary policy decision-making: how are household and firm heterogeneity incorporated in Hungary?[1]

Laura Komlóssy, Alexandr Palicz, Péter Simon, Veronika Tengely and Tímea Várnai*

Abstract

Studying the granularities in household and firm data may reveal important lessons for the transmission of monetary policy, for the economic outlook and for assessing the distributive effects of economic policies. Therefore, to make informed decisions about the economy, central banks need to consider that households and firms are heterogeneous. In this note, we review some of the heterogeneities present in the Hungarian economy and discuss how the Magyar Nemzeti Bank (MNB) takes these into account when formulating its policies. We argue that sufficient data which are available in a timely manner can greatly inform central bank decision-making. However, global discussions are needed on the practical lessons of incorporating heterogeneity into central banking to inform policymakers and experts alike. Accordingly, we contribute to this conversation by sharing the MNB's experience regarding two specific policies: a targeted lending programme aimed at small and medium-sized enterprises, and a set of borrower-based macroprudential measures aimed at addressing heterogeneities in household credit risk.

[1] The views of the authors do not necessarily reflect the official view of the Magyar Nemzeti Bank.

1. Introduction

In many aspects, strong differences can be found in the behaviour of households and firms. In recent years, growing emphasis has been placed on these differences and how they influence economic activity.

Addressing heterogeneity can improve our understanding of economic processes in a number of ways. Most importantly for central banks, differences between various households and firms affect the way monetary policy is transmitted to the economy (see, for example, Kaplan et al (2018)). Moreover, these differences may vary in time, also causing the attributes of the transmission mechanism to change. For instance, consider a household that, as a rule of thumb, consumes all income for a set period: this household does not weigh consumption-savings decisions. It is easy to see that the larger the share of such households, the weaker the central bank's ability to encourage household savings on an aggregate level.

In addition to affecting the transmission of monetary policy, exploring heterogeneities may lead to an enhanced understanding of the economic outlook or the distributional effects of economic policies. Overall, to make informed decisions about their policies, central banks need to take into account heterogeneities that are present across households and companies.

Hungary is no different in this regard. Heterogeneities present themselves in various forms: household net wealth, firm size, inflation expectations, etc. In line with international practice, the Magyar Nemzeti Bank (MNB) has been working on compiling data that present these differences in a meaningful way. The variety of households and companies is also considered in the decision-making process of the MNB.

In this note, we aim to provide an overview of the heterogeneities in the Hungarian economy and discuss how the MNB takes these into account when formulating its policies. The emphasis is on how the transmission of monetary policy is affected. We argue that for an inflation-targeting central bank, this is the aspect that must be the top priority. In addition, we also give practical examples that present the MNB's experience regarding certain programmes where heterogeneities were taken into account. We do so to facilitate conversation about the utility of these types of programmes, which may prove useful to economic policymakers.

Our note is organised as follows. In Section 2, we briefly review the transmission mechanism of monetary policy. In Section 3, we explore different aspects of heterogeneity and how they are present in the Hungarian economy. Perspectives of incorporating granular data into central bank decision-making are discussed in Section 4. In Section 5, we draw conclusions on certain programmes of the MNB that were designed with firm or household heterogeneities in mind. We conclude in Section 6.

2. A brief review of monetary policy transmission

Monetary policy transmission is the mechanism through which the actions of monetary policy affect and influence the economy. This mechanism may vary due to institutional attributes or the legal framework in which central banks operate (Balogh et al (2017)). As a result, different central banks follow slightly different schematic models of monetary policy transmission (see, for example, ECB (2000), Bank of England (1999), MNB (2012)). In the following, we briefly discuss the central channels of transmission (based on Felcser et al (2017)), along with the most relevant insights from the point of view of household and firm heterogeneity.

The interest rate channel is to be thought of as the channel responsible for governing consumption-savings decisions and therefore aggregate demand and price developments (Balogh et al (2017)). Assuming some degree of price stickiness, a change in the policy rate of the central bank leads to a shift in real interest rates as well, resulting in a re-evaluation of optimal consumption-savings and investment decisions and therefore in a shift in aggregate demand. The interest rate channel is generally considered to be fundamental and relatively strong, especially in developed economies (Bernanke et al (1999), Balogh et al (2017)).

The above process is subject to a central assumption; namely, that the interest rates that households and companies face also adjust in accordance with the change in the central bank policy rate. However, that is not necessarily the case. Indeed, empirical research has found significant regional and temporal variation regarding the pass-through of changes in the central bank's policy rate to retail interest rates (Beyer et al (2024), Andries and Billon (2016), Karagiannis et al (2010)). However, asset type, market structure, financial sector concentration, liquidity and the availability of deposits relative to profitable lending opportunities seem to matter, while cross-country heterogeneities can also manifest due to public policy decisions (Beyer et al (2024)).

Regarding retail interest rates, empirical results point to a greater degree of pass-through to lending rates relative to deposit rates (Karagiannis et al (2010)). In addition, there is also evidence that short-term lending rates and longer-term deposit rates adjust more following a change in the policy rate compared to long-term lending and short-term deposit rates (Andries and Billon (2016)). Overall, the pass-through of changes in the policy rate to retail interest rates seems to be incomplete even in the long run (Felcser et al (2017)). In particular, it was weaker and slower during the post-pandemic hiking cycle compared to past cycles (Beyer et al (2024)).

The interest rate channel in Hungary works in line with economic theory as described above and international experience. However, we observe weak pass-through to term deposit rates in the household sector in the last interest rate hike cycle that started in 2021.

The exchange rate channel of monetary policy transmission describes the effects of fluctuations in the exchange rate on price developments. For instance, a lower policy rate is consistent with a weaker domestic exchange rate, which raises consumer prices via price increases on imported goods, while net exports also increase. This mechanism is an especially important channel of policy transmission in small open economies.

The credit channel describes the changes in aggregate credit supply and demand that take place following a change in the policy rate. Regarding credit supply, a decrease in the policy rate may strengthen bank lending by lowering the profitability of banks and by making available more external funding possibilities, while also possibly increasing the search for yield. On the demand side, an easing in monetary conditions drives credit demand higher, with firms' propensity to invest and their creditworthiness increasing, due to stronger demand for their products and increasing firm value (Felcser et al (2017)). This financial accelerator effect complements the interest rate channel of monetary policy transmission (Bernanke et al (1999)).

When making a decision, actors in the economy take into consideration their expectations regarding the future – this is where the expectations channel plays a central role. This channel controls the feedback mechanism in which economic agents individually take some action based on their expectations and produce an aggregate result, which then feeds back into their expectations. For instance, fluctuations in market interest rates, exchange rates and prices tend to reflect the evolution of market participants' expectations regarding the future state of the economy. Similarly, if households expect inflation to be high, they might decide to spend more in the present in order to avoid the price increases. However, this leads to an increase in aggregate demand, to which companies may respond by raising prices, thus elevating actual inflation.

It is clear from the previous example that for inflation-targeting central banks, inflation expectations are crucial. More precisely, they need to be anchored around the central bank target. This notion is supported by empirical evidence that points to monetary policy playing an important role in macroeconomic stabilisation through the expectations channel (Kryvtsov and Petersen (2013)). Overall, theoretical and empirical results suggest that strengthening credibility improves the central bank's influence over expectations (Diegel and Nautz (2021), Coibion et al (2022), Amatyakul et al (2023)).

Household and firm heterogeneity affects the transmission of monetary policy. For instance, in the case of the interest rate channel, aggregate demand is likely to be sensitive to the degree of heterogeneity. Moreover, firms with poorer access to credit display a stronger investment response to a change in the policy rate (see, for example, Bernanke et al (1999)), which also seems to vary with firm size, age and product durability (Durante et al (2022)). Finally, the expectations channel may also be affected, as survey-based studies show that inflation expectations tend to be heterogeneous across age, gender, wealth, education, financial literacy and IQ (D'Acunto et al (2024)). However, although these aspects are worth exploring, the inquiry may be limited by the availability of data.

3. How does heterogeneity affect transmission in Hungary?

From the previous section, it is evident that heterogeneity affects the transmission of monetary policy. Therefore, to have a clear view of how the transmission mechanism develops, it is crucial to closely follow changes and trends in the granular data. In

recent years, the MNB has explored some related areas, and this section provides an overview of some of the most important developments.

3.1 Net wealth and indebtedness

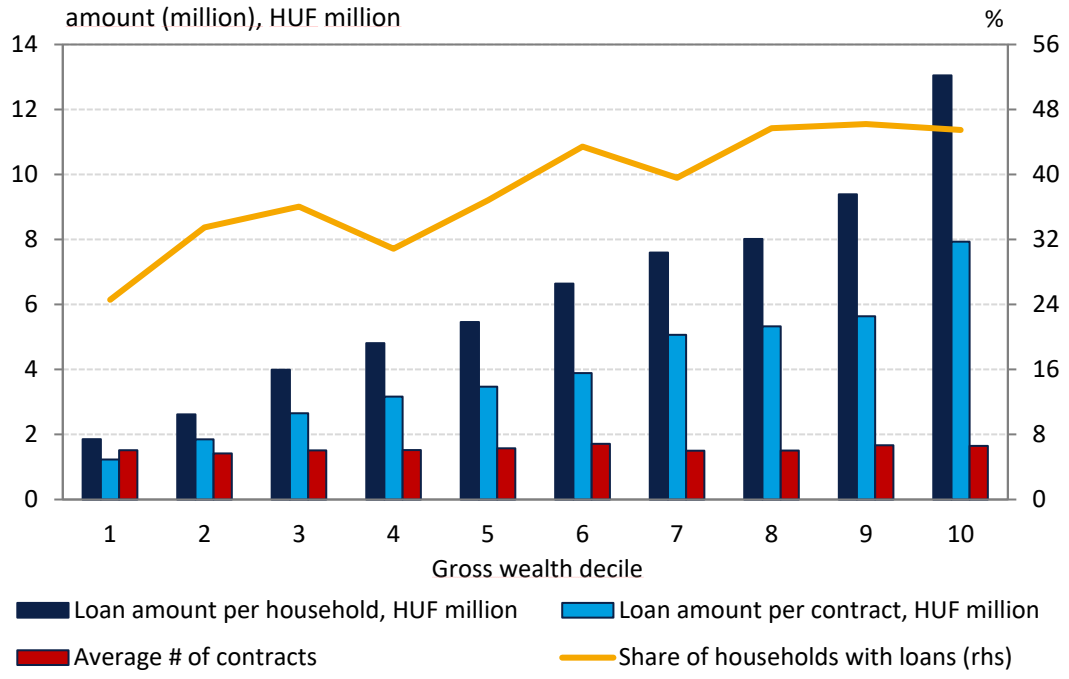
The MNB voluntarily coordinates the Hungarian version of the Household Finance and Consumption Survey (HFCS), a survey aimed at providing comparable data on the characteristics and distribution of household wealth, income and consumption across EU member states. In addition, the MNB collects household data on a quarterly basis in its Quarterly Survey of Households, as well as analysing registry data.

The main source of information for the asset side of households' balance sheets is the HFCS. However, currently, the latest available data come from 2020, and the responses for the 2023 wave of the survey are currently being processed. According to the results of the 2020 HFCS, approximately 40% of Hungarian households have some kind of debt, with higher-income households being relatively more indebted (Figure 1).

Households that are more indebted tend to adjust their consumption-savings decisions more markedly when facing a change in the interest rate environment (due to changes in net financial wealth). This suggests that a higher degree of household debt is associated with stronger transmission of monetary policy through the interest rate and credit channels.

Indebtedness of Hungarian households across gross wealth deciles

Figure 1



Source: MNB.

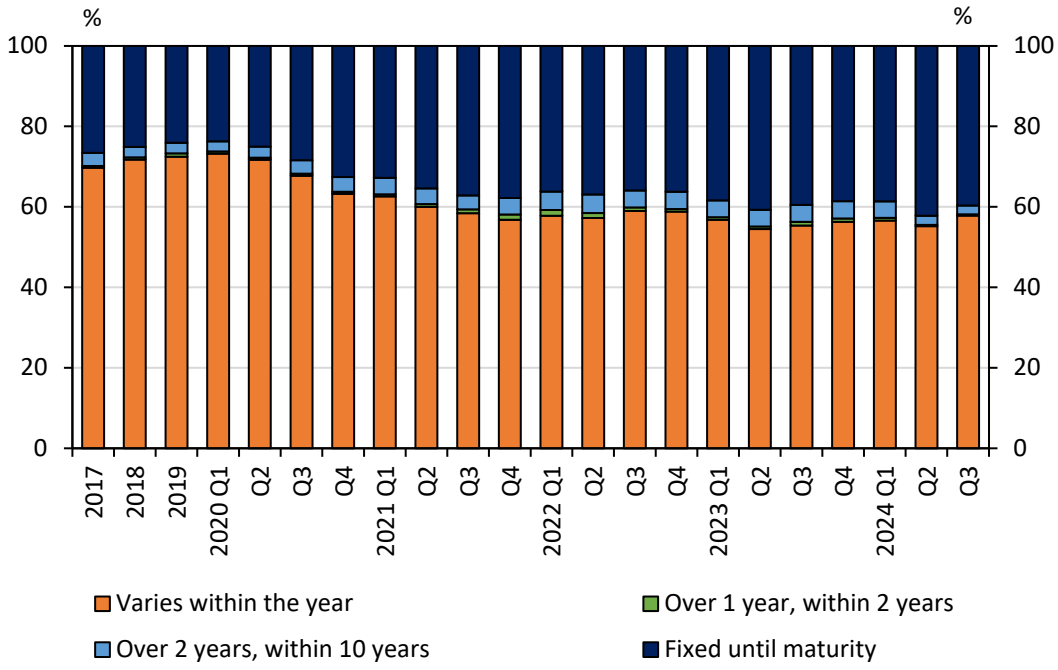
Furthermore, households with lower labour income generally behave in a "hand-to-mouth" way, ie they consume all of their income. When the central bank increases the policy rate, households with lower net wealth hit liquidity constraints (eg by losing creditworthiness). This forces them to adjust their consumption, once again strengthening transmission.

3.2 Variable and fixed rate lending

In Hungary, the share of loans with interest rates fixed until maturity has risen significantly in the corporate segment both in the outstanding loan portfolio and in new disbursements in recent years. In the outstanding non-financial corporate loan portfolio, the share of fixed rate loans was 24% at the end of 2019, but due to subsidised loan programmes introduced following the Covid-19 pandemic, their share increased to 38% by the end of 2021 (Figure 2). Since then, the share of fixed rate loans has stagnated within the loan portfolio, amounting to 40% in the third quarter of 2024.

Breakdown of the outstanding loan portfolio of non-financial corporations by interest rate period

Figure 2



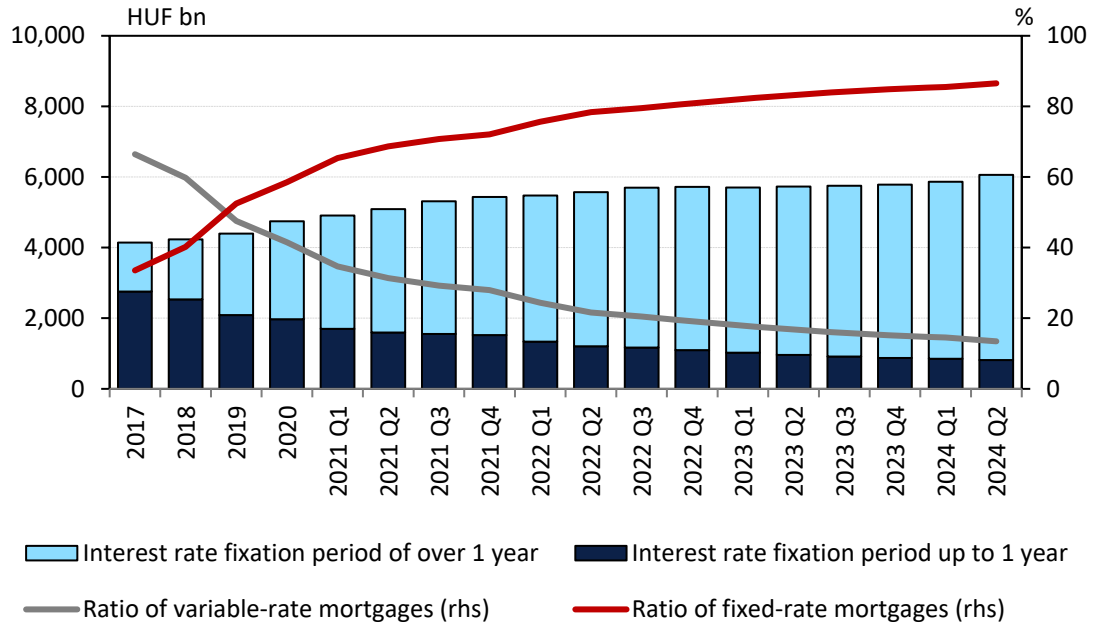
Source: MNB.

In parallel with this, the share of loans with fixed interest rates until maturity was 42% within new disbursements in 2022–23 and 39% in the first nine months of 2024. The share of fixed rate loans within new disbursements is relatively high, due to subsidised loan programmes (eg the Széchenyi Card Programme and the Baross Gábor Reindustrialisation Loan Programme).

For households, almost all new mortgage loans have their interest rate fixed for at least one year; the share of these loans is close to 90% within mortgage loans outstanding (Figure 3). By comparison, this ratio was only 34% at the end of 2017. The MNB has supported mortgage lending with a longer interest period via several measures, such as the introduction and promotion of the Certified Consumer-Friendly Housing Loans certification and the differentiation of regulatory limits based on the interest rate risk of housing loans. As a result, the share of mortgage loans with an interest rate fixed for a longer period rose significantly within new mortgage loan disbursements, and their ratio amounted to 98.6% in September 2024. Subsidised loan programmes, for example the Home Purchase Subsidy Scheme for Families (HPS), also supported the increase in the share of fixed rate mortgage loans. Longer-term interest rate fixation mainly refers to interest rates that are fixed for at least 10 years, but many mortgages have fixed interest rates until maturity.

Mortgage loans outstanding in the credit institution sector by interest rate period

Figure 3



Home Purchase Subsidy Plus Scheme for Families (HPS Plus) loans, available from January 2024, have been considered as fixed rate loans, as the client interest rate is fixed and cannot exceed 3%.

Source: MNB.

Fixed rate mortgages provide several benefits in terms of financial stability, such as offering stable, predictable instalments that shield borrowers from interest rate risk. This predictability may increase the shock resilience of households, resulting in lower credit losses over time. The stability in debt service costs can also lead to lower risk premia for borrowers. However, there are costs associated with fixed rate mortgages as well. Fixed rate loans usually have higher initial interest rates and after a time of high interest rates, borrowers might find themselves locked into high rates for extended periods.

Moreover, fixed rate loans may reduce the effectiveness of monetary policy transmission. However, this effect may be much more limited in small open economies such as Hungary, as it is counteracted by a strong exchange rate channel (Soós et al (2020)).

As the predictability of instalments supports financial stability and increases the room for manoeuvre of monetary policy without greatly affecting its transmission, in 2017 the MNB decided to shift the mortgage loan market towards longer interest rate fixation through a range of regulatory steps (MNB (2023)). Owing to these measures, variable rate mortgage lending practically came to a halt by the end of 2018 and fixed rate mortgages became the new norm. This has materially contributed to amortisation of the variable rate mortgage stock and has played a pivotal role in maintaining financial stability during the MNB's rate hike cycle that began in 2021, in response to high inflation.

3.3 Firm size heterogeneity

In Hungary, an overwhelming majority of firms are micro enterprises and small and medium-sized enterprises (referred to jointly as SMEs), making up over 99% of all enterprises. In addition, based on 2022 data, SMEs were responsible for approximately 67% of all domestic employment. However, at the same time, they only accounted for around 44% of value added by corporations and their share of total company revenues was only 36%. Value added by SMEs was approximately 38% of value added by large enterprises in 2022 (HCSO (2024)). Additionally, the growing number of SMEs in recent years mainly reflects a rise in micro enterprises, instead of small and medium-sized enterprises.

In general, the smaller a firm, the more difficulty it faces in raising funds. Not only are their internal funds limited, the financing premium of SMEs is also higher than that of large enterprises, resulting in less access to external funding. However, in Hungary, capital market financing is less pronounced, due to limited market development in that regard; therefore, credit markets provide the majority of external funds. Consequently, heterogeneities in firm size do not generally lead to restricted access to external funding for SMEs, but rather to differences in the price of credit.

Heterogeneities in the price of credit affect the transmission of monetary policy and have implications for financial stability as well. As the central bank raises the policy rate, SMEs face a larger increase in the interest rate environment due to their higher financing premium. On the one hand, this leads to more subdued investment activity by SMEs, as the projected profitability of their projects decreases significantly. On the other hand, this also means that monetary policy decisions can have a sizeable impact on SME credit risk, which the central bank also needs to consider. However, the SME sector in Hungary is often supported by subsidised loan programmes by the EU, the Hungarian government or the MNB, and therefore the sector's overall credit risk remains low even in a high interest rate environment.

3.4 Heterogeneity of inflation expectations

According to the MNB's Quarterly Survey of Households, the interquartile range of perceived inflation was relatively high in Hungary in recent quarters. In the third

quarter of 2024, average perceived inflation over the past year ranged from 9% in the second quartile to 16% in the third quartile (actual inflation decreased from above 10% to below 4% in the relevant period). In line with this, and partly due to their backward-looking nature, inflation expectations also display a large degree of heterogeneity.

Wide disagreements in households' inflation expectations can affect the transmission of monetary policy. There is evidence that large disagreements are mainly driven by a lack of information: some households misinterpret a pure monetary policy shock as a mixture of shocks, which results in a response that is markedly different from the one produced by benchmark models (Falck et al (2021)). Given the substantial range of expected inflation rates in Hungary, this may affect savings decisions and/or portfolio choices.

A further dimension of inflation expectation heterogeneity may be uncovered by looking at demographic breakdowns. International evidence suggests that expectations vary across age, gender, wealth and education (D'Acunto et al (2024)). Additionally, it would be worth exploring whether they display any sort of regional heterogeneity within one country. However, the short sample periods for available survey-based measures constrain addressing demographic questions on a granular data level.

4. Incorporating heterogeneity into the decision-making process in Hungary

We have seen that household and firm heterogeneities affect not only the transmission of monetary policy, but also financial stability in some cases. The question arises: how can economic policymakers and models take these aspects into consideration? In this section, we briefly explore the data-compiling and modelling activities of the central bank that revolve around heterogeneous household and firm data.

The MNB started to conduct a quarterly survey of household savings behaviour and expectations in the third quarter of 2021. Originally, the goal was to obtain a better understanding of the rapid changes in household balance sheets during the Covid-19 period. Since then, the survey has shifted more towards eliciting household expectations of main macro variables and introduced policies. Given the highly unusual recent economic environment and the short time frame that this survey has been in operation, quantitative studies rigorously analysing this data have not yet been completed. However, the survey results have nonetheless been able to inform the decision-making body of the MNB.

As mentioned previously in Section 3.1, the MNB also gathers HFCS and credit registry data. However, HFCS results are available with a significant reporting lag, and their historical coverage is limited, similarly to the quarterly surveys. Credit registry data are timely, but offer no breakdown regarding demographics. Consequently, the utility of these data sources for informing policymaking is narrow, especially in a rapidly changing environment.

Regarding macroeconomic modelling, the MNB takes into account precautionary motives in households' behaviour. After the Great Financial Crisis, it became evident that economic agents' debt and leverage constraints have significant macroeconomic effects, and thus the explicit incorporation of such cannot be neglected. The leverage constraints of households result in precautionary motives in households' behaviour, which have been incorporated into the MNB's main forecasting and policy model (Békési et al (2016)).

The wealth heterogeneity of households is reflected in two types of households: an indebted one and one with positive net financial assets. The precautionary motive results in household behaviour in the model that is in line with empirical results. On the one hand, the average marginal propensity to consume increases with precaution. On the other, the marginal propensity to consume for the poorer (indebted) households will be higher, while for richer households it will be lower. Furthermore, although not explicitly built into the modelling framework, the various levels of perceived inflation and different consumption-savings behaviours of households with different income levels are also taken into account.

Incorporating additional types of heterogeneity into a DSGE framework raises several technical and conceptual challenges. These include obstacles such as modelling complexity, computational costs and data calibration. First, the distribution of variables affected by heterogeneity can endogenously affect aggregate behaviour, and the multiple types of heterogeneity can cause externalities and other interactions in the model. Additionally, the presence of heterogeneity can affect optimal monetary policy, creating conflicts between different versions of the model. Furthermore, in many cases, solving the framework may require numerical approximations rather than analytical solutions. Finally, detailed micro data are needed for the calibration of the model, some of which are not available at the desired granularity or timeliness.

5. Main lessons for central bank policies

Central bank policies need to take household and firm heterogeneity into account to facilitate macroeconomic stabilisation. However, there are multiple ways of achieving this. On the one hand, monetary policy can introduce targeted measures that support a specific group of households or companies. One example of a targeted programme is the MNB's Funding for Growth Scheme (FGS), which provided funding specifically for SMEs.

On the other hand, household heterogeneity can influence financial stability and the effectiveness of monetary policy as households have heterogeneous credit risk characteristics. Macroprudential policy tools can efficiently target these heterogeneities to manage risk proportionately and give monetary policy more room for manoeuvre.

In this section, we present the Hungarian experience in these aspects. Specifically, we discuss the lessons from two MNB programmes: the FGS, aimed at SMEs, and the borrower-based measures that are able to address household heterogeneity.

5.1 The FGS

The MNB launched its first targeted lending incentive instrument, the FGS, in June 2013. The FGS played an important role in halting years of decline in the SME loan stock following the 2008 crisis and subsequently fostering increasingly dynamic growth. In the later phases of the scheme, the focus increasingly shifted to investment loans. The Covid-19 pandemic that hit Hungary at the beginning of 2020 prompted an extension of the scheme. The resulting "FGS Go!" provided funding to the SME sector under more favourable conditions than before, with a wide range of use options, and was one of the most important crisis management tools.

The phases of the FGS to date have provided some 75,000 enterprises (more than 8% of all SMEs in Hungary in 2022) with access to favourable funds in the amount of approximately HUF 6,400 billion (comparable to 10% of Hungarian GDP in 2022). The scheme had a positive impact not only on the credit volume but also on the composition of the loan stock, significantly increasing the proportion of predictable loans without any interest rate and exchange rate risk. According to the MNB's estimates, the FGS contributed to economic growth by more than 6 percentage points between 2013 and 2023 and, on a micro level, it significantly improved the efficiency and productivity of participating enterprises.

5.2 Hungary's borrower-based macroprudential measures

Heterogeneities in household credit risk may stem from their balance sheet and income structure, shock adaptability and financial literacy. In this regard, the amount of liquid assets and cash reserves, the share of total debt and its risk characteristics (denomination, interest rate fixation, etc) and the amount and stability of income are pivotal. From a monetary policy perspective, the interest rate risk and FX risk exposure of households' liabilities are particularly important, as a high share of household foreign currency debt or a high share of variable rate loans could materially amplify the financial stability risks and real economic costs of monetary policy tightening.

Macroprudential policy tools, such as borrower-based measures (BBMs) can efficiently manage these risks proportionately and give monetary policy more room for manoeuvre. The two most widespread approaches to BBMs are affordability or sensitivity tests, and the application of differentiated limits.

- **Sensitivity/affordability tests:** Borrowers and collateral are expected to meet the applied BBM regulatory limits even assuming various stress events such as interest rate shocks, currency depreciation, income or real estate price drops, etc. The advantage of this approach is its direct risk proportionality, while a potential disadvantage is its complexity, which makes it difficult to interpret for less informed borrowers.
- **Differentiated limits:** Different regulatory limits can be set according to the risk characteristics of various loans and borrowers. For instance, different loan-to-value or debt service-to-income limits could be set depending on the currency denomination of the loans, the length of interest rate fixation of mortgages, the income of borrowers, the purpose of property purchase, the energy efficiency of the financed real estate, etc. While differentiation of limits may be less risk

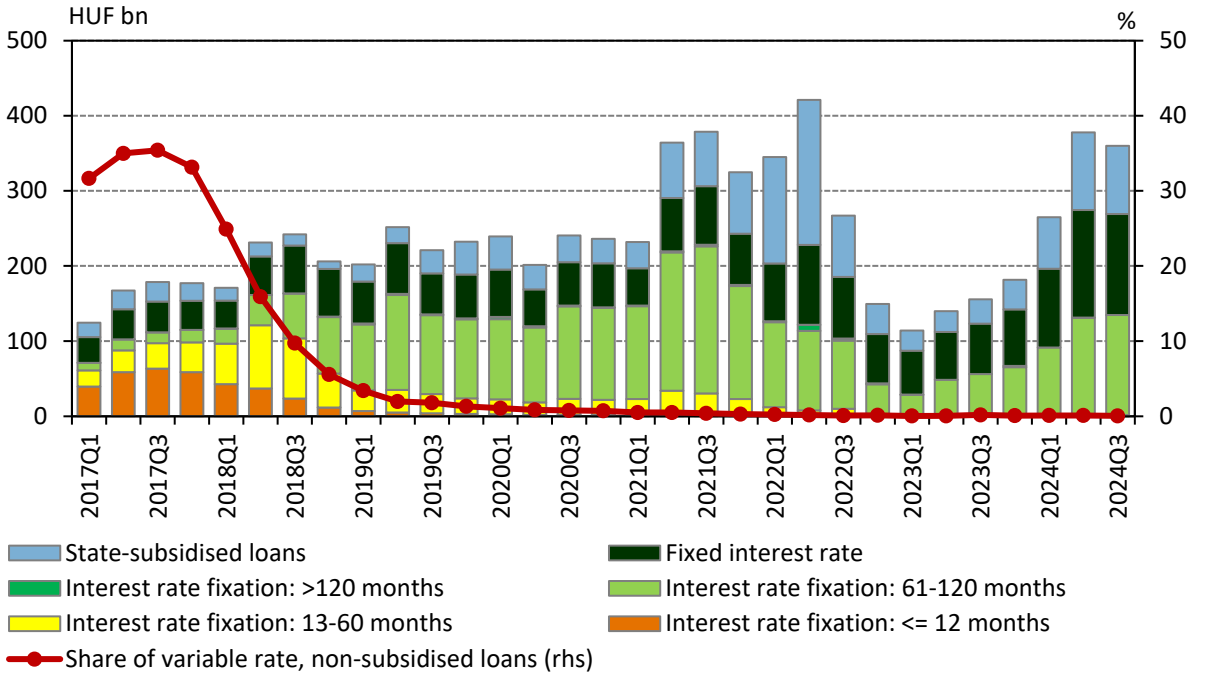
proportionate in comparison to sensitivity tests, its simplicity and transparency makes this an effective solution for ensuring proportionality.

To limit excessive household indebtedness and ensure a resilient structure of household debt, in 2015 the MNB established a legally binding loan-to-value (LTV) and debt service-to-income (DSTI) framework which applies a range of differentiation dimensions. In order to preserve the simplicity of the measures while accounting for credit risk heterogeneity, differentiated regulatory limits were applied depending on the currency denomination of the loans, and on the income of borrowers in the case of DSTI. Since their introduction, the applicable differentiation dimensions have been extended several times to align the rules with the newly arising financial stability risks as well as to minimise any potential negative side effects of the regulation (Fáykiss et al (2018)). For instance, in 2023 the MNB decided to apply lower LTV limits for first-time home buyers starting in 2024 (Grosz et al (2023)). From 2025, lower LTV and DSTI limits will apply for energy-efficient mortgages and for loans with energy efficiency increasing purposes (MNB (2024)).

The BBM framework has established an income and collateral buffer that is proportional to the heterogeneity in the risk profile of borrowers (Figure 4). This has contributed to financial stability in general and especially to the high level of portfolio quality seen in recent years in the Hungarian banking sector, despite the macroeconomic shocks since 2020. Furthermore, by specifically targeting FX and interest rate risks, monetary policy has also had more room for manoeuvre without negative financial stability consequences.

New housing lending by interest rate fixation

Figure 3



The interest rate fixation periods are depicted only for non-subsidised loans, whereas state-subsidised loans are shown separately, as they do not entail interest rate risk for borrowers.

Source: MNB.

6. Conclusion

Our analysis sheds light on how heterogeneity affects monetary transmission and what central banks might do about it. In our discussion, we also present practical aspects of how the MNB deals with granular economic data and what policies it uses to address heterogeneity. With this hands-on approach, we aim to facilitate discussion related to how heterogeneity can be effectively incorporated into central bank decision-making.

The MNB regularly collects data and tracks the evolution of heterogeneity to have a better understanding of its effects on the transmission of monetary policy. In addition, the central bank incorporates some of the data – explicitly or implicitly – into its forecasting models; however, due to lags in data publication and limited historical coverage, the immediate utility of incorporating granular data into the policy model is currently limited.

Over the years, the MNB has addressed heterogeneities directly when designing economic policy. For instance, the Funding for Growth Scheme has provided favourable funding of approximately 10% of domestic GDP over 10 years, targeting SMEs specifically. To complement monetary policy, the MNB also addressed the heterogeneity in household credit risk by introducing differentiated regulatory limits. These measures contributed to establishing a sound financial system and high debt portfolio quality, therefore securing room for manoeuvre in monetary policy.

Nonetheless, challenges remain. In some areas, collection of granular data has only recently started. Once sufficient data become available in a timely manner, they can greatly inform central bank decision-making. Finally, discussion needs to be furthered about concrete policy tools that are designed to address heterogeneity. This may help policymakers learn about international best practice and enable experts to overcome technical difficulties.

References

Amatyakul, P, F De Fiore, M Lombardi, B Mojon and D Rees (2023): "The contribution of monetary policy to disinflation", *BIS Bulletin*, no 82, December, www.bis.org/publ/bisbull82.htm.

Andries, N and S Billon (2016): "Retail bank interest rate pass-through in the euro area: an empirical survey", *Economic Systems*, vol 40, no 1, pp 170–94, doi.org/10.1016/j.ecosys.2015.06.001.

Balogh, A, Zs Horváth and A Kollarik (2017): "A hagyományos monetáris politikai transzmisszió", *Magyar Nemzeti Bank Oktatási Füzetek*, no 17, September, www.mnb.hu/letoltes/mnb-oktatasi-fuzetek-17-szam-2017-szeptember-balogh-andras-horvath-zsofia-kollarik-andras-a-hagyomanyos-monetaris-politikai-transzmisszio-online.pdf.

Bank of England (1999): "The transmission mechanism of monetary policy", *Bank of England Quarterly Bulletin*, May, www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/1999/the-transmission-mechanism-of-monetary-policy.

Békési, L, Cs Köber, H Kucsera, T Várnai and B Világi (2016): "The macroeconomic forecasting model of the MNB", *MNB Working Papers*, no 2016/4, www.mnb.hu/en/publications/studies-publications-statistics/working-papers-1-1/wp-2016-4-laszlo-bekesi-csaba-kober-henrik-kucsera-timea-varnai-balazs-vilagi-the-macroeconomic-forecasting-model-of-the-mnb.

Bernanke, B, M Gertler and S Gilchrist (1999): "The financial accelerator in a quantitative business cycle framework", in J Taylor and M Woodford (eds), *Handbook of Macroeconomics*, vol 1, part C, pp 1341–93, Elsevier, doi.org/10.1016/S1574-0048(99)10034-X.

Beyer, R, R Chen, F Misch, C Li, E Ozturk and L Ratnovski (2024): "Monetary policy pass-through to interest rates: stylized facts from 30 European countries", *IMF Working Papers*, no WP/24/9, January, ISBN: 9798400263613, www.imf.org/en/Publications/WP/Issues/2024/01/12/Monetary-Policy-Pass-Through-to-Interest-Rates-Stylized-Facts-from-30-European-Countries-543715.

Coibion, O, Y Gorodnichenko and M Weber (2022): "Monetary policy communications and their effects on household inflation expectations", *Journal of Political Economy*, vol 130, no 6, pp 1537–84, doi.org/10.1086/718982.

D'Acunto, F, E Charalambakis, D Georgarakos, G Kenny, J Meyer and M Weber (2024): "Household inflation expectations: an overview of recent insights for monetary policy", *NBER Working Paper Series*, no 32488, doi.org/10.3386/w32488.

Diegel, M and D Nautz (2021): "Long-term inflation expectations and the transmission of monetary policy shocks: evidence from a SVAR analysis", *Journal of Economic Dynamics and Control*, vol 130, 104192, doi.org/10.1016/j.jedc.2021.104192.

Durante, E, A Ferrando and P Vermeulen (2022): "Monetary policy, investment and firm heterogeneity", *European Economic Review*, vol 148, September, 104251, doi.org/10.1016/j.euroecorev.2022.104251.

European Central Bank (2000): "Monetary policy transmission in the euro area", *ECB Monthly Bulletin*, July, www.ecb.europa.eu/pub/pdf/other/mbjul2000_article07.pdf.

Falck, E, M Hoffmann and P Hürtgen (2021): "Disagreement about inflation expectations and monetary policy transmission", *Journal of Monetary Economics*, vol 118, pp 15–31, doi.org/10.1016/j.jmoneco.2019.08.018.

Fáykiss, P, A Palicz, J Szakács and M Zsigó (2018): "Experiences of debt cap regulations in Hungarian retail lending", *Financial and Economic Review*, Magyar Nemzeti Bank, vol 17, no 1, pp 34–61, doi.org/10.25201/FER.17.1.3461.

Felcser, D, K Lehmann and B Vonnák (2017): "A monetáris politika működése – transzmisszió a válság előtt és után", in B Vonnák (ed), *Modern jegybanki gyakorlat*, Magyar Nemzeti Bank, www.mnb.hu/letoltes/mnb-modern-jegybanki-gyakorlat.pdf.

Grosz, G, G Izsák, A Palicz and K Szász (2023): "Improving access to credit for first-time home buyers under borrower-based measures", *Financial and Economic Review*, vol 22, no 2, pp 25–53, doi.org/10.33893/FER.22.2.25.

HCSO (2024): *Statistical Yearbook of Hungary, 2023,* Központi Statisztikai Hivatal, ISSN: 1416-2768.

Kaplan, G, B Moll and G Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743, doi.org/10.1257/aer.20160042.

Karagiannis, S, Y Panagopoulos and P Vlamis (2010): "Interest rate pass-through in Europe and the US: monetary policy after the financial crisis", *Journal of Policy Modeling*, vol 32, no 3, pp 323–38, doi.org/10.1016/j.jpolmod.2010.02.006.

Kryvtsov, O and L Petersen (2013): "Expectations and monetary policy: experimental evidence", *Bank of Canada Working Papers*, no 2013-44, www.bankofcanada.ca/wp-content/uploads/2013/11/wp2013-44.pdf.

Magyar Nemzeti Bank (2012): *Monetáris politika Magyarországon,* ISBN: 978-963-9383-95-1, www.mnb.hu/letoltes/monetaris-politika-magyarorszagon-2012.pdf.

——— (2023): *Macroprudential Report 2023*, www.mnb.hu/letoltes/macroprudential-report-2023-eng.pdf.

——— (2024): *Macroprudential Report 2024*, www.mnb.hu/kiadvanyok/jelentesek/makroprudencialis-jelentes/makroprudencialis-jelentes-2024.

Soós, G, J Kelemen and M Horváth (2020): "Polaris, új eszköz a jegybanki előrejelzésekhez" (Polaris, a new tool for central bank forecasts), *MNB Working Papers*, no 2020/1, www.mnb.hu/kiadvanyok/elemzesek-tanulmanyok-statisztikak/mnb-fuzetek/wp-2020-1-soos-gabor-daniel-kelemen-jozsef-horvath-milan-polaris-uj-eszkoz-a-jegybanki-elorejelzesekhez

Monetary policy and heterogeneities – India

Reserve Bank of India

Effective conduct of monetary policy requires a thorough understanding of the structure of the economy and the transmission channels of these policies. Monetary transmission depends not only on the country's monetary policy framework but is also related to the macroeconomic outlook, regulations, global conditions, and other structural and cyclical factors (Deb et al (2023)). The relative importance of the different channels of monetary policy transmission is not only country-specific but also evolves significantly over time. Efforts to examine the modalities of monetary policy transmission, now place significant focus on the characteristics and responses of microeconomic agents – both firms and households (Ashcraft and Campello (2007); Auclert (2019); Cloyne et al (2020); Laine (2023)).

In what follows, this country note outlines key aspects of monetary policy transmission and the manner in which heterogeneities are incorporated into the monetary policy decision-making process by the Reserve Bank of India (RBI).

I. Monetary policy transmission

The monetary policy framework in India has undergone several changes in the past three decades (Raghuvanshi and Ahmad (2024)). With an amendment in 2016 to the Reserve Bank of India Act, 1934, flexible inflation targeting was formally adopted as the monetary policy framework in India; with the target set at 4% headline inflation with a tolerance band of +/– 2%.[1] Since the adoption of this regime, inflation has broadly remained within target, with some bouts of exceptions during the Covid-19 pandemic (Graph A.1).

In a recent paper, Patra et al (2024) suggest that while anticipated policy changes do not have any instantaneous impact on long-term rates in India, policy surprises, however, significantly impact all financial market segments and across tenors.[2] Policy surprises are found to have a relatively lower but significant pass-through to the exchange rate and equity prices. In terms of the impact of policy rate tightening on the real economy, a significant negative impact on inflation expectations is observed. The long-run elasticity of the policy rate with respect to inflation expectations reveals that an increase in policy rate anchors expectations effectively. The paper also finds that the 250 basis point (bp) increase during the current tightening cycle from May

[1] rbi.org.in/scripts/FS_Overview.aspx?fn=2752.

[2] The recent rate cut of 25 basis points, it may be argued, was already priced-in, as most surveys indicated that experts believed that the Monetary Policy Committee would reduce the policy rate. This was noted in several unofficial surveys as well as the Reserve Bank of India Survey of professional forecasters. In the Reserve Bank of India Survey, the mean policy repo rate at the end of Q2 2025/26 is expected to be 5.94 and at the end of Q3 2025/26 it is expected to be 5.87 (Kumar (2025); Reserve Bank of India (2025)).

2022 to February 2023[3] negatively contributed to aggregate demand and headline inflation by 160 bp each until Q2 2024/25, working through various policy transmission channels (Patra et al (2024)). There is also some evidence suggesting that effects of monetary policy action may be asymmetric in India, with expansionary shocks having a stronger effect on inflation, particularly during a recession (Shah and Kundu (2024)).

Monetary policy transmission to money markets is usually instantaneous and complete in India, especially across collateralised segments (Patra et al (2024)). In the uncollateralised call money market – the focus of transmission – sporadic and episodic deviations are observed. These deviations usually take place at the time of reserve requirement and balance sheet dates as well as during recurring events such as advance tax outflows and government salary payments. The government securities (G-sec) market assumes a central position in the intermediate to longer end of the interest rate continuum, providing the risk-free term structure for pricing financial instruments issued by all other sectors of the economy. Liquidity in the G-sec market is not uniform across the curve but concentrated in a few maturity segments because of market participants' "preferred habitat" and "market segmentation" behaviour.

Corporate bond yields track the movements in G-sec yields, with changing risk spreads over time caused both by variations in the risk-free rate and the creditworthiness of corporates. Fixed income segments of the interest rate spectrum are also vulnerable to global spillovers. In the credit segment, the extent and speed of policy rate pass-through to lending and deposit rates have varied sizeably in tightening episodes, depending upon factors such as the duration of the cycle, the speed of the rate hikes and the prevailing liquidity conditions (Patra et al (2024)).

The extant literature suggests that transmission of monetary policy works through five main channels – interest rates, credit, asset prices, exchange rate and expectations. Several studies have examined monetary transmission in India, each focusing on one (or two) of these channels and for different time periods.[4] A recent study finds that as the banking sector is the predominant source of credit for Indian firms and households, the credit channel has a significant role in monetary policy transmission in India (Raghuvanshi and Ahmad (2024)). The shift to a flexible inflation targeting framework has resulted in a growing impact for the credit and interest rate channels on inflation, but their contribution to output changes has moderated. It has also been suggested that the introduction of the external benchmark-based lending rate system of loan pricing, effective from October 2019, has improved transmission in the credit market (Kashyap et al (2023)).

There are also several idiosyncratic factors that influence monetary policy transmission, namely interest rate subventions; mismatches in the maturity profile of banks' assets and liabilities; loans being mostly contracted at floating rates with deposits contracted at fixed rates; rigidity in banks' savings deposit rates; competition from administered rates on small savings instruments; and the asset quality of financial intermediaries. For instance, using an open-economy Dynamic Stochastic General Equilibrium (DSGE) model with monopolistic competition and sticky prices and wages, formal and informal sectors, and frictions in labour and product markets,

[3] See Graph A.2 which plots the policy rate in India.

[4] See Raghuvanshi and Ahmad (2024) for a detailed review of the related literature.

Anand et al (2016) find that monetary policy tightening is more effective in a low friction environment in India.[5] In another study on emerging market economies in Asia including India, it is documented that the interest rate sensitivity of output is stronger in countries with higher levels of financial inclusion (Mehrotra and Nadhanael (2016)).

II. Monetary policy and the use of micro data

The RBI, as part of its monetary analysis, uses a variety of surveys to gather real-time insights into economic conditions, that capture a considerable amount of heterogeneity and act as inputs in monetary policy decisions.

The Inflation Expectations Survey of Households (IESH) and Consumer Confidence Survey (CCS) are conducted on a bi-monthly basis to understand the directional information on near- and medium-term inflationary pressures. The IESH is a survey of households in 19 major cities in India, and seeks information on current, three-months-ahead and one-year-ahead inflation expectations. Considerable levels of household heterogeneity are captured in the IESH, with responses on inflation expectations canvassed across groups varying by age, gender, occupation and city of residence. The bi-monthly Consumer Confidence Survey collects current perceptions (vis-à-vis a year ago) as well as the one-year-ahead expectations of households on their general economic situation, employment scenario, overall price situation, own income and spending across 19 major cities. It has been seen that the numerical value of households' inflation expectations is not comparable with official measures of inflation in India as it typically relates to a household's own consumption basket. The survey, however, provides valuable inputs to understand the direction of short- and medium-term expectations of households.

The bi-monthly Survey of Professional Forecasters (SPF) collects macroeconomic forecasts from a panel of economists and experts in various financial institutions. It is used to gauge expectations regarding key economic indicators, such as GDP growth, inflation, unemployment and interest rates. It provides assessment on near-, medium- and long-term growth and inflation expectations. The heterogeneity of opinions among panellists with regard to the indicators covered by the survey is used as an input during discussions on monetary policy.

Heterogeneity in price assessment and outlook across various firms are captured in the in-house quarterly Industrial Outlook Survey (IOS) and Services and Infrastructure Outlook Survey (SIOS). IOS encapsulates qualitative assessments and expectations of the business climate by Indian manufacturing companies on a set of business parameters relating to demand conditions, price situation and other business conditions. Similarly, the forward-looking SIOS captures qualitative assessments and expectations of Indian companies engaged in the services and infrastructure sectors.

[5] The paper refers to product and labour market frictions. In particular, it focuses on product market regulations that affect firm entry costs and the degree of competition, as well as labour market regulation that affects hiring costs.

Heterogeneity in wages across sectors and varying cost conditions across firm types are included in projection models at the Reserve Bank of India. Inputs for the projection models include wage rates for rural agricultural and non-agricultural labourers and information on manufacturing and services sector input costs and selling prices, among other items.

The operating framework of monetary policy aims at aligning the operating target – the weighted average call rate – with the policy repo rate through proactive liquidity management to facilitate transmission of repo rate changes through the entire financial system, which, in turn, influences aggregate demand – a key determinant of inflation and growth. The Reserve Bank of India Act, 1934 provides for the constitution of a Monetary Policy Committee (MPC) to determine the policy rate required to achieve the inflation target. The MPC makes the decision after assessing the current and evolving macroeconomic conditions, in consonance with the objective of achieving the medium-term target for CPI inflation, while supporting growth.

III. Distributional effects of monetary policy

Long-term changes in economic inequality are largely due to structural factors outside the domain of monetary policy and that, in our opinion, are best addressed by fiscal and structural policies. The mandate of RBI does not explicitly state that distributional effects should be considered in addition to the focus on aggregate targets. Under the Reserve Bank of India Act, 1934 (as amended in 2016), RBI is entrusted with the responsibility of conducting monetary policy in India with the primary objective of maintaining price stability, while keeping in mind the objective of growth. Distributional effects of monetary policy on households and firms is implicit in this mandate. Inflation has to be kept low and stable which restricts its incidence and impact on the poor. Food inflation has a weight of about 46% in headline inflation. With this high share, ignoring food price pressures would have spillover effects, eventually leading to further monetary tightening that, in turn, would have serious implications for growth and income distribution. A recent study, using household-level consumption data, suggests that expansionary monetary policy shocks increase the relative price of food, which in turn raises household-level food consumption inequality in India (De and Kakar (2021)).

It is difficult to distinguish between the distributional effects of monetary policy and the interaction of monetary transmission with micro-level heterogeneities. While the former has more to do with the health of households and firms – ie big or small, rich or poor – the latter relates to the health of the financial system that influences monetary transmission. Detailed examination of the manner in which monetary transmission plays out at the disaggregated level may be useful to inform the monetary policy decision-making process and aid its effectiveness. While there are very few studies on these heterogeneities, a recent study on Indian firms suggests that an increase in credit may not always find its way towards increasing investments in India, with firms using cheaper credit to finance their current liabilities rather than enhancing capital formation (Garg et al (2024)).

IV. Other policies

RBI is a full-service central bank in charge of monetary policy, as well as the supervision and regulation of the banking and non-banking sectors. It also undertakes measures to ensure financial inclusion and the smooth flow of credit to the unserved and underserved segments under the priority sector lending scheme, as these sectors are crucial for inclusive growth.

Priority sector lending[6] was formalised by RBI in 1972 and priority sectors were defined.[7] With an initial target of 33% of total credit of scheduled commercial banks, later revised to 40% of total credit,[8] this policy aims to enhance credit outreach to the underserved and deepen financial inclusion. The sectors included under the scheme and the sub-targets are revised from time to time depending on evolving macroeconomic and structural requirements. RBI also uses several macroprudential measures to address heterogeneities.

RBI also undertakes standalone measures to address financial vulnerabilities in times of duress. For instance, during the Covid-19 pandemic, several measures were undertaken to meet the liquidity and credit requirements of some specific entities facing liquidity stress.[9] RBI also took measures to ease liquidity conditions as well as policies designed to increase access to credit.[10] These came with sunset clauses, stipulated at the time of announcements of the policies themselves, providing clear forward guidance to the market. RBI has also used other tools at its disposal to enhance credit to cash-strapped segments like micro, small and medium enterprises (MSMEs).[11] During this time, the priority sector lending classification was extended to

[6] Began in India in 1966 when the government identified sectors that needed more financial support.

[7] These include agriculture, MSMEs, export credit, education, housing and social infrastructure.

[8] On the basis of the recommendations of the Working Group on the Modalities of Implementation of Priority Sector Lending and the Twenty Point Economic Programme by Banks, all commercial banks were advised to achieve the target of priority sector lending at 40% of aggregate bank advances by 1985.

[9] These included five Targeted Long-Term Repo Operations (TLTRO) auctions conducted during March–April 2020 that injected INR 1.13 billion into the banking system. Special refinance facilities were provided to National Bank for Agriculture and Rural Development, Small Industries Development Bank of India and National Housing Bank to enable them to meet sectoral credit needs. A line of credit was also extended to Export-Import Bank of India for a period of 90 days from the date of availing with rollover up to a maximum period of one year to enable it to make use of a US dollar swap facility to meet its foreign exchange requirements of INR 15,000 crore.

[10] For instance, there was a moratorium on payments of loan installments until August 2020. There were also measures taken to ease working capital financing by banks and certain concessions that banks were being allowed to make, at the time, were excluded for the purposes of asset classification downgrades.

[11] For instance, extending the cash reserve ratio exemption available to scheduled commercial banks for credit disbursed to micro, small and medium enterprises (MSMEs) up to 31 December 2021. This was for exposures up to INR 2.5 million. For the purpose of this exemption, "new" MSME borrowers were defined as those MSME borrowers who had not availed themselves of any credit facilities from the banking system as of 1 January 2021.

cover lending by banks to non-bank financial companies (NBFCs), as NBFCs are often lenders to segments that are unserved by the commercial banking sector.[12]

RBI has actively pursued an inclusive financial system in addition to its active policies on improving financial access to all segments. Along with efforts towards raising financial awareness, RBI has constructed and periodically publishes a Financial Inclusion Index. For the year ending March 2024 it was 64.2, up from 60.1 in March 2023.[13]

V. Conclusion

Monetary policy tools are focused on meeting the mandate set by the government for RBI – ie price stability quantified as a headline inflation target of 4% with a +/– 2% tolerance around it, while keeping in mind the objective of growth. However, during times of crisis, depending on evolving economic circumstances, the RBI has undertaken measures to address funding or liquidity constraints. These sector-specific targeted policies not only had sunset clauses embedded in them but also avoided outright giveaways.[14] The measures worked through meeting the credit requirements of the sectors that were more severely affected by the pandemic and faced more severe financing constraints.

The RBI has also taken several steps to address temporary inequities to ameliorate the difficulties of marginal borrowers, aimed at enhancing financial inclusion as well as paving the way for the smoother transmission of monetary policy by bringing varied segments within the purview of metrics that the RBI can monitor and target.

[12] Also applied to fresh credit granted by small finance banks (SFBs) to registered NBFC-microfinance institutions (NBFC-MFIs) and other eligible MFIs (societies and trusts etc). The priority sector lending limit for loans against negotiable warehouse receipts/electronic negotiable warehouse receipts was enhanced from INR 5million to INR 7.5 million per borrower. The modified interest subvention scheme for short-term loans for agriculture and allied activities availed through the Kisan credit card was extended to farmers during the financial year 2021/22. The scheme has also been extended to SFBs and computerised primary agriculture cooperative societies which have been superseded by scheduled commercial banks, in addition to public sector and private sector banks (in respect of loans given by their rural and semi-urban branches only), on use of their own resources. The RBI has also issued guidelines for co-lending by banks and NBFCs to improve credit flow to underserved sectors of the economy. This is done through the co-lending model, announced in November 2020.

[13] A multidimensional composite Financial Inclusion Index has been constructed based on 97 indicators, which quantifies the extent of financial inclusion and is responsive to availability, ease of access, usage, unequal distribution and deficiency in services, financial literacy and consumer protection. The annual Financial Inclusion Index is on a scale of 0 to 100, with three sub-indices, viz "access", "usage" and "quality".

[14] These were measures like (i) various iterations of long-term repo operations; (ii) simultaneous sale and purchase auctions under operational twists to moderate rates for long-term government borrowing; (iii) refinance facilities and liquidity support to sector-specific liquidity stress and redemption pressures; and (iv) Government Securities Acquisition Programme (G-SAP), which helped soften yields, among others.

References

Anand, R, S Das and P Khera (2016): "Monetary policy transmission in the presence of product and labour market frictions: the case of India" in C Ghate and K Kletzer (eds), *Monetary policy in India*, Springer.

Ashcraft, A and M Campello (2007): "Firm balance sheets and monetary policy transmission", *Journal of Monetary Economics*, vol 54, no 6, pp 1515–28.

Auclert, A (2019): "Monetary policy and the redistribution channel", *American Economic Review*, vol 109, no 6, pp 2333–67.

Cloyne, J, C Ferreira and P Surico (2020): "Monetary policy when households have debt: new evidence on the transmission mechanism", *Review of Economic Studies*, vol 87, no 1, pp 102–29.

De, K and V Kakar (2021): "Effects of monetary policy on food inequality in India", *The Journal of Development Studies*, vol 57, no 11, pp 1852–70.

Deb, P, J Estefania-Flores, M Firat, D Furceri and S Kothari (2023): "Monetary policy transmission heterogeneity: cross-country evidence", *IMF Working Papers*, no 204.

Garg, P, S Ghosh and A Narayanan (2024): "Monetary policy transmission in India: new evidence from firm-bank matched data", *Macroeconomics and Finance in Emerging Market Economies*, vol 17, no 3, pp 526–42.

Kashyap, Y, A Kumar, A Prakash and S Latey (2023): "Monetary policy transmission in India: recent dynamics", *RBI Bulletin*, November.

Kumar, A (2025): "Here are the sectors and stocks in focus amidst RBI rate cut hopes", *Moneycontrol*, 7 February.

Laine, O (2023): "Monetary policy transmission to firms' investments – it may depend on the tool", *Economics Letters*, vol 229.

Mehrotra, A and G Nadhanael (2016): "Financial inclusion and monetary policy in emerging Asia", in S Gopalan and T Kikuchi (eds), *Financial inclusion in Asia*, Palgrave Macmillan.

Patra, M, I Bhattacharya, J John and A Kumar (2024): "Monetary policy transmission in India: the recent experience", RBI Bulletin, October.

Raghuvanshi, A and W Ahmad (2024): "Inflation targeting and monetary policy response in India", *Journal of Asian Economics*, vol 95.

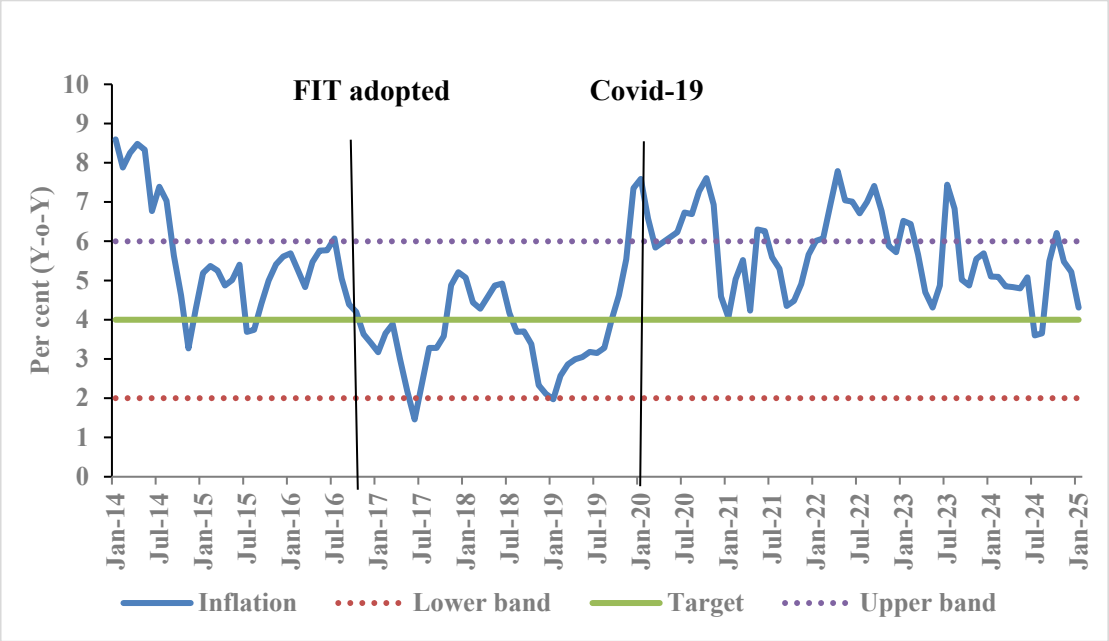
Reserve Bank of India (2025) "Survey of professional forecasters on macroeconomic indicators – results of the 92nd round", 7 February.

Shah, I and S Kundu (2024): "Asymmetric effects of monetary policy: evidence from India", *Empirical Economics*, vol 66, pp 243–77.

Appendix

Monthly headline CPI inflation in India

Graph A.1

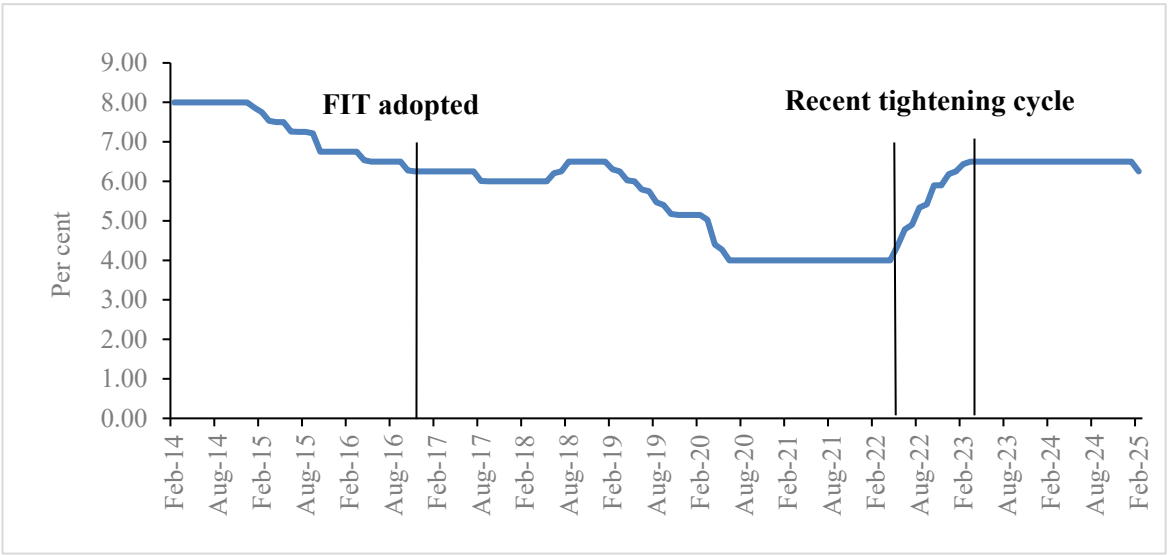


FIT = flexible inflation targeting.

Source: Ministry of Statistics and Programme Implementation.

Repo rate in India

Graph A.2



FIT = flexible inflation targeting.

Source: Reserve Bank of India

Bank Indonesia's approach to incorporating household and firm heterogeneity in monetary policy decision-making

Bank Indonesia

Introduction

Monetary policy decision-making in the modern era increasingly recognises the importance of household and firm heterogeneity. This note examines how Bank Indonesia incorporates these diverse economic agents into its policy analysis. We explore how heterogeneity impacts the various transmission channels of monetary policy and highlight the role of household heterogeneity in monetary policy transmission and the distributional effects of monetary policy. Bank Indonesia will continue to explore heterogeneity in monetary policy analysis to further strengthen the effectiveness of its monetary policy.

Monetary policy's key transmission channels: effects on households and non-financial firms

Bank Indonesia's monetary policy objective is to achieve the stability of the rupiah to support sustainable economic growth. This objective encompasses two key elements: price stability – reflected in the inflation rate – and exchange rate stability. To achieve this, Bank Indonesia utilises the BI-Rate as its main policy instrument to strategically influence economic activity, with the ultimate objective of maintaining price stability.

The transmission of monetary policy in Indonesia functions through several channels. These encompass the interest rate, bank lending (credit), balance sheet, asset price, exchange rate and expectations channels. The effectiveness of these transmission mechanisms has been bolstered by significant enhancements to the monetary policy framework following both the Asian financial crisis and the Great Financial Crisis. The adoption of an inflation targeting framework and the implementation of a comprehensive policy mix have reinforced the robustness and relevance of these transmission channels, ensuring their continued efficacy in addressing Indonesia's unique economic landscape.

In terms of the impact of monetary policy on households and firms, Bank Indonesia assesses that the main channels with the most significant effects are: (i) the interest rate (saving-investment) channel; (ii) the bank lending channel; (iii) the exchange rate channel; and (iv) the expectations channel. Additionally, Bank Indonesia assesses that transmission through the balance sheet and the cash flow channels also have strong, though relatively weaker, impacts compared with the other four channels.

The interest rate channel is the first channel that directly responds to changes in the monetary policy stance. Adjustments to the BI rate influence deposit and lending rates in the banking industry. Recent studies show that this channel is transmitted quite effectively, especially on deposit rates, lending rates and output (Bathaluddin et al (2019)). Adjustments to the BI rate impact **household consumption and savings** through the intertemporal substitution effect, the wealth effect and the income effect, as well as **household and non-financial firm investment**, by influencing deposit and lending rates in the banking industry.

The bank lending channel operates by affecting corporate and household demand for loans. When lending rates decrease, the cost of borrowing becomes more affordable, encouraging corporations to take on loans for investment purposes. This reduction in the cost of capital enables businesses to expand operations, purchase new equipment or undertake growth projects. For households, lower lending rates make it easier to obtain credit for large expenditures, such as housing or education, which further stimulates consumption**.**

The exchange rate channel operates by transmitting the effects of exchange rate fluctuations into domestic inflation, a phenomenon known as the "exchange rate pass-through." When the exchange rate depreciates, the cost of imported goods and services rises, which can lead to higher domestic inflation. For households, a depreciation in the exchange rate can erode purchasing power, particularly for those reliant on imported products. For corporations, exchange rate fluctuations can affect production costs, especially for businesses heavily dependent on imported raw materials, and influence competitiveness in international markets, impacting revenues and investment decisions.

The expectations channel has grown increasingly significant in Indonesia's forward-looking inflation targeting framework. This channel focuses on how economic agents, such as households, businesses and investors, form their expectations regarding inflation and monetary policy. Effective communication by the central bank is essential in shaping expectations and ensuring they remain anchored to the inflation target. By managing expectations, the central bank enhances the credibility of its policies, which helps guide economic behaviour in ways that support macroeconomic stability and policy effectiveness.

The balance sheet channel operates by influencing corporate debt costs and cash flows. When interest rates decrease, corporations experience lower debt servicing costs, which improve their financial position and allow for greater flexibility in operations and investments. Conversely, higher interest rates increase debt burdens, potentially constraining corporate spending and investment decisions. It also decreases corporate cash flow, reducing profitability and corporate value as reflected in declining asset and collateral values.

The role of household heterogeneity in monetary policy transmission

Bank Indonesia recognises the importance of household heterogeneity in the transmission of monetary policy. Several characteristics of heterogeneity that are considered as part of the background analysis for monetary policy formulation at Bank Indonesia are: (i) household-specific inflation experiences; (ii) heterogeneity in inflation expectations; (iii) the level and composition of debt and the debt burden;

and (iv) financial literacy. Based on our analysis, these characteristics matter for monetary policy transmission.

- **Households may have specific experiences of different inflation rates based on their consumption patterns, geographic locations and income levels.** This heterogeneity can arise from consumption preferences for goods and services, especially between upper-middle class and lower-income households, leading to varied inflation experiences. Households that spend a greater proportion of their income on basic needs, like food, may feel the impact of food price inflation more acutely than those that spend more on tertiary goods and services. Moreover, regional differences may impact inflation rates. These may vary significantly across regions in Indonesia due to the availability of local goods, transportation costs, affordability and regional economic characteristics. Regarding income levels, lower-income households may be more sensitive to price changes in essential goods than upper-middle class ones, which may have greater access to goods and services that are less affected by inflation.
- **Heterogeneity in inflation expectations can differ widely among households, influenced by information asymmetry and anchoring effects from past experiences.** Different levels of access to information can lead to varying perceptions of future inflation. Indeed, households that are more well informed about economic development may have more accurate expectations than those that rely on anecdotal evidence. On the other hand, households that have experienced high inflation in the past may have different expectations about future inflation compared with those that have not. Examples of such experiences include those related to the adjustment of fuel prices by the government, constrained food supply that drives food inflation, and rising transportation costs.
- **The level, composition and burden of household debt significantly affect monetary policy transmission by shaping household responses to interest rate changes.** High levels of debt, particularly variable rate loans, amplify sensitivity to interest rate changes, with higher rates increasing debt servicing costs and reducing consumption, while lower rates ease the burden and encourage spending. The composition of debt, such as mortgages versus consumer loans, influences wealth effects, as higher interest rates can depress housing prices and reduce household wealth, curbing consumption. A heavy debt burden may also lead to greater risk aversion, limiting the effectiveness of monetary easing as households prioritise debt repayment over spending. Additionally, the distribution of debt across income groups can create varying responses, with low-income households often reacting more strongly. Lastly, excessive household debt can prompt tighter lending standards, weakening the bank lending channel and reducing credit availability, further impacting monetary policy effectiveness.
- **Financial inclusivity also plays a role in monetary policy transmission**. Many households, especially those in rural areas or lower-income brackets, have limited access to formal financial services, weakening the credit channel of monetary policy. Households without access to credit are less responsive to interest rate changes. Indonesia's geographical vastness and economic diversity result in significant differences in economic activity, income levels and financial access across regions. These regional differences can affect how monetary policy

is transmitted. For example, households in more developed urban areas may have greater access to financial services and thus be more responsive to policy rate changes than those in remote rural regions.

Bank Indonesia primarily collects data on heterogeneity from market data sources and surveys. These insights are essential for analysing the short-term impact of monetary policy on household spending and inflation expectations.

Link between heterogeneity and monetary policy decisions

Bank Indonesia incorporates data on household and firm heterogeneity into its quantitative analysis and projection models as part of the monetary policy decision-making process. The central bank uses a variety of tools and models to assess the impact of heterogeneity on policy transmission. In addition to traditional econometric models, Bank Indonesia integrates machine learning techniques into its monetary policy analysis, leveraging their ability to process large data sets, identify complex patterns and improve the accuracy of forecasts related to economic growth, inflation and the transmission mechanisms of monetary policy.

Distributional effects of monetary policy

Bank Indonesia acknowledges that monetary policy can have substantial distributional effects on both households and firms, as outlined in the previous section of this note. These effects are considered in the policymaking process, although they are not the main consideration. This is in line with the objectives of monetary policy according to the mandate, namely achieving rupiah stability to support sustainable economic growth.

Bank Indonesia communicates the relevance of distributional effects to the public through various channels. Bank Indonesia publications, such as economic reports, monetary policy reviews and press releases often discuss how inflationary pressures vary between different income groups and how different sectors of the economy respond to credit conditions. In press conferences following major monetary policy decisions, Bank Indonesia officials explain how the central bank's actions are designed to protect the purchasing power of vulnerable groups, particularly by stabilising food and energy prices. Further, Bank Indonesia's financial stability reviews include detailed discussions on how different sectors, regions and firm sizes are performing under current economic conditions, particularly in terms of financial risks and vulnerabilities.

Measures to address heterogeneity

Bank Indonesia employs various measures to address heterogeneity in the economy, recognising that different segments of households and firms may require targeted approaches. These measures are part of the Bank Indonesia policy mix strategy, which focuses on growth and stability aspects, supported by inclusion. The Bank Indonesia policy mix involves the seamless and dynamic integration of mutually complementary and reinforcing main policies, underpinned by supporting policies. This serves to safeguard comprehensive, credible, accountable and

consistent policies to undertake the central bank's tasks and achieve its goals. In pursuit of its goals, Bank Indonesia leverages its monetary and macroprudential policy mix, supported by the payment system policy and supporting policies.

Bank Indonesia's monetary policy is currently not the main policy instrument used to address heterogeneity. As discussed earlier, monetary policy applies to all economic agents and it is directed to manage the economy in aggregate, to achieve its objectives according to the mandate, rather than for specific economic agents.

Macroprudential policies play a key role in addressing heterogeneity. Bank Indonesia implements an accommodative macroprudential policy stance to increase bank lending/financing to priority sectors and create job opportunities, including in the Micro, Small and Medium Enterprises (MSME) sector and green economy, while maintaining prudential principles. There are many macroprudential policy instruments that Bank Indonesia uses in addressing heterogeneity such as the macroprudential liquidity incentive (KLM), the macroprudential inclusive financing ratio (RPIM) and loan-to-value (LTV)/financing-to-value (FTV) ratios. The KLM offers a reduction of rupiah reserve requirements for banks that meet certain lending criteria for certain sectors. As of January 2025, the KLM policy focuses on revitalising bank lending/financing to sectors that can drive economic growth and create jobs, namely: (i) agriculture, trade and the manufacturing industry; (ii) transportation, storage, tourism and the creative economy; (iii) construction, real estate and public housing; (iv) MSMEs; (v) ultra-micro enterprises; and (vi) the green economy. RPIM mandates banks to allocate a portion of their credit to MSMEs, underbanked segments and low-income households. It accommodates the heterogeneity in banks' lending strategies by providing flexibility in meeting these targets, including through indirect lending channels such as fintech lending or investments in securities issued for inclusive financing purposes. LTV/FTV ratios enhance financing access for households, particularly benefiting first-time homebuyers and middle-to-lower income groups. Bank Indonesia retains the option to change the ratio for first, second and third facilities to accommodate heterogeneity in debtors' profiles.

Payment system policy is directed towards bolstering growth, particularly in the trade and MSME sectors, strengthening reliable infrastructure and reinforcing the structure of the payment system industry, while expanding acceptance of payment system digitalisation.

Meanwhile, supporting policies are oriented towards helping to achieve the Bank Indonesia policy mix targets. **Supporting policies that address heterogeneity include the following**:

1. **Regional economic and financial policies**. Regional economic and financial policies are oriented towards achieving the inflation target and fostering regional economic growth, increasing access to finance and MSME development, and maintaining a secure and seamless payment system, accompanied by a healthy payment ecosystem through the achievement of various indicators and optimising the full panoply of regional economic and financial policy instruments. The approach is tailored to reflect the characteristics and potentials of each region.

2. **Inclusive and green policies.** Inclusive and green policies are oriented towards achieving the target of supporting MSMEs for food security and exports, inclusive

finance, access to finance and green MSMEs, as well as MSME digitalisation through the various indicators and optimising the range of green and inclusive policy instruments available.

3. **Sharia economy and finance policies**. Sharia economy and finance policies are aimed at achieving the goals of increasing the contribution of halal products, enhancing the role of Islamic finance, deepening the sharia financial market and improving sharia economic literacy.

These measures demonstrate that Bank Indonesia's policy mix is a comprehensive approach to addressing economic heterogeneity. By tailoring policies to different segments of households and firms, the central bank aims to ensure that monetary policy transmission is effective across all sectors of the economy while promoting sustainable growth.

Conclusion

Bank Indonesia recognises the importance of incorporating the heterogeneity of households and firms into models for monetary policy analysis. Data on heterogeneity complements traditional aggregate inputs, enhancing our understanding of the economic outlook, the distributional impacts of policy changes and the transmission mechanisms of monetary policy. Over the next decade, we anticipate that the use of heterogeneity data on households and firms will continue to evolve, driven by advances in data availability, improved methods and algorithms, and greater computational power. However, analysis of household and firm heterogeneity has not yet become a major consideration in the formulation of Bank Indonesia's monetary policy. This is in line with the nature of monetary policy, which applies to all economic agents, to achieve the objectives in accordance with the mandate. Moving forward, Bank Indonesia will continue to explore heterogeneity in monetary policy analysis to further strengthen the effectiveness of monetary policy.

References

Bathaluddin, M. Barik, Dalawati, M., & Mochtar, F. 2019. "Revisiting the Transmission of Monetary Policy in Indonesia Through the Interest Rate Channel," Research Report in Department of Economic and Monetary Policy, Bank Indonesia.

Monetary tightening at work: transmission and heterogeneity

Andrew Abir[1] and Amit Friedman[2]
Bank of Israel

1. Introduction

The rapid and uneven recovery after the pandemic against the backdrop of expansionary fiscal and monetary policies, along with an energy price shock caused a global inflation surge. Inflation rates hovered well above targets in the major economies as well as in other jurisdictions. Consequently, central banks implemented a highly synchronised and sharp tightening cycle, as they tried to first stabilise and then to reverse inflation. After years of low interest rates – near or at the zero lower bound (ZLB), many central banks had to put the power of monetary policy to the test. This sharp tightening cycle creates an opportunity to reassess the transmission of monetary policy and the differential impact of monetary policy on different economic agents. Understanding heterogeneity is essential when tightening rapidly, because such a policy can have significant social and financial stability ramifications.

Effective monetary policy involves several channels through which the central bank's decisions can affect the markets and agents in those markets. The classic channels are well known: interest rates, the exchange rate, credit, asset prices and expectations. In addition to deciding on the necessary degree of monetary tightening or easing, modern central banking is in essence about making sure these channels are working efficiently. In recent years the expectations channel has become more central, and in order to strengthen it, it is more important than ever for the central bank to explain its actions and signal its intentions going forward. Transparent publications of economic forecasts, including for the policy rate itself, and frequent and ongoing interaction with the public through the traditional media as well as digital/social media are meant to achieve this goal.

The overarching framework of monetary policy which guides the Bank of Israel (BOI) and almost all central banks in OECD countries is the inflation targeting regime. This framework, if implemented successfully over time, provides a credible anchor for monetary policy and expectations.[3] The recent breach of the targets in Israel as well as in many other countries was a stress test to this framework. The results are reassuring: while actual inflation rates deviated considerably from the targets for relatively long periods, expectations for the medium and long run remained relatively

[1] Deputy Governor, Bank of Israel.

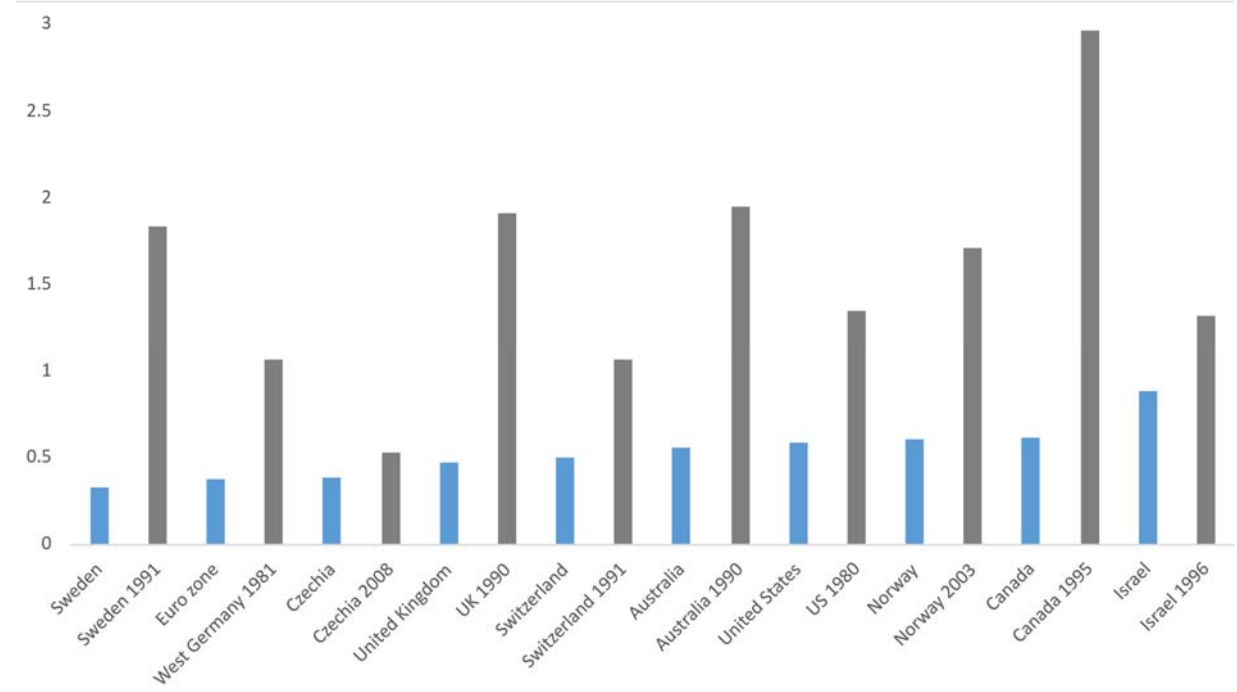
[2] Markets Department, Bank of Israel.

[3] The BOI recently completed a review of its inflation target. The review concluded that the current target, which was set as a range between 1 and 3 percent in 2000, is still the preferable option. See www.boi.org.il/en/communication-and-publications/press-releases/6-11-24/.

stable and anchored around the targets. This phenomenon, which reflects a "credibility gain" central banks earned by keeping inflation rates around the targets for years since they had been adopted probably allowed central banks to react moderately in terms of changing the relevant policy rate: Graph 1 shows that in the United States, euro zone and selected Small and Medium Economies the highest policy rate in the cycle was lower than inflation at its peak. A historical perspective shows the interest rate hikes that were required to stabilise inflation in recent years were low relative to the hikes that were required to put the inflation genie back into the bottle in the past.[4] Therefore, the costs of monetary tightening in terms of unemployment are lower when compared with the past.[5]

The ratio between the highest interest rate and maximum inflation in the 2022–23 cycle vs previous historical inflation surges

Graph 1



Source: Bloomberg.

The adoption of inflation targeting has allowed central banks to be more effective than ever in controlling inflation, but it is not a panacea. In order to reap the benefits of inflation targeting, monetary policy has to be transmitted into financial markets, firms and households. This note focuses on the *interest rate channel* of monetary policy, ie how the key rates affected market interest rates and yields. We show that monetary policy has a heterogeneous impact on different economic agents, and distinguish between large and small firms and households on both sides

4 In each country, the last hiking cycle is compared with a previous episode of inflation surge.

5 For example, the increase in unemployment in the US in the current cycle is 0.6 percentage points, while in the early 1980s unemployment increased by 5 percentage points. The unemployment rate has not risen at all in the euro zone in the current tightening cycle.

of the market, ie lenders and borrowers. Specifically, we zoom in on mortgages, as in Israel one third of the typical home loan is an adjustable rate mortgage (ARM) with a contractual interest rate linked to the policy rate.

The interest rate channel is not the only one at work when the policy rate is lifted. Monetary policy can affect the exchange rate, credit, asset prices and expectations. We do not attempt to give a full account of the impact of the BOI's recent policy; however, the exchange rate channel in the recent tightening cycle was probably not a dominant one. The reason is that interest rate hikes were highly synchronised globally. Specifically, as the BOI and the Federal Reserve hiked in unison, the US-Israel interest rate spread remained low, so this channel was probably muted.[6]

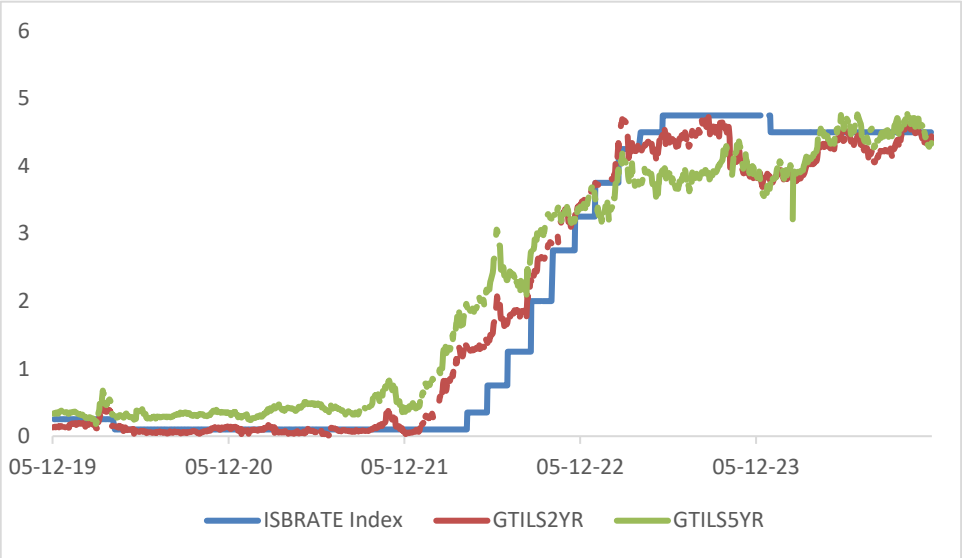
2. The bond market

We start with the government bond market, as it is the cornerstone for financial markets, as well as for the banking system and real economy, as many consumption and investment decisions are linked to the rates from the bond market (with an additional spread). The Graph below plots the BOI's policy rate versus the yields of two-year and five-year government nominal bonds. As one can expect given the rise in inflation, the increase in yields preceded that in the policy rate, but in early 2023 the policy rate caught up in full. Later, however, the five-year yields plateaued at below 4% while the policy rate was tightened to 4.75%, a move that was not fully priced in in January 2023. The bottom line is that although the BOI's rate hikes affected mid-term yields in full during the early stages of hiking cycle, the last two to three increases did not have any noticeable effect.[7] Although a flattening of the yield curve is a natural feature of late-stage tightening, this still points to the limited power of monetary policy.

[6] Recent empirical results point that the USD/ILS exchange rate is affected symmetrically by Fed and BOI policy (Caspi, Friedman and Ribon, 2024).

[7] Naturally, the yields are affected by other factors both domestic and global, and the drop in US yields in the summer of 2023 probably also affected local yields.

Bank of Israel policy rate, two-year and five-year government bond yields, % Graph 2



Source: Bloomberg.

3. Deposits

The banking system is a central channel through which central banks' monetary policy reaches firms and households, lenders and borrowers alike. Graph 3 below shows how the BOI's monetary policy passed through into deposit rates during the recent hiking cycle that started in April 2022, and the ZLB period that preceded it (actually the key rate was 0.1% then). During the ZLB period, deposit rates were compressed tightly to near zero levels and heterogeneity by sector had become negligible for all practical purposes.[8] However, once the monetary tightening cycle commenced a clear pattern emerged: bigger clients receive higher rates. Larger firms are getting higher rates than smaller ones, and households receive the lowest rates on their deposits. The ZLB period temporarily obscured all these differences between the agents, but once the lift-off took place they resurfaced.

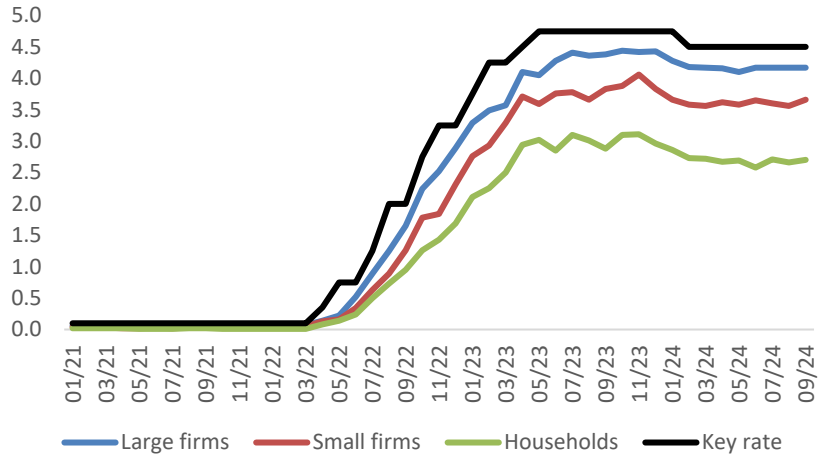
This outcome reflects economics of scale in a non-competitive market. Larger clients have larger deposits, are usually better informed and have more alternatives. All this puts them in a better position for negotiating deposit rates, while for less sophisticated households the rates are often posted as take-it-or-leave-it offers. Households too can shop around and look for alternatives: the BOI's regulation ensures that deposits are comparable, and in order to promote competition the BOI's website displays a real-time comparison of the deposit rates by bank, maturity and type (ie fixed or floating rate). In addition, households can invest in money market

[8] Although the "pecking order" was preserved, the differences were practically immaterial. For example, in January 2021, while the BOI rate was 0.1%, the deposit rates for large firms was 0.06%, for small firms 0.04% and for 0.02% households.

funds that offer attractive returns but at the price of some uncertainty, which possibly deters some clients while others are simply unaware of this option.[9]

The bottom line is that the pass-through of the BOI's hike into deposits is partial. The average households deposit rate today is 2.7%, while the BOI's key rate is 4.5%. This represents a pass-through rate of 60%. As to the implications, such a partial pass-through can result in a lower impact of monetary policy on consumption of middle-income households.[10] This problem is further exacerbated by the very significant amounts held in checking accounts that receive zero interest rate. The pass-through to the business sector is much higher, and large firms can get a rate that is very close to the BOI's policy rate.

BOI key rate and average deposit floating rate interest rate by sector, % Graph 3



Large firms are those with an annual turnover of over ILS 250 million. Small firms are those with an annual turnover below ILS 10 million.

Source: Bank of Israel.

4. Credit

4.1 New credit

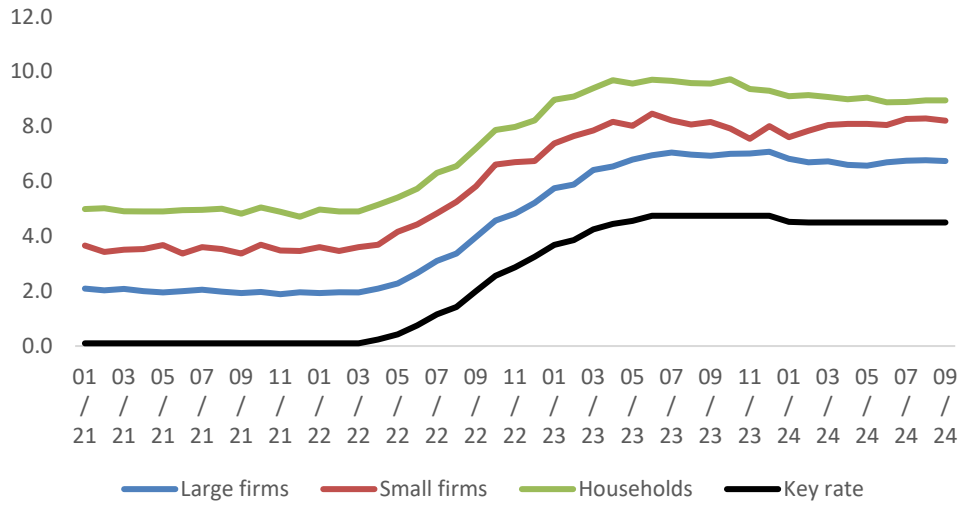
The banking system is also a major credit provider. Graph 4 presents the central bank rate and the rates on new loans to the same sectors as in the previous section. Unlike in the case of deposits, the pass-through to market rates seems to be full, and the spreads that prevailed in the ZLB period remained almost unchanged.

9 Risk aversion itself cannot explain the reluctance to use money market funds as the whole distribution is above the return on the "risk free" bank deposit. In addition, these days money market funds are also available to clients who do not have an investment account at their bank (ie a checking account is sufficient). Therefore, it seems that financial illiteracy plays a role here.

10 Wealthy households' consumption might be also affected by a negative wealth effect.

Average interest on new credit by sector and BOI policy rate

Graph 4



Large firms are those with an annual turnover of over ILS 250 million. Small firms are those with an annual turnover below ILS 10 million. Households' credit includes consumer loans (ie excluding mortgages).

Source: Bank of Israel.

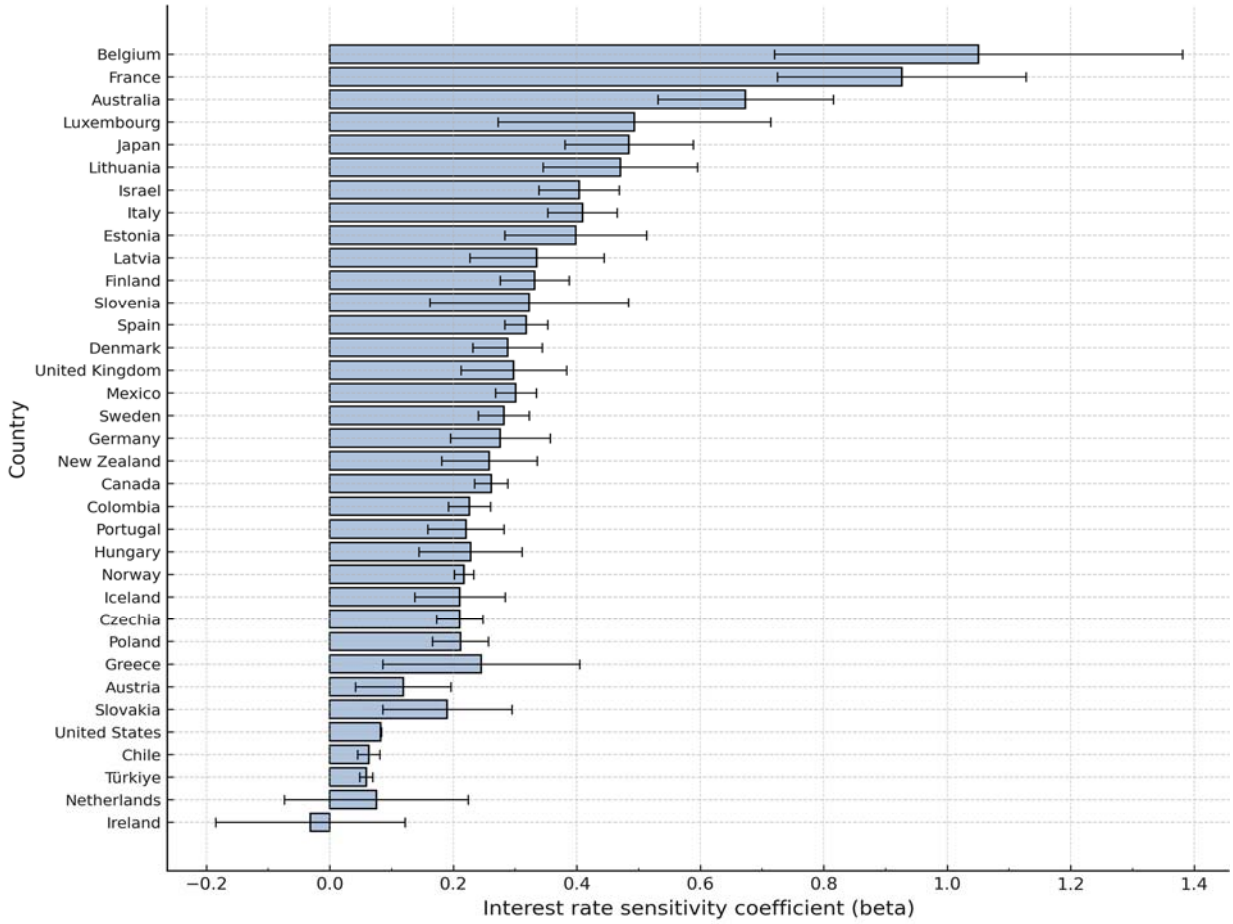
4.2 The credit stock

The full transmission of the BOI's rate to the price of new, relatively short-duration loans is a natural and almost trivial outcome one can expect. The full impact of the interest rate channel, however, is a function also of the adjustment of the interest rates on the pre-existing stock of credit. The higher the share of floating rate loans, the stronger the impact of monetary policy.

Graph 5, based on a cross-country panel of banks in OECD countries, compares the elasticity of banks' gross interest rate income with respect to a change in the key central bank rate. This income includes payments made by firms and households. These elasticities are a function of both the share of floating rate loans and the endogenous reaction of credit demand to rate changes, and also a possible interaction or correlation between monetary policy and financial risk, which might affect credit supply. As such, they are not easy to interpret, but from central banks' perspective they indicate the aggregate impact of monetary policy on the cost of the credit stock.

The graph shows that while in some countries the immediate impact is very low and even insignificant, in others the impact is sizeable. Israel clearly belongs to the latter group of countries, and this means that the BOI has to take into account that its interest rate changes directly and immediately affect consumers' disposable income as well as firms' cash flow. Other things equal, this should work to shorten the lag of monetary policy impact, and reduce the amplitude and magnitude of interest rate changes.

Elasticity of commercial banks' gross interest income with respect to the policy rate Graph 5



The graph shows the impact of a 1 percentage point increase in the central bank's interest rate on the gross interest income of banks, in per cent. These elasticities are based on a quarterly panel of 10,958 banks in 38 OECD countries between 2002 and 2023. Error bars represent 95% confidence intervals. A higher βj indicates greater sensitivity to interest rate changes, suggesting a higher prevalence of adjustable rate credit.

Source: Eshel (2024).

4.3 Mortgages

One of the reasons for the relatively large impact of the BOI's rate change on banks' interest rate income in Israel is the structure of the mortgage market. A few words of background are necessary here, in order to understand why mortgages in Israel are so dominant.

On the one hand, a high rate of population growth[11] leads to a fundamentally high demand for housing by young, newly established households that purchase their first home, and about 30% of households have a mortgage. On the other hand, the

[11] Population growth is 1.9% per year, ranked third in the OECD, after Iceland and Luxembourg (source: OECD data for 2019).

scarcity of land results in high and ever increasing population density[12] and land prices. These factors are compounded by planning and zoning bottlenecks, and house prices are consequently very high.[13]

Mortgages are composed of fixed, semi-fixed and floating rate tranches, so almost all have some element of adjustable rate and thus are at least partly ARMs. The floating rate tranche in a typical mortgage that was originated by December 2020 is close to 33%, which was the limit under BOI regulation at that time.[14] The contractual floating interest is set as a fixed spread relative to the BOI's key rate and is updated continuously on a monthly basis.[15] Therefore, the pass-through of monetary policy to the ARM tranches of existing mortgage loans is full and immediate.

The increase in interest rates increased mortgage payments, an outcome that was continuously monitored and assessed by the BOI's Monetary Policy Committee (MPC). The MPC did have real-time access to granular data on the stock and flow of mortgages, also because the BOI is the supervisor of banks and operates a national credit data register. These data allowed the MPC to take into account the economic impact of its decisions as well as the public reaction to its decisions. This is important because public discussion and media coverage on monetary policy centred on its impact on mortgage payments. Monetary policy deliberations cannot be completely divorced from the public discussion around the costs of the policy, nor should they be.

The increase in households' mortgage payments had a direct impact on their consumption patterns. Graph 6 shows the marginal impact on debit card spending of a 1 percentage point increase in the size of the adjustable rate tranche share in a mortgage, which can be referred to as the ARM share, around the BOI's rate lift-off in April 2022. Before the lift-off, there was no clear relation between a higher ARM share on monthly spending. After the lift-off, however, there is a clear pattern.A monthly spending of households with a higher ARM share is lower.

The impact increased over time because the interest rate kept going up. The dynamic specification reveals that by June 2023 the difference in consumption response was around 10 basis points for a 1% higher ARM share. As the average ARM was tightly grouped around 32%, this implies that by June 2023 consumption of those households dropped by over 3% relative to the level in April 2022 when compared with households with no mortgage. During this time, the BOI's key rate increased from 0.1% to 4.75%. This points to a very high elasticity of consumption with respect to the key rate of this group of households, although the drop in consumption, in absolute terms, was only 39% of the average increase in mortgage payment, which implies consumption smoothing was at work.

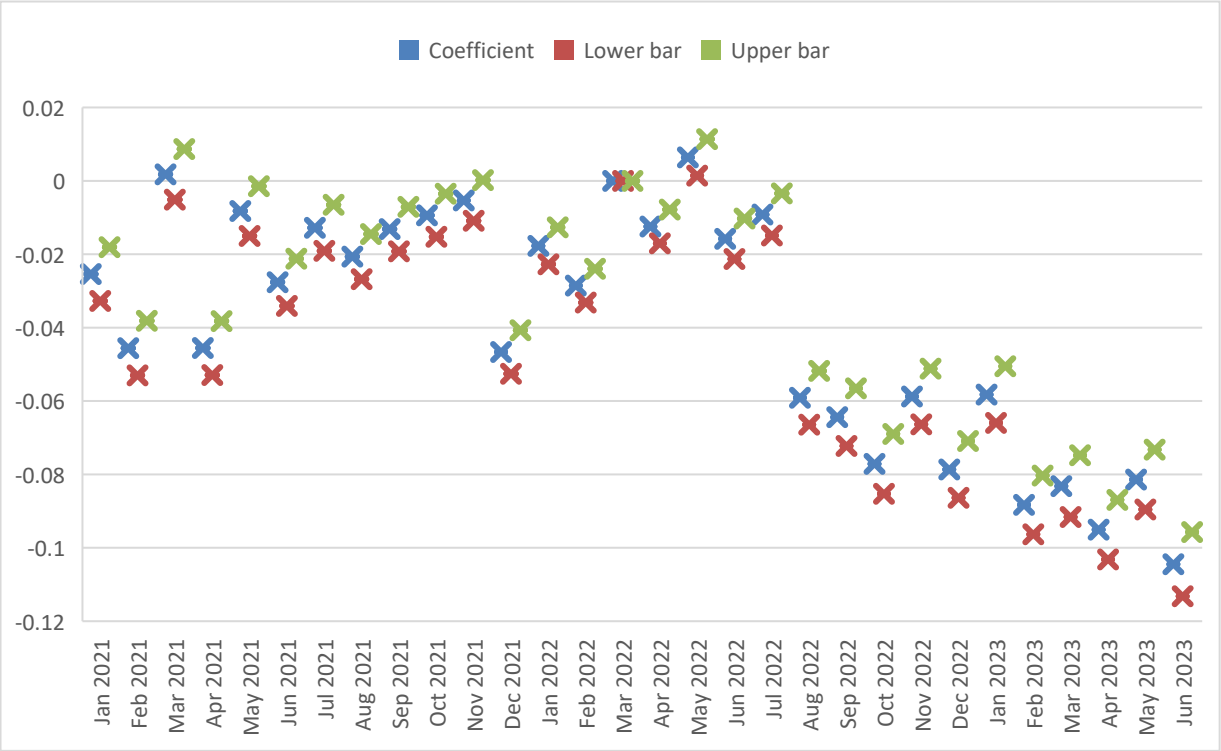
[12] Population density is 426 people per square kilometer, ranked third in the OECD, after Korea and the Netherlands (source: United Nations).

[13] The ratio of the median 90 square metre home price to the annual median household disposable income is 14.3, ranked fifth in the OECD, after Korea, Colombia, Chile and the Slovakia (source: NUMBEO).

[14] This cap increased to 66% in late 2021. The average floating tranche in early 2022 increased to 36%.

[15] The average spread is usually about 2%, depending on the risk as assessed by the issuers.

Marginal impact of the adjustable rate ratio on monthly credit spending, %[1] Graph 6



[1] BOI rate hikes started in April 2022. The upper and lower and upper bounds indicate a 90% confidence interval.

Source: Caspi, Eshel and Segev (2024).

5. Conclusions

Like many other central banks, the BOI significantly increased its interest rate in 2022–23 to combat the spike in inflation above its target range. The recent tightening cycle provides a fresh opportunity to look into issues of monetary policy transmission and heterogeneity. We focus on the interest channel and show that it is a powerful channel through which the BOI's actions affected bond yields, deposit and credit rates, banks' interest rate income and household debit card spending. Nonetheless, the interest rate hikes had not been transmitted in full and not evenly across different segments of the economy.

Thus, monetary tightening has a heterogeneous impact. First, it puts a fundamental wedge between lenders and borrowers. While lenders are not necessarily better off, because for example tightening might have an adverse impact on asset prices, borrowers are worse off almost by definition. Next, the impact is heterogeneous among borrowers: while new borrowers can adjust their demand for credit, the onus of monetary tightening falls hard on borrowers with existing floating rate loans, and with perhaps the most glaring example being borrowers with an ARM. Lastly, the impact on depositors is uneven, and is a function of their relative market power and size. In this short paper we show how this heterogeneity looks.

As monetary policy might affect financial stability, and central banks' ultimate purpose is social welfare, their aggregate assessment has to be complemented with a granular approach that focuses on the heterogeneous impact of their actions on the most vulnerable households and weakest firms. Systematically collecting household- and firm-level data and analysing the impact of monetary policy based on these data is a step forward for conducting better policies.

References

Caspi, I, N Eshel and N Segev (2024): "The mortgage cash-flow channel: how rising interest rates impact household consumption", *Bank of Israel Research Department Discussion Paper 2024.13*.

Caspi, I, A Friedman and S Ribon (2024): "Shocks and currents: monetary policy and Israel's foreign exchange market", *Comparative Economic Studies*, vol 66, no 3, pp 454–81, September.

Eshel, N (2024): "Adjustable-rate credit and monetary policy transmission: a cross-country analysis", Bank of Israel, mimeo.

Heterogeneity and monetary policy in Korea

Bank of Korea

Abstract

Heterogeneity in economic agents is increasing in Korea and these changes may affect the transmission channels and the effectiveness of monetary policy. In particular, the ageing population, high household debt levels, and differences between manufacturing and non-manufacturing companies, large enterprises and SMEs, and domestic demand-oriented and export-oriented firms are focuses of interest in Korea.

The effect of the increasing heterogeneity in the economy on the effectiveness of monetary policy is not obvious. However, recent studies suggest that the rising population of elderly households tends to reduce the effect of monetary policy, while the influence of high levels of household debt needs to be evaluated more comprehensively. Also, service industries, SMEs and domestic demand-oriented firms are more sensitive to interest rate changes compared to others.

Although the heterogeneity of households and firms is an important issue in monetary policy, the Bank of Korea (BOK) focuses on overall economic trends as captured by aggregate indicators for its monetary policy decisions, rather than explicitly considering the heterogeneity of agents such as sectoral income inequality and business cycle divergences. This is because it primarily aims to achieve macroeconomic stability by focusing on price and financial stability and is not designed to directly address sectoral imbalances. However, heterogeneity needs to be considered in economic assessments and analyses of policy effects, and the BOK could also contribute to narrowing sectoral gaps and reducing inequality by effectively achieving its mandate of price and financial stability.

Post-pandemic monetary policy operations show that the BOK focused primarily on the overall economic conditions in its monetary policy decisions, despite sectoral differences. In the meantime, it has also sought to enhance policy acceptance, especially for the vulnerable, through active communication, and has partially addressed the heterogeneity in economic agents through the Bank Intermediated Lending Support Facility (BILSF).

As the issue of heterogeneity among economic agents is expected to become more important in the future, it will be necessary to continue studying its interrelationship with monetary policy.

1. Introduction

In recent years, academia and central banks have increasingly focused on analysing the macroeconomy and policy effects considering the heterogeneity in economic agents. The Great Financial Crisis (GFC) and Covid-19 highlighted[1,2] the importance of the interrelationship between the characteristics of individual economic agents (such as income, assets and debt) and economic fluctuations. As analytical constraints have been eased due to the expansion of micro-level data and improvements in economic models and computational techniques, heterogeneous agent New Keynesian (HANK) models have been developed.

HANK models enable analysis of macroeconomic fluctuations and policy effects considering micro-level characteristics of economic agents, such as incomes, assets and debt of individual households and firms. Major studies on monetary policy using HANK models so far have shown that in the case of households, the main monetary policy transmission channel can vary[3] depending on the proportion of households facing borrowing constraints. Regarding firms, the effects of monetary policy may differ[4] depending on the distribution of companies with high default risk.

In the meantime, concerns have emerged that monetary policy easing might worsen asset inequality in the aftermath of the GFC and Covid-19. This has spurred research into the effects of monetary policy on inequality and distributional structures within the economy. However, studies have yet to reach a consensus on whether monetary policy impacts asset and income inequality.[5]

1 In the past, heterogeneity analysis was primarily focused on issues related to inequality or welfare, as there was a general consensus that the dynamics of macroeconomic fluctuations could be adequately explained using the representative agent New Keynesian (RANK) model. However, over the past decade, the importance of the interrelationship between the heterogeneity of economic agents and economic fluctuations has grown and its influence has spread. In other words, the heterogeneity of economic agents affects economic fluctuations and vice versa (Alves et al (2022)).

2 Following the GFC, central banks in major economies maintained accommodative monetary policies for a considerable time, raising concerns about widening asset inequality. Furthermore, as the Covid-19 shock, which was a health crisis, disproportionately affected low-income households with weak employment stability and the face-to-face services sector, there has been an increase in attention to the heterogeneity in the economy.

3 In the absence of borrowing constraints, households adjust their savings and borrowing in response to interest rate changes to smooth consumption between the present and the future (intertemporal substitution). Therefore, monetary policy effects are mainly transmitted to consumption through an intertemporal substitution in RANK models without borrowing constraints. In contrast, HANK models, which account for households with borrowing constraints (often referred to as hand-to-mouth households), show that monetary policy affects consumption primarily through indirect channels, such as changes in household income due to interest rate fluctuations, rather than through intertemporal substitution effects (Kaplan et al (2018)).

4 For firms with high default risk, even if overall financial conditions ease, for example due to interest rate cuts, their borrowing costs do not decrease significantly. Consequently, their investment sensitivity to changes in monetary policy is relatively lower than that of firms with low default risk (Ottonello and Winberry (2020)).

5 While opinions on whether monetary policy affects asset and income inequality differ from study to study, overall they tend to fall into three categories: (1) rising asset prices stemming from accommodative monetary policy may widen asset inequality; (2) monetary policy easing could alleviate income inequality by improving employment; and (3) monetary policy could temporarily affect inequality, but has neutral impacts in the long term (McKay and Wolf (2023)).

In Korea, there is a growing concern about how to incorporate the heterogeneity of economic agents into monetary policy operation. Rapid population ageing, high household debt levels and the realignment of global trade structures have acted to increase the heterogeneity in households and firms. These changes could affect the transmission channels of monetary policy and even policy effectiveness by altering the behaviours of consumption, savings, labour supply and investment.

In this paper, we first assess the major features of heterogeneity in households and firms that are considered in the conduct of monetary policy. Then, we detail the ways in which heterogeneity is considered in actual policy operation and central bank loan policy. Finally, we conclude with recommendations to further improve the use of heterogeneity for conducting monetary policy.

2. Heterogeneity in households and firms in Korea

The Bank of Korea (BOK) is focusing on the heterogeneity in economic agents, as it could significantly influence monetary policy transmission channels and overall effectiveness of policy. For households, key aspects of heterogeneity include a rapidly ageing population and substantial household debt levels, which affect consumption and saving behaviour. For firms, persistent disparities exist between the manufacturing and service sectors, large corporations and small and medium-sized enterprises (SMEs), and domestic demand-oriented and export-oriented firms, reflecting Korea's manufacturing- and export-driven growth structures.

2.1 Household heterogeneity

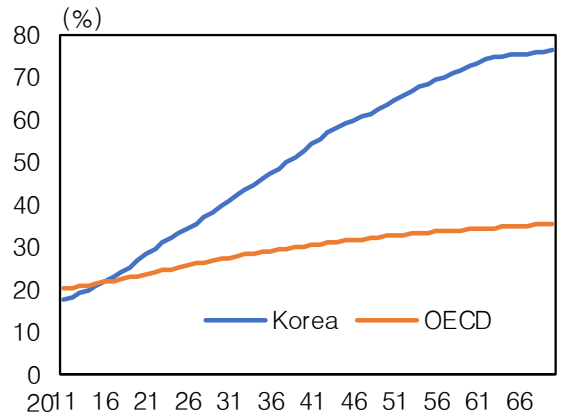
Starting with household heterogeneity, Korea is one of the fastest-ageing countries in the world, and the increasing share of elderly people is likely to influence monetary policy transmission. From a theoretical perspective, the impact of population ageing on household consumption and assets varies depending on whether the ageing process is in its early stages or has reached maturity. Ageing can also exert both upward and downward pressure on the neutral interest rate, indicating that its effects on monetary policy effectiveness are not obvious.[6] However, recent empirical studies[7]

[6] Population ageing influences the effectiveness of monetary policy through channels such as changes in the neutral interest rate and shifts in household consumption and asset holdings. A decline in the neutral interest rate reduces the scope for monetary policy, thereby diminishing its effectiveness. Population ageing simultaneously contracts aggregate supply (by reducing labour supply and undermining productivity) and expands aggregate demand (due to increased consumption by the elderly and a decline in their savings, in line with the life-cycle income hypothesis). As a result, ageing exerts both upward and downward pressure on the neutral interest rate. However, as population ageing progresses, aggregate demand may eventually decline due to rising precautionary savings, as individuals seek to secure their living standards post-retirement. During this period, ageing may exert downward pressure on the neutral interest rate. In terms of household consumption and asset holdings, the sensitivity of consumption to interest rates may increase in the early stages of ageing, as individuals accumulate assets in preparation for retirement. Once the ageing process matures, however, consumption begins to exceed savings and asset holdings decline, reducing the sensitivity of household consumption to interest rate changes (Yim et al (2022)).

[7] Lee (2024) finds that the interest rate sensitivity of consumption decreases as household age increases. This is attributed to elderly individuals' higher reliance on service consumption, which

suggest that in Korea, the rising proportion of elderly households is tending to reduce the sensitivity of consumption to interest rates, thereby limiting the effectiveness of monetary policy.

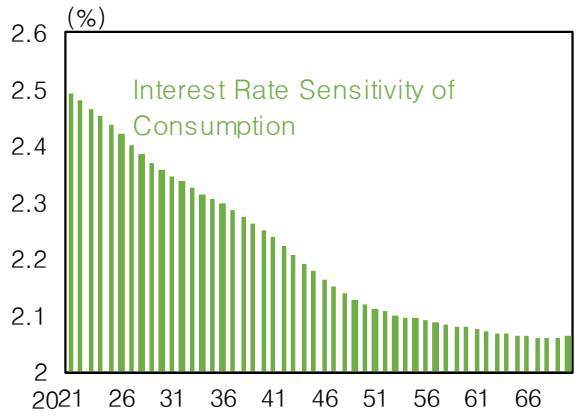
Figure 1: Share of the elderly population (aged 60 and above)[1]



[1] Figures for Korea are based on Statistics Korea's future population projections, and figures for OECD countries on UN estimates.

Sources: United Nations; Statistics Korea.

Figure 2: Interest rate sensitivity of consumption[1]



[1] The percentage of consumption decreases due to a 1%p increase in interest rates under the population structure of each year.

Source: Lee (2024).

In addition, household debt has risen significantly across the economy, and the increasing proportion of heavily indebted households – those with large debt burdens relative to income – has become a critical concern, particularly regarding its impact on monetary policy transmission channels. Generally, higher household debt amplifies changes in debt repayment burdens caused by interest rate fluctuations, thereby enhancing the impact of monetary policy on consumption through the cash flow channel. In Korea, where the household debt-to-income ratio is high and a substantial share of household debt has historically been in floating rate loans,[8] the transmission of monetary policy to the real economy has been relatively rapid during the post-Covid-19 period of interest rate hikes.

However, household debt levels are now estimated[9] to have exceeded the threshold at which they restrict consumption, and the proportion of heavily indebted households has continued to grow. As a result, during future interest rate reductions, the traditional channel of "rate cut → loan expansion → consumption growth" may

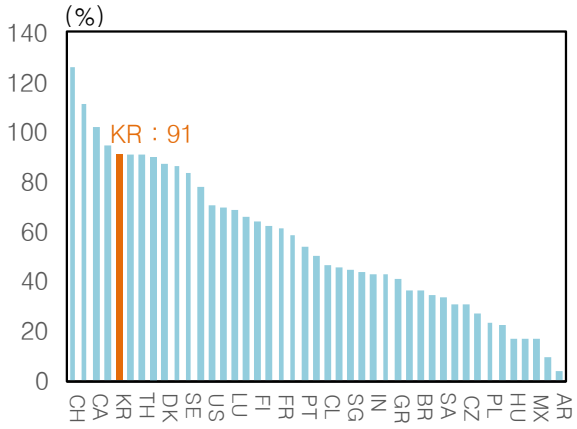
makes it more challenging to adjust intertemporal consumption in response to interest rate fluctuations. Additionally, their substantial net financial asset holdings may lead to an increase (or decrease) in their consumption capacity during periods of interest rate cuts (or hikes). Similarly, Lee (2023) finds that consumption among younger households, particularly those aged 30 and under, is more sensitive to interest rate changes compared to other age groups.

[8] The proportion of floating rate loans in Korea's total household loans (based on outstanding amounts) peaked at 72.5% in July 2022. Since then, driven by policy efforts to improve the structure of household loans, it has steadily declined and reached 54.5% as of October 2024.

[9] As of Q2 2024, Korea's household debt-to-GDP ratio stands at 91%, exceeding the growth-constraining threshold of approximately 80% estimated in major studies such as Cecchetti et al (2011) and Lombardi et al (2017).

be restricted due to borrowing constraints[10] and household debt repayment burdens. Nevertheless, the overall change in the effectiveness of rate cuts in the context of rising household debt should be evaluated comprehensively, taking into account the potentially strengthened effects of the cash flow channel.

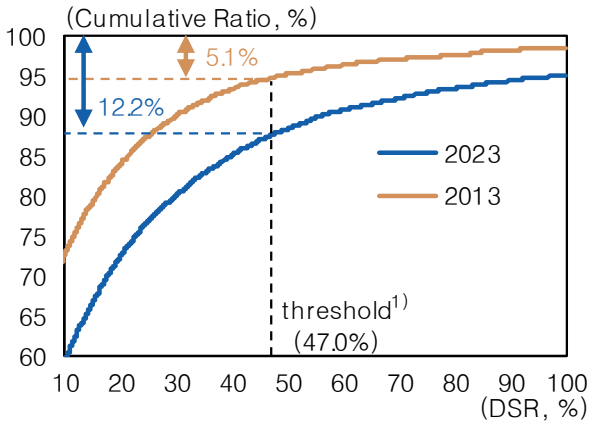
Figure 3: Household debt-to-GDP ratios[1,2]



[1] As of Q2 2024. [2] Calculated using BIS "Credit to the non-financial sector" statistics for 43 countries.

Source: BIS.

Figure 4: Share of households by DSR level



[1] The consumption-constraining DSR was estimated using panel micro data from the Survey of Household Finances and Living Conditions, covering the years 2013 to 2023.

Sources: Bank of Korea estimates; Statistics Korea.

2.2 Firm heterogeneity

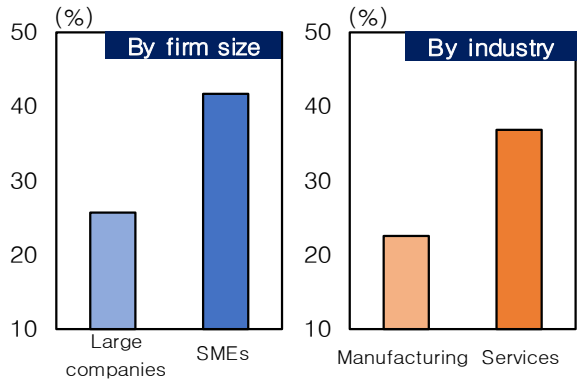
In the case of firms, differences between manufacturing and non-manufacturing companies, large enterprises and SMEs, and domestic demand-oriented and export-oriented firms have persisted, due to a growth structure centred on manufacturing, large corporations and exports. Service industries, SMEs and domestic demand-oriented firms are directly influenced by changes in the domestic economy and have a high dependence on indirect financing, such as bank loans. As a result, they are more sensitive to domestic economic conditions and interest rate changes compared to manufacturing, large enterprises and export-oriented firms. Empirical analysis shows that the impact of monetary policy changes on investment, profitability and financing costs is larger for SMEs than for large corporations. An analysis using recent regional data shows that the impact of monetary policy is greater in regions with a higher share of non-manufacturing, domestic demand-oriented and small companies.[11]

[10] With the overall level of household debt relative to income elevated and stricter debt service ratio (DSR) regulations in effect compared to the past, the proportion of households facing borrowing constraints may increase even if interest rates are lowered.

[11] Kim (2022), Baak and Ryuk (2018) and Park and Lee (2017) all consistently found that the impact of monetary policy on investment, profitability and financing costs is greater for SMEs compared to large corporations. According to Joo et al (2024), an analysis of regional panel data in Korea found

In addition, foreign investment by domestic companies has been expanding due to reshoring in major advanced economies. If this trend continues, the impact of monetary policy on domestic investment could become more limited.

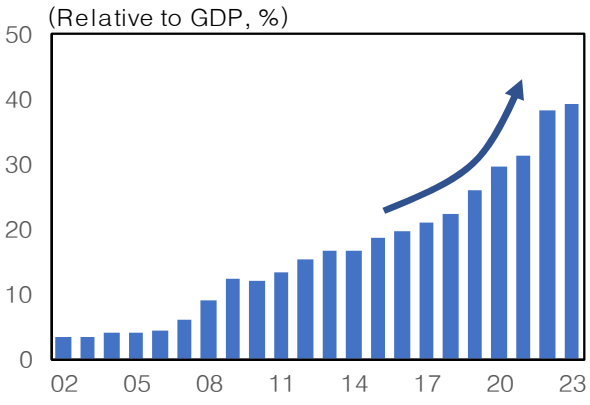
Figure 5: Total borrowings and bonds payable to total assets ratio by firm characteristics[1]



[1] As of 2023.

Source: Bank of Korea.

Figure 6: Trends in foreign direct investment



Source: Bank of Korea.

2.3 Limitations in considering heterogeneity in monetary policy transmission analysis

The heterogeneity of households and firms discussed earlier is an important issue in analysing the transmission effects of monetary policy. However, the BOK mainly uses a representative agent New Keynesian (RANK) model, which assumes homogeneous economic agents, to analyse the average effects on the overall economy when forecasting the economy and analysing policy impacts for monetary policy decisions. The reason for this is that, while micro data at the household and firm level are continuously expanding, long frequency, time lags and short time series of the data still pose limitations[12] for their use in analyses supporting monetary policy decisions. Furthermore, experience and confidence in the HANK model have not yet been sufficiently accumulated.

The BOK has developed and is supplementarily utilising the two agent New Keynesian (TANK) model,[13] which partially incorporates household heterogeneity into

that the growth impact of monetary policy shocks is larger in regions with a higher proportion of non-manufacturing industries, domestic demand-oriented firms and SMEs.

12 Statistics Korea has been providing micro data compiled by itself and various statistical compilation organisations since 2015, but the compilation interval, the length of time series, and other characteristics vary significantly by data, and the time lag between compilation and release can be as long as two years or so.

13 Bae et al (2018) constructed a TANK model in a BOK-DSGE model that divides households into general households and hand-to-mouth households, and individual researchers have been

the BOK-DSGE model. When necessary, we also utilise models that analyse economic conditions and the effects of monetary policy transmission by sector to provide further reference for monetary policy implementation.

3. Consideration of heterogeneity in monetary policy operations

In its monetary policy decisions, including policy interest rate adjustments, the BOK does not explicitly consider the heterogeneity of agents, especially in terms of sectoral income inequality and business cycle divergences. As monetary policy primarily aims to achieve macroeconomic stability, focusing on price and financial stability, and is not designed to directly address sectoral imbalances, the BOK focuses on overall economic trends in inflation and growth as captured by aggregate indicators for its monetary policy decisions. Furthermore, given that economic inequality is a long-term structural issue, and monetary policy has limitations in dealing with it, the BOK remains sceptical about directly addressing inequality within its policy framework.

As discussed earlier, however, the heterogeneous characteristics of economic agents have implications for monetary policy transmission and the macroeconomy, and thus need to be considered in economic assessments and analyses of policy effects. The BOK could also contribute to narrowing sectoral gaps and reducing inequality by effectively achieving its mandate of price and financial stability.

Post-pandemic monetary policy operations show that the BOK focused primarily on the overall economic conditions of growth, inflation and financial stability in its monetary policy decisions, despite sectoral differences in business cycles. It began raising the Base Rate in August 2021, earlier than other major economies, as the domestic economy and prices recovered due to its aggressive monetary policy accommodation after Covid-19.

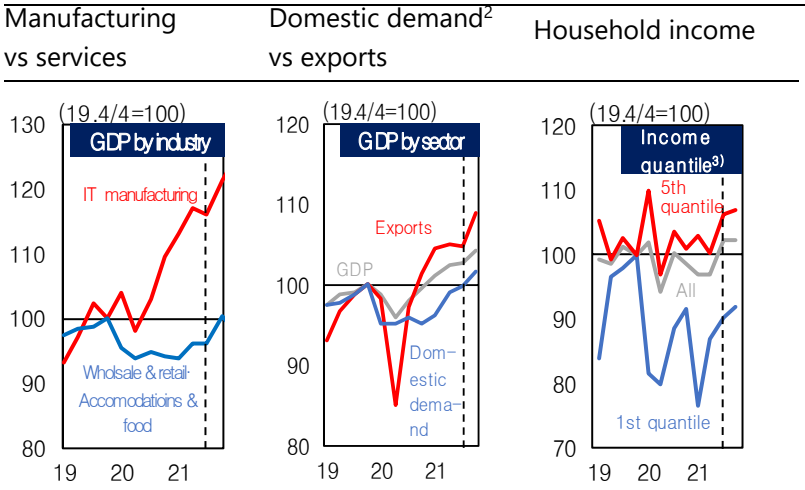
At the time, the pace of recovery was different across sectors. Exports, manufacturing and large corporations had already shown a rapid recovery, reaching pre-pandemic levels by the second half of 2020, driven by the increased demand for IT products during the pandemic. In contrast, low-income households, domestic demand, the service sector and SMEs were recovering at a slower pace. The BOK concluded[14] that aligning monetary policy with the overall momentum of recovery and normalising the low interest rate environment was necessary to achieve price and financial stability, in light of the broader economic trends of growth and inflation as well as concerns about financial stability, such as household debt. This pre-emptive

developing and utilising HANK models for purposes such as analysing the inequality effects of monetary policy.

[14] In mid-2021, inflation was not a significant concern, with core inflation remaining in the lower 1% range. However, the BOK deemed it appropriate to begin normalising the exceptionally accommodative monetary policy stance, due to clear signs of economic recovery and the rapid rise in housing prices and household debt under the ultra-low interest rate environment. Housing prices (based on actual transaction prices of apartments) rose by 14.5% in 2020 and 16.3% in 2021, while household debt increased by 6.6% and 5.9% relative to GDP during the same periods (Rhee and Park (2024)).

rate hike allowed the BOK to take a more gradual approach to raising interest rates[15] during the subsequent high-inflation period compared to other major economies.

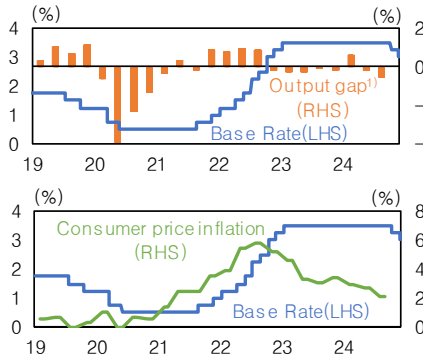
Figure 7: Sectoral differences in recovery pace at the time of most recent rate hike cycle[1]



[1] Dotted lines indicate the timing of the Base Rate hike (Q3 2021).
[2] Domestic demand is defined as consumption and investment in GDP. [3] Household income excluding transfer income in each quantile.

Source: Bank of Korea.

Figure 8: Bank of Korea Base Rate



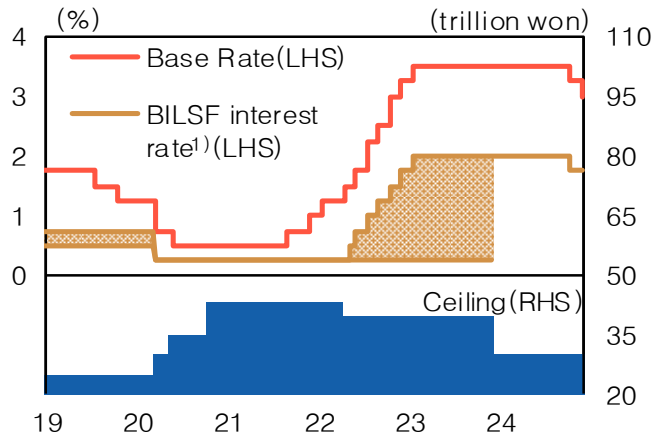
[1] Estimated using HP filter (Q1 2000–Q3 2024).

Sources: Bank of Korea; Statistics Korea.

However, some economic agents frequently argue that differences in the pace of recovery across sectors should be considered when the BOK conducts its monetary policy. In response, the BOK is striving to enhance policy acceptance through active communication about the decision-making process and objectives. For instance, during the process of raising interest rates to tame high inflation, it actively communicated through press conferences that interest rate hikes were unavoidable, as persistent inflation could disproportionately affect the vulnerable, including low-income households.

15 In its response to post-pandemic inflationary pressures, the BOK raised the Base Rate by a total of 300 basis points, from 0.5% to 3.5%, between August 2021 and January 2023.

Figure 9: Ceiling and interest rates of the BILSF



[1] The shaded area represents the upper and lower bounds of the range where loan interest rates were different or each programme.

Source: Bank of Korea.

Furthermore, unlike other major central banks, the BOK has the Bank Intermediated Lending Support Facility (BILSF), a selective lending policy instrument. The BOK uses the BILSF as one of its policy instruments to partially address heterogeneity among economic agents. As the programme was originally designed to support SMEs with limited access to financing by providing low-interest loans, its funding size and interest rates are adjusted primarily in line with the monetary policy stance. However, since the facility can also target specific sectors, it is used as a tool for supporting areas that need financial assistance. Looking at the recent application of this programme, during the period of monetary easing right after Covid-19 the BOK significantly expanded the total amount and the target of loans and cut interest rates to reinforce the stance of monetary easing. After the pandemic, although the BOK reduced the loan volume in alignment with monetary tightening and raised interest rates over the course of interest rate normalisation, it maintained lending support for a considerable period to help ease the burden on those businesses that had experienced relatively greater difficulties as a result of the rate hikes.[16]

[16] The BOK reduced the total ceiling of the BILSF, which had been significantly raised during the Covid-19 period. However, in January 2024, the BOK decided to implement the Temporary Special Support Program for SMEs to help alleviate the difficulties they were facing due to prolonged high interest rates. The programme is scheduled to run until July 2025.

Programmes under the BILSF

In trillions of won

Table 1

Programme		Feb 2020	Mar 2020	May 2020	Oct 2020	Dec 2023	Apr 2024
Support for trade financing		2.5	2.5	2.5	2.5	1.5	1.5
Support programme for new growth engine development and job creation		10.0	11.0	11.0	13.0	13.0	13.0
Programme for stabilisation for SME lending		6.5	5.5	5.5	5.5	0.3	0.3
Support for regional SMEs		5.9	5.9	5.9	5.9	5.9	5.9
Ceiling reserves	Support programme for SMEs affected by Covid-19	-	5.0	10.0	13.0	-	-
	Support programme for small businesses	-	-	-	3.0	-	-
	Temporary special support programme for SMEs	-	-	-	-	-	9.01
	Special support programme for emergency disaster relief	0.1	0.1	0.1	0.1	0.3	0.3
	Temporary ceiling reserves	-	-	-	-	9.0	-
Totals		25.0	30.0	35.0	43.0	30.0	30.0

[1] The ceiling for the programme was allocated in April 2024, following the decision made in January 2024.

Source: Bank of Korea.

4. Future tasks

As the heterogeneity in economic agents in the Korean economy is expected to become more important in the future due to demographic changes and the reorganisation of global trade and industry, it is necessary to strengthen efforts, such as improving models, to account for heterogeneity in the analysis of monetary policy transmission. Since data constraints will gradually ease as time series data

accumulate, the development of heterogeneous economic agent models, which is currently being done by individual researchers, should be more systemised. Furthermore, if income and asset parities between sectors in the economy widen in the future, the demand for considering heterogeneity in monetary policy operations may increase. Therefore, it will be necessary to continue contemplating how to use monetary policy and other macroeconomic policies to address these concerns.

References

Alves, F, C Bustamante, X Guo, K Kartashova, S Lee, T Pugh, K See, Y Terajima and A Ueberfeldt (2022): "Heterogeneity and monetary policy: a thematic review", *Staff Discussion Papers*, no 2022-2, Bank of Canada.

Baak, S and S Ryuk (2018): "Monetary policy and corporate investment: analysis of the asset price channel and the balance sheet channel", *BOK Economic Analysis,* vol 24, no 4, Bank of Korea.

Bae, B, J Yoo and C Chee (2018): "Improvements to the BOKDSGE model for economic forecasts and policy analyses", *Articles in Monthly Bulletin*, vol 72, no 1, Bank of Korea.

Cecchetti, S, M Mohanty and F Zampolli (2011): "The real effects of debt", *BIS Working Papers*, no 352, September.

Joo, H, S Park and I So (2024): "Heterogeneous regional effects of monetary policy: evidence from Korea", *Journal of Asian Economics*, vol 94, October.

Kaplan, G, B Moll and G Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743.

Kim, H (2022): "Effects of rising base rates on major manufacturing industries and policymaking", *i-KIET Issues & Analysis*, no 131, Korea Institute for Industrial Economics & Trade.

Lee, J (2024): "Demographic shifts and sensitivity of consumption to interest rate changes", *The Korean Journal of Economic Studies*, vol 72, no 1, pp 175–204.

Lee, T (2023): "The changes in South Korea's demographic structure and the transmission of monetary policy shocks", *Journal of Korean Economy Studies*, vol 41, no 3, pp 79–107.

Lombardi, M, M Mohanty and I Shim (2017): "The real effects of household debt in the short and long run", *BIS Working Papers*, no 607, January.

Mckay, A and C Wolf (2023): "Monetary policy and inequality", *Journal of Economic Perspectives*, vol 37, no 1, pp 121–44.

Ottonello, P and T Winberry (2020): "Financial heterogeneity and the investment channel of monetary policy", *Econometrica*, vol 88, no 6, pp 2473–502.

Park, H and J Lee (2017): "The distribution effect of monetary policy on the Korean firms' debt structure", *KIF Research Paper*, no 2017-17, Korea Institute of Finance.

Rhee, C and Y Park (2024): "The Bank of Korea's policy response during the high inflation after COVID-19", in B English, K Forbes and A Ubide (eds), *Monetary policy responses to the post-pandemic inflation*, Centre for Economic Policy Research, pp 251–66.

Yim, G, S Nah and D Oh (2022): "Cross-country differences in the effects of monetary policy shocks on outputs and prices and their determinants", *BOK Working Papers*, no 2022-20, Bank of Korea

Household and firm heterogeneity in monetary policy decision-making – Malaysia's perspective

Bank Negara Malaysia

Introduction

Heterogeneity among households and firms is an important component embedded in the Bank Negara Malaysia's (BNM) economic surveillance for monetary policy decision-making. Information on heterogeneity serves two purposes. First, it informs economic outlook assessments such as the trajectories of private consumption and private investment growth. Heterogeneous responses to various shocks and policy interventions reveal potential vulnerabilities and underlie the sustainability of economic growth. Second, it sheds light on the effectiveness of monetary policy transmission. Alongside stylised observations on the structural characteristics of households and firms, preliminary empirical estimations suggest that the aggregate effect of monetary policy action on specific transmission channels may mask some varying effects across heterogeneous groups. Further, surveillance of bank and borrower behaviours shows that heterogeneity may influence responses to shocks depending on the state of the economy, as increased risk aversion during downturns, which can have implications for policy efficacy. While the distributional impact of monetary policy (ie the overall effect on inequality outcomes) does not directly influence policy interest rate decisions, such information, to the extent that it is obtainable, is important for understanding the potential unintended consequences of the overall transmission mechanism and thus serves to inform communication strategies as well as complementary policies.

The first part of this note provides a comprehensive overview of the monetary transmission mechanism in Malaysia at the aggregate level, highlighting the relative strength of different channels. The second part delves into the role of household and firm heterogeneity in monetary policy analysis. The final part touches on the relevance of distributional effects of monetary policy and discusses heterogeneity concerns more broadly in the context of BNM's other mandates.

Part I: The monetary transmission mechanism in Malaysia

Monetary policy transmission has remained effective with the adoption of an interest rate-based monetary policy framework and amid supportive structural developments in the economy and financial system.

Five years after the Asian financial crisis,[1] following significant reforms and the strengthening of Malaysia's economic and financial sector fundamentals, BNM transitioned towards a new market-based interest rate targeting framework through the introduction of the New Interest Rate Framework (NIRF) in April 2004. This followed extended periods of monetary targeting in the 1980s and early 1990s and the adoption of the three-month intervention rate in 1998 to facilitate policy signalling and immediate transmission of policy rate changes to banks' base lending rates (BLRs).[2] Since 2004, under the current NIRF, the monetary policy stance is signalled by the Overnight Policy Rate (OPR), the target for the average overnight interbank rate. A flexible exchange rate regime was also subsequently adopted in July 2005. This monetary policy framework remains in place today.

Amid this evolution in the design of the monetary policy framework, the transmission mechanism has remained effective. For example, estimates based on a sample from Q2 1991 to Q2 2023 assessing the impact of a monetary policy shock on real GDP growth and core inflation were found to be higher in a subsample beginning in 2007.[3] Nevertheless, the transmission lag of policy has remained steady, with peak transmission to real GDP growth and inflation occurring at two and three quarters, respectively, after a policy shock.

The stronger transmission (policy impact) likely stems from the alignment of the NIRF's characteristics with domestic structural trends. For example, targeting the shortest market rate ensured the highest degree of controllability of the policy target by the central bank. The NIRF also entailed greater emphasis on communications to guide expectations.[4] At the same time, key changes had taken place in the domestic economy and financial system. These include increased access to financial services for

1 For discussion on the monetary policy framework in the lead-up to and during the Asian financial crisis, refer to BNM (1999).

2 At the same time, to support monetary autonomy, a fixed exchange rate regime and selective exchange controls were introduced in September 1998. The latter was removed in stages thereafter.

3 This currently unpublished BNM internal staff assessment was conducted using a DSGE model, MyGPS (Malaysia's Generalised and Parsimonious Simulation Model), adopted from the Bank of England's COMPASS (Central Organising Model for Projection Analysis and Scenario Simulation) and calibrated to Malaysia. Further findings will be released in an upcoming publication. The impact of a monetary policy shock on aggregate macroeconomic variables is assumed to be symmetric in this model. For more details, please refer to Burgess et al (2013).

4 BNM's Monetary Policy Committee (MPC) began issuing the Monetary Policy Statement (MPS) in May 2004.

businesses (including micro, small and medium enterprises (MSMEs))[5] and households and the maturation of Malaysia's financial system, in which financing from a more diversified and competitive banking system continued to expand alongside deeper and more liquid equity and bond markets. This stronger transmission has occurred despite global structural phenomena, such as the (pre-Covid-19) flattening of Phillips curves, in which standard prescriptions for monetary policy may prove to be destabilising (Beaudry et al (2024)), or the stronger co-movements of business cycles between countries, potentially influencing domestic monetary policy autonomy as central banks have to align their responses to global economic shifts (Bräuning and Sheremirov (2023)).

The strength of monetary policy transmission reflects relative high sensitivity to the cash flow channel driven by broad reliance on floating rate bank financing.

The overall impact of monetary policy on key aggregate macroeconomic variables in Malaysia, while efficacious, subsumes differing influences across individual transmission channels. A key feature of the monetary transmission mechanism is the relative strength of the cash flow channel. This channel is particularly relevant in Malaysia given the high level of financing provided by the banking system (accounting for 79.3% of overall financing in Malaysia).[6] Furthermore, this bank-based financing is characterised by a high share of floating rate loans, which has increased over time (accounting for around 80% and 75% of outstanding household and non-financial firms' loans, respectively).[7] This means that a significant portion of Malaysian households and firms experience changes in cash flows following the repricing of bank loans due to adjustments in the OPR.

The BNM's introduction of the Standardised Base Rate (SBR) in August 2022, as part of the revised Reference Rate Framework, reinforces the strength of the cash flow channel. The SBR serves as the main reference rate for all new retail floating rate loans and moves in tandem with the quantum of OPR adjustments. This not only ensures that OPR changes are uniformly reflected in retail BLRs across banks, but also provides households with greater predictability and transparency regarding borrowing costs.

Further efforts to contrast the cash flow channels for households and firms indicate that the cash flow channel for firms is slightly less potent. While MSMEs, which are reliant on bank-based financing, made up 96.9% of firms and 39.1% of GDP

5 Micro, small and medium enterprises (MSMEs) were defined at the 14th National SME Development Council (NSDC) Meeting in July 2013. The criteria are based on either sales turnover or the number of full-time employees: for the manufacturing sector, MSMEs are defined as firms with sales turnover not exceeding MYR 50 million or no more than 200 full-time employees; for the services and other sectors, MSMEs are defined as firms with sales turnover not exceeding MYR 20 million or no more than 75 full-time employees.

6 As at September 2024, Malaysia's credit-to-GDP ratio stood at 148% (133% as at March 2005). Credit refers to outstanding loans to households and non-financial corporations from the banking system and development financial institutions (DFIs) and outstanding corporate bonds issued by non-financial corporations (including short-term papers). Figures computed based on BNM (2024) and DOSM (2024a).

7 As at September 2024 (compared with 61% and 62%, respectively, in January 2013).

in 2023,[8] business loans are priced based on a wider set of reference rates, such as Kuala Lumpur Interbank Offered Rates (KLIBOR) and banks' internal cost of funds,[9] due in part to the varied and less homogeneous nature of business credit facilities, and also include a slightly higher share of fixed-rate agreements. Additionally, larger firms tend to have access to more diverse sources of funding, such as retained earnings and bond issuances (with fixed coupon rates throughout a bond's duration).

While changes in interest rates significantly influence the disposable income available to households and firms – and thus aggregate demand – through the cash flow channel, intertemporal behavioural responses to save and invest appear more muted in Malaysia. Adjustments to monetary policy have a moderate effect on households' marginal decision on when to consume or save, likely given a non-trivial share of financially constrained households.[10] Findings from BNM's monthly Consumer Sentiment Survey (CSS) show that about 40% of households claim to face difficulties making ends meet.[11] These households are likely less sensitive to changes in deposit rates, for instance, given low savings and capacity to save to begin with. According to the CSS, only about 37% of financially constrained households can sustain their spending for three months or longer in the event of loss of income sources (in contrast to approximately 66% of non-financially constrained households). A similar pattern can be observed among firms with regard to the relevance of OPR changes. Engagements by BNM's Regional Economic Surveillance (RES) teams indicate a relatively small role played by interest rates in affecting (mostly large) firms' investment decisions. Firms tend to be more influenced by other economic and business factors, such as the overall economic outlook and general uncertainty about the future.

The dominant role of banks as financial intermediaries amplifies the impact of monetary policy on loan market outcomes. This confirms the presence of the credit channel, a combination of both the balance sheet and bank lending channels in Malaysia. Leveraging data from Malaysia's central credit registry,[12] internal research suggests that contractionary monetary policy shocks reduce both the volume and value of new loans across all major segments (households, MSMEs and larger firms).

Beyond the channels described above, through which the banking system plays a key role, the expectations channel of monetary policy transmission also directly

8 See DOSM (2024b).

9 While other reference rates are also influenced by the OPR as well as prevailing market conditions, the transmission of the OPR to the SBR is relatively more direct as the SBR moves directly in tandem with the OPR.

10 Financially constrained/lower-income households' consumption is relatively more affected by indirect cash flow channel effects on employment and wages, while intertemporal substitution effects work through unconstrained/wealthier households which are more able to save and smooth their consumption.

11 This qualitative survey question aims to understand how households perceive their financial condition based on the ease with which they can get through any given month on their monthly income (on a scale from difficult to very easy). The share of households facing difficulties making ends meet is calculated by adding up the shares of households which chose a response of "Not Very Easy" and "Difficult" to the survey question.

12 The Central Credit Reference Information System (CCRIS) is Malaysia's credit registry, which consists of loan- and borrower-level information on loans and financing facilities extended by – but not limited to – banks, DFIs and non-bank financial institutions (NBFIs).

affects the economy, especially through household expectations. Recent research has established the role of household inflation expectations in transmitting monetary policy adjustments. For instance, a contractionary monetary policy shock was found to have reduced households' expectation of future inflation, which in turn reduces current consumer spending and actual inflation. Although significant, the effect was found to be somewhat dampened among financially constrained households.

Meanwhile, the exchange rate channel has a more limited role in transmitting domestic monetary policy adjustments to the economy. This is notwithstanding Malaysia's status as a highly open economy (with a trade-to-GDP ratio of 145%).[13] Changes in the OPR have limited impact on the ringgit, and only marginally more so post-NIRF implementation, which coincides with the adoption of the managed float exchange rate regime. Further, the little implication for growth from this channel is also due to the relatively inelastic exchange rate sensitivity of exports, which may reflect the combination of various factors, including that Malaysia is a price taker amid dominant currency pricing, as well as significant integration into global supply chains.

Some gaps remain in understanding monetary policy transmission channels.

Assessments of monetary policy transmission in Malaysia have thus far focused on establishing the presence and absolute strength of individual channels. Efforts to disentangle the different transmission channels or rank their relative strengths have been challenging, due mainly to current limitations on the availability of comprehensive and high-quality data, such as:

- The unavailability of reliable household- or firm-level balance sheet data across time: This has posed difficulties in disentangling the extent to which the credit channel operates through revaluations of borrowers' balance sheets that affect their creditworthiness (balance sheet channel) or shifts in banks' willingness to extend credit (bank lending channel). Existing firm-level balance sheet data in Malaysia are thus far limited to large publicly listed firms, whereas granular data for MSMEs are incomplete.
- Insufficiency of data sources regarding firms' inflation expectations across Malaysia: While internal assessments have been carried out for Malaysian households by leveraging available household inflation expectations data from the CSS, the use of a similar approach to empirically model the expectations channel for Malaysian firms, ie whether changes in monetary policy affect firms' inflation expectations or economic outlook, has been particularly challenging.

BNM recognises the need to address such data limitations over the longer term in order to enhance monetary policy analysis given that the heterogeneity of households and firms could result in differing impacts of monetary policy across the distribution of households or firms, thereby strengthening or undermining the efficacy of the monetary transmission mechanism.

[13] As at 2023 (the average for 2015–19 was 124.9%). While the trade-to-GDP ratio has increased relative to its pre-pandemic level, more recent figures have experienced some fluctuations. Figures computed based on DOSM (2024c) and DOSM (2024d).

Part II: The role of heterogeneity in monetary policy analysis

Heterogeneity across households and firms is considered by BNM as part of its economic surveillance, primarily to inform two key aspects in the formulation of monetary policy strategy: first, it informs economic outlook assessments, and second, it sheds light on the effectiveness of monetary policy transmission. Accounting for the heterogeneous nature of households and firms contributes to forming the basis for an overall aggregate assessment of the outlook for domestic activity and inflation and, consequently, the appropriate monetary policy actions moving forward.

Incorporating household heterogeneity into monetary policy analysis has proven to be insightful and highly relevant for policy considerations.

A recent illustrative experience of the key role of heterogeneity in assessing Malaysia's economic outlook took place in early 2024: BNM's Monetary Policy Committee (MPC) discussed varying scenarios of macroeconomic impacts arising from the Malaysian government's planned subsidy rationalisation measures, including on retail fuel prices. Amid growing conversations on the possibility of the government complementing such measures with targeted cash transfers, staff analysis of households' fuel expenditures, savings buffers and marginal propensity to consume across income quintiles – that is, heterogeneity across disposable income – contributed significantly to the development of potential trajectories of private consumption growth and, by extension, the growth of the Malaysian economy (private final consumption as a percentage of current GDP was 62.7% as at Q3 2024).

A key insight from the analysis was that the contractionary impact from subsidy rationalisation measures on private consumption was expected to be subdued, partially due to limited changes in consumption by middle- to high-income households, specifically the top three income quintiles, which accounted for around 80% of private consumption expenditure.[14] These households were relatively more able to smoothen their consumption over time amid less binding financial constraints and greater latitude in substituting across goods and services, consistent with prior research that showed diminishing marginal propensity to consume as income increased.[15] This supported the view that private consumption growth would remain sustainable, thereby shaping – alongside prospects for overall economic activity and inflation – the strategic considerations for monetary policy during the year.

Beyond helping to formulate a better assessment of the economic outlook, dimensions of heterogeneity can provide critical information on the efficacy of monetary policy transmission. Notably, the challenges BNM faced in navigating the Covid-19 crisis highlighted the role of household heterogeneity in influencing state-dependent sensitivity to monetary policy. A BNM survey of banks in the second half

14 Staff estimates using DOSM (2023).

15 See Suah (2024). Although this study suggests that the contractionary impact from subsidy rationalisation is expected to be greater for low-income households due to their higher marginal propensity to consume, this impact would be partly mitigated by the support to consumption provided through cash transfers.

of 2020 proved useful in gauging potential shifts in risk aversion amid the transition to a state of elevated economic uncertainty. For example, the study found that banks were more willing to extend credit to households with stable and formal employment given the stability of their incomes relative to those working in informal sectors, such as gig economy workers, who experienced greater variability and risk in their incomes. There were also indications that credit costs were likely to increase somewhat, especially for personal loans, amid uncertainty about the economic outlook. Even without tightening credit standards, credit supply was expected to be affected by the deterioration in prospective borrowers' balance sheets. Thus, although the cumulative reduction in the OPR during the year had generally led to lower lending rates, the study suggested that there were partially countervailing credit constraints for certain borrower segments that risked a negative feedback loop. Backed with this richer view of the potency of monetary policy in the downturn amid Covid-19, monetary policy was calibrated to ensure the appropriate degree of monetary stimulus for the macroeconomy. This was coordinated with a range of more targeted fiscal measures and financial reprieve initiatives, such as loan repayment moratoriums and targeted repayment assistance.

BNM intends to further explore how household heterogeneity influences the monetary transmission mechanism, ie whether there is meaningful variation across different segments that underlies how specific channels transmit policy action. For example, collaborative research under way[16] suggests that contractionary monetary policy has a dampening effect on mortgage credit allocation, but this effect varies among income groups. Higher-income households[17] experience consistent declines in loan application values and realised mortgage amounts, which suggest demand-driven flexibility in their own borrowing decisions rather than credit supply constraints.[18] These results pointing to relatively interest rate-elastic credit demand are intuitive as higher-income households tend to borrow more, including for property investments, thereby having greater exposure to the effects of higher interest rates on debt repayment and property prices. In contrast, middle-income households[19] do not experience a significant change in loan application values and realised mortgage amounts, though this group does show the most pronounced (albeit modest) decline in the probability of loan approval. In contrast to middle- to higher-income households, lower-income households exhibit relatively inelastic credit demand and the probability of loan approval is largely unaffected, which could point to necessity-based borrowing or the influence of targeted homeownership initiatives. The preliminary study also suggests that search activity (multiple applications) rises and is more pronounced for middle- to higher-income households.[20] Altogether, these results provide a snapshot of transmission specific to credit allocation, which borrower segments account for the potency of OPR

16 See Ho et al (forthcoming). This study aims to answer the question of how a contractionary monetary policy shock affects new mortgages across income groups by exploiting high-frequency policy surprises alongside granular loan- and borrower-level data.

17 Refers to the top four deciles.

18 In terms of the probability of loan approval among higher-income households, findings suggest some small negative effects, but these are imprecisely estimated.

19 Specifically, the 5th to 6th deciles.

20 Refers to the above-median deciles.

adjustments, and how this may be influenced by disparities in financial inclusivity (with non-necessity-based borrowing more affected) and households' ability to acquire information (with higher-income borrowers potentially more able to seek out better loan terms).

The presence of both large firms and MSMEs is also a consideration for understanding economic outlook and policy impact.

Several interlinked dimensions of firm heterogeneity, namely size, business sector and financing sources, are integral to economic outlook assessments and are also considered when evaluating monetary policy transmission. These firm characteristics shape how the economy responds to macroeconomic developments and policies, influencing business decisions on investments and labour hiring, sectoral performance and overall economic growth prospects.

For example, like value added, private investment is dominated by large firms across export-oriented industries, such as commodities and manufacturing, and predominantly domestic-focused service sectors. Export-oriented large firms, which accounted for 87.8% of total exports in Malaysia in 2023, benefit from strong integration into global value chains (GVCs), leveraging economies of scale, international market access and foreign direct investments. Large firms also accounted for most of the employment in Malaysia (51.5%) in 2023.[21] As a result, surveys conducted by BNM's RES teams that focused mainly on large firms' expectations and outlook can well approximate key aggregate economic trends. Meanwhile, MSMEs are mainly domestically oriented, with some having backward linkages to the export-oriented industries supplying inputs, logistics and other services that support the export sector. Thus, MSMEs are relatively more sensitive to domestic shocks, in part due to structural characteristics such as comparatively low financial buffers, but simultaneously play a crucial role in employment generation and consumption-driven resilience. As such, where possible, analyses are also carried out for MSMEs, particularly with regard to access to financing and potential effects arising from shocks and policy interventions.

The coexistence of large firms and MSMEs influences the extent to which the efficacy of monetary policy may be affected by adverse economic conditions, as well as how changes to the OPR are transmitted across firms. As with the case of households discussed in the previous section, the same study of banks' behaviour during the pandemic, coupled with a firm survey on access to financing, helped contextualise for businesses the prevailing monetary accommodation and other supportive measures at the time. This, in turn, provided some guidance on the principles for responses going into 2021. For instance, the uncertain economic outlook at the time and sector-specific prospects meant that there was disproportionately greater risk aversion and tighter credit underwriting towards corporates given large ticket sizes and the unsecured nature of financing. While MSMEs were much more affected by credit tightening at the onset of the Covid-19 crisis, there was subsequently some loosening aided in part by access to financing schemes from BNM and the government and MSMEs' tendency to take on secured

[21] Figures for large firms' share of exports and employment calculated based on DOSM (2024b).

financing. Nevertheless, MSMEs could still be adversely affected to the extent that there was avoidance of new-to-bank customers on the credit supply side and a discouraged mindset on the demand side. Cumulatively, these observations suggested some dampening of the impact from easier funding conditions through monetary policy actions and regulatory flexibilities, and were thus factored into the continuous calibration of policies, which sought to balance economic recovery and longer-term sustainable growth.

Regarding how firm heterogeneity influences the various transmission channels of OPR changes, the lack of micro-level data across different firm characteristics precludes in-depth studies at this juncture. However, some empirical observations have provided a few insights. For example, the credit channel study mentioned in Part 1 of this note further suggests that for a +100bp shock to monetary policy, the probability of new loan approvals is dampened for corporates but not for MSMEs, while the amount of loans approved is reduced for MSMEs but not corporates. Some possible implications of these findings include that during an expansionary monetary policy phase, working capital loans are an important source of cash flow for MSMEs with established relationships with banks, but new-to-bank or at-the-margin MSMEs may still face barriers, including risk aversion, and thus represent a less potent conduit of monetary policy action. Taking a higher-level view of transmission channels, firm heterogeneity comes into play through firms' different funding profiles. Large firms typically rely on diverse sources of external funding, including bank loans, bonds and equity. Thus, these firms will also be affected through the asset price and expectations channels as financing for business investments will be influenced by bond risk premia and spreads and market valuations. In contrast, MSMEs have more limited alternative financing sources to bank loans and thus are generally more exposed to the credit channel and procyclical financing conditions.

Part III: Distributional effects of monetary policy

While the distributional impact of monetary policy does not directly influence OPR decisions, such information is important for understanding the transmission mechanism and informing communication strategies as well as complementary policies.

BNM is undertaking work to empirically evaluate the impact of monetary policy on key dimensions of inequality in Malaysia. Thus far, staff research has focused on analysing the distributional effects of monetary policy across households given available data on heterogeneity to aid such assessments. A preliminary study that allows for exposure across different transmission channels (both direct and indirect) finds that the relative impacts of a monetary policy shock on changes in real consumption across Malaysian households of different income levels tend to even out over time.[22] The variation in real consumption responses across income groups is

[22] See Goh (forthcoming). This study examines how monetary policy affects household consumption across different income, wealth and age groups through multiple transmission channels by using the

modest, and the impacts on higher-income households are somewhat larger. This study suggests that while low-income households are less affected by higher debt repayments due to limited access to credit, following a contractionary monetary policy shock, consumption effects transmit from their susceptibility to an earnings shock precipitated by changes in labour market conditions. High-income households, on the other hand, are harder hit through higher debt repayments, but their earnings are relatively resilient.

Nevertheless, more comprehensive studies are needed to establish robust assessments and conclusions. While addressing distributional effects falls outside BNM's monetary policy mandate, as the OPR is less suited as an instrument for targeting equity-related outcomes given its bluntness, the knowledge gained from these research efforts is still valuable for various purposes. Besides improving understanding of monetary policy transmission, especially via the interaction with heterogeneity, and helping to anticipate possible unintended consequences of monetary policy actions, it has been used to enhance the central bank's communications, inform the use of tools under its "non-monetary hats" and support its advisory role to the government especially when it comes to coordination with fiscal policies aimed at redistribution efforts, including targeted fiscal assistance.

Failure in communicating the trade-offs of monetary policy actions – including their possible distributional implications – or perception of indifference to the welfare impacts of monetary policy actions on specific segments can lead to public discontent directed at the central bank, even if monetary policy objectives or targets are met. This is especially the case in periods when necessary monetary policy actions seemingly leave economic agents worse off (for example, through higher debt repayments and indirect earnings effects), in the absence of the counterfactual effects from even higher inflation that disproportionately affects low-income segments of the population. This potential erosion in credibility could have implications for the formation of expectations. However, at this juncture, such implications have yet to be quantified or empirically ascertained, ie whether distributional effects could affect BNM's credibility and in turn feed into the broader monetary policy transmission mechanism. Nonetheless, it has been recognised that if such effects are present, effective communication becomes key to mitigating them. For BNM, this means having a layered and tailored approach with the aim of reaching a heterogeneous audience.

As an example, BNM faced some public pushback during the monetary policy normalisation in 2022–23 following pandemic lows for the OPR, with concerns that the higher interest rates disproportionately affected low-income households and MSMEs which were still struggling in the economic recovery and would be further burdened by higher financing costs. Consequently, communication efforts were intensified and broadened, for example across different platforms including official publications, briefings and social media. Communication narratives were also crafted to address concerns more directly, highlighting available targeted assistance programmes via BNM and the government and advocating for structural reforms, alongside communications on monetary policy actions.

2022 Household Income and Expenditure Survey (HIES) to quantify the effects of various transmission channels based on households' balance sheet exposure.

Outside of its monetary policy remit focused on the aggregate goals of price stability and sustainable growth, BNM has other tools at its disposal to address distributional concerns.

Despite BNM's lack of an explicit mandate regarding distributional objectives, the Central Bank of Malaysia Act 2009 articulates the promotion of a sound, progressive and *inclusive* financial sector as a primary function of BNM. As such, BNM has pursued policies that aim to promote the financial inclusion of all segments of society, thereby indirectly addressing distributional disparities within the economy. These policies include initiatives that target vulnerable groups such as MSMEs and low-income households. One notable programme is iTEKAD, designed to assist low-income microentrepreneurs in strengthening their financial management and business acumen in order to generate sustainable income. By combining social finance instruments with microfinance and structured training, iTEKAD enables participants to access funding and develop essential skills, ultimately fostering economic resilience. Additionally, BNM has enhanced the MSME financing ecosystem through dedicated funds aimed at providing reasonable access to financing to MSMEs across all economic sectors. While the primary aim of these initiatives is financial inclusion, they inherently address distributional concerns by empowering underserved communities and promoting equitable economic growth, while also potentially contributing to the efficacy of monetary policy with the higher share of bankable economic agents.

Conclusion

Consideration of household and firm heterogeneity, to the extent that data and methods allow, contributes to a richer evaluation of economic prospects and understanding of monetary policy transmission. This is important, especially in the face of shocks or structural shifts whereby the interaction with heterogeneity may introduce vulnerabilities and dynamic feedback loops that ultimately affect aggregate outcomes that matter for the monetary policy mandate. It also allows for a more informed calibration of monetary policy and the use of complementary policies under BNM's "non-monetary hats" that indirectly support transmission while serving BNM's other mandates with respect to financial stability and financial inclusion. This whole-of-bank approach was particularly evident during the Covid-19 crisis. Agent heterogeneity also needs to be considered when developing effective communications for maintaining credibility. While a judicious approach was employed for policy rate increases in 2022–23, some segments (low-income households and MSMEs) were understandably perceived to be more adversely affected than others, requiring enhanced and targeted communications. This episode reinforces the need to work towards a more comprehensive picture of the interaction of heterogeneity with the transmission mechanism and, ultimately, a robust understanding of distributional impacts on heterogeneous groups of agents across direct and indirect channels.

References

Beaudry, P, C Hou and F Portier (2024): "Monetary policy when the Phillips curve is quite flat", *American Economic Journal: Macroeconomics*, vol 16, no 1, January, pp 1–28.

Bräuning, F and V Sheremirov (2023): "The transmission mechanisms of international business cycles: international trade and the foreign effects of US monetary policy", *IMF Economic Review*, vol 71, no 1, March, pp 300–25.

Burgess, S, E Fernandez-Corugedo, C Groth, R Harrison, F Monti, K Theodoridis and M Waldron (2013): "The Bank of England's forecasting platform: COMPASS, MAPS, EASE and the suite of models", *Bank of England Working Paper*, no 471, May.

Central Bank of Malaysia (BNM) (1999): *The central bank and the financial system in Malaysia: a decade of change 1989–1999*.

Central Bank of Malaysia (BNM) (2024): *BNM Quarterly Bulletin*.

Department of Statistics Malaysia (DOSM) (2023): 2022 *Household Income and Expenditure Survey*.

——— (2024a): *Quarterly Gross Domestic Product September 2024*.

——— (2024b): 2023 *Economic Census, Micro, Small and Medium Enterprises*.

——— (2024c): 2023 *Final External Trade Statistics*.

——— (2024d): 2023 *Gross Domestic Product*.

Goh, A (forthcoming): "Balancing the scales: The effects of monetary policy on consumption inequality", *Bank Negara Malaysia Working Papers*.

Ho, S-J, Ö Karagedikli and S P Ong (forthcoming): "Beyond the aggregate: Heterogenous effects of monetary policy on credit allocation", unpublished manuscript.

Suah, J L (2024): "A pseudo-panel analysis of marginal propensity to consume from transfers along the income distribution in Malaysia", *Bank Negara Malaysia Working Papers*, no WP1/2024, May.

Monetary policy transmission in Mexico: an overview and banking channels insights using granular data

Banco de México

Introduction

In Mexico, monetary policy transmits to real activity and prices primarily through channels affecting the exchange rate, inflation expectations and the yield curve (ie the interest rate channel). In addition, although banking-related channels (through both credit and deposits) are relatively weaker due to the country's low level of financial inclusion and credit penetration, the monetary policy reference rate remains a crucial factor driving the behaviour of bank lending and deposit interest rates. In contrast, other channels, such as those related to asset and debt holdings (which include cash-flow and balance-sheet effects), are less relevant due to the low proportion of households and firms directly affected.

This short note provides a general overview of Mexico's monetary policy transmission mechanisms. The first section briefly describes the most effective transmission channels in the country, presenting qualitative evidence on their importance. The second section provides quantitative evidence on the effect of policy rate adjustments on output, prices, and the exchange rate. Using the results from several structural vector autoregression (SVAR) models, the section highlights three key findings: (i) output and inflation respond to monetary policy adjustments in a manner consistent with international evidence, both in terms of timing and magnitude; (ii) economic sectors that are more sensitive to exchange rate variations, such as merchandise, exhibit stronger price and real activity responses to monetary policy adjustments compared with more domestically driven sectors, such as services; and (iii) not enough evidence exists to suggest that the monetary policy transmission mechanism has suffered significant changes in recent years, particularly when comparing the periods before and after the Covid-19 pandemic.

Finally, the third section explores in more detail the banking channels of monetary policy transmission. Even when these may be less powerful than other channels due to the country's low level of financial inclusion and credit penetration, we document that banking channels are present and important for those firms and households that have deposits and credit with the banking system. Indeed, changes in the policy rate, to a large extent, drive adjustments in the interest rates for bank loans and deposits, although with heterogeneity between firms and households. These results suggest that as higher levels of financial and credit penetration are achieved in Mexico, the banking channels of monetary policy would be expected to become more relevant.

Overview of main transmission channels

As a small open economy with a high degree of trade openness, Mexico's **exchange rate plays an important role in the transmission of monetary policy**.[1] In recent years, the exchange rate has been notably influenced by the interest rate spread between Mexico and the United States particularly during periods of low financial volatility. In this vein, a high interest rate spread, adjusted for volatility, tends to appreciate the Mexican peso, as this currency becomes more attractive to market participants.

For example, in 2023, when the interest rate spread remained elevated amid low financial volatility, the exchange rate appreciated by 13.2% over the year. This appreciation helped to reduce production costs of tradable good sectors, such as merchandise, contributing to a decline in the inflation rate of these goods. Specifically, merchandise inflation dropped from 11.09% in December 2022 to 4.89% in December 2023, and further to 2.39% by November 2024, reckoning a lower level than before the pandemic. In the second half of 2024, the exchange rate experienced heightened volatility driven by both domestic and external factors, leading to a depreciation of the Mexican peso. In this context, the central bank has remained vigilant regarding the potential inflationary effects of this recent depreciation.

It is important to note that while the interest rate spread is partially influenced by Banco de México's decisions, the central bank conducts monetary policy solely to fulfil its primary mandate of price stability. Consequently, it does not target a specific level for the interest rate spread or the exchange rate. In fact, Mexico's flexible exchange rate regime is a cornerstone of the country's macroeconomic framework. This regime acts as a shock absorber, enabling the central bank to remain focused on its primary objective of maintaining price stability.

The **inflation expectations channel** is also one of the most effective monetary policy transmission channels in the country. This mechanism has been tested during various episodes, especially since Banco de México adopted the inflation-targeting regime in 2001. Despite the severity of certain episodes, such as the recent one related to the pandemic and geopolitical tensions, central bank actions have successfully contributed to keeping long-term inflation expectations stable and anchored close to the target. In this vein, recent evidence shows that long-term inflation expectations comply with different properties of anchoring (Banco de México (2023b)). As a result, they are stable, as professional forecasters' revisions are infrequent and of low magnitude. Additionally, these expectations are unresponsive to inflationary surprises or changes in short- and medium-term inflation expectations.

The anchoring of long-term inflation expectations results from the credibility that the central bank has built over the years through its commitment to fulfil its primary mandate of price stability. During the most recent inflationary episode, Banco de México's timely and decisive actions have further reinforced this commitment. This anchoring also serves as indirect evidence of the effectiveness of monetary policy,

[1] Mexico's degree of trade openness is three times that of the United States. Indeed, exports plus imports as a proportion of GDP in Mexico has averaged 76% in the last 10 years. Over the same period in the United States. this ratio has fluctuated between 20 and 30%.

since only in a regime where there is confidence in the central bank's ability to maintain low and stable inflation can expectations remain firmly anchored.

The **interest rate channel** is another effective monetary policy transmission channel. Empirical analysis shows that changes in the policy rate have a statistically significant effect on government bond interest rates along the yield curve, for maturities from 1 month to 10 years (Banco de México (2022)). As expected, the impact is more pronounced for shorter maturities.[2] These results document the strong influence that domestic monetary policy displays on the short end of the yield curve.

As for **the bank credit and deposit channels**, although they may be perceived as less powerful due to the country's low level of financial inclusion and credit penetration, changes in the policy rate, to a large extent, drive adjustments in the interest rates for bank loans and deposits. On the one hand, the pass-through of policy rate adjustments to interest rates of banking business loans is nearly one-to-one. For consumer credit and mortgages the pass-through is lower, but still positive. On the other hand, bank deposit rates also mimic, to different degrees, changes in the policy rate, with the pass-through being substantially larger for term deposits of both firms and households than for check deposits (see Banco de México (2024)).

Other channels, such as those related to asset and debt holdings (which include cash-flow and balance-sheet effects), are less relevant in Mexico. The main reason behind this is, again, the country's low level of financial inclusion. Nevertheless, for those households and firms holding debt and financial assets, changes in the monetary policy rate influences their debt service, as well as the interest income of deposits and other financial investments. In particular, the service of firms' bank debt responds to changes in the monetary policy rate, since most of these loans are granted at variable interest rates. In contrast, households' debt service is relatively less affected, as around 70% of household debt consists of mortgage loans, which have a fixed interest rate.

Through the above channels, monetary policy effectively influences domestic financial conditions, affecting the private sector's spending and saving decisions and the production costs of sectors sensitive to exchange rates. Overall, these actions have contributed to the anchoring of inflation expectations. The most recent inflationary episode is a clear example of how monetary policy has been transmitted through the economy, moderating the inflation surge and contributing later to the disinflationary process. From June 2021 to March 2023, Banco de México raised the policy rate by 725 basis points (bp) to face an increase in inflation not seen in two decades. Along the way, government bond and bank interest rates rose, shifting some aggregate spending to savings and increasing the lending costs of firms. The exchange rate appreciated, especially when volatility was low, and this contributed to reducing production costs, notably for merchandise sectors, lowering the inflation of these goods. And finally, inflation expectations remained well-behaved, with those for the short-term reflecting the effects of the shocks but also the anticipation that they were not permanent, while those for the long-term remained anchored.

[2] The pass-through effect on medium- and long-term rates is lower, as these rates respond to additional factors such as future short-term rate expectations, inflation forecasts and risk premiums.

Measuring the transmission mechanism with structural vector autoregression models

A formal way to measure the monetary policy transmission mechanism in Mexico is through the estimation of structural vector autoregression (SVAR) models. In these exercises, the interest is on the responses of key macroeconomic variables, such as output and inflation, to an unanticipated change in the monetary policy rate.[3] In this context, evidence gathered by Banco de México's staff points to three main findings (Carrillo et al (2025)):

- First, output and inflation in Mexico respond to monetary policy in a similar way in terms of timing and magnitude, as observed in international evidence. These results are robust to a variety of models and identification strategies.
- Second, economic sectors that are more sensitive to exchange rate variations, such as merchandise, display larger responses of prices and real activity to monetary policy adjustments than more domestically driven sectors, such as services. This result suggests that pricing decisions, as those influenced by the exchange rate, might be more relevant than saving/spending decisions, which directly affect aggregate demand. The relatively lesser importance of saving/spending channels is consistent with the low level of financial inclusion in Mexico, as firms and households have limited resources to smooth spending.
- Third, there is not enough evidence suggesting that the monetary policy transmission mechanism has suffered significant changes in late years, especially when considering the period before and after the pandemic.

Regarding the first point, the findings indicate that after an increase in the short-run nominal interest rate, output decelerates and inflation decreases after several months of the policy adjustment. In particular, following a monetary policy shock of 100 bp in the policy rate:

- the output gap decreases (within a plausible range) between 30 and 65 bp after 1 to 1.5 years
- inflation falls (within a plausible range) between 15 and 22 bp after 1 to 2 years[4]

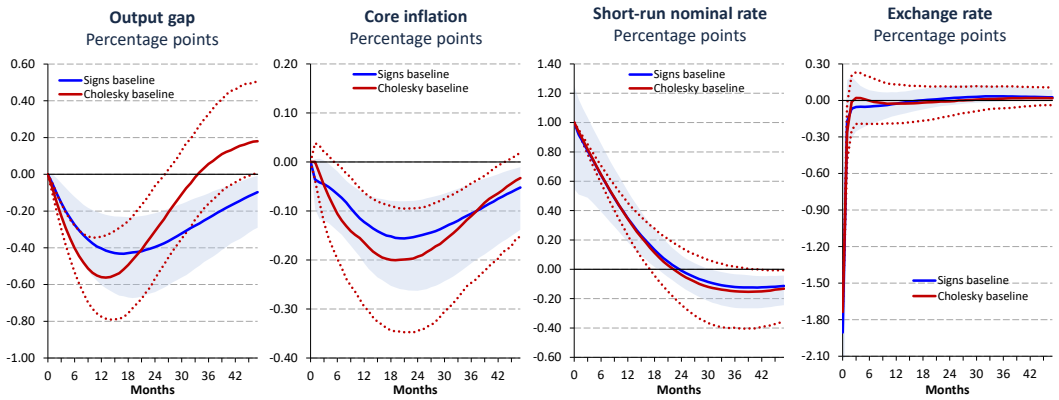
[3] In the literature, it is standard to measure the transmission of monetary policy through its unexpected component, that is, through the so called "monetary policy shock". This shock is defined as a change in monetary policy that is not expected by markets. This approach to isolate monetary policy adjustments is standard and necessary to properly identify its transmission mechanism. This is the case because monetary policy usually reacts to several shocks affecting the economy. Thus, the transmission of policy rate adjustments could be confounded with that of the shock monetary policy is responding to. A common approach to estimate the effects of monetary policy on output, inflation and the exchange rate involves using VAR models and an identification strategy based on exclusion restrictions (eg Cholesky decomposition), sign restrictions, or narrative restrictions. Recently, other strategies have emerged based on high-frequency data collected around monetary policy announcements.

[4] It is standard in the literature to normalise the size of the policy rate adjustment to either 25 bp or 100 bp. This normalisation allows for straightforward international comparisons. The plausible ranges are computed using the results of 11 different SVAR models, in which the minimum and maximum value of the response of the variable of interest for each time horizon is removed. See the Annex for further details regarding the 11 models.

These numbers are obtained after analysing the results of several SVAR models, of which two are considered as the baseline estimations. Graph 1 displays the responses of the output gap, core inflation, the short-run nominal interest rate and the nominal exchange, according to the two baseline models (see the Annex for the results derived from the rest of models).

Responses of selected Mexican variables to a monetary policy shock, according to baseline models

Graph 1



The dotted red lines and the blue shaded area represent the uncertainty bands that cover 68% of the estimated distribution in each model. The estimations are performed on a monthly frequency for a pre-Covid-19 pandemic sample from January 2002 to December 2019.

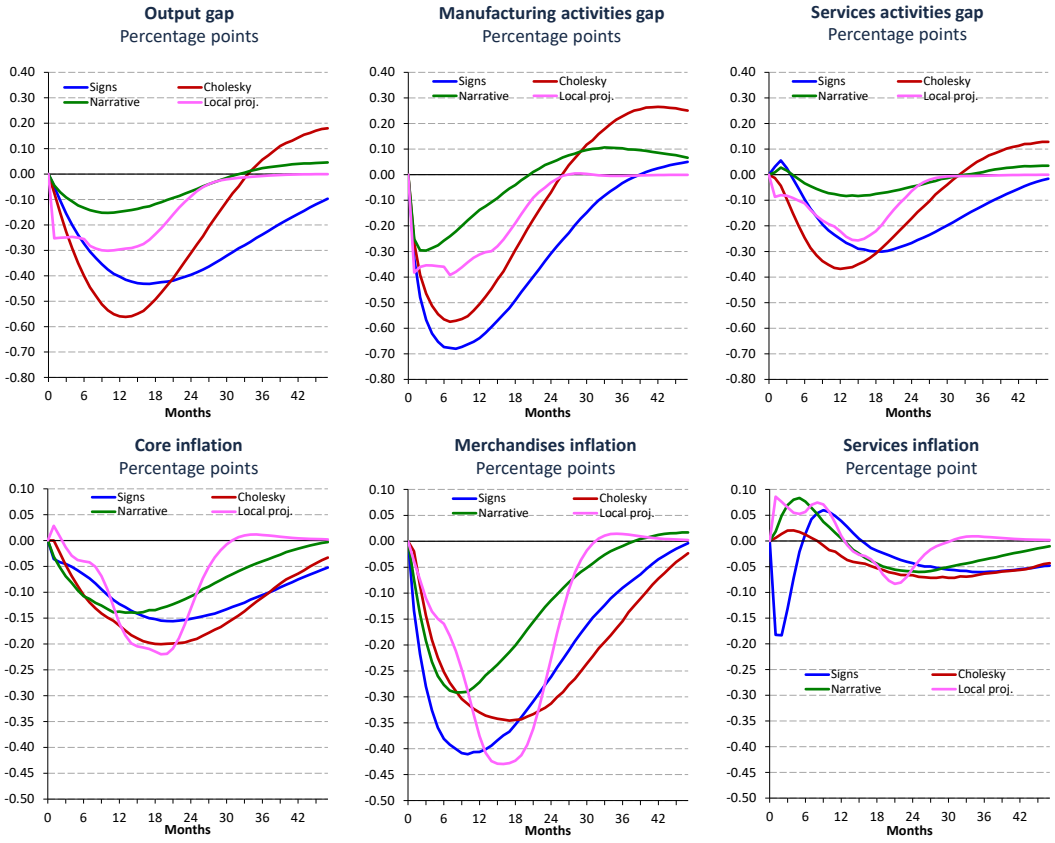
Source: Carrillo et al (2025), with data from National Institution of Statistics and Geography, Banco de México, Bloomberg, Proveedor Integral de Precios (PiP), Valmer.

These findings for Mexico align with the international evidence. Recent estimates by Deb et al (2023) for advanced and emerging markets show that the effects of monetary policy transmission are consistent across different income levels, with the responses of output and inflation peaking within two years in both advanced and emerging market economies. Specifically, their estimates indicate that following a monetary policy shock of 100 bp in the policy rate, inflation falls on average by 40 bp in advanced economies and by 20 bp in emerging market economies. The impact on output is similar, with a decline ranging from 20 bp to 40 bp following a 100 bp increase.

As for the second point, the estimation results point to a larger response of real activity and prices to a policy rate adjustment in the manufacturing sector than in the services sector (see Graph 2). Also, merchandise inflation reacts faster than services inflation to the monetary policy adjustment. The results are robust to different specifications of the SVAR models. Overall, these findings suggest that the exchange rate channel appears as relatively stronger than savings/spending channels that directly affect aggregate demand.

Responses of real activity and prices in the manufacturing and services sector to a monetary policy shock

Graph 2



The dotted red lines and the blue shaded area represent the uncertainty bands that cover 68% of the estimated distribution in each model. The estimations are performed on a monthly frequency for a pre-Covid-19 pandemic sample from January 2002 to December 2019.

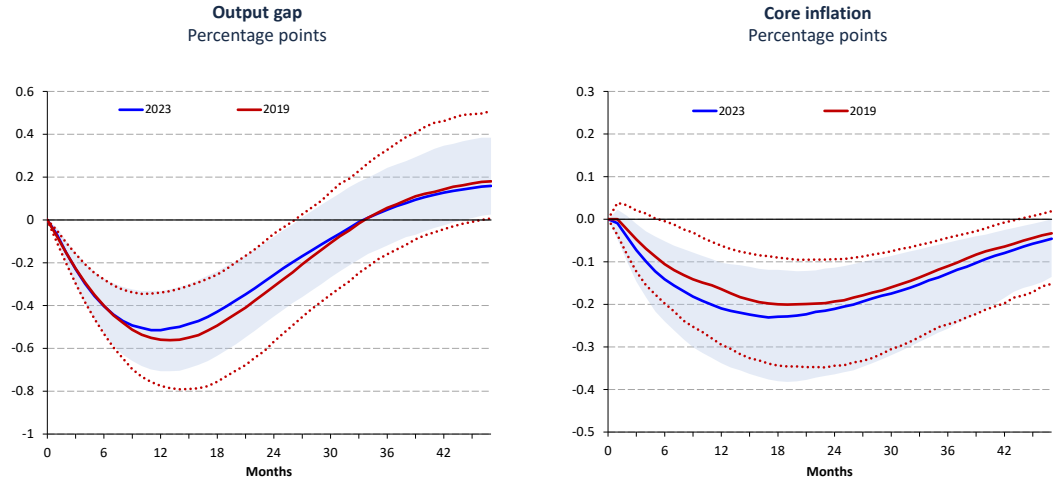
Source: Carrillo et al (2025), with data from National Institution of Statistics and Geography, Banco de México, Bloomberg, Proveedor Integral de Precios (PiP), Valmer.

Finally, concerning the third point, the estimation results are not statistically different regarding the monetary policy transmission mechanism before and after the pandemic (Graph 3). Indeed, according to the baseline models, the responses of macro variables do not display statistically significant changes between the two periods. It is worth noting that including the pandemic in the analysis is not trivial, as the broad, deep and unprecedented shocks affecting real variables need to be controlled for using specific techniques to maintain unbiased estimates (see the Annex).

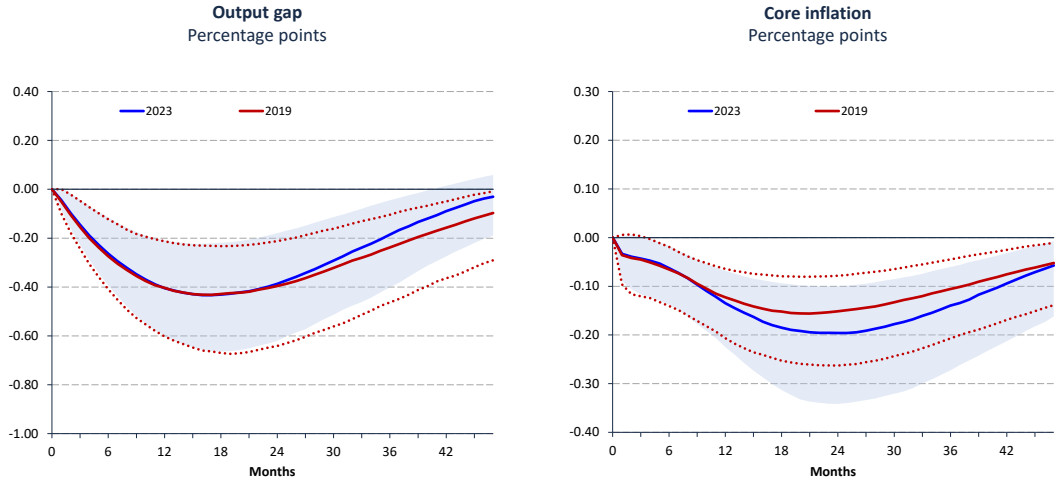
Responses of real activity and prices to a monetary policy shock, before and after the Covid-19 pandemic, according to baseline estimations

Graph 3

A. Results from Cholesky restrictions: 2019 versus 2023, after controlling for pandemic shocks



B. Results from sign restrictions: 2019 vs 2023, after controlling for pandemic shocks



The estimations are performed on a monthly frequency for two time periods: a pre-pandemic sample, from January 2002 to December 2019; and a sample including the pandemic, extending the above to December 2023. Details about the implementation of these estimations are provided in the Annex.

Source: Carrillo et al (2025), with data from National Institution of Statistics and Geography, Banco de México, Bloomberg, Proveedor Integral de Precios (PiP), Valmer.

Banking channels using surveys and granular data

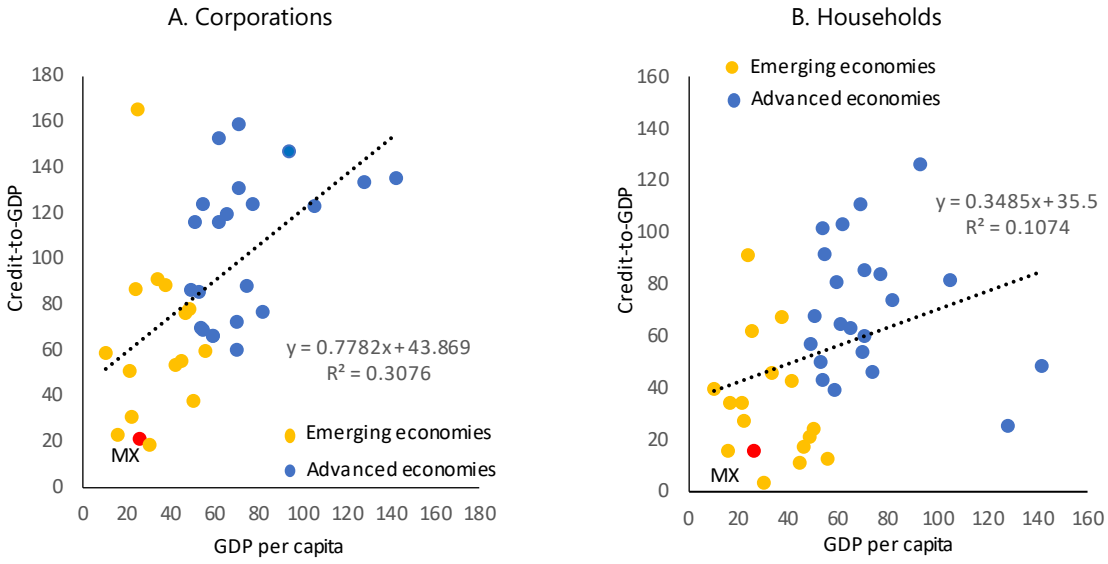
Monetary policy is transmitted to bank interest rates in Mexico both in lending rates to the private sector and in deposit and savings instruments, although with different degrees of pass-through. On the bank's credit side, lending rates to non-financial private firms have a larger and faster reaction after a change in the policy rate than lending rates to households. On the bank's deposit side, the pass-through of changes in the monetary policy rate is stronger for term deposits than for transferable deposits.

To have a better understanding of the performance of monetary policy channels in Mexico, we must consider the level of financial penetration and the heterogeneity in the access to credit and holdings of financial assets among private firms and households. Financial inclusion and credit penetration in Mexico is low compared with other emerging economies. The ratio of credit to the non-financial sector to GDP, both to firms and households, is lower than most economies, even among those with similar levels of per capita income (Graph 4). In addition, the distribution of credit and financial assets across the private sector is highly concentrated among larger and formal firms and among the richest households.

This section explores the banking channels of monetary policy transmission, first for non-financial corporations and later for households, distinguishing on the credit side between consumer credit and mortgages.

Credit to the non-financial sector and GDP per capita

Percentage of GDP and thousands of dollars — Graph 4



Credit-to-GDP figures as of June of 2023, figures for Mexico as of September 2024. GDP per capita PPP (current international $) figures as of 2023. Includes Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea Rep, Malaysia, Mexico, New Zealand, Norway, Poland, Portugal, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom and United States.

Sources: Banco de México; World Bank; BIS.

a. Non-financial corporations

The key takeaways of this subsection are as follows:

- Credit penetration for non-financial firms is low and highly concentrated in a small number of firms.
- For this reason, the bank lending channel is likely to be weak for private non-financial corporations in Mexico, even when there is evidence of a strong and fast pass-through from the policy rate to lending rates.
- For those firms with access to bank financing and with holdings of financial assets, the credit and cash flow channels are relevant.

Credit to non-financial corporations in Mexico is relatively low and is highly concentrated among the largest and formal firms. Low credit penetration for private firms is explained in part by the large proportion of firms that belong to the informal sector (Graph 5.A). But also, within firms in the formal sector, only 11% of them have a credit line with a commercial bank (Graph 5.B). All in all, only 4% of the universe of firms, formal and informal, had a commercial bank credit line in 2023.[5, 6] In this vein, according to a survey conducted by Banco de México to non-financial formal corporations with at least 10 employees, only 27% of firms with up to 100 employees and 35% of larger firms had at least one outstanding bank loan as of the third quarter of 2024.[7]

Within this small number of firms with access to bank credit, the total amount of financing is highly concentrated in the largest firms. Graph 6 shows that, using data from the credit registry where commercial bank credit is classified according to the firm size, this financing is concentrated in larger firms, with 83.1% of the outstanding credit being held by 3.6% of the borrowers.

[5] This number is the ratio of total firms with a commercial bank loan (source: Credit Registry, Formulario R04C Cartera de créditos comerciales), National Banking and Securities Commission to the number of business establishments in Mexico in 2023 according to the National Institution of Statistics and Geography (INEGI).

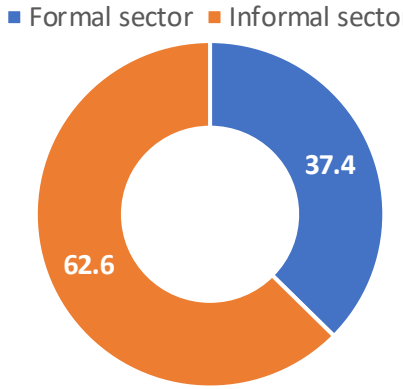
[6] Data are from Censos Económico 2019, Características de los negocios (INEGI). Informal businesses have the following characteristics, among others: five or fewer employed people; do not pay social security or social benefits; and do not have an accounting system. Firms of the informal sector of the economy do not have access to bank credit since commercial banks require firms to present their federal tax returns, the company charter, and financial information, among other requirements.

[7] Data are from the *Credit Market Survey*, July–September 2024, Banco de México. According to Censos Económicos 2019, 95% of firms had less than 10 employees.

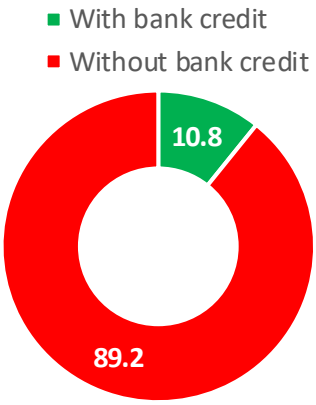
Firms and access to bank credit, 2023

Graph 5

A. Total firms in the economy by status
Percent of all firms



B. Formal sector firms: access to bank credit
Percent of all formal firms

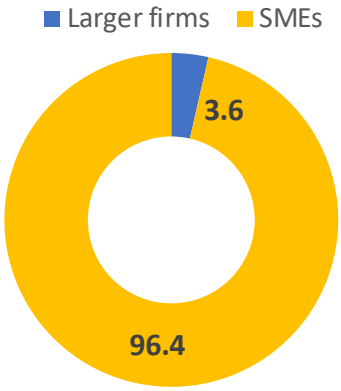


Sources: National Institution of Statistics and Geography and Banco de México, with data from the credit registry (Formulario R04C Cartera de créditos comerciales); National Banking and Securities Commission.

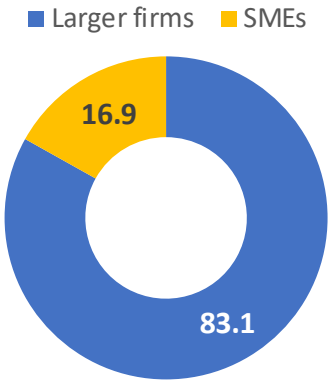
Commercial Bank Credit to Non-financial Firms, September 2024

Graph 6

A. Loans
Percent of all loans



B. Balance of outstanding credit
Percent of overall balance



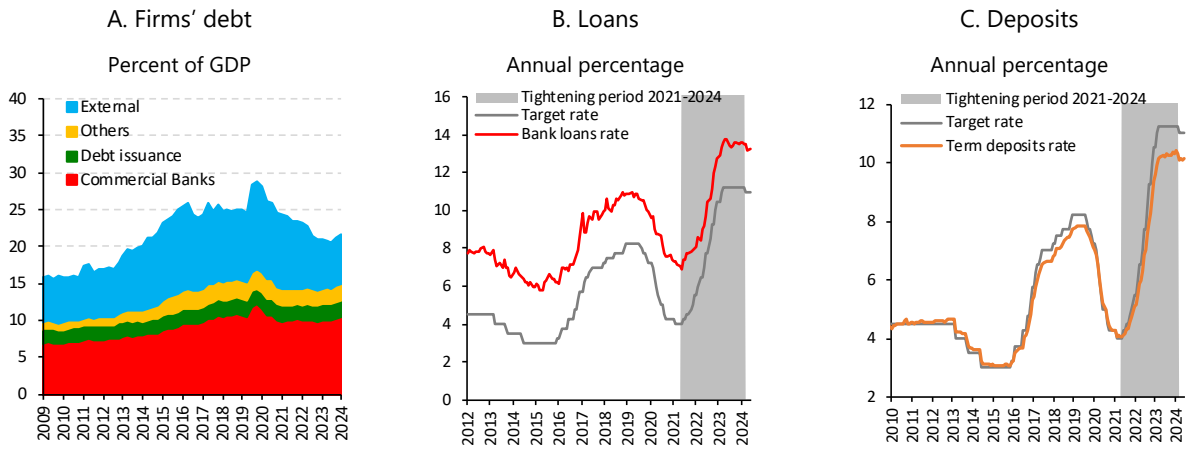
"SMEs" -Small and medium size enterprises- ("Larger firms") are defined as companies that have had credit balances up to (greater than) 100 million Mexican pesos at least in some month from December 2003 to date.

Sources: Banco de México, with data from the credit registry (Formulario R04C Cartera de créditos comerciales); National Banking and Securities Commission.

The low level of credit penetration, coupled with the high concentration of credit in a small number of firms, explains the relatively low importance of the lending channel in comparison with the FX or the expectations channels, even when there is an important pass-through from the policy rate to lending rates for firms. Indeed, recent studies by Banco de México suggest that the pass-through of policy rate adjustments to bank interest rates of new business loans is almost complete over

a period of 12 months: a 94 bp increase in firms' credit interest rates for a 1 percentage point (pp) increase in the policy rate (Graph 7 and Graph A.4).[8, 9] Lastly, for firms with access to bank credit, the cash flow channel might be relevant. Around 80% of bank credit is granted at variable interest rates, and for credit at fixed rates the vast majority of loans falls within a maturity of three months. In addition, there is a significant pass-through of the monetary policy rate to firms' bank deposit rates: over a period of 12 months, we see a 90 bp increase in firms' term deposits interest rates for a 1 pp increase in the policy rate (Graph 7 and Graph A.5).[10]

Firms' debt and Banco de México's target interest rate and bank' interest rates — Graph 7



"Others" includes development banks and other financial intermediaries.

"Banks loans rate" refers to the weighted average interest rate of new loans to non-financial corporations.

"Term deposits rate" also includes bank bonds and securities with a residual term less than or equal to 5 years at domestic banks in national currency and corresponds to the effective interest rate.

The tightening period considers June 2021 to February 2024.

Source: Banco de México.

[8] An econometric model was estimated to quantify the pass-through of the reference rate to bank interest rates. In this model, the dependent variable is the monthly change in the interest rate of the credit or deposit segment and the independent variables are *n*-lags of the monthly change of the monetary policy interest rate and a vector of variables to control effects associated with the economic activity and inflation, among others. This specification allows calculating the pass-through for different time horizons by adding the beta values associated with the monthly change in the monetary policy rate (Banco de México (2024)).

[9] The behaviour of commercial bank credit to firms responds to different determinants, in addition to the interest rate. In Mexico, the evidence indicates that the growth of economic activity is the most important factor to explain firms credit dynamics (Banco de México (2021)).

[10] In September 2024, term deposits at the banking system represented 24.5% of total M2 instruments held by non-financial firms.

b. Households

The key takeaways of this subsection are as follows:

- Financial inclusion and credit penetration for households is low in Mexico.
- Savings accounts are relatively prevalent across households' income distribution. By contrast, bank term deposits are highly concentrated in the richest households.
- The pass-through of the monetary policy rate to consumer loans is positive but smaller than that to firms. The pass-through to mortgages is even smaller and only affects new loans granted by banks and not those of other mortgage institutions (eg Infonavit Fovissste).[11]
- Accordingly, from the perspective of the intensive and the extensive margins, the banking channels operating through households are likely weak.

The National Household Finance Survey (ENFIH) is a representative survey whose primary objective is to collect information on the balance sheet of households in Mexico, that is, on their assets and liabilities, both financial and non-financial.[12] According to this survey, **financial inclusion in Mexico is low and financial savings are highly concentrated**. Whereas the percentage of households that have an M1-M0 financial instrument (savings, deposit or checking account) is 66.6%, financial assets of the monetary aggregate M2-M1 (bank term deposits, shares of money-market funds, etc.) are held by 1.5% of total households and are concentrated in those at the highest income percentiles.[13] The main financial asset for households is the pension savings account, which is the result of mandatory contributions and does not respond directly to changes in the monetary policy interest rate (Graph 8).

Data from the ENFIH about the distribution of financial assets held by households is shown in Graph 8.C. Financial assets, except for government transfers accounts, are concentrated in the top quantile of the income distribution. In contrast, the lowest income quantile has scarce participation on financial assets holdings.

[11] The Institute of the National Housing Fund for Workers (Infonavit) is an institution specialised in mortgage credit with the resources of workers housing savings accounts. The Federal Government, workers' organisations and employers' organisations participate in its decision-making bodies. The Housing Fund for Public Sector Workers (Fovissste) is a public sector institution that provides mortgage loans to public sector employees.

[12] The ENFIH also contains information on the socio-demographic characteristics of households. The first survey was conducted in 2019 by the INEGI in collaboration with Banco de México.

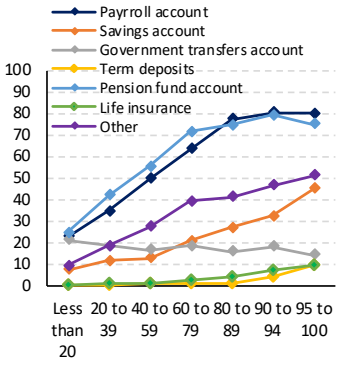
[13] Instruments of M1 includes having at least one payroll account, a savings account and/or a government transfer account, and instruments of M2-M2 includes term deposits.

Households' financial savings

Graph 8

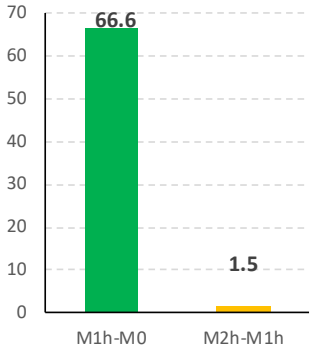
A. Frequency of financial assets holdings

Percent by household per income percentile



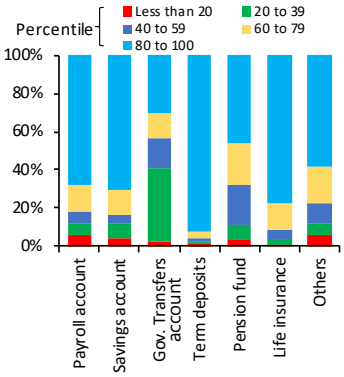
B. Holdings of M2-M0

Percent of all households



C. Amount of financial assets holdings

Percent by household per income percentile



"Term deposits" and "M2h-M1h" include shares in money and non-money markets funds.

"Life insurance" includes instruments that allows money withdrawals.

"Other" includes savings outside the financial sector.

"M1h-M0" includes having at least one payroll account, a savings account and/or a government transfer account.

Source: National Household Finance Survey, 2019, Banco de México and National Institution of Statistics and Geography.

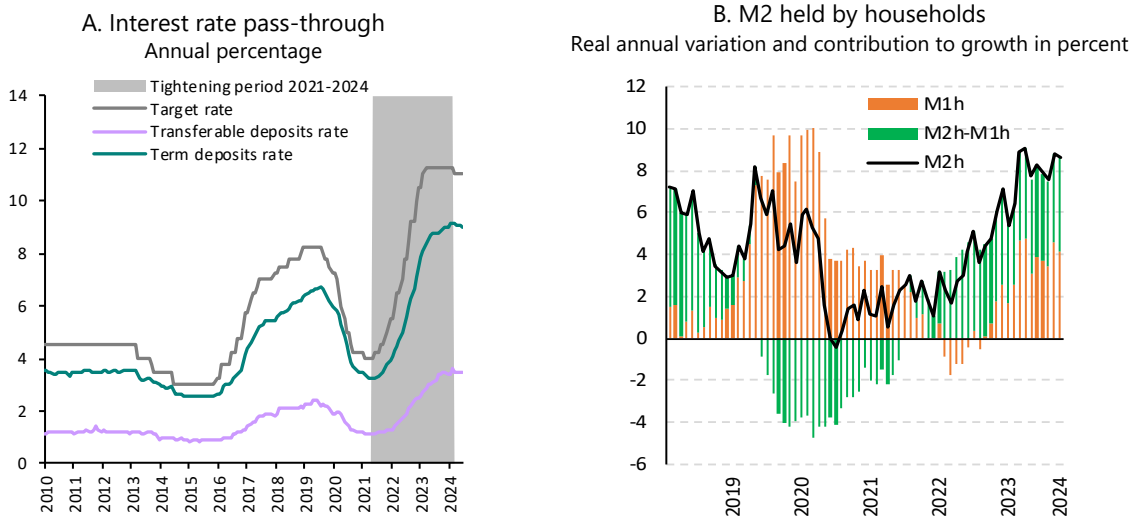
The composition of households' financial savings in Mexico is sensitive to the behaviour of interest rates. The pass-through of the monetary policy rate to households' bank deposit rates over a period of 12 months is 0.73 for term deposits rates, and 0.22 for transferable deposits (Graph A.5). In addition, recent evidence indicates that increases in the interest rate of households' term deposits have a negative impact on their demand for currency and transferable deposits (highly liquid assets, M1h) and, at the same time, a positive effect on the demand for other monetary instruments (term deposits, repurchase agreements, shares of money market funds, M2h-M1h (Banco de México (2023a). Therefore, the change in the composition of households' M2 portfolio observed since 2021 has responded in part to the cycle of increases in the monetary policy rate, which induced an increase in banking deposit rates that led to a substitution of household financial assets against M1h and in favour of other monetary instruments (M2h–M1h) (Graph 9).[14] Thus, incentives to modify households' financial asset portfolio work intuitively,

[14] An exercise was carried out to illustrate the impact of the cycle of increases in the reference rate on households' holdings of monetary instruments. To do this, the trajectories of household financial savings in Mexico were estimated under two scenarios: (i) one in which term deposits interest rates remain constant from the second quarter of 2021 to the fourth quarter of 2022 (counterfactual scenario); and (ii) the model estimates using the observed evolution of term deposits interest rates (base scenario). Under the counterfactual scenario, the M1h would have registered a real annual variation of 9.4% in December 2022, a figure 8.4 pps higher than that obtained in the base scenario. In contrast, the growth of (M2h–M1h) would have been 7.0 pps lower in the counterfactual scenario compared with the base scenario. This suggests that by inducing an increase in banking deposit rates, the cycle of increases in the monetary policy rate has encouraged households to increase their financial savings.

incentivising savings and postponing current consumption for the future (but for a limited number of households).

M2h held by households

Graph 9



"Transferable deposit rate" corresponds to the weighted average of interest rates of checking accounts and current account deposits.

"Term deposits rate" also includes bank bonds and securities with a residual term less than or equal to 5 years at domestic banks in national currency and corresponds to the effective interest rate.

The tightening period considers June 2021 to February 2024.

Source: Banco de México.

Regarding household debt, **in the mortgage market, commercial banks target the highest income quintile and its credit is granted at market rates**, and practically all are issued at fixed rates. The median "loan-to-value" is 72% and an average term of 19 years. However, mortgages provided by commercial banks represent only 39.6% of the total outstanding loans (Graph 10.A). The Institute of the National Housing Fund for Workers (Infonavit) is the most relevant financial intermediary in this market (49.7% of the total outstanding loans) and mainly serves lower to middle income households. It provides loans at previously determined interest rates (Graph 10.B) that carry a subsidy for poorer households.[15]

In this vein, **Infonavit grants credit at fixed rates that do not respond to market conditions**, that range from 3.76% to 10.45%, and are determined based on the worker's salary, with a maximum "loan-to-value" of 90% and a maximum term of 30 years.[16] Likewise, according to the ENFIH, the distribution of mortgage loans by income range presents heterogeneity, such that in the lowest income quantile only 3.9% of households have a mortgage loan, while in the highest income quantile the percentage is 20.8% (Graph 10.C). Mortgage financing to households represents 10.8% of GPD (4.3% of GDP for bank credit).

[15] Fovissste provides loans at previously determined interest rates, with a market share of 10.0%.

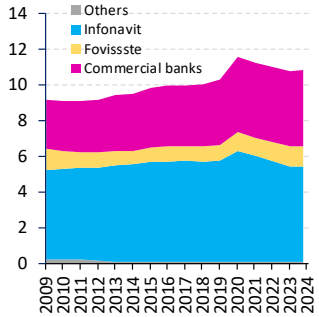
[16] This new interest rate structure was established in May 2021 with a range of 1.91% to 10.45%.

Households: Mortgage debt

Graph 10

A. Outstanding loans by intermediary

Percent of GDP

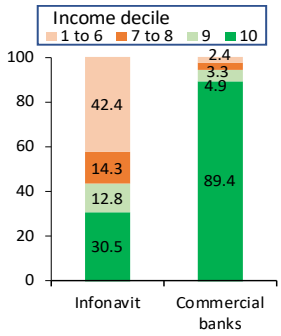


"Others" includes development banks and other financial intermediaries.

Source: Banco de México.

B. Amount of new loans by income decile

Percent of 2023 total amount

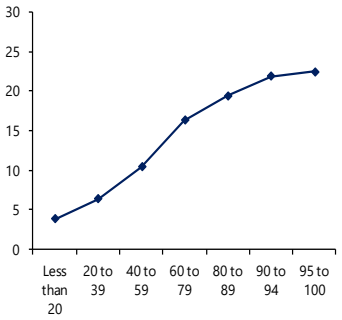


Loans in co-participation with commercial banks are excluded from National Housing Fund for Workers.

Source: Banco de México with information from National Housing Fund for Workers and National Banking and Securities Commission.

C. Frequency of mortgage debt holdings

Percent by household income percentile



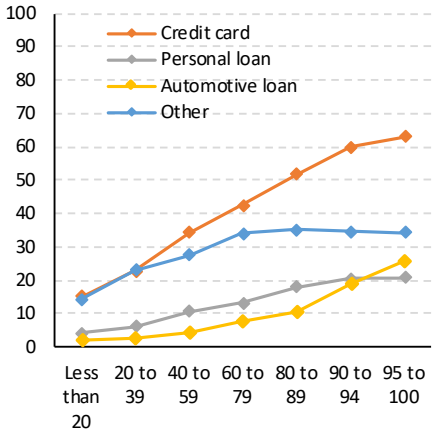
Source: National Housing Fund for Workers and National Household Finance Survey (2019), Banco de México and National Institution of Statistics and Geography.

For consumption credit, the results of the ENFIH show the **presence of a low level of financial inclusion and unequal access to this financing**. The percentage of households with a credit card debt was 34.3%, a personal loan 10.7%, and an automotive loan 6.6%. Nevertheless, its distribution by income range presents heterogeneity, such that in the lowest income quantile only 15.1% of households have a credit card and in highest income quantile the percentage is 56.7% (Graph 11.A). The percentage of the balance of consumer loans is concentrated in the highest income quantiles, particularly for automotive loans (Graph 11.B). Meanwhile, lower-income segments concentrate their debt in informal sources of financing. Finally, households' consumer credit represents 5.7% of GDP, and the most relevant segment is credit cards (31.1% of the total balance).

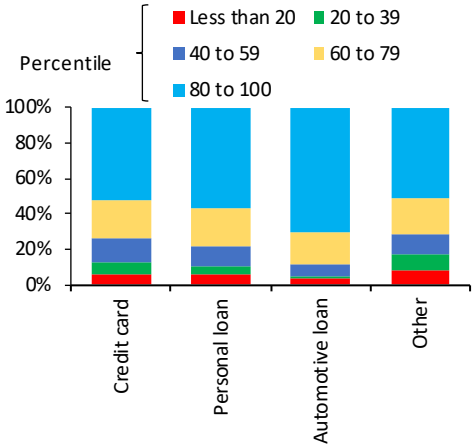
Households: Consumer debt

Graph 11

A. Frequency of consumer debt holdings
Percent by household income percentile



B. Amount of consumer debt holdings
Percent by household income percentile



"Other" includes educational and employee loans, loans from family or friends, pawn shop loans and others.

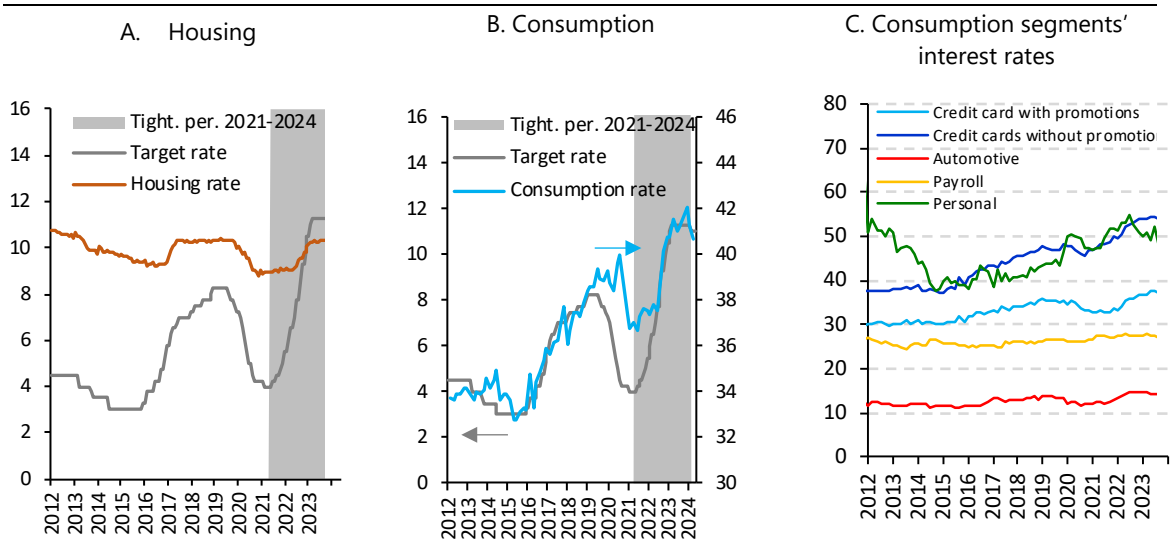
Source: National Household Finance Survey, 2019, Banco de México and National Institution of Statistics and Geography.

In the household sector, the bank credit and the cash flow channels are weaker than for the corporate sector (Graph 12). For consumer bank credit and mortgages loans, the pass-through over 12 months is positive: a 67 bp increase in consumer credit for a 1 pp increase in the policy rate. For mortgages, it is only 21 bp (Graph A.4). Regarding the cash flow channel, for those households holding financial assets, the impact on changes in the monetary policy rates on their debt service is limited, since around 65.5% of household debt consists of mortgage loans, which have a fixed interest rate. Likewise, 43.3% of credit card debt does not pay interests, since the debtor pays in full the amount of their monthly debt ("*totaleros*") or has made purchases using a deferred interest plan. Altogether, total mortgage and credit card debt service not affected by changes in the monetary policy rate represents 70.2% of household debt. As we mentioned before, the low level of financial inclusion, in terms of both users and holdings of financial assets and debt liabilities, limits the effect of these channels on aggregate demand.

Banco de México's target interest rate and bank households' loans' interest rates

Annual percentage

Graph 12



"Bank households' loans' interest rates" refer to the weighted average interest rates of new loans.

"Credit cards interest rates" refer to the weighted average rate of active, widely used credit cards of debtors that do not pay in full the amount of their monthly debt ("no-totaleros" clients). Data from the consumer credit registry (Formulario de créditos al consumo revolventes, Banco de México).

"Automotive, payroll and personal loans interest rates" refer to the weighted average rate of new credits, excluding overdue, or restructured credits, credits granted to related parties of the institution, credits granted under preferential conditions to employees, as well as credits that are not in national currency. Data from the consumer credit registry (Formulario de créditos al consumo no revolventes, Banco de México).

The tightening period considers June 2021 to February 2024.

Source: Banco de México.

Concluding remarks

This note provides a general overview of the monetary policy transmission mechanisms in Mexico, highlighting key facts about its most effective channels, which correspond to those influencing the exchange rate, inflation expectations and the yield curve. Furthermore, quantitative analysis suggests that the responses of output and inflation to monetary policy adjustments are consistent with international evidence. In addition, given Mexico's characteristics as a small open economy with a high degree of trade openness and low financial inclusion, sectors sensitive to the exchange rate, such as merchandise, exhibit larger responses than domestically driven sectors, such as services. This suggests that the exchange rate channel is relatively stronger than savings/spending channels that directly affect aggregate demand.

The note also delves into the importance of heterogeneity in access to banking credit and deposits for both firms and households, and its implications for monetary policy transmission. It argues that for non-financial firms, since credit penetration is low and highly concentrated in a small number of firms, the bank lending channel is

likely to be weak even when there is evidence of a strong and fast pass-through from the policy rate to lending rates. In the household sector, financial inclusion and credit penetration is also low and tilted toward the more affluent. Particularly, financial assets are highly concentrated in the richest households. The pass-through from the policy rate to consumer lending rates is smaller than the one to firms, and even smaller for mortgages, and the effect of the cash-flow channel is limited since a high proportion of households' debt is granted at fixed interest rates. Hence, the banking channels of monetary policy transmission are probably weaker than for firms.

Overall, this note reviews and provides evidence on the relative importance of different transmission channels for monetary policy in Mexico. As some channels seem weaker than others, due to low financial inclusion and credit penetration, the implementation of monetary policy would benefit from an enhancement of the banking channels in general. Indeed, increasing access to financial services and products, reaching a larger share of firms and households, would improve the transmission of monetary policy, specially through the savings/spending channels.

However, this is not an easy task. Moreover, the expansion of financial penetration should proceed at a sound and sustainable pace and with an understanding of the causes of its current low level. The roots of low financial access and credit penetration in Mexico are diverse and complex. Changes in the structure of the economy that promote an increase in formal firms and workers would ease the access restriction for financial services. At the same time, a more transparent, robust and competitive financial system would make the use of credit for production and consumption and for long-term savings more attractive to all economic agents, promoting formality and boosting productivity.

References

Antolín-Díaz, J and J Rubio-Ramírez (2018): "Narrative sign restrictions for SVARs", *American Economic Review*, vol 10, no 10, pp 2802–29.

Banco de México (2021): "Box: Determinants of commercial bank credit to firms", *Quarterly Report*, July–September.

——— (2022): "Box: Pass through of Mexico's policy rate to interest rates across different maturities", *Quarterly Report*, April–June).

——— (2023a): "Box: Recent changes in the composition of households' financial savings in Mexico". *Quarterly Report* (January–March).

——— (2023b): "Box: Anchoring of long-term inflation expectations in Mexico", *Quarterly Report* (April–June).

——— (2024): "Box: Evidence on the pass through of the monetary policy rate to banking interest rates in Mexico", *Quarterly Report* (April–June).

Bobeica, E and Hartwig, B (2023): "The COVID-19 shock and challenges for inflation modelling", *International Journal of Forecasting*, vol 39, no 1, pp 519–39.

Carriero, A, T Clark, M Marcellino and E Merten (2022): "Addressing COVID-19 Outliers in BVARs with Stochastic Volatility", *The Review of Economics and Statistics*, vol 106, no 5, pp 1403–17.

Carrillo, J, R Elizondo and L Hernández-Román (2020): "Inquiry on the Transmission of US Aggregate Shocks to Mexico: A SVAR Approach", *Journal of International Money and Finance*, vol 104, no C, pp 1–24.

Carrillo, J, R Elizondo, L Hernández-Román, R Ibarra and M Quiroga (2025): "Identification of the effects of monetary policy in a small open economy before and after the pandemic: the case of Mexico", Banco de México, mimeo.

Cascaldi-Garcia, D (2022): "Pandemic Priors", *Board of Governors of the Federal Reserve System/International Finance Discussion Papers*, no. 1352.

Deb, P, J Estefania-Flores, M Firat, D Furceri and S Kothari (2023): "Monetary policy transmission heterogeneity: cross-country evidence," *IMF Working Papers*, 2023/204.

Ferreira, L, S Miranda-Agrippino and G Ricco (2023): "Bayesian local projection", *The Review of Economics and Statistics*, doi.org/10.1162/rest_a_01334.

Holston, K, L Laubac and J Williams (2023): "Measuring the natural rate of interest after COVID-19", Federal Reserve Bank of New York, Working Paper.

Jarociński, M and P Karadi (2020): "Deconstructing Monetary Policy Surprises—The Role of Information Shocks," *American Economic Journal: Macroeconomics*, vol 12, no 2, pp 1–43.

Jordà, Ò (2005): "Estimation and inference of impulse responses by local projections", *American Economic Review*, vol 95, no 1, pp 161–82.

Lenza, M and G Primiceri (2022): "How to estimate a vector autorregression after March 2020", *Applied Econometrics*, vol 37, no. 4, pp 688–99.

Maroz, D, J Stock and M Watson (2021): "Comovement of economic activity during the COVID Recession", Princeton University, Bendheim Center for Finance, Working Paper.

Ng, S (2021): "Modeling macroeconomic variations after COVID-19", *NBER Working Papers*, no 29060.

Pattanaik, S, H Behera and S Sharma (2022): "Revisiting India's natural rate of interest", *RBI Bulletin* (June).

Primiceri, G and A Tambalotti (2020): "Macroeconomic Forecasting in the Time of COVID-19", Northwestern University Working Paper.

Schorfheide, F and D Song (2024). "Real-Time Forecasting with a (Standard) Mixed-Frequency VAR During a Pandemic," *International Journal of Central Banking*, vol 20, no 4, pp 275–320.

Solís, P (2023): "Does the exchange rate respond to monetary policy in Mexico? Solving an exchange rate puzzle in emerging markets," *Journal of Money, Credit and Banking*, vol 5, no 8, pp 2093–2113.

Annex

A. Structural vector autoregression models included in the analysis

Consider the following general representation for a structural vector autoregression model (SVAR) (see full details in Carrillo et al (2025)):

$$X_{t+h} = \begin{bmatrix} Z_{t+h} \\ Y_{t+h} \end{bmatrix} = C_h + \sum_{\ell=1}^{p} B_{\ell,h} X_{t-\ell} + A u_{t+h}, \qquad (1)$$

where h is the time horizon; Y_t and Z_t are vectors containing endogenous and exogenous variables, respectively; u_t is a vector of structural shocks, which includes the monetary policy shock; A is a structural matrix denoting the impact effect of shocks u_t on variables Y_t and Z_t; and, finally, C_h and $B_{\ell,h}$ are matrices of parameters, in which the latter are consistent with the assumption of block exogeneity, so that:

$$B_{\ell,h} = \begin{bmatrix} B_{zz}^{\ell,h} & 0 \\ B_{yz}^{\ell,h} & B_{yy}^{\ell,h} \end{bmatrix}.$$

To identify matrix A, different strategies with diverse type of restrictions are considered, including Cholesky (recursive) restrictions, sign and zero restrictions, narrative sign restrictions and external instruments using high frequency data. In turn, matrices $B_{\ell,h}$ are estimated using Bayesian techniques on either the canonical SVAR model (so that $B_{\ell,h} = (B_\ell)^h$) or local projections (so that each $B_{\ell,h}$ is estimated independently and does not depend on $B_{\ell,h-1}$). Overall, the results from five methodologies are analysed, from which two are considered as baseline. For robustness purposes, variations to the baseline specification are also included. In sum, the analysis includes the estimation results from a total of 11 SVAR models, as depicted in table A.1.

Table A.1. Total number of estimated models

Approach (type of structural vector autoregression model)	Variation number	Estimation number
i. Cholesky restrictions	1, baseline model	1
	2, with more lags	2
	3, with alternative hyperparameters	3
	4, with alternative output gap	4
ii. Sign and zero restrictions	1, baseline model	5
	2, with more lags	6
	3, with alternative hyperparameters	7
	4, with alternative output gap	8
iii. Local projections with Cholesky restrictions	1	9
iv. Narrative sign restrictions	1	10
v. External instruments using high-frequency data	1	11

Unless specified otherwise, all models include up to one lag.

The estimations are performed on a monthly frequency for two time periods:

- A sample from before the Covid-19 pandemic, from January 2002 to December 2019.
- A sample including the pandemic, extending the above to December 2023. Details about the implementation of this estimations are provided below.

  The variables used in the estimation are summarised in Table A.2.

Table A.2: Variables included in the estimation

	Approach (type of structural vector autoregression model)				
	(i) Cholesky	(ii) Signs and zeros	(iii) Local projections	(iv) Narrative signs	(v) External instruments
Exogenous variables					
For the US economy:					
Price of oil (WTI), output gap, CPI core inflation, Wu-Xia shadow federal funds rate, yield curve slope (10y-2y), VIX index	✓	✓	✓ (except VIX)	✓	✓
For the Mexican economy:					
Monetary policy surprise (narrative information)				✓	
Monetary policy surprise (high frequency data)					✓
Endogenous variables for the Mexican economy					
12-month-ahead headline inflation expectations	✓		✓		
Output gap	✓	✓	✓	✓	✓
Producer price inflation	✓		✓		✓
Core inflation	✓	✓	✓	✓	✓
Short-run nominal interest rate	✓	✓	✓	✓	✓
Nominal exchange rate	✓	✓	✓	✓	✓
EMBI+ index	✓	✓	✓	✓	
Yield curve slope (10 years–2 years)		✓		✓	
Total number of variables included	13	12	12	13	12

Inflation indicators refer to the annualised quarterly variation at a monthly frequency. The exchange rate is included as a monthly variation. For Mexico, the short-run nominal interest rate refers to the overnight banking funding rate before August 2008 and to the monetary policy reference rate after this date. For the external instrument approach, output, price indexes and exchange rate are included in log-levels. Also, only for this approach, the short-run nominal interest rate corresponds to the 1-year rate.

The results from all models are depicted in Graph A.1. Details on each of the five identification approaches are as follows:

1. **Cholesky restrictions.** To identify the monetary policy shock, it is assumed that variables placed before the short-run nominal interest rate do not respond in the impact period to an unexpected change in this variable. The order of variables used in this strategy is depicted in column (i) of Table A.2.

2. **Sign and zero restrictions.** Four structural shocks for the Mexican economy are identified to reduce the uncertainty bands around the responses of endogenous variables to a monetary policy shock. The other three structural disturbances are a central bank information shock, an aggregate supply shock and an aggregate demand shock. Table A.3 summarises the sign and zero restrictions used to identify these shocks. Within this approach, distinguishing between a monetary policy shock and a central bank information shock is necessary to disentangle the effects of new information provided by the central bank about the state of the economy and changes in the reference rate at the time of a monetary policy decision. In this case, it is assumed that after a restrictive monetary policy shock, the slope of the yield curve decreases, while after a pessimistic central bank information shock, this slope rises. For the former, the restriction implies that the 10-year yield remains steady as the 2-year yield increases. Conversely, after a pessimistic central bank information shock, the 10-year yield rises more than the 2-year yield, driven by a surge in the term premium (ie the risk compensation demanded by investors) (see Jarociński and Karadi (2020); Carrillo et al (2020)).

3. **Local projections with Cholesky restrictions**. The impact response ($h = 0$) of endogenous variables to a monetary policy shock is given by the corresponding column of matrix A. This matrix is obtained by applying Cholesky restrictions on a canonical SVAR model, following the order of variables presented in column (iii) of Table A.2. To compute the response of each variable for time periods after the shock ($h > 0$), equation (1) is estimated as a linear regression using Bayesian techniques for each horizon of interest (for instance, $h = 1, 2, \dots, 48$). To estimate matrices $B_{\ell,h}$, Minnesota-type priors are employed to ensure that the responses of more distant periods gradually converge to zero (see Jordá (2005); Ferreira et al (2023)).

Table A.3: Sign and zero restrictions imposed on the responses of endogenous variables to structural shocks

	Structural shocks			
	Monetary policy	Central bank information	Aggregate supply	Aggregate demand
Response on impact ($h = 0$)				
Output gap	**0**	**0**		**+**
Core inflation	**0**	**0**	**+**	
Short-run nominal interest rate	**+**	**+**		
Yield curve slope	**-**	**+**		
Nominal exchange rate	**-**			
Response six months after the shock ($h = 6$)				
Output gap	**-**	**-**	**-**	**+**
Core inflation	**-**	**-**	**+**	**+**
Short-run nominal interest rate				
Yield curve slope				
Nominal exchange rate				

Restrictions are based on Carrillo et al (2020). In the present analysis, since the interest is on measuring the monetary policy transmission mechanism in Mexico, the restrictions are imposed on Mexican variables, instead of US variables.

4. **Narrative sign restrictions**. This approach uses the same variables and sign and zero restrictions as in in column (ii) of tables A.2 and A.3. The difference is that the identification includes narrative information, external to the VAR model, regarding the presence of monetary policy shocks. As a result, the narrative approach requires some key events with conclusive information about the sign of the monetary policy shock. Adding this information into the model may significantly reduce uncertainty in the impulse-response functions (Antolín-Díaz and Rubio-Ramírez (2018)). The narrative information for Mexico exploits the difference between the observed monetary policy rate and a forecast of this rate from a Bloomberg survey. For the narrative information, the signs of the largest surprises are considered. As a result, the sign of the March 2009 surprise is used, as well as those of the surprises from March and April 2020 for the sample including the pandemic.

5. **External instruments using high frequency data**. In this approach, monetary policy surprises around Banco de México announcements are incorporated as an external instrument within the SVAR model. In particular, the monetary policy shock is identified using changes in the 3-month swap interest rate within a half-hour window around Banco de México's monetary policy decisions (Solís (2023)). Large changes in the 3-month swaps are interpreted as reflecting surprises in market expectations regarding the monetary policy rate. The advantage of using

these surprises is that the likelihood of other structural shocks influencing the swap rate within the specific time window is minimal (Jarociński and Karadi (2020)). To estimate the impulse responses of endogenous variables to the monetary policy shock, a two-stage linear regression is performed. In the first stage, a regression of the residuals corresponding to the monetary policy indicator equation is estimated on the external instrument, and adjusted residuals are obtained. In the second stage, these adjusted residuals are used to estimate the effects of the monetary policy shock on the variables analysed.

Estimation with the sample including the pandemic. Applying conventional methodologies to estimate the transmission mechanism of monetary policy during the pandemic has been complicated given the presence of extreme shocks affecting real activity. If not handled, these shocks may bias the estimation results, as their presence violates the assumptions underneath these models (eg well-behaved error terms). As a result, the biased estimations may suggest false or erratic changes in the transmission mechanism (graphs A.2 and A.3).

Dealing with the pandemic shocks has required exploring alternatives to adapt the methodologies. These efforts can be classified into three categories:

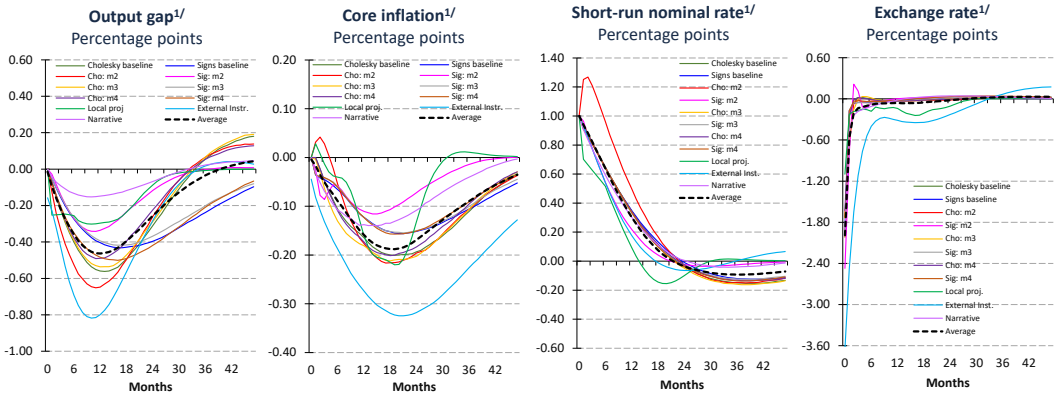
- Adapted models: More flexible structures are considered to model the error variance, so that pandemic shocks are captured and isolated. Among these structures, pandemic priors are a popular choice (Primiceri and Tambalotti (2020); Bobeica and Hartwig (2023); Lenza and Primiceri (2022); Carriero et al (2022); and Holston et al (2023)).
- Pandemic dummies: Dichotomous variables are incorporated for various periods to isolate pandemic shocks (Maroz et al (2021); Ng (2021); Cascaldi-Garcia (2022); and Holston et al (2023)).
- Cleaning of outliers: First, periods of atypical movements in real variables are identified. Subsequently, the following options are considered: (i) exclude these values for the estimation of the error variance; (ii) use these values to estimate extraordinary volatility and uncertainty; or (iii) clean real variables of atypical movements using confinement indicators (eg Google Mobility Index) (Marcellino et al (2021); Arriola et al (2022); and Pattanaik et al (2022)).

For the Cholesky approach, pandemic dummies were used. For sign and zero restrictions, as well as for local projections, the cleaning of outliers was used. In turn, for the narrative sign restrictions, the pandemic prior's strategy, as in Cascaldi-Garcia (2022), was used. Finally, the external instrument approach has not been yet applied in the sample including the pandemic, as high-frequency data after 2019 has not yet been included.

Disentangling the monetary policy transmission mechanism on output and inflation. To explore the strength of the monetary policy transmission on different sectors of the economy, additional variables are included in the SVAR models, with minimal or no restrictions. The variables relate to economic activity in the manufacturing and services sector, as well as the merchandise and services prices. Each variable is added to the SVAR model on isolation (ie one at a time).

Responses of selected Mexican variables to a monetary policy shock, according to baseline and alternative models

Graph A.1



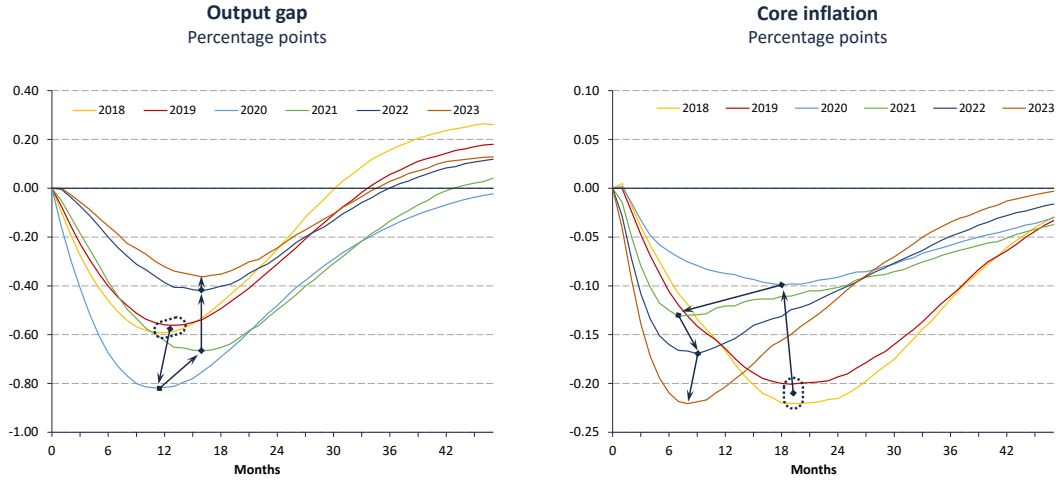
Model 2 includes two lags; model 3 uses different hyperparameters in the estimation process; and model 4 considers an alternative output gap.

Sources: Banco de México; National Institution of Statistics and Geography; Bloomberg; Proveedor Integral de Precios (PiP); Valmer.

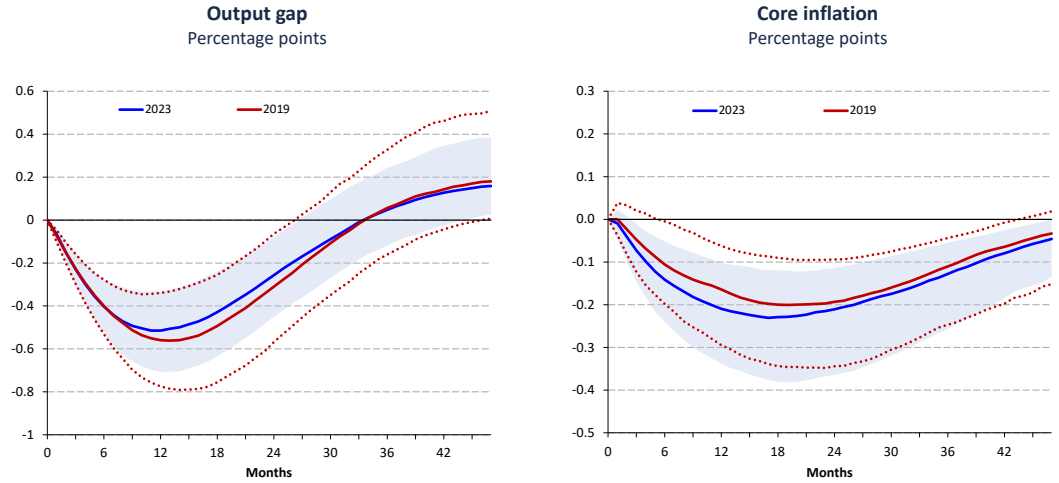
Responses of real activity and prices to a monetary policy shock, before and after the Covid-19 pandemic, according to Cholesky restrictions

Graph A.2

A. Results from Cholesky restrictions: 2018–23, without controlling for pandemic shocks



B. Results from Cholesky restrictions: 2019 versus 2023, after controlling for pandemic shocks



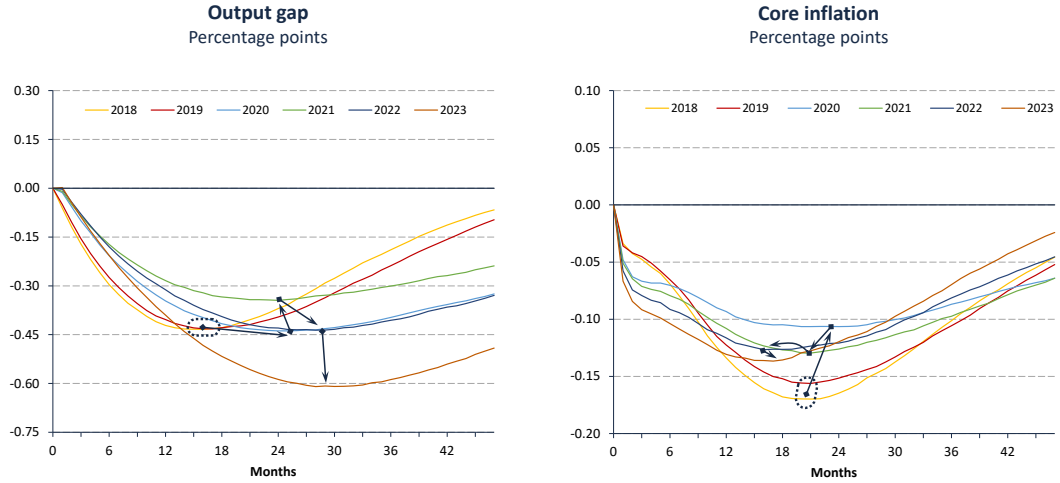
The dotted red lines and the blue shaded area represent the uncertainty bands that cover 68% of the distribution in each model.

Sources: Banco de México; National Institution of Statistics and Geography; Bloomberg; Proveedor Integral de Precios (PiP); Valmer.

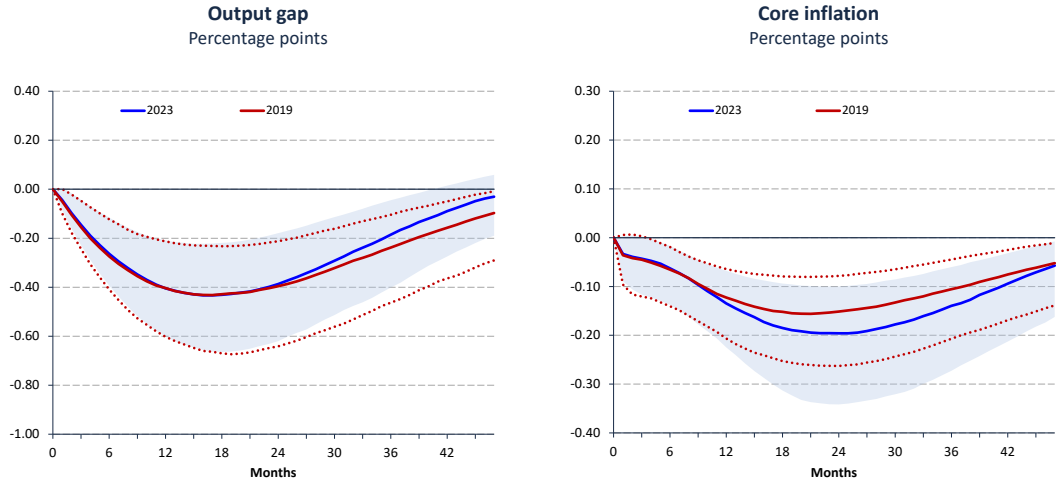
Responses of real activity and prices to a monetary policy shock, before and after the Covid-19 pandemic, according to sign and zero restrictions

Graph A.3

A: Results from sign and zero restrictions: 2018–23, without controlling for pandemic shocks



B: Results from sign and zero restrictions: 2019 versus 2023, after controlling for pandemic shocks



The dotted red lines and the blue shaded area represent the uncertainty bands that cover 68% of the distribution in each model.

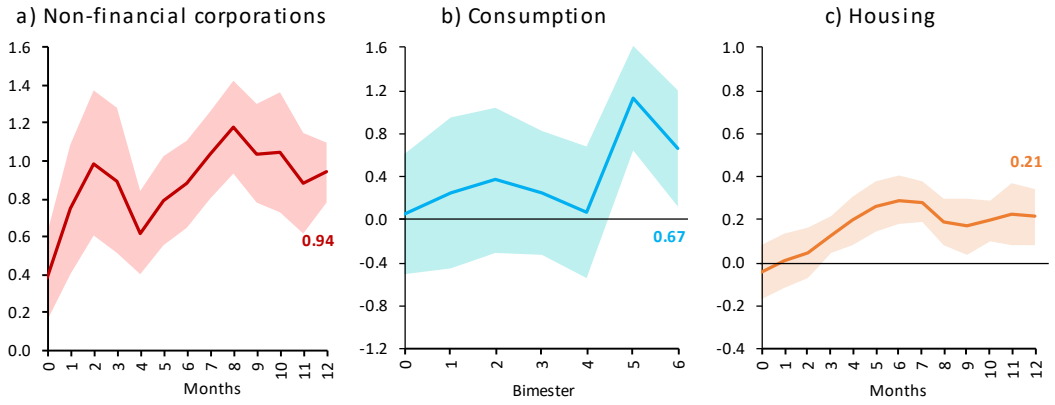
Sources: Banco de México; National Institution of Statistics and Geography; Bloomberg; Proveedor Integral de Precios (PiP); Valmer.

B. Estimates of the pass-through of Banco de México's target interest rate to commercial bank loans and deposit interest rates

Estimated pass-through of Banco de México's target interest rate to bank loans' interest rates

Cumulative effect

Graph A.4



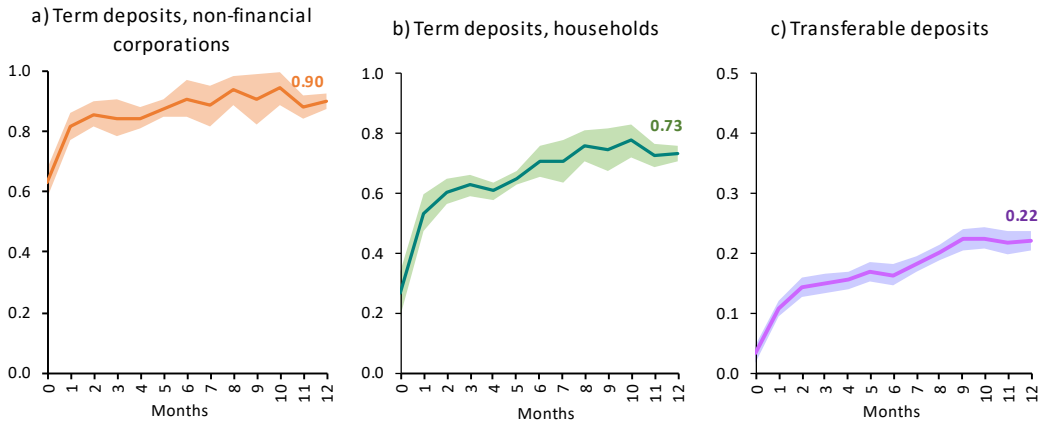
Pass-through is measured as the beta coefficient obtained from the following regression:

$\Delta r\_t^d = \alpha + \sum_{k=0}^{K} [\![\beta\_k^M \Delta r\_(t-k)^{target}]\!] + \theta X\_t^d + \epsilon\_t$. For loan rates, it is the weighted average interest rate of new loans to non-financial corporations, consumption and housing, correspondingly. $\Delta r\_(t-k)^{target}$ is the monthly change in Banco de México's target interest rate, and X_t^d is a vector of variables that control for economic activity, inflation and other effects. Confidence intervals at 95%, Newey-West standard errors. The adjusted R2 for each regression is: non-financial firms 0.516, consumption 0.554, and housing 0.456. Consumption includes credit cards, auto and payroll loans.

Source: Banco de México

Estimated pass-through of Banco de México's target interest rate to bank deposits' interest rates

Cumulative effect — Graph A.5



Pass-through is measured as the beta coefficient obtained from the following regression:

$\Delta r\_t^d = \alpha + \sum\_(k=0)^K \beta\_k^M \Delta r\_(t-k)^{target} + \theta X\_t^d + \epsilon\_t$. For deposit rates, Δr_t^d is the monthly change of the effective interest rate of term deposits to non-financial corporations, households and transferable deposits, accordingly. $\Delta r\_(t-k)^{target}$ is the monthly change of Banco de México's target interest rate, and X_t^d is a vector of variables that control for economic activity, inflation and other effects. Confidence intervals at 95%, Newey-West standard errors. Adjusted R2 for each regression is: non-financial firms 0.906, households 0.797, and transferable deposits 0.350. "Term deposits, households" shows effective weighted interest rate of term deposits and debt securities issued by banks with a residual maturity lower or equal to 5 years. For "overnight deposits", weighted average interest rate is calculated over the total of checking accounts and current account deposits at commercial banks.

Source: Banco de México

Heterogeneity considerations in monetary policy design: the case of Peru[1]

Central Reserve Bank of Peru

1. Introduction

There has been a recent surge in research on the implications of household and firm heterogeneity in monetary policy. The Central Reserve Bank of Peru (BCRP) is well-acquainted with this trend, as heterogeneity is a defining feature of Peru's economy. The BCRP's mandate focuses on preserving monetary stability, a goal that necessitates a deep and granular understanding of the economy. For this reason, the BCRP has also been considering aspects of heterogeneity for some time, recognising their relevance to Peru's economy, which is characterised by a large informal sector and financial dollarisation.

This article examines how the BCRP incorporates heterogeneity considerations into monetary policy analysis. It also outlines various indicators developed to measure heterogeneity, explores how aggregate outcomes affect different population segments, and considers - at least theoretically - whether wealth heterogeneity influences key aggregates relevant to monetary policy.

The monetary policy assessment process consists of two key stages: (i) performing data analysis of relevant indicators; and (ii) using forecasting models conditioned on different policy stances. The first stage primarily focuses on aggregate data but is complemented by indicators capturing heterogeneity among agents. In Peru, the interest rate, exchange rate and expectations channels are the most relevant for monetary policy transmission. These channels are incorporated into the BCRP's Quarterly Projection Model (Aguirre et al (2019)). While the model's aggregate framework does not explicitly capture heterogeneity, it is accounted for through the calibration process and the construction for certain variables. The influence of heterogeneity on monetary policy transmission is discussed in Section 2.

Inflation is often described in the literature as a tax that disproportionately affects lower-income groups. High inflation rates explicitly affect income distribution among households, underscoring the critical role of monetary policy in ensuring price stability. An exercise measuring how inflation is perceived across income levels—and its implications for poverty—is presented in Section 3.

Given that informality is a significant source of heterogeneity among workers, a preliminary analysis of the informal labour market's influence on real interest rates is presented in Section 4. A relevant paper on informality in the Peruvian economy by Castillo and Montoro (2010) is also discussed in a box within this section.

[1] Authors: Adrián Armas, Carlos Montoro, Alan Ledesma, Leonardo Alvaro, and Luis Castillo (BCRP).

Drawing on Peru's experience with past economic instability, the BCRP has long recognised the importance of heterogeneity in the economy. Its strategy has focused on maintaining low inflation, which especially benefits more vulnerable households. Moreover, several unconventional BCRP policies—such as liquidity operations during the pandemic and de-dollarisation programmes—have indirect distributional effects, even though they were not designed for this purpose. These policies are outlined in Section 5.

2. Heterogeneity in monetary policy design

2.1 Monetary policy transmission

Monetary policy has differentiated distributional effects across firms and households, as it operates through distinct monetary transmission channels. Corporate entities typically experience a faster pass-through of interest rate changes, whereas smaller or riskier firms face slower and less pronounced effects. This aligns with Ottonello and Winberry (2020), who show that the effects of monetary policy shocks on investment depend on firms' financial frictions. Contrary to the standard financial accelerator mechanism—which suggests that more constrained firms would significantly expand investment during monetary easing—it is instead less risky firms that tend to drive investment growth. Higher-risk firms face a steeper marginal cost of investment, limiting their responsiveness to policy changes.

Significant heterogeneity also exists in the transmission of monetary policy across households. Those with greater access to financial products tend to respond more directly and rapidly to policy changes, while households with limited financial inclusion experience these effects more indirectly, often through general equilibrium adjustments. The literature highlights the importance of household wealth heterogeneity in shaping household responses. Kaplan et al. (2018) argue that transmission depends on households' positions within the wealth distribution. In their framework, the classical substitution effects of interest rate changes on consumption are relatively small, while a high share of hand-to-mouth households amplifies the income channel. Hong (2022) finds that marginal propensities to consume are significantly higher among Peruvian households than in the United States, suggesting a potentially stronger role for this channel in Peru.

2.2 Data on heterogeneity

Monitoring economic data is a critical component of monetary policy analysis. It complements forecasting models by providing insights into aspects of the economy that models may not fully capture. In the case of Peru, several dimensions of agent heterogeneity are relevant, and monetary policy assessment relies on a range of datasets covering households and firms.

The National Household Survey (*Encuesta Nacional de Hogares*, ENAHO), an annual survey with quarterly updates, is the primary source of household-level data. It features a quasi-panel structure, tracking a subset of households annually. ENAHO provides information on a wide range of characteristics, including financial inclusion,

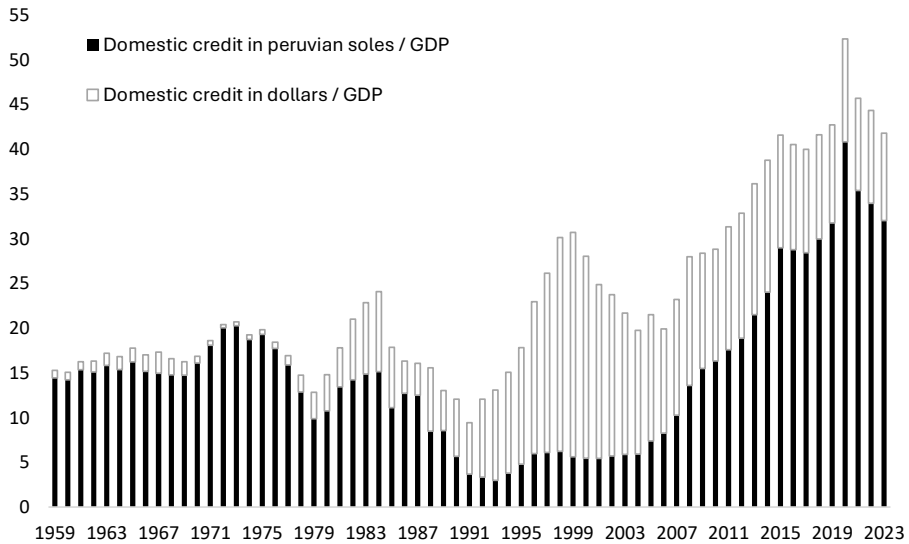
financial literacy, expenditure, income, indebtedness, homeownership, and employment. Since 2021, the National Labour Survey (*Encuesta Permanente de Empleo Nacional,* EPEN) has offered monthly labour market data. Additionally, formal firms report employment data to the Superintendency of Customs and Tax Administration (*Superintendencia Nacional de Aduanas y de Administración Tributaria*, SUNAT). Together, these sources enable the estimation of informal employment indicators. The implications of informality for Peruvian business cycles are explored in Section 4.

Firm-level activity data—covering revenue, costs, employment—are sourced from the Annual Economic Survey (*Encuesta Económica Anual*, EEA) and the Economic Census (Censo Económico). The latter captures the universe of firms in the country but is conducted only intermittently, with the most recent editions in 2022 and 2008. While both sources offer annual data, they are available with a one-year lag and are therefore unsuitable for high-frequency policy analysis. However, they remain valuable for understanding longer-term structural trends. In addition, the BCRP closely monitors customs data on international trade flows, reflecting the economy's reliance on mineral exports and its increasing diversification into non-commodity exports.

2.3 Heterogeneity and financial dollarisation

Heterogeneity in financial dollarisation at the firm level is a defining feature of Peru's economy. Armas (2016) provides a detailed account of its dimensions and evolution, tracing its roots to the inflationary and hyperinflationary episodes between the 1970s and early 1990s. These events severely eroded the value of the local currency, prompting people to store their wealth in dollars. Unlike other countries, Peru lacked financial options, such as inflation-indexed savings instruments, to preserve the value of savings, which exacerbated dollarisation (Graph 1).

Financial intermediation (credit as % of GDP) Graph 1



Information for depository institutions supplemented by banking system data until 1991.

Over the past 20 years, dollarisation has declined due to shifting preferences and de-dollarisation programmes implemented by the BCRP. Since Explicit Inflation Targeting (EIT), the sol became more profitable and savings in dollars lose value. In the period between 1999 to 2010, dollarisation of credit reduced from 81.7% to 45.6%. Following this period and with the end of the commodity boom and the following depreciation of the sol, the de-dollarisation programmes led by the BCRP managed to help reduce dollarisation of credit between 40.4% in 2013 to 29% in 2016.

Financial dollarisation affects firms unevenly. Although dollarisation remains prevalent among larger firms, its decline has been more pronounced in credit to smaller firms and households (personal loans), benefiting them given their lower capacity to hedge against currency mismatches (Table 1). The BCRP's FX interventions also aim to mitigate this risk.

Dollarisation of credit by depository institutions to the private sector (% of credit) Table 1

	Jan 2011	Dec 2013	Dec 2016	Dec 2024
Corporate and large firms	69.0	65.2	48.9	52.5
Medium firms	67.1	62.3	42.9	36.5
Small and micro-firms	18.9	12.3	7.0	5.6
Credit to businesses	55.5	50.8	38.1	34.0
Credit to individuals	26.0	22.0	13.3	6.5
Total	45.6	40.4	29.0	22.8
Broad financing 1/				
Corporate and large firms	81.4	82.1	76.0	73.3
Credit to businesses	66.6	66.1	61.3	53.9
Total	55.4	53.8	48.6	38.5

1/ Broad financing encompasses funding from depository institutions, local capital markets, and foreign sources.

Source: BCRP.

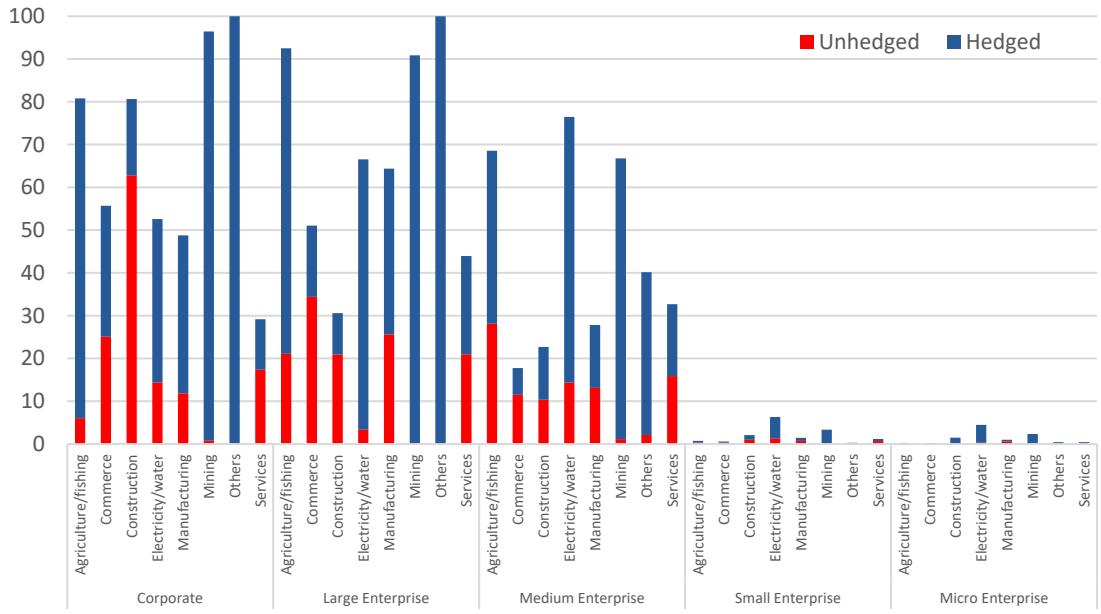
In Peru's highly dollarised economy, currency mismatches between firms' assets and liabilities increase the risk of default during periods of significant exchange rate volatility. The Consolidated Credit Report (*Reporte Consolidado de Crédito*, RCC) provides administrative data from financial institutions on individual firm and consumer debt. Updated monthly with minimal delay, it serves as a reliable indicator of indebtedness in the economy.

A more granular analysis of firms' exposure to exchange rate risk is made possible by a complementary dataset from the Superintendency of Banking, Insurance, and Private Pension Fund Administrators (SBS). This dataset, known as the Credit Report on Debtors (*Reporte Crediticio de Deudores*, RCD), includes a variable that captures the exchange rate exposure of each debtor as assessed by the lending bank. When combined with information on the economic sectors to which firms belong, this allows for an assessment of unhedged dollarization at the sectoral level.

The analysis (Graph 2) reveals that while dollarization is more prevalent among larger firms, these firms are generally better hedged against exchange rate risk. Their risk mitigation strategies include generating revenue in U.S. dollars and employing financial derivatives. For instance, in the mining sector, large and corporate firms

show dollarization ratios exceeding 90%. However, this exposure is almost entirely hedged—either through dollar-denominated income or the use of currency derivatives.

Unhedged dollarisation rate by borrower industry and type in 2023 (percent) Graph 2

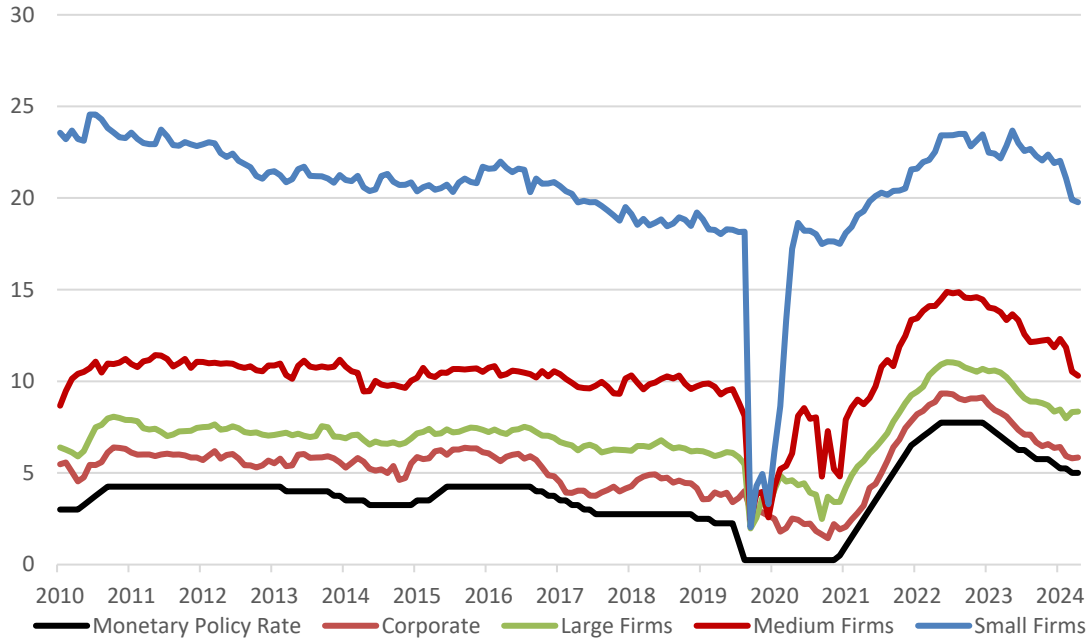


Source: SBS.

2.4 Heterogeneity and credit markets

Another valuable dataset from the SBS includes information on the cost of credit, with interest rates disaggregated by firm size. As shown in Graph 3, interest rates tend to be lower for larger firms, which is consistent with empirical evidence that such firms pose lower credit risk. Moreover, the transmission of monetary policy to market interest rates appears to be effective. During the COVID-19 pandemic, the *Reactiva Perú* program (discussed in Section 5) had a clear impact on lending rates by reducing the credit risk, bringing them closer to money market and yield curve rates across all firm size categories.

Average interest rate by firm size (percent) Graph 3



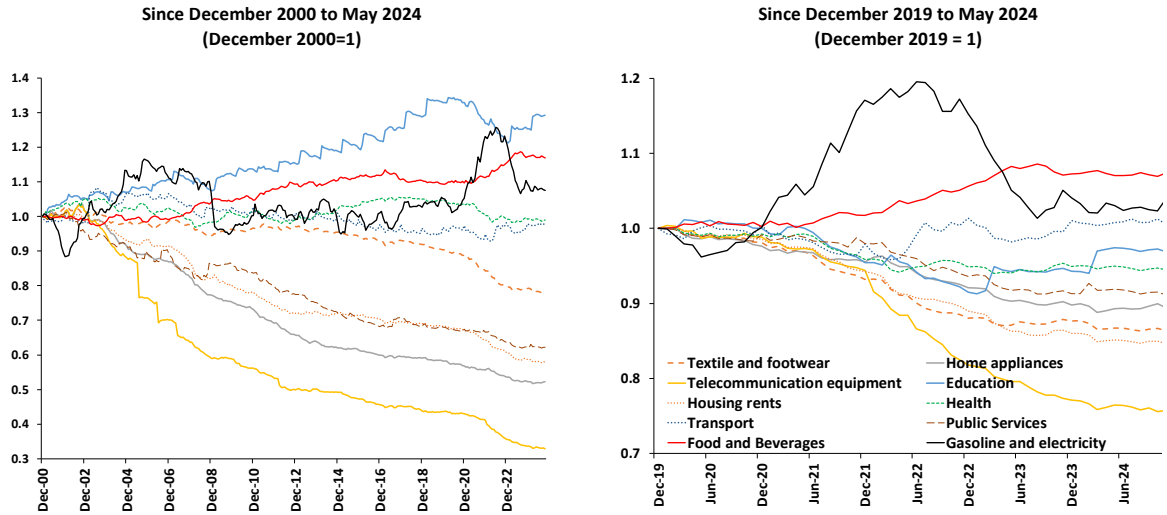
Source: SBS.

2.5 Heterogeneity and relative prices

Crucially, the BCRP monitors relative prices and inflation expectations to better understand additional dimensions of economic heterogeneity. During the recent global inflationary episode, data on inflation heterogeneity revealed significant changes in relative prices. International supply disruptions, including those for oil and fertilisers, combined with climate events, led to persistent increases in the relative prices of food and energy. This complicated inflation control, as inflation and output moved in opposite directions.

Prices relative to the consumer price index

Graph 4



Source: SBS.

When supply shocks are expected to be temporary, it may be optimal for a central bank to refrain from responding, given the lag in monetary policy effects. However, the BCRP observed that supply shocks affecting relative prices spilled over into inflation expectations. This prompted the BCRP to shift from an expansionary stance during the pandemic to a contractionary one to regain control over inflation.

Since the BCRP adopted explicit inflation targets, there have been five inflationary episodes, defined as periods when inflation expectations exceeded the upper limit of the target range. These episodes occurred during times of elevated inflation, which began to influence inflation expectations. BCRP (2024) reviews these inflationary episodes and examines the statistical relationship between inflation and inflation expectations. The analysis finds that inflation Granger-causes inflation expectations, with the food and energy component of inflation playing a key role, suggesting an important spillover effect of supply shocks on expectations.

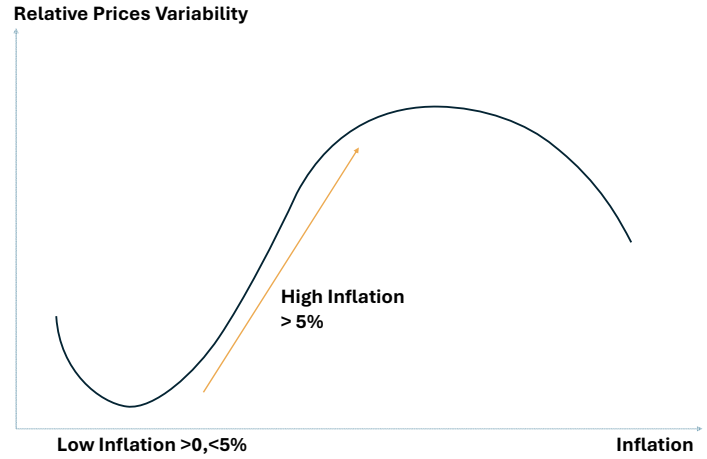
The BCRP remains committed to controlling inflation at the aggregate level, thereby mitigating the risk of severe distributional consequences that could result from economic instability associated with unanchored inflation. Failure to respond to inflationary pressures in a timely manner could undermine the BCRP's credibility, substantially increasing the welfare costs of restoring stability in the future.

By controlling inflation, monetary policy also affects price dispersion, as these two indicators are positively related during periods of high inflation and exhibit a U-shaped relationship when inflation is low (Ascari et al (2018)) as shown in Graph 5. Price dispersion, which reflects changes in relative prices, directly affects welfare. While some price dispersion is efficient, reflecting relative scarcities, dispersion caused by price rigidities is inefficient, as some firms are unable to adjust their prices. Therefore, controlling inflation reduces this price volatility, enhancing overall

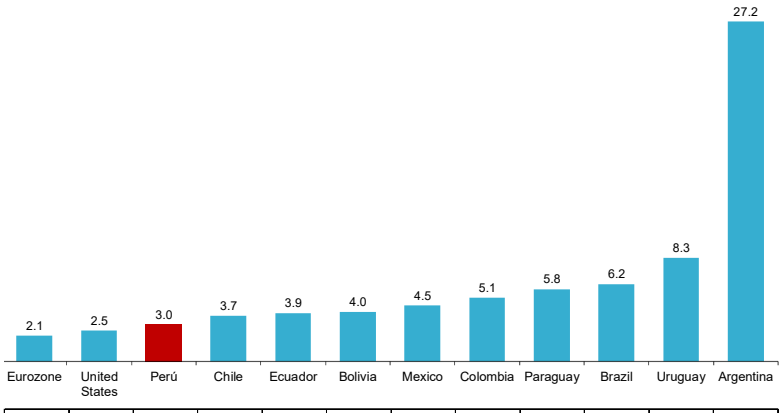
Graph 6: Average annual inflation and standard deviation (2001-23)

economic welfare. Peru's average annual inflation and inflation variability have been among the lowest in Latin America this century (Graph 6).

Relative price variability and inflation — Graph 5



Average annual inflation and standard deviation (2001-23) — Graph 6



Source: WEO (October 2024) and BCRP

3. Heterogeneous household perception of inflation

The consumer price index (CPI) reflects the average consumption basket of the population. However, consumption patterns differ across wealth levels and geographic areas, leading to variations in perceived inflation, which distinguishes individual inflation experiences from headline inflation (calculated using the CPI).

To estimate perceived inflation for different population groups in Peru, we first determine the average structure of each group's consumption basket using ENAHO

data on income, expenditures and other demographic and socioeconomic characteristics at both the household and individual levels. Total household expenditure is categorised into nine groups: (1) food and non-alcoholic beverages at home; (2) food and non-alcoholic beverages away from home; (3) clothing and footwear; (4) housing rent, fuel, electricity and household maintenance; (5) furniture, appliances and housing upkeep; (6) healthcare and medical services; (7) transport and communications; (8) recreation, entertainment, cultural services and education; and (9) other goods and services. For each group, a price index is constructed as a weighted sum of the individual price indices for each expenditure category, with weights reflecting the consumption basket's composition each year.

The composition of consumption baskets varies significantly across expenditure levels and between urban and rural areas. Consistent with a common pattern, the share of expenditure on food and non-alcoholic beverages is much higher among the poorest households. In 2023, this category accounted for 54.8% of total expenditure for the lowest quintile, down from 57.9% in 2019. In contrast, for the highest quintile, food and beverages made up 32.1% of total expenditure in 2023.

Average structure of total expenditure by per capita expenditure quintile (%) Table 2

Quintile of per capita expenditure	2019					2023				
	I	II	III	IV	V	I	II	III	IV	V
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Food and non-alcoholic beverages	57.9	52.7	48.1	43.3	31.9	54.8	52.7	48.3	43.3	32.1
At home	*45.6*	*38.8*	*33.5*	*28.5*	*19.5*	*44.9*	*41.4*	*35.9*	*30.6*	*20.8*
Away from home	*12.3*	*14.0*	*14.6*	*14.9*	*12.5*	*9.9*	*11.3*	*12.3*	*12.7*	*11.3*
Clothing and footwear	4.5	4.1	3.9	3.8	3.8	3.5	3.4	3.3	3.3	3.1
Housing rent, fuel, electricity and household maintenance	12.9	15.4	16.9	18.6	22.1	17.0	17.2	18.5	19.5	24.7
Furniture, appliances and housing upkeep	3.7	3.3	3.5	3.4	4.7	4.4	3.9	3.8	3.7	4.4
Healthcare and medical services,	5.6	6.1	6.9	7.5	9.3	4.9	5.7	7.1	8.7	10.5
Transport and communications	6.8	8.9	10.4	11.7	13.6	7.9	9.1	10.0	11.4	12.8
Recreation, entertainment, cultural services and education	5.2	5.8	6.4	7.4	9.9	4.6	4.8	5.5	6.3	8.1
Other goods and services	3.5	3.7	4.1	4.2	4.7	3.0	3.2	3.5	3.8	4.3

Source : Authors' calculations based on data from INEI – ENAHO.

Geographical differences also influence expenditure patterns. Rural households, which typically fall into lower expenditure quintiles, allocate a larger share of their spending to food and non-alcoholic beverages than urban households.

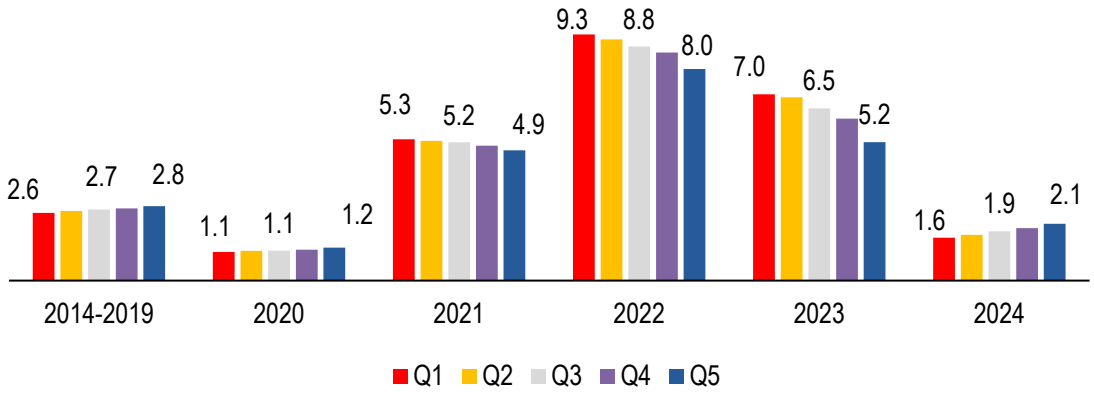
Average structure of total expenditure by geographical area (%) Table 3

	2019		2023	
	Urban	Rural	Urban	Rural
Total	**100**	**100**	**100**	**100**
Food and non-alcoholic beverages	39.4	57.2	39.2	56.6
At home	*25.9*	*43.4*	*27.7*	*43.3*
Away from home	*13.5*	*13.8*	*11.4*	*13.3*
Clothing and footwear	3.7	5.0	3.1	4.5
Housing rent, fuel, electricity and household maintenance	20.3	9.6	22.7	9.7
Furniture, appliances and housing upkeep	3.9	4.4	3.9	5.2
Healthcare and medical services,	7.9	7.4	8.7	7.8
Transport and communications	12.0	8.2	11.6	8.8
Recreation, entertainment, cultural services and education	8.4	4.6	7.0	4.0
Other goods and services	4.4	3.7	3.9	3.4

Source : Authors' calculations based on data from INEI – ENAHO.

As a result, periods of high food inflation disproportionately erode the purchasing power of low-income households. This is evident when comparing perceived inflation across groups. Between 2015 and 2019, average year-on-year inflation was relatively consistent across expenditure quintiles, a pattern that continued through 2020. However, between 2021 and 2023, perceived inflation was significantly higher for the lowest quintile. Between December 2020 and December 2023, the CPI increased by 12.0%, while the food and non-alcoholic beverages price index rose by 18.0%. This trend has moderated recently, with the CPI rising by 1.8% and food prices by 1.5% between December 2023 and October 2024, reflecting the normalisation of food inflation following global and domestic shocks, including the Russia-Ukraine war and El Niño–Southern Oscillation (ENSO) events.

Perceived inflation by per capita expenditure quintile (%) Graph 7

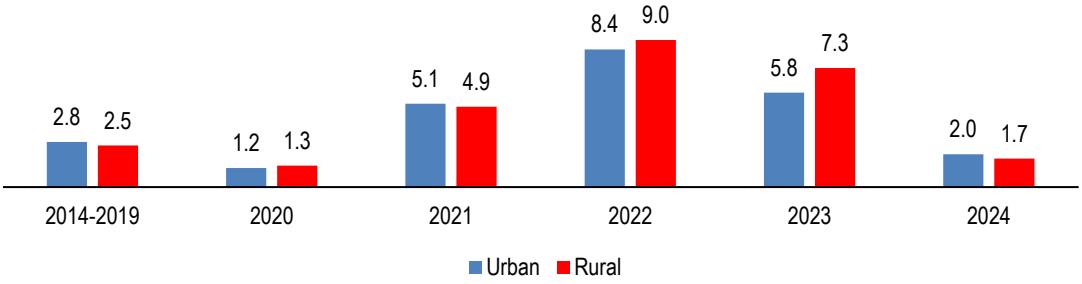


* The 2014-19 values represent average perceived inflation over this period.

Source: Authors' calculations based on data from INEI.

Similar patterns emerge when comparing urban and rural households. Prior to the food price shocks, inflation rates were broadly comparable. However, as food prices surged, rural households experienced higher perceived inflation.

Perceived inflation by geographical area (%) Graph 8



* The 2014-19 values represent average perceived inflation over this period.

Source: Authors' calculations based on data from INEI.

These heterogeneous effects have implications for monetary policy:

- Distributional effects: food inflation disproportionately affects poorer households, exacerbating inequality during prolonged periods of food price shocks. While monetary policy has limited influence on food prices, acknowledging these disparities can improve how the policy is communicated to the public.
- Impact on inflation expectations: differences in perceived inflation can shape inflation expectations. Groups perceiving higher inflation than the CPI suggests may adjust their consumption behaviour in unexpected ways, challenging central bank forecasts and analysis.

Variations in perceived inflation provide valuable insights into broader economic conditions. For example, Peru's poverty rate rose sharply from 20.1% in 2019 to 27.6% in 2024 after the pandemic, even as real GDP per capita recovered to just 0.8% above its 2019 level. This discrepancy is partly attributed to stagnant real incomes among the poorest households, driven by weak wage growth and their higher exposure to the inflation surge.

4. A heterogeneous agent model of labour informality for determining the steady-state real interest rate

One of the defining features of the Peruvian economy is labour informality, which reflects significant heterogeneity among households and firms. While it is challenging to fully quantify the aggregate effects of this heterogeneity, it is possible to explore its theoretical implications for key variables relevant to monetary policy. Galindo et al (2024) examine how labour informality influences the equilibrium real interest rate by affecting the loanable funds market.

To illustrate this relationship, the authors consider a closed economy with an exogenous endowment and two structural states: formality and informality. Each period, market participants face an exogenous probability of transitioning between

these states or remaining in their current one.[2] Compared with formal workers, informal participants earn lower incomes, do not pay taxes and face a higher interest rate premium. In addition, there is no market for contingent assets, so individuals manage income risk by issuing or holding bonds in the financial market. Participants in the formal sector, due to their higher incomes, generally demand bonds. However, since state transitions are exogenous, both formal and informal participants may act as borrowers or lenders.

One of the earliest theoretical papers on informality and business cycle is the work by Castillo and Montoro (2010), discussed in Box 1. The analysis presented in this section is theoretical and subject to important caveats. For instance, the model excludes traditional interest rate determinants, omits unemployment as a distinct labour state, and assumes exogenous transition probabilities, disregarding potential state dependencies. These limitations underscore that the conclusions should be interpreted as theoretical hypotheses requiring empirical validation.

It is important to emphasise that, in this model, the only driver of dynamics is the exogenous probability of changing states. If there is no probability of changing states after a worker is assigned a status at the initial moment, there will be no precautionary savings, no variation in the distribution of workers, and the interest rate will solely reflect the subjective discount rate. Heterogeneity will have no role in equilibrium. Consequently, the results highlighted here should be understood as a marginal contribution to the determination of the aggregate interest rate. Depending on the calibration, their relevance may remain limited when standard macroeconomic determinants are considered.

In this set up, informality drives heterogeneity, as participants make optimal consumption and savings decisions, accounting for potential state transitions. Formal sector participants save to prepare for potential transitions to informality, while informal sector participants may borrow in anticipation of entering the formal sector. This results in wealth disparities across the two groups. Consistent with this, the model's simulations show that economies with higher informality experience more pronounced wealth inequality.

The main result concerning equilibrium in the loanable funds market shows that an increase in the size of the informal sector generates two opposing forces:

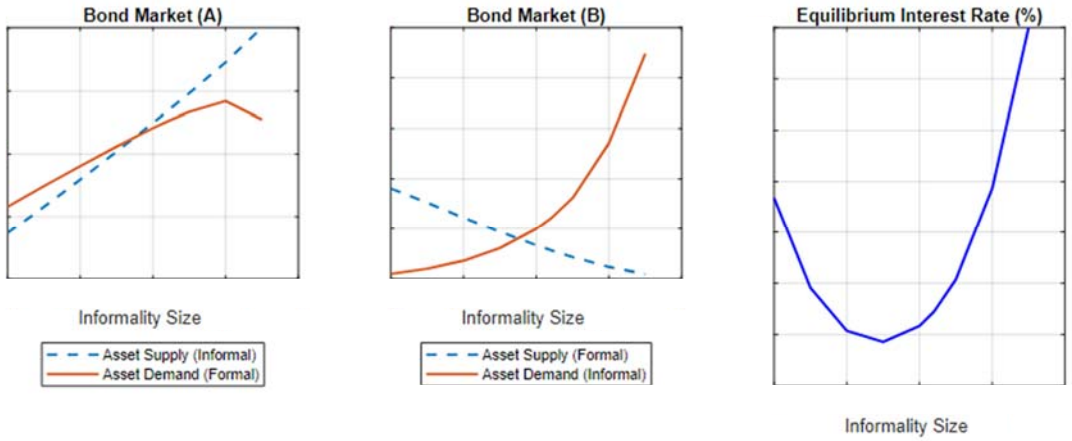
- A higher likelihood of transitioning to informality increases precautionary savings, boosting bond demand. This increases bond prices and lowers the real interest rate.
- A larger share of the population transitioning to informality increases bond supply to fund consumption, pushing bond prices down and raising the real interest rate.

Graph 9 shows that, for this specific calibration and abstracting from other macroeconomic determinants, these forces result in a U-shaped relationship between the real interest rate and informality. At low informality levels, bond supply dominates, driving bond prices higher and interest rates lower. Beyond a certain

[2] The framework in use builds on the continuous-time general equilibrium model with incomplete markets and uninsured labour risk introduced by Achdou et al (2022), which extends the seminal works by Bewley (1977), Imrohoroglu (1989), Huggett (1993), and Aiyagari (1994).

threshold, the likelihood of transitioning to informality increases to the point where formal workers raise their bond demand more than the supply added by informal workers. As a result, bond prices fall, and the interest rate rises.

Bond market equilibrium and real interest rate determination Graph 9



* The 2014-19 values represent average perceived inflation over this period.

Source: Authors' calculations based on data from INEI.

The steady-state (long-run) real interest rate represents a point of neutral monetary policy. The model suggests that a country like Peru, characterised by a large informal sector (abstracting from other factors), may have a higher neutral interest rate compared with one with a smaller informal sector. Furthermore, an increase in the size of the informal sector could elevate the neutral rate.

Although this model is highly stylised, abstracting from many factors relevant to emerging market economies like Peru, it highlights the potential effect of heterogeneity stemming from labour informality. Other determinants of the neutral rate, such as international interest rates, domestic productivity, and demographic trends, remain critical.

Box 1

"Monetary policy in the presence of informal labour markets"
(Castillo and Montoro, 2010)

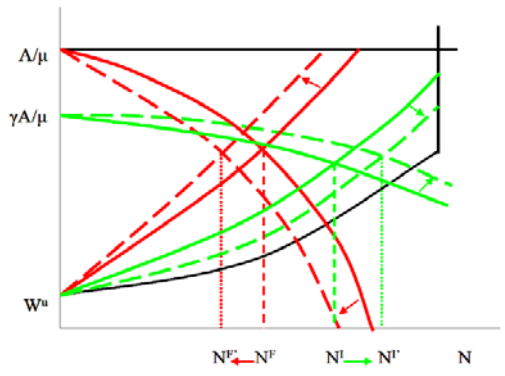
Castillo and Montoro (2010) extend a standard New Keynesian framework by incorporating a search model with two types of labour: formal and informal. This approach allows for a comparison of two counterfactual scenarios—one without informality and another where both types of labour coexist. The model examines the economy's steady state, its dynamics under AD and productivity shocks, and the monetary policy implications.

Labour market frictions are modelled following Blanchard and Gali (2010), where hiring costs depend on labour market tightness, defined as the ratio of vacancies to unemployment. Informal labour is characterised by lower productivity and reduced hiring costs compared with formal labour, consistent with the empirical evidence. The study focuses on an equilibrium where firms employ both types of labour, equalising marginal costs across sectors. Wages are determined through Nash bargaining between workers and firms, dividing the surplus generated by employment matches.

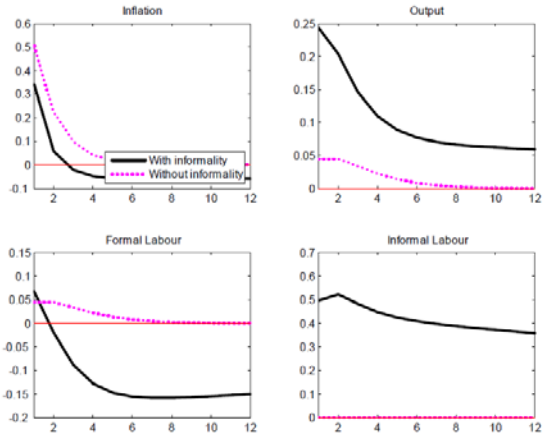
In equilibrium, the wage curve is upward sloping, starting at the reservation wage for unemployed workers (W^u) and rising with employment levels due to increased labour market tightness. The labour demand curve is downward sloping, beginning at A/μ for formal workers and $\gamma A/\mu$ for informal workers, where A represents productivity, μ is the retail sector markup, and $\gamma<1$ reflects the productivity gap between the formal and informal sectors. While both sectors exhibit similar shapes for their demand and wage curves, the informal sector's flatter curves reflect its greater flexibility.

The model simulates an increase in formal sector hiring costs (B^F), which shifts the wage curve upward and the demand curve downward, reducing formal employment (N^F). This leads to lower tightness in the informal sector, shifting its demand curve upward and the wage-setting curve downward, thereby increasing informal sector employment (N^I).

Graph 10: Labour market steady-state equilibrium. Effects of an increase in formal sector hiring costs (B^F)



Graph 11: Impulse responses to an AD shock



To explore monetary policy implications, the model evaluates impulse responses to an AD shock. The inflation response is 42% higher in an economy with only formal labour compared with one that includes both formal and informal sectors. Output increases more in the latter case, as informal employment alleviates wage pressures in formal labour markets, enabling firms to expand production.

The underlying mechanism is grounded in workers' decision-making. When offered a formal job, workers weigh the option of accepting it against waiting for higher wages. The existence of informal labour markets reduces the probability of alternative offers, making workers more likely to accept lower wages. As a result, AD shocks generate a more muted inflationary response while supporting output expansion. Informal labour thus works as a buffer against shocks, weakening the correlation between output and inflation in response to shocks, and reducing the effectiveness of interest channel of monetary policy.

5. Monetary and non-monetary policies impacting heterogeneity

The BCRP's objective is to maintain monetary stability, with a focus on ensuring low and stable inflation. In doing so, it recognises that low inflation benefits households at the lower end of the income and wealth distributions more significantly. Historically, inflation has been likened to a tax on the poor, disproportionately eroding their incomes and savings.

Notably, the BCRP's mandate prohibits directing credit to specific industries or financing the Treasury. This restriction reflects lessons from Peru's economic history. Between 1962 and 1992, the BCRP operated under multiple objectives—including economic development and growth—which contributed to high and volatile inflation (Montoro et al., 2021).

One of the BCRP's key functions is maintaining and improving the payments system. Recent initiatives include facilitating the interconnection of privately issued electronic wallets, which has significantly expanded financial inclusion by providing financial services to individuals without access to bank accounts. This interconnection has expanded the functionality and reach of these wallets, improving their effectiveness in providing financial services. Additionally, the BCRP has launched a pilot for its own central bank digital currency.

Macroprudential policies aimed at ensuring financial stability also address aspects of economic heterogeneity. Peru's macroprudential framework - jointly overseen by the BCRP and the Superintendency of Banking, Insurance, and Pension Funds (*Superintendencia de Banca, Seguros y AFP*, SBS) - has evolved over decades, drawing lessons from episodes like the Asian and Russian crises, which underscored the need for tools to mitigate risks linked to financial dollarisation (Rossini and Quispe (2017)). The BCRP employs reserve requirements as a complementary instrument for macroprudential purposes.

Over the past decade, the BCRP implemented a de-dollarisation programme targeting dollar loans. This policy directly addresses heterogeneity in dollar funding, which exposes firms and households to varying degrees of exchange rate risk. The programme has been particularly successful in reducing credit dollarisation, especially for smaller firms and households (Table 1). Between December 2013 and December 2024, the dollarisation of credit from depository institutions to the private sector fell from 40.4% to 22.8%, with an even more striking decline in credit to individuals - from 22% to just 6.5%. Similarly, the dollarisation of credit to small and micro-enterprises dropped significantly, from 18.9% in 2011 to 5.6% in 2024.

Reactiva Perú stands out as the most significant economic programme of the last decade to avoid a credit crunch, with varying effects across sectors and population groups. Montoro (2020) provides an overview of the programme's design and presents statistics on the credit allocated. Implemented as part of the BCRP's unconventional monetary policy during the Covid-19 pandemic, its primary goal was to stabilise the credit market to prevent economic collapse. The programme involved three key actors: the BCRP, the Treasury and private banks. Under strict eligibility criteria, banks issued low-interest loans to firms; the Treasury guaranteed them against default; and the BCRP supplied the liquidity needed for their issuance.

Although the programme was not specifically designed to target smaller firms - those most vulnerable to lockdowns and mobility restrictions - it was extensively utilised by them. While accounting for only 30% of total sales, medium, small and micro enterprises received 44% of the credit allocated under the programme. *Reactiva Perú* is widely considered successful, as it helped avert an economic depression and limited the business failure rate by supporting firms that otherwise might not have survived the economic challenges of the pandemic.

Finally, the BCRP places significant emphasis on communication and outreach, tailoring its efforts to diverse stakeholders, including journalists, business representatives, students, and the general public. These efforts encompass educational initiatives on currency handling, financial literacy, and specialised training in economics and finance. While primarily focused on enhancing public understanding, these activities also indirectly address educational disparities closely linked to income inequality.

6. Conclusions

This report summarises the various sources of information used by the BCRP to incorporate heterogeneity into monetary policy analysis. Household and firm heterogeneity are closely monitored as part of the BCRP's background analysis, with particular attention to credit and dollarisation, reflecting their relevance in shaping economic dynamics. Another key dimension is relative prices, which are closely tracked to assess the appropriate monetary policy response.

Understanding perceived inflation is crucial for capturing the varied impacts of price changes across population groups, particularly the disproportionate impact of food price shocks on poorer households and rural communities. Recognising differences in perceived inflation can enhance inflation forecasting, improve policy analysis, and provide more precise diagnoses of economic challenges, particularly for vulnerable populations.

To evaluate the aggregate effects of heterogeneity, this report explores a model that explicitly incorporates labour informality. The model shows that the average proportion of informal workers significantly affects the loanable funds market. This impact is reflected on both the supply side (through precautionary savings by formal workers) and the demand side (through increased funding needs by informal workers), influencing the real interest rate. The model highlights a U-shaped relationship between the size of the informal sector and the real interest rate, reflecting the interplay of these forces.

The BCRP's focus on monetary stability is not incompatible with taking distributional concerns into account. Inflation places a greater burden on poorer households, and therefore the BCRP plays a crucial role in mitigating inequality by maintaining price stability. While not explicitly designed for this purpose, several BCRP instruments have significant indirect distributional implications.

References

Achdou, Y, J Han, J-M Lasry, P-L Lions and B Moll (2022): "Income and wealth distribution in macroeconomics: a continuous-time approach", *The Review of Economic Studies*, vol 89, issue 1, pp 45-86.

Aguirre, J, J Arrieta, L Castillo, D Florián, A Ledesma, J Martinez, V Morales and A Vélez (2023): "Modelo de proyección trimestral: una actualización hasta 2019", *Revista Estudios Económicos*, Banco Central de Reserva del Perú, vol 42, pp 9–58.

Aiyagari, S R (1994): "Uninsured idiosyncratic risk and aggregate saving", *Quarterly Journal of Economics*, vol 109, no 3, pp 659–84.

Armas, A (2016): "Dolarización y desdolarización en el Perú", in G Yamada and D Winkelried (eds), *Política y estabilidad monetaria en el Perú*, Fondo Editorial de la Universidad del Pacífico, pp 61–94.

Ascari, G, L Phaneuf and E Sims (2018): "On the welfare and cyclical implications of moderate trend inflation", *Journal of Monetary Economics*, vol 99, pp 56–71.

Bewley, T (1977): "The permanent income hypothesis: a theoretical formulation", *Journal of Economic Theory*, vol 16, no 2, pp 252–92.

Banco Central de Reserva del Perú (2024): *Reporte de Inflación*, September.

Blanchard, O and J Gali (2010): "Labor markets and monetary policy: A new Keynesian model with unemployment", *American Economic Journal: Macroeconomics*, vol 2, no 2, pp. 1-30.

Castillo, P and C Montoro (2010): "Monetary policy in the presence of informal labour markets", Banco Central de Reserva del Perú *Working Papers,* no 2010-009.

Galindo, H, A Ledesma, C Salinas and L Yepez (2024): "Informality and wealth distribution: a heterogeneous agent model", Banco Central de Reserva del Perú *Working Papers,* no 2024-005.

Hong, S (2023): "MPCs in an emerging economy: evidence from Peru", *Journal of International Economics*, vol 140, 103712.

Huggett, M (1993): "The risk-free rate in heterogeneous-agent incomplete-insurance economies", *Journal of Economic Dynamics and Control*, vol 17, no 5–6, pp 953–69.

Imrohoroglu, A (1989): "Cost of business cycles with indivisibilities and liquidity constraints", *Journal of Political Economy*, vol 97, no 6, pp 1364–83.

Kaplan, G, B Moll and G Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743.

Montoro, C (2020): "El programa Reactiva Perú", *Revista Moneda*, Banco Central de Reserva del Perú, vol 182, no 4, pp 24–33.

Montoro, C, F Perez, F Orrego and y R Herrada (2021): "El mandato del Banco Central y la política monetaria contracíclica", *Revista Moneda*, Banco Central de Reserva del Perú, vol 187, no 1, pp 4–9.

Ottonello, P and T Winberry (2020): "Financial heterogeneity and the investment channel of monetary policy", *Econometrica*, vol 88, no 6, pp 2473–502.

Rossini, R and Z Quispe (2017): "Implementation of macroprudential policy in Peru", *BIS Papers*, no 94.

Monetary Policy and Degree of Heterogeneity in the Philippines

Bangko Sentral ng Pilipinas

1. Monetary policy channels

What are the main monetary policy transmission channels that affect households and non-financial corporations (NFCs) in your jurisdiction?

The effectiveness of monetary policy transmission channels depends on prevailing economic and financial conditions, the policy environment (e.g., adoption of the inflation targeting framework) and the degree of heterogeneity among households and firms. For the Philippines, the key transmission channels often highlighted are the interest rate channel, the credit channel and, recently, the inflation expectations channel.

Savings-investment channel (interest rate channel)

An increase in the nominal policy interest rate raises the real interest rate, influencing consumption, investment and savings decisions of economic agents (both households and NFCs). Specifically, higher borrowing costs discourage consumption and investment, tempering aggregate demand, while higher real interest rates encourage saving.

For the Philippines, on average, a sustained 100 basis-point increase in the policy rate from 1995 to 2007, when monetary policy gradually shifted to inflation targeting, resulted in improved transmission to market interest rates. However, the impact was relatively small. It also reduced money supply, consumption and investment.[1] The small impact of policy rate adjustments on market interest rates stems from the gradual rate adjustments by the BSP to ensure inflation remains within target as well as from the government-dominated bond market.[2] Crises such as the 2008 Great Financial Crisis and the 2020 Covid-19 pandemic also demonstrated that they could impair monetary policy transmission to market interest rates and the economy.

The Bangko Sentral ng Pilipinas (BSP) established the interest rate corridor (IRC) system in 2016 to guide short-term market interest rates toward the policy rate, thereby strengthening the transmission of monetary policy through the financial system. The expansion and modification of the monetary tools to include auction-

1 Using the BSP's preliminary Long-Term Macroeconometric Model (LTMM).

2 M C N Tuaño-Amador, E T Glindro and R A Claveria (2009): "Some perspectives on the monetary policy transmission mechanisms in the Philippines". *Bangko Sentral Review*, www.bsp.gov.ph/Media_And_Research/Publications/BS09_A2.pdf.

based open market operations and standing facilities, among other reforms, laid the foundation for the IRC implementation. Further enhancements to the monetary operations and framework, including the shift to a variable-rate auction format in 2023, were also implemented.

Credit channel

In 2022, despite aggressive policy rate hikes by the BSP to combat inflation, borrowing activities of NFCs continued.

- The BSP's 2022 Corporate Financial Trends Survey (CFTS)[3] showed that NFCs' leveraging activities in the Philippines have increased steadily over the years, with funds being sourced primarily from the banking sector.[4]
- The BSP's balance sheet approach also reflected NFCs as net debtors of the Philippine economy, with a high net external liability position of PHP 3 trillion in the first quarter of 2024.[5]

However, the rise in interest rates since 2022 to address inflation has led to a reduction in bank loans to the production sector.

- The share of loans for production activities to total loans of the banking system declined to 78.2% in September 2024 from 80.6% in September 2023. This aligns with the findings of Allon-Pineda et al (2024), who observed that lending growth reacts negatively to changes in policy rates, with this effect persisting for up to two years following the initial shock.[6]
- About 48.6% of the total banking system loan portfolio was for production activities, with significant shares in real estate (18.9%); wholesale and retail trade, and repair of motor vehicles and motorcycles (11.0%); electricity, gas, steam, and air conditioning supply (9.4%); and manufacturing (9.3%).

Inflation expectations channel

With the shift to inflation targeting, the BSP focused on building credibility through effective communication and transparency. Using ordinary least squares and generalised method of moments (GMM), the BSP staff found that announced targets, BSP's one-year-ahead inflation forecasts and lagged inflation significantly influence inflation expectations. Moreover, a 1 percentage point increase in real policy rates, using the weighted monetary operations rate (WMOR) adjusted for inflation, leads to

[3] The 2022 CFTS results are based on the responses of 112 firms, covering their operations for the period 2019–21, across 19 industries.

[4] For the period 2020–21, the majority of corporate borrowings were sourced from loans (48.2%), issuance of notes (24.7%) and bonds (24.6%).

[5] See: "Preliminary Q1 2024 Philippine balance sheet approach (BSA): The country's net external liability position widens, quarter-on-quarter", press release, BSP, 30 September 2024, www.bsp.gov.ph/SitePages/MediaAndResearch/MediaDisp.aspx?ItemId=7268.

[6] J Allon-Pineda, S Castañares, J Dacio, J Eloriaga, S de Guia and M Rosellon (2024):"Estimating the impact of BSP policy adjustments on bank lending: a panel VAR Model approach", *Bangko Sentral ng Pilipinas Discussion Paper*, no 2024-08. www.bsp.gov.ph/Sites/researchsite/Publications/BSP-Discussion-Papers/DP202408.pdf.

a 0.04 to 0.09 percentage point decline in inflation expectations (based on GMM results) (Españo and Santillan (2018)).[7]

Is the primary impact of the channels on activities (eg savings, investment) or on pricing decisions (eg wage negotiations, product pricing)?

The primary impact of monetary policy adjustments in the Philippines is mostly on aggregate demand (ie consumption, investment, net exports). However, inflation expectations and the exchange rate could also partly affect wage negotiations and pricing decisions. For example, wage and transport fares are linked closely with prevailing inflation conditions and expectations, while product pricing also depends on the share of import content (for the exchange rate channel) for the commodity.

Nevertheless, the bulk of negotiations also depends on existing institutional arrangements and direct measures (subsidies). These arrangements influence pricing decisions and mitigate second-round effects stemming from petitions for wage hikes and transport fares, toll rates, and power rates. **In the Philippines, wages** are set by regional boards on a 12-month cycle, reducing the risk of frequent and large wage adjustments. Other regulatory boards also ensure reasonable adjustments in transport fares and power costs.[8]

How do these channels compare in terms of their relative strength? Has their relative importance changed over the last few years?

The strength of transmission channels has evolved over the years. A study by Tuaño-Amador et al (2009) found that the interest rate pass-through and the bank lending channels increased starting in 1995 amid increased emphasis on inflation control. More recently, Austria and Bondoc (2018),[9] using the Kashyap and Stein model, found "weak to no evidence of monetary policy transmission through the bank lending channel." Similarly, findings by Armas (2021)[10] using a dynamic panel GMM model on individual bank data, also found a weak bank lending channel of monetary

[7] V T Españo and M Aizl Santillan (2018): "Determinants of inflation expectations in the Philippines". *Bangko Sentral Review*. www.bsp.gov.ph/Pages/MediaAndResearch/PublicationsAndReports/regular_bsrev18.aspx.

[8] Among others, the Philippines has the Land Transportation Franchising and Regulatory Board for public utility vehicle fares, the Energy Regulatory Commission for electricity rate adjustments, and the Toll Regulatory Board for toll fares.

[9] C P Austria and B M M Bondoc (2018): "The impact of monetary policy on bank lending activity in the Philippines". *Bangko Sentral Review,* www.bsp.gov.ph/Pages/MediaAndResearch/PublicationsAndReports/regular_bsrev18.aspx.

[10] J C A Armas (2021): "Is the bank lending channel of monetary policy evident in the Philippines? A dynamic panel data approach". *Asian Economic Journal*, vol 35, no 3, pp 246–69, onlinelibrary.wiley.com/doi/abs/10.1111/asej.12249.

policy in the Philippines as highly liquid banks tend to react more to monetary tightening than less liquid banks.

Meanwhile, the interest rate pass-through in the Philippines showed that the BSP policy rate still plays a significant role in influencing market interest rates (Dakila and Claveria (2006)).[11] Dacio et al (forthcoming) found that the pass-through of monetary policy adjustments has strengthened particularly for short-term market rates, and long-run pass-through converged faster after the adoption of the IRC system. These results underpin the improvement in monetary policy transmission through the interest rate channel, which is one of the main objectives of implementing the IRC system.[12]

In recent years, there has been increased emphasis on the inflation expectations channel. The rising interest in the impact of forward guidance and central bank credibility has been further highlighted during the pandemic. A study by Españo and Santillan (2018) found that BSP-announced inflation targets and forecasts significantly influence expectations, indicating that the BSP's credibility is crucial. Results from the GMM also found that current monetary policy stance (real policy rate) is also an important determinant of private sector inflation forecasts.

2. Role of household heterogeneity in monetary policy transmission

Is data on heterogeneity among households considered in the background analysis for monetary policy? If so, is this heterogeneity understood to affect monetary policy transmission in your jurisdiction?

Household-level data in the Philippines are less frequently updated. For example, the Family Income and Expenditure Survey, a survey of income and expenditure patterns of households, was previously only published every three years, although the latest 2023 version marked the start of its biennial conduct. Nonetheless, the BSP conducts the Consumer Expectations Survey (CES), which draws information on consumer sentiment, inflation expectations and, to an extent, demand prospects. The Technical Staff regularly reports the results of the survey in the monetary policy analysis process. The Philippine Statistics Authority also releases a separate headline CPI for the bottom 30% income households, which is regularly included in the review of monetary policy stance.

There is still limited research on the impact of household heterogeneity and monetary policy in the Philippines. Nonetheless, there have been recent efforts to capture the varying effects of monetary policy on household and bank

[11] F G Dakila and R A Claveria (2006): "The impact of BSP policy interest rates on market interest rates", *Bangko Sentral Review*, January.

[12] J Dacio, R Platitas and E Santos (forthcoming): "Revisiting the Monetary policy transmission mechanism in the Philippines". Bangko Sentral ng Pilipinas Discussion Paper.

heterogeneity. Recent papers found that high-income households are more susceptible to policy rate adjustments given their sources of income (Cabote and Fernandez (2020)).[13]

Which dimensions of differences across households matter for monetary policy transmission? How do they matter, and which transmission channels are affected?

Existing studies on this topic focused on investigating household heterogeneity using income quantiles. Cabote and Fernandez (2020) showed that increases in the reverse repurchase (RRP) rate tend to reduce total income across all income quantiles, with more pronounced effects at the higher income quantiles. They suggested this is because higher income households source their income from business, capital and financial assets. Consequently, tighter policy-setting tends to raise borrowing cost and lower investments and profits.

Meanwhile, Lomibao (2021)[14] investigated the impact of policy rate adjustments on headline inflation for all income households and the headline inflation rate for the bottom 30% income households Results of impulse response function showed that a policy rate hike negatively affects inflation rate for both all income households and bottom 30% households. However, the inflation rate for all income households tend to be affected faster than inflation rate for the bottom 30% households. The disparity could be attributed partly to the composition of the indices, with inflation rate for the bottom 30% household placing more weight on commodities that tend to be volatile (i.e., food as well as housing, electricity, gas and other fuels).[15]

What are the sources of granular household data? What are the impediments in accessing such data or using them in monetary policy analysis (e.g., incomplete or outdated data, privacy restrictions, lack of tools to analyse unstructured data)?

The BSP conducts the CES, Consumer Finance Survey (CFS), and Consumer Payments Survey (CPS), which can offer insights on household-level perceptions, conditions and outlook.

- The CES is a quarterly survey that gathers information on Filipino households' outlook in topics such as family financial situation, buying intentions and

[13] See N J Cabote and J R A J Fernandez (2020): "Distributional impact of monetary policy: evidence from the Philippines", *Bangko Sentral ng Pilipinas Working Paper*, no 2020-09.

[14] N F G Lomibao (2021): "Heterogeneity in responses of inflation to monetary policy in the Philippines", *BSP Research Note*, December, DOI:10.13140/RG.2.2.27671.85929.

[15] Rice accounts for 17.9% in the total CPI basket of the bottom 30% households.

macroeconomic outlook.[16] Overall consumer outlook and inflation expectations are of particular interest in current monetary policy-setting exercises.

- The CFS is a triennial survey that aims to collect data on the financial conditions of Filipino households, specifically their income, assets, expenditure and liabilities.[17]
- The CPS, piloted in 2024 (results forthcoming), elicits information on Filipino households' awareness, ownership, usage and perception of various payment instruments.[18]

While household inflation expectations are an important consideration in monetary policy formulation, challenges primarily involve the frequency, length, granularity and topical coverage of the CES data series.

- The CES is conducted quarterly and began capturing a key variable of interest—12-months-ahead inflation expectations—only in 2014.
- The limited availability of demographic variables can preclude further nuancing in research using CES data. For instance, the sample allows for statistically reliable estimates only up to two broad geographic domains (National Capital Region and Areas Outside the National Capital Region), making it difficult to analyse heterogeneity at a regional level.
- CES questions on inflation expectations are limited to short-term forecast horizons (i.e. current quarter, next quarter and next 12 months). A longer forecast horizon—beyond the 12-month time frame—would provide a better assessment of the anchoring of household inflation expectations.

The low frequency of the CFS and CPS—which are conducted every three and two years, respectively—hinders their use in the regular monetary policy analysis cycle.

The BSP aims to narrow existing data gaps by operationalising the ability under the law, via an upcoming circular,[19] to collect information from households and firms for statistical and policymaking purposes.

[16] For more information, see the BSP's Consumer Expectations Survey at www.bsp.gov.ph/SitePages/MediaAndResearch/ConsumerExpectationSurvey.aspx.

[17] For more information, see the BSP's Consumer Finance Survey at www.bsp.gov.ph/SitePages/MediaAndResearch/ConsumerFinanceSurvey.aspx.

[18] See "Consumer Payments survey (CPS)—December 2023", Department of Economic Research, www.bsp.gov.ph/Media_and_Research/Primers%20Faqs/ConsumerPaymentsSurvey(CPS).pdf.

[19] The upcoming circular provides the effective enforcement of Section 23 of Republic Act No 7653 (as amended by Republic Act No 11211) or the New Central Bank Act, which provides the BSP the authority to require any data from any person or entity, including government offices and instrumentalities, or government-owned or -controlled corporations, for statistical and policy development purposes.

3. Role of non-financial corporations (NFCs) heterogeneity in monetary policy transmission

Are data on heterogeneity among NFCs considered in the background analysis for monetary policy? If so, is this heterogeneity understood to affect monetary policy transmission in your jurisdiction?

1. **The BSP utilises available data to assess the financial conditions of NFCs in the country,** which form part of the monetary policymaking and regulatory process at the BSP. For a more data-driven policy analysis, the BSP is pursuing the following heterogeneity of NFC data:

- **Sectoral analysis**: NFCs – particularly in key sectors such as agriculture, manufacturing, and services – contribute differently to economic activity and employment. The BSP analyses these sectors to gauge the overall economic conditions and potential impact of monetary policy on their ability to finance borrowings and sustain operations.
- **Firm size and access to credit**: Heterogeneity in terms of firm size (eg micro, small and medium enterprises (MSMEs) versus large corporations) forms a significant part of the policy analysis. Smaller firms often face more challenges in accessing credit and are more sensitive to interest rate changes, which is relevant for monetary policy transmission.
- **Debt and leverage**: NFCs with high levels of debt are more vulnerable to changes in interest rates. Analysing firm-level data on leverage provides insights into potential vulnerabilities that monetary policy actions could impact the finances and activities of corporates.
- **Survey-based data**: The BSP conducts surveys, such as the Business Expectations Survey (BES), which capture firms' perceptions of economic conditions, credit access, and inflation expectations; and the CFTS, which monitors the financial performance and trends of the Philippine corporate sector including conglomerates, large firms, and MSMEs. These data are used to support and aid in the conduct of monetary policymaking.
- **Macro-financial linkages**: The interconnectedness between NFCs and financial institutions is likewise monitored to ensure financial stability. Monetary policy adjustments could affect NFCs' profitability and could likewise affect the stability of banks that lend to these firms.

2. Data heterogeneity of NFCs is therefore critical in understanding the impact of monetary policy. The BSP ensures that existing measures and regulations related to NFCs are appropriately calibrated to support economic growth, financial stability and inclusive development.

- The main challenge in collecting granular firm-level data is in the extensive resource allocation and coordination it requires. Moreover, activities such

as surveys and interviews may suffer from low response rates,[20] which may have implications for the representativeness, broadness and reliability of the data.

- While corporate data for many firms are generally available from data service providers, the lack of standardisation in data from various providers complicates the aggregation and analysis process. Additionally, the lack of granularity in key aspects and the minimal coverage for non-listed firms and MSMEs limit the level of analysis that can be achieved.

Which dimensions of differences across firms matter for monetary policy transmission? How do they matter, and which transmission channels are affected?

- Please refer to 1a and 3a.

How adequate is the availability of granular and timely firm-level data? What are the sources of such data?

Through the Financial Stability Coordination Council[21] financial regulators in the Philippines are continuously addressing the data gaps on NFC surveillance to gain an understanding of their financial condition.

3. However, the timely availability of granular information on corporates remains a significant challenge for the BSP. This is being addressed through the conduct of surveys and by utilising third-party providers of information of corporate finance.

- The CFTS is conducted annually to provide a better understanding of the NFCs in terms of firm-level borrowing activity; profitability; liquidity and solvency conditions; and funding structure and usage. By gathering more granular key corporate financial data, the CFTS aids in assessing the overall condition and potential vulnerabilities of the corporate sector which are essential to the formulation of sound, responsive and well informed monetary and regulatory policies.[22]

[20] For instance, the CFTS, which is a voluntary survey that aims to cover non-financial corporations across all industries and firm sizes, has garnered relatively low response rates. The first conduct of the CFTS in 2018 achieved a response rate of 21.3% followed by 58.4% in the second conduct, 33.6% in the third conduct and 27.1% in the fourth conduct, which ended in 2024.

[21] The Financial Stability Coordination Council is an inter-agency council where the principals from the BSP, the Department of Finance, the Securities and Exchange Commission, the Insurance Commission and the Philippine Deposit Insurance Corporation convene on a quarterly basis. These meetings provide the venue to assess possible systemic risks and to decide on appropriate macroprudential policy interventions.

[22] The accomplished survey templates by respondent NFCs are submitted via email at cfts@bsp.gov.ph or via the BSP's reports receiving system, whenever applicable. Similarly to most of the BSP's surveys, participation in the CFTS is voluntary. Results derived from the information are relatively unique, structured and symmetric across various industries.

- Third-party providers include S&P Global, London Stock Exchange Group, Bloomberg and National University of Singapore – Credit Research Initiative (NUS-CRI), which provide balance sheet and income statement information on public corporates.

4. The link from heterogeneity to monetary policy decisions

How do data on heterogeneity among households and firms feature in the quantitative analyses (eg projection models) prepared as part of the monetary policy decision-making process?

Both the CES and the BES provide insights useful for understanding inflation expectations. **While the distribution and composition of these expectations are taken into consideration in monetary policy analyses, these are more descriptive and have yet to be featured as quantitative inputs into projection models.**

The consideration of heterogenous economic agents is currently limited in the preparation of macroeconomic projections. In particular, the current workhorse models – the Multi-Equation model and Single Equation model – do not account for agent heterogeneity.

The Policy Analysis Model for the Philippines (PAMPh) considers heterogeneity, albeit in a limited manner. Specifically, the labour sector in the PAMPh considers the minimum and non-minimum wage earners. Approximately 20% of the labour force earns the government-set minimum wage, while the rest have wages influenced by business cycle conditions. Wage setting has material impact on inflation and domestic demand via household consumption. The PAMPh's credit block distinguishes between households and firms regarding the type of credit these economic agents avail. Household credit affects consumption, while firm credit affects investments.

How about the role of heterogeneity in the qualitative inputs (e.g., surveys of sentiments)?

Firm and household inflation expectations (particularly the composition, shape and statistical moments of the expectations distributions) are regularly reported in the formulation of monetary policy. Examining heterogeneity in these indicators sheds light on underlying patterns in the inflation outlook of different segments of the population.

Staff research incorporating heterogeneity has also nuanced our understanding of the formation of inflation expectations. For instance, one study revealed differences in the way demographic classes (i.e., income level, age group and

educational attainment) account for price changes in specific commodities (Mapa et al (2024)).[23]

Has incorporating heterogeneity led to decisions that are different (e.g., in terms of whether to cut rates or by how much) from those in a hypothetical scenario where heterogeneity is ignored?

No. The above considerations are already part of the baseline forecasts, which are considered in the endogenous monetary policy rule.

Do you communicate the relevance of data on heterogeneity to the public? If so, how?

Various BSP communications reflect the relevance of data on heterogeneity in the BSP's monetary policymaking process:

- The BSP publishes the BES and CES on a quarterly basis. These surveys provide indicators of overall business and consumer sentiment as well as outlook for economic conditions.
  - The CES includes consumer outlook across different income groups (ie low-, middle- and high-income groups) and geography (ie National Capital Region). Aside from economic outlook, savings behaviour and debt situation are also captured in the CES report.
  - The BES disaggregates the business outlook sentiment by area, type of business (ie importer, exporter, domestic-oriented) and size of employment (ie small, medium or large).

Results from these surveys serve as qualitative inputs that can be useful in monetary policy.

- The August 2024 Monetary Policy Report also included a box that discusses the key role of households' inflation expectations in inflation dynamics. The box shows which price changes are salient in forming Filipino consumers' inflation expectations, using data from the CES.
- Several BSP discussion papers also provide insights on the importance of data heterogeneity, focusing on household inflation expectations and uncertainty surrounding these expectations.[24]

[23] C R Mapa, M K C Bunyi, A C T Arcin and E B L Fuentes (2024): "Dissecting consumer attention: insights on consumers' inflation expectations in the Philippines", *Bangko Sentral ng Pilipinas Discussion Paper*, no 2024-15, www.bsp.gov.ph/Sites/researchsite/Publications/BSP-Discussion-Papers/DP202415.pdf.

[24] Recent BSP discussion papers on inflation expectations include Mapa et al (2024); and V T Españo, M A C C Santillan and N D De Guzman, "Measuring uncertainty in inflation expectations", *Bangko Sentral ng Pilipinas Discussion Paper*, no 2024-04.

5. Distributional effects of monetary policy

Are the distributional effects of monetary policy on households and firms also considered when setting monetary policy? Which is a more important consideration: the distributional effects of monetary policy or the interaction between heterogeneity and transmission?

Demand or output considerations are given due attention in policy discussions; the distributional effects of policy decisions are not directly or extensively considered, even though there is an awareness that high inflation tends to significantly affect lower income households. The BSP considers business and consumer sentiment – including inflation expectations at both the aggregated and disaggregated level as reported in the BES and CES – in setting the monetary policy stance. The BSP also monitors inflation developments for the bottom 30% of households, apart from overall inflation. The BSP also investigates the impact of interest rate changes on household debt situation and corporate sector financial conditions only when necessary due to data limitations. The BSP also provides more emphasis on the strength of transmission of monetary policy adjustments through different channels in general but will probably account for heterogeneity if heterogeneity will weaken monetary policy transmission.

Moreover, the BSP has also supported targeted intervention measures by the national government in addressing supply constraints. The national government, through the Economic Development Group and the Inter-Agency Committee on Inflation and Market Outlook, has identified and implemented several policy measures to address supply side price pressures and cushion the impact on vulnerable sectors. This includes (among others) cash transfers, fuel vouchers for public transportation franchisers, fuel discounts to farmers and fisherfolk, and reducing import tariffs.

Does your central bank have a mandate that distributional effects should be considered in addition to the focus on aggregate targets?

The BSP's primary mandate is price stability. Distributional effects are only implicitly considered in the BSP's assessment of price and demand conditions. Part of the BSP's pursuit of price stability requires an assessment of price and demand conditions in various sectors, such as real estate and the financial markets, which may entail looking at potential distributional effects.

Have distributional effects been mentioned in past policy communications? If yes, please provide examples.

Communications on the BSP's monetary policy stance do not typically or directly mention distributional effects.

6. Measures to address heterogeneity

Which monetary policy tools, if any, are used to address heterogeneity? Through what mechanisms do these tools work?

Heterogeneity in the distribution of liquidity among banks can influence the transmission of the monetary policy stance. To address distributional differences of funds across the banking system, the BSP offers a standing overnight lending facility (OLF) to help banks manage their daily liquidity requirements. The OLF provides unlimited funds against high-quality collateral (ie government securities) without stigma. The OLF rate is the ceiling of the BSP's IRC, thereby ensuring that overnight funds will not diverge significantly from the target RRP rate.

The BSP also has the discount window facility – formerly, the rediscount facility – which is a standing credit facility complementary to the OLF to help banks meet *temporary* liquidity needs by refinancing the loans they extend to their clients. Through the facility, the BSP makes possible the timely delivery of credit to all productive sectors of the economy. Moreover, the discount window facility is one of the monetary tools the BSP uses to influence the volume of credit in the financial system, consistent with its objective of price stability. This acts as the short-term safety valve for the banking system when banking institutions meet an unexpected shortage of reserves or funding for their temporary liquidity needs.

The imposition of the interest rate ceiling is another temporary measure of the BSP that takes into account and addresses household and firm heterogeneities. This tool works directly through the interest rate channel, where the BSP, in consultation with other regulatory agencies, sets an upper bound on the interest rates imposed on various loan/credit products. At present, the BSP has ceilings imposed on interest rates charged by: (i) lending companies, financing companies and their online lending platforms;[25] and (ii) credit card companies.[26] The ceilings were imposed to protect borrowers – especially low-income households and MSMEs – from predatory lending and high interest rates. The policies are subject to periodic review to regularly discuss their relevance.

The BSP's monetary operations aim to ensure effective transmission of monetary policy to the economy through the management of system liquidity and guidance of short-term market rates towards the policy rate to achieve the BSP's price stability mandate. Banks and non-banks with quasi-banking functions have access to BSP's active liquidity management facilities, including BSP Securities, which is also open to trust counterparties. The BSP Securities Facility is the BSP's main tool to absorb and lock in structural excess liquidity, thus, it has a broader set of eligible counterparties.

[25] Under BSP Circular No 1133 dated 22 December 2021, the BSP approved the ceilings on interest rate rates charged by lending companies, financing companies and their online lending platforms on short-term and low-value loans at 6.0% per month for the nominal interest rate and 15.0% per month for the real interest rate.

[26] The BSP initially prescribed a ceiling on credit card transactions at 24.0% per annum under Circular No 1098 dated 24 September 2020. This ceiling was amended under Circular No 1165 dated 19 January 2023, which raised the cap to 36.0%.

To further strengthen the features of its policy instruments, the BSP regularly engages with market participants through regular market consultations. This allows it to get the views of market participants on a range of issues relevant to the conduct of its monetary operations, which are vital information the BSP considers prior to implementation of operational refinements.

What other measures are used by your central bank to address heterogeneities (eg special lending facilities for selected business sectors)?

The BSP largely deals with banks and has no monetary instruments that directly cater to specific segments in the financial market. However, moving forward the BSP is studying the introduction of a framework for Islamic liquidity management to provide Shari'ah-compliant liquidity risk management tools for Islamic banks. An established Shari'ah-compliant facility will allow Islamic banks to manage their excess liquidity in a way that meets BSP's regulatory requirements. At the same time, having a Shari'ah-compliant facility supports a nascent Islamic banking industry in the Philippines, which has only three Islamic banking units.

Which measures are temporary and which ones are of a relatively permanent nature?

- **An Islamic liquidity management facility is envisioned to be part of the regular monetary operations of the BSP in the medium term.** The BSP will soon offer deposit accounts and standing liquidity facilities that are Shari'ah compliant and are common central bank Islamic liquidity facilities.[27]

[27] Islamic deposit accounts and standing liquidity facilities are currently being offered in Bangladesh, the Gulf Corporation Council (GCC), Indonesia, Malaysia, Nigeria, Pakistan and the United Kingdom. The facilities are in the form of murabahah, wakalah or mudarabah.

Monetary policy and welfare redistribution in Poland*

Marcin Bielecki[#] Michał Brzoza-Brzezina[$] Marta Kightley[&]

Abstract

We use a life-cycle model with real and nominal frictions to study how Polish monetary policy redistributes welfare. We concentrate on the age dimension of heterogeneity and show that an unexpected monetary expansion benefits young households at the cost of older agents. Redistribution is mainly driven by nominal assets and labour income. While these general findings are similar to those found in the euro area, a more detailed examination reveals important differences. For instance, lower asset and liability holdings of Polish households flatten the redistribution profile in Poland.

JEL: E31, E52, J11

Keywords: monetary policy, life-cycle models, welfare redistribution, Poland

* The views expressed herein are those of the authors and not necessarily those of Narodowy Bank Polski.

Narodowy Bank Polski, email: marcin.bielecki@nbp.pl.

$ Narodowy Bank Polski, email: michal.brzoza-brzezina@nbp.pl.

& Narodowy Bank Polski, email: marta.kightley@nbp.pl.

1. Introduction and literature

Monetary policy plays a critical role in shaping economic conditions and influencing inflation, output and employment. However, beyond these aggregate effects, monetary policy also has redistributive consequences across different segments of the population. The transmission of monetary policy impacts households unevenly due to differences in income composition, asset holdings and consumption patterns. This study explores the redistributive effects of monetary policy in Poland, focusing on key income and wealth channels through which policy-induced changes affect households.

While the distributional consequences of monetary policy have already been studied in the international context (see below for details), this has, so far, not been the case in Poland. We try to fill this gap. Using a life-cycle model, we examine how shifts in monetary policy restrictiveness impact labour income, nominal and real asset returns, housing wealth, and ultimately welfare across various household groups. Our framework is closely related to Bielecki et al (2022) and features a rich heterogeneous environment of households. There are 80 cohorts of overlapping generations and households are allowed to keep a diversified portfolio of assets: they accumulate housing, claims on firms and government bonds or nominal loans. Households also differ with respect to their labour market status. Those under 63 years old[1] work and provide an age-specific number of hours, while those of 63 years of age and older are retired and live on pensions and capital income.

What are the main findings? An unexpectedly more expansionary monetary policy stance affects young and old households differently. The former gain on several fronts: higher inflation lowers the real value of their mortgage debt, while an increase in overall economic activity boosts their labour market income. Middle-aged households gain on the labour market but lose from their already positive bond holdings, which depreciate in real terms. Older, retired households face losses on nominal assets which are not compensated by gains from stock holdings.

While the general findings seem similar to those obtained, eg by Bielecki et al (2022), for the euro area, a more detailed examination reveals important differences. As Poland differs from the euro area in the asset ownership structure, aggregate asset holdings and labour income distribution in the population, the distributional consequences of monetary policy differ as well. For instance, the outstanding stock of mortgage loans is lower and the related gains of young cohorts are smaller. This results in the overall welfare effect turning negative at a younger stage in life (in comparison with euro area households). Similarly, as both stock and bond holdings are smaller than in the euro area, gross gains (from stocks) and gross losses (from bonds) of older cohorts are smaller as well. So is their net loss, which is approximately twice as weak as in the euro area for the most affected cohorts.

It should be stressed that our findings are normative rather than positive. The mandate of policymakers is expressed in terms of aggregate variables and we do not discuss whether policymakers should take intergenerational distributional effects into account. This, however, would appear to be an interesting topic for future research.

1 The minimum eligible retirement age in Poland is 60 years old for women and 65 years old for men.

*****

The redistributive effects of monetary policy have recently become a focal point in macroeconomic research, particularly as the consequences of policy actions extend beyond aggregate outcomes to individual households. Traditional macroeconomic models, often based on representative agents, largely overlook how income sources, asset portfolios and household demographics can shape the impact of, and be affected by, monetary adjustments. This limitation has spurred a shift towards heterogeneous-agent models and overlapping generations frameworks, which incorporate household differences to better capture distributional effects.

One line of research explores income and wealth heterogeneity in the context of monetary policy transmission. Kaplan et al (2018) contribute to this field by examining how differentiated holdings of assets influence the transmission of monetary policy in a heterogeneous-agent New Keynesian (HANK) model. Auclert (2019) expands this perspective by identifying core channels of redistribution, emphasising in particular the role of unhedged interest rate exposure as a primary factor in redistribution.

Another key area within this literature involves the intergenerational effects of monetary policy, with life-cycle models shedding light on how policy impacts vary across age groups. Bielecki et al (2022) demonstrate that younger households in the euro area, often characterised by net borrowing and labour reliance, are affected differently by monetary adjustments than older, asset-rich cohorts. This research suggests that a monetary easing redistributes resources towards younger households by reducing debt burdens and enhancing labour market conditions.

Empirical studies provide further insight into redistributive outcomes. For instance, Adam and Zhu (2016) use Household Finance and Consumption Survey (HFCS) data to analyse household exposure to interest rate changes, finding that nominal asset holders, typically older cohorts, tend to lose wealth during monetary expansions due to inflation-induced devaluation. Similarly, Doepke and Schneider (2006) investigate the effects of inflation on wealth distribution in the United States, concluding that unexpected inflation transfers wealth from creditors to debtors, with younger, indebted households benefiting at the expense of older, wealthier ones. Recent studies also emphasise that the housing market is a significant redistributive channel. Jordà et al (2015) demonstrate that housing prices are highly sensitive to interest rate fluctuations, with expansions leading to housing booms that disproportionately benefit property owners.

The aforementioned studies concentrate on either the euro area or the United States. In this paper we provide a different perspective – of a relatively small economy which has been successfully catching up in terms of income with richer countries over the last 30 years. One consequence of this process is that the asset ownership structure, aggregate asset holdings and labour income distribution differ from those observed in the euro area or the United States. This provides a unique perspective on the distributional consequences of monetary policy in a catching up economy.

The rest of the paper is structured as follows. Section 2 briefly presents the model used in our analysis and its calibration. Section 3 shows our main findings and Section 4 concludes.

2. Model and calibration

To analyse the distributional effects of monetary policy, we use a New Keynesian model with overlapping generations of finitely lived households. Households face age-dependent mortality risk and have access to housing and two types of financial assets. As is standard in the Keynesian literature, nominal rigidities encompass both price and wage stickiness. The model economy is also populated by two types of producers, investment funds, as well as fiscal and monetary authorities. The problems that the agents solve are described below. While denoting prices, we employ the convention of using upper case for nominal values and lower case for their ratio to the aggregate price index P_t. Variables without time indices denote their non-stochastic steady state levels. The model is based on Bielecki et al (2022). In what follows we present the household problem where the two frameworks differ. The model frequency is annual.

2.1 Model overview

Each household consists of a single agent, who is assumed to enter the model at age 20 and is assigned an age index j = 1. The maximum lifespan of a household is 99 years (J = 80) and at each year the household faces age-dependent mortality risk ω_j. Thus, at each time period, there are 80 cohorts of overlapping generations, with their size denoted by N_j. Within a cohort, households differ only by the amount of labour supplied due to staggered wage contracts. However, we assume that idiosyncratic wage risk can be perfectly insured so that all other allocations chosen by agents in the same cohort are identical.

A j-aged household ι maximises its expected remaining lifetime utility that depends on consumption $c_{j,t}$, end-of-period housing stock $h_{j+1,t+1}$ and hours worked $l_{j,t}$ according to

$$U_{j,t}(\iota) = \mathrm{E}_t \sum_{s=0}^{J-j} \beta^s \frac{N_{j+s}}{N_j} \left[\begin{array}{c} \ln\left(c_{j+s,t+s} - \chi \bar{c}_{j+s,t+s-1}\right) + \\ \psi_{j+s} \ln h_{j+s+1,t+s+1} - \phi_{j+s} \dfrac{\ell_{j+s,t+s}(\iota)^{1+\varphi}}{1+\varphi} \end{array} \right] \quad (1)$$

where β is the subjective discount factor, the ratio N_{j+s}/N_j represents the probability of surviving for at least s more years, ψ_j and φ_j are the age-dependent parameters regulating preference for housing and leisure, ϕ is the inverse of the Frisch elasticity of labour supply, and χ controls the strength of external habits, expressed relative to average consumption of the same age group in the previous period.

Households face the following budget constraint

$$\begin{aligned} c_{j,t} + p_{h,t}[h_{j+1,t+1} - (1-\delta_h)h_{j,t}] + a_{j+1,t+1} = \\ = (1-\tau_t)\, w_t(\iota) z_j \ell_{j,t}(\iota) + \Xi_{j,t}(\iota) + (1-\tau)\, pen \cdot \mathbf{1}_{j \geq JR} + \frac{R^a_{j,t}}{\pi_t} a_{j,t} + beq_{j,t} + beq^h_{j,t} \end{aligned} \quad (2)$$

where P_t denotes the aggregate price level, $\pi_t \equiv P_t/P_{t-1}$ is (gross) inflation, $p_{h,t}$ denotes the real price of housing, δ_h is the housing depreciation rate, $a_{j,t}$ stands for the beginning of period t real stock of financial assets that are managed by investment funds and that yield the gross nominal rate of return $R_{j,t}{}^a$ (where the rate

of return is age-specific), τ_t is the proportional tax on labour income, w_t is the real wage per effective hour, z_j represents age-specific labour productivity, $beq_{j,t}$ and $beq_{j,t}^h$ denote, respectively, received bequests of financial and housing wealth, and $\Xi_{j,t}$ collects net real payments from the wage insurance scheme.

Our model features exogenous retirement upon reaching the age of 63 (JR = 44), and hence we set $z_j = 0$ for all $j \geq JR$. Retired agents receive uniform pension benefits, taxed at the constant steady state tax rate. Since most agents die before reaching the maximum age, they leave unintentional bequests in the form of financial assets and housing. Both are redistributed equally across all agents that are not retired in the form of lump-sum transfers so that $beq_{j,t} = beq_{j,t}^h = 0$ for $j \geq JR$.[2]

The pension benefits in turn depend on the average wage, scaled by an exogenous replacement rate ρ according to the formula

$$pen = \rho wl/(1 - N^{ret})$$

where $N^{ret} \equiv \sum_{j=JR}^{J} N_j \,/\, \sum_{j=1}^{J} N_j$ denotes the retired fraction of the population. The government budget constraint is closed with the labour income tax, which finances debt service (with a constant level of government debt) and government spending

$$b + \tau_t w_t \ell_t = (1 - \tau)\, pen \cdot N^{ret} + \frac{R_{t-1}}{\pi_t} b + g_y y_t$$

The remainder of the model is unchanged compared with Bielecki et al (2022).

2.2 Calibration

We calibrate the model at the annual frequency for Poland. To establish steady state ratios between aggregate variables, we rely on time series evidence between 2005 and 2023. Over this time period the housing valuation to GDP ratio averaged 1.9 and the total fixed assets (net of dwellings)-to-GDP ratio averaged 1.12. To calculate these ratios we rely on Eurostat data and Narodowy Bank Polski's estimates for house values in Łaszek (2024). The statistics for household-side nominal assets and liabilities are obtained from Eurostat's financial balance sheets data. The average household debt-to-GDP ratio is 0.31 and the average nominal assets to GDP equal 0.57. We also use national accounts statistics data to calculate the average investment (net of residential construction investment)-to-GDP ratio of 0.18 and the government spending-to-GDP ratio of 0.18.

Turning to the household sector, we model it as a stationary population structure. The mortality risk profile is based on the age-specific survival probability averages for the years 2014–23 (actual) and 2024–34 (projected) from the United Nations World Population Prospects (2024 revision). While our model, in principle, allows for trends in aggregate population size, the number of adults in Poland over these years is

[2] The upper age limit on receiving bequests is consistent with typical assumptions in the literature, see eg De Nardi and Yang (2014).

almost perfectly constant, which allows us to abstract from population growth entirely.

The age-dependent asset holdings and income profile are based on the Household Wealth and Debt Survey (Badanie Zasobności Gospodarstw Domowych) conducted in the years 2014 and 2016 by Narodowy Bank Polski in cooperation with Poland's Central Statistical Office, which were a part of the first two waves of the Household Finance and Consumption Survey (HFCS), see Grejcz and Żółkiewski (2017) and Bańbuła et al (2017). Unfortunately, the data for more recent years have not been collected. The profiles were subsequently adjusted for household size using an appropriate equivalence scale. While self-reported data on housing and mortgage loans are reasonably in line with the aggregate statistics, the Polish surveys suffer considerably from overall misreporting of financial asset holdings and under-sampling of high net worth individuals. Therefore, we decided to maintain the shape of the self-reported asset profiles by age while scaling them appropriately to bring them in line with the aggregate ratios discussed above. The resulting model-implied profiles are depicted in Graph 2.

The housing and leisure preference parameters are chosen to perfectly replicate steady state profiles of housing holdings and labour income. The pension replacement ratio reflects the average replacement ratio for pensions in Poland, according to Eurostat, for the last 14 years. The capital depreciation rate and elasticity of output with respect to capital are chosen to generate the observed capital-to-GDP and investment-to-GDP ratios, as well as the steady state real interest rate of 1.9%. The latter value is based on the average estimates from a Laubach-Williams style exercise for Poland for years 2005–23, using the method described in Bielecki et al (2024). Given this interest rate, the household discount factor is chosen to reflect the average net nominal assets-to-GDP ratio for Poland.

Calibrated parameters as functions of steady state targets

Table 1

Calibration targets			Corresponding parameters		
Target	Symbol	Value	Parameter	Symbol	Value
Housing to GDP	h/y	1.90			
Housing asset profile	hj	vector	Housing preference	ψj	vector
Capital to GDP	k/y	1.12	Capital depreciation rate	δ	0.161
Investment to GDP	i/y	0.18			
Real interest rate	r	0.019	Capital share in output	α	0.202
Net nominal assets to GDP	b/y	0.26	Discount factor	β	0.996
Government spending to GDP	g/y	0.18	Labour tax wedge	τ	0.392
Labour income profile	zj	vector	Leisure preference	φj	vector
Steady state profits	f	0	Fixed cost	Φ	0.200

The remaining parameters governing the out-of-steady-state dynamics of the economy are based on the DSGE model estimated for the Polish economy by Brzoza-Brzezina et al (2016), after applying the necessary adjustments for time frequency disparity. Finally, the price and wage Calvo probabilities are chosen in line with the

literature, which typically finds wages stickier than prices. This specific calibration also delivers almost identical peak responses of GDP and inflation to a monetary policy shock, in line with time-series model estimates by Ciżkowicz-Pękała et al (2023).

Calibrated exogenous parameters — Table 2

Parameter	Symbol	Value
Mortality risk	ωj	vector
Consumption habit	χ	0.744
Inverse of Frisch elasticity	ϕ	2
Pension replacement rate	ρ	0.6
Housing depreciation rate	δh	0.01
Investment adjustment cost	S1	4.14/4
Price markup	μ	1.2
Wage Calvo stickiness	θ_w	0.75^4
Gross inflation target	π^*	1.025
Taylor rule autoregression	γ_R	0.92^4
Taylor rule inflation weight	γ_π	2.01
Taylor rule GDP growth rate weight	γ_y	$0.095 \cdot 4$

3. Model simulations

Let us now use the model to discuss the distributional consequences of monetary policy across generations. To understand them better, we start by showing the impulse responses of key macroeconomic aggregates to an expansionary monetary policy shock. Then we show the distribution of assets, which is crucial to understand the impact of monetary policy on welfare. Finally, we present and explain the distributional consequences of the monetary expansion.

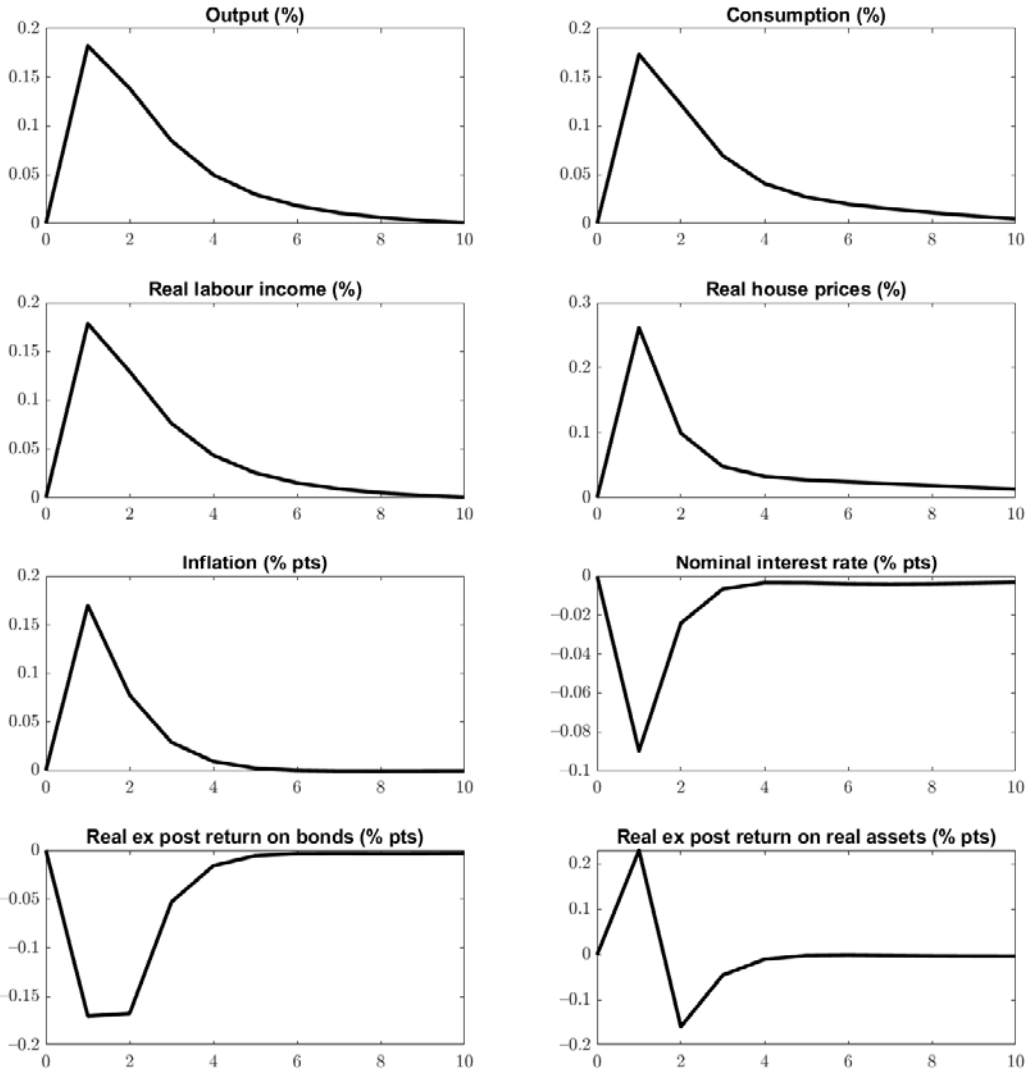
3.1 Aggregate effects

To evaluate the effects of monetary policy across the age distribution, two elements are required: the life-cycle profiles for income and asset positions and the reaction of macroeconomic aggregates to policy shocks. The latter are shown in Graph 1 in the form of impulse responses. Note that the frequency of our model is annual, and so is the scale on the horizontal axis. The vertical axis shows the reactions in percentage (or percentage point in the case of inflation and the interest rate) deviations from the steady state.

In line with empirical evidence (see eg Ciżkowicz-Pękała et al (2023)), a monetary expansion triggers a surge in aggregate output, which bolsters labour income and, consequently, allows for increased aggregate consumption spending. This leads to higher inflation, while the heightened demand for housing drives up real house prices. For the redistributive outcomes discussed later, it is crucial to highlight the differences in the reactions of returns on the two types of financial assets. The return

on real assets exhibits a strong positive response on impact, indicative of stock price appreciation, whereas the real ex post interest rate declines due to surprise inflation.

Impulse responses to an expansionary monetary policy shock Graph 1



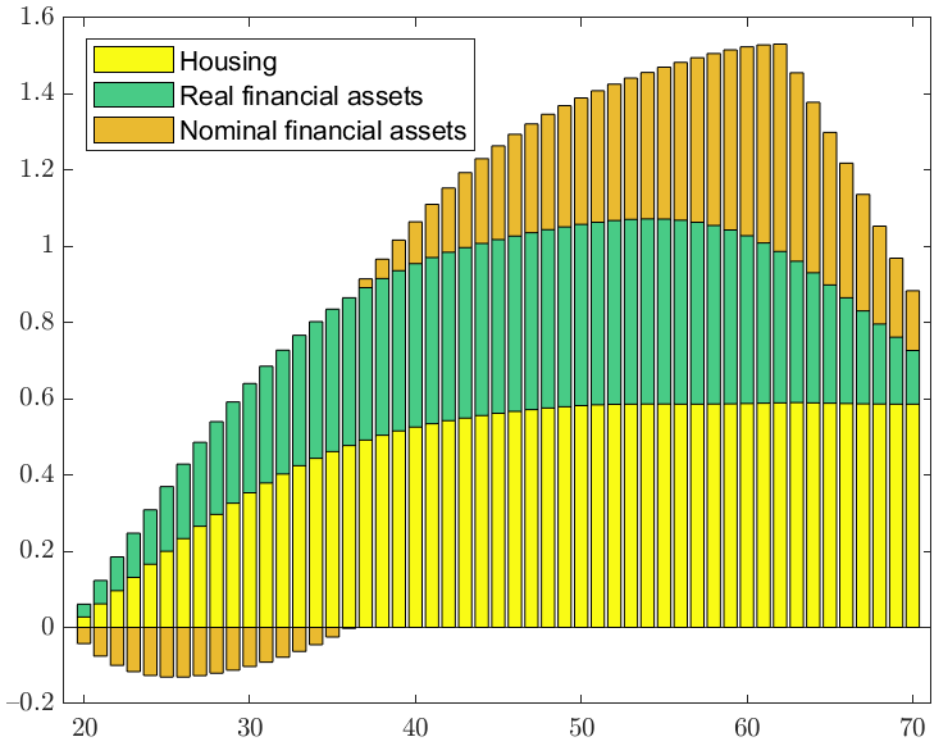
3.2 The impact on welfare

We now turn to the main topic of this paper, which is the redistributive effects of monetary policy across the age cohorts. To understand the effects associated with changes in asset prices described above, it is useful to recall their distribution over the life cycle. We summarise it in Graph 2: Polish households accumulate assets until their early 60s, and the decumulation process begins upon retirement. Young

households buy housing property, which they finance via mortgage loans – hence their negative position in net financial assets, which net out around the age of 35. After reaching the retirement age, agents start lowering their nominal assets. Real assets are accumulated steadily through the life cycle until the mid-50s. It should be noted that in the data these holdings refer not only to stocks, but also to direct firm ownership. Hence, it is not surprising that these assets are decumulated relatively quickly as agents retire and stop running their businesses. In contrast, the housing stock remains almost constant after the age of 50.

Age profiles of assets as implied by the model

Graph 2



The age profiles are expressed relative to the mean value of total assets for ages 20–70.

A natural measure that captures all aspects relevant to an individual household in our model is household welfare defined in equation (1) and in what follows we present our results in these terms. As shown by Bielecki et al (2022), the change in welfare that follows a monetary expansion can be decomposed into the effects of changes of prices and aggregate quantities that (following the monetary easing) affect the household budget constraint.

Graph 3 presents such a decomposition for cohorts aged 20 to 70. In order to render the results interpretable, we present them as equivalents of a given cohort single-period consumption in the steady state. The black line shows the total impact of our monetary policy shock on the welfare of each cohort. The bars denote the contribution of the components related to aggregate reactions. Let us discuss them in detail.

Welfare effects of monetary policy by cohort Graph 3

For each cohort, the welfare gain corresponds to the expected remaining lifetime and is expressed as a percentage of the single-period consumption in the steady state of this cohort.

Beginning with the total welfare impact, the picture shows that younger households (aged 40 or below) gain from the monetary easing, while older ones lose. Why is that? Let us move to the components.

We begin with the house price component due to its instructive potential. Note that, in spite of house price increases, the welfare effect is negative for all depicted cohorts. This is because wealth accumulation, rather than the level of assets, is crucial. Rising house prices benefit agents only if they are in the phase of reducing their housing stock. Since our youngest agents accumulate housing, their welfare diminishes with real house price increases due to higher costs for additional residential property purchases. Older households have an approximately constant housing stock and hence do not experience significant welfare effects of house price changes.

The second component pertains to changes in returns on nominal assets and is the most significant one. Its contribution is positive for young households (up to age 35) and negative thereafter. This pattern is linked to the decline in the ex post real

interest rate, particularly due to surprise inflation. The effect is positive for young (debtor) households and negative for older (creditor) households.

The next component involves the return on real assets, influenced by two opposing forces. Owners of real assets benefit from a high ex post rate of return on impact, mainly reflecting increased capital prices, as seen in Graph 1. However, households following their life-cycle pattern of real asset accumulation face higher costs for additional capital claims, reducing welfare. The net effect is negative for households aged fifty and below, with initial capital gains outweighing additional accumulation costs only after this age. The highest gains are for capital-rich households in their mid-sixties.

Turning to the labour income component, the narrative is straightforward: working-age households benefit from the macroeconomic expansion following the monetary easing, which boosts gross wages and allows for reduced labour income tax rates.

*****

How do our findings compare with the results obtained by Bielecki et al (2022) for the euro area? The general pattern seems to be the same: younger agents gain while older agents lose. However, a closer inspection reveals significant differences.

Poland has been catching up with rich countries over the last 30 years. While incomes have converged to a large extent (GDP per capita reached approximately 80% of the euro area average in 2024), the level of assets is converging at a much slower pace: assets are a stock variable and naturally take time to accumulate. Also, the prevalence of mortgage loans is smaller than in highly developed countries, probably due to a higher degree of financial exclusion. The age-specific distribution of labour productivity differs as well, as fast economic growth boosts the income of young agents compared with older cohorts.

As a consequence of lower loan penetration, the related gains of young cohorts are smaller and the overall welfare effect turns negative at a younger age. Similarly, as both stock and bond holdings are smaller than in the euro area, gross gains (from stocks) and gross losses (from bonds) of older cohorts are smaller as well. So is their net loss, which is approximately twice as weak as in the euro area for the most affected cohorts.

4. Conclusions

We investigate the intergenerational redistributive effects of monetary policy in Poland. To this end we use a calibrated life-cycle model with real and nominal frictions. The model is calibrated to match the main features of the Polish economy, including aggregate and, in particular, distributional variables.

We show that an expansionary monetary policy stance affects young and old households differently. The former gain due to higher inflation (which lowers the real value of their mortgage debt) and due to the economic boom which boosts their labour market income. Middle-aged households gain from higher labour market income, but lose from bond holdings, which they own in substantial amounts, and

which depreciate in real terms. Older, retired households gain from appreciating stock holdings but lose more on nominal assets.

Our general findings are similar to those obtained, eg by Bielecki et al (2022) for the euro area. However, a detailed examination reveals significant differences. Poland differs from the euro area in the asset ownership structure, aggregate asset holdings and labour income distribution in the population. As a consequence, the distributional consequences of monetary policy differ as well. For instance, mortgage loans are less popular, and consequently the related gains of young cohorts are smaller. Stock and bond holdings of older agents are smaller than those of their peers in the euro area and so gains from stocks and losses from bonds of older cohorts are smaller as well. The total welfare effect is approximately twice as weak as in the euro area for most cohorts.

References

Adam, K and J Zhu (2016): "Price-level changes and the redistribution of nominal wealth across the euro area", *Journal of the European Economic Association*, vol 14, no 4, pp 871–906.

Auclert, A (2019): "Monetary policy and the redistribution channel", *American Economic Review*, vol 109, no 6, pp 2333–67.

Bańbuła, P, K Grejcz, J Jabłonowski, J Przeworska and Z Żółkiewski (2017): *Zasobność gospodarstw domowych w Polsce. Raport z badania 2016 r*, Economic Analysis Department and Financial Stability Department Report 2017, Narodowy Bank Polski.

Bielecki, M, M Brzoza-Brzezina and M Kolasa (2022): "Intergenerational redistributive effects of monetary policy", *Journal of the European Economic Association*, vol 20, no 2, pp 549–80.

Bielecki, M, M Brzoza-Brzezina, A Błażejowska, K Kuziemska-Pawlak and G Szafrański (2024): "Estimates and projections of the natural rate of interest for Poland and the euro area", *Gospodarka Narodowa. The Polish Journal of Economics*, vol 319, no 3, pp 1–32.

Brzoza-Brzezina, M, M Kolasa and M Szetela (2016): "Is Poland at risk of the zero lower bound?", *Bank i Kredyt*, vol 47, no 3, pp 195–226.

Ciżkowicz-Pękała, M, A Kocięcki, T Łyziak, M Pipień and E Stanisławska (2023): "Monetary policy transmission mechanism in Poland: what do we know in 2023?", *NBP Working Papers*, no 365.

De Nardi, M and F Yang (2014): "Bequests and heterogeneity in retirement wealth", *European Economic Review*, vol 72, pp 182–96.

Doepke, M and M Schneider (2006): "Inflation and the redistribution of nominal wealth", *Journal of Political Economy*, vol 114, no 6, pp 1069–97.

Grejcz, K and Z Żółkiewski (2017): "Household wealth in Poland: the results of a new survey of household finance", *Bank i Kredyt*, vol 48, no 3, pp 295–326.

Jordà, Ò, M Schularick and A Taylor (2015): "Betting the house", *Journal of International Economics*, vol 96, no S1, pp 2–18.

Kaplan, G, B Moll and G Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743.

Łaszek, J (2024): *Raport o sytuacji na rynku nieruchomości mieszkaniowych i komercyjnych w Polsce w 2023 r*, Financial Stability Department Report 2024, Narodowy Bank Polski.

Household and firm-level heterogeneity in monetary policy: the case of Saudi Arabia

Saudi Central Bank

Introduction

The Saudi economy is fiscally led, with its performance historically closely linked to oil market developments. These dynamics have shaped the behaviour of households and firms, reflecting the central role of fiscal policy in the economy. While traditional monetary policy transmission channels influence consumption, investment and financial conditions, their overall effectiveness remains moderated by public initiatives and fiscal expenditure. This underscores the ongoing role of government measures in supporting economic reforms and diversification efforts through Vision 2030 programmes.

Saudi Arabia's economy is undergoing a substantial transformation, with emphasis on diversification and growth in non-oil sectors. Traditionally reliant on high public sector employment and government subsidies, households are now navigating a dynamic financial landscape marked by increased access to consumer credit, home ownership programmes and policies aimed at diversifying fiscal revenues. Concurrently, government initiatives such as the Kafalah programme are being designed to support the private sector, particularly small and medium-sized enterprises (SMEs), by facilitating credit access and reducing their vulnerability to interest rate fluctuations.

The Saudi Central Bank's (SAMA's) monetary framework is anchored in the fixed exchange rate regime, which has been maintained since 1986. This regime has demonstrated resilience through periods of global and domestic economic turbulence. It has ensured monetary and financial stability and continues to play a critical role in safeguarding economic stability.

Monetary policy transmission channels

Monetary policy transmission channels, the mechanisms through which adjustments in a central bank's monetary policy impact the broader economy, serve as the critical link between monetary policy decisions and real economic outcomes for households, businesses and financial markets. It is widely recognised that the effectiveness of transmission channels varies across economies, influenced by structural factors, the development of the financial markets and the underlying monetary policy framework (Svensson (2013)).

In Saudi Arabia, monetary policy transmission channels are shaped by the characteristics of its economic and financial system. Understanding the relative strengths and limitations of these channels is vital for designing policies tailored to

Saudi Arabia's distinct economic environment. SAMA's monetary policy is centred around the fixed exchange rate regime, which requires alignment with the anchor currency's policy rate. This alignment limits flexibility for using the policy rate as a tool and means that liquidity management plays a significant role in influencing monetary conditions. As such, fiscal policy assumes a central role in steering economic activity.

Interest rate channel

The interest rate channel is widely regarded as a crucial Keynesian transmission mechanism, whereby changes in policy rates influence bank lending and deposit rates, ultimately affecting output and savings decisions (Al-Jasser (2008), Cevik and Teksoz (2013)). In Saudi Arabia, however, the effectiveness of the interest rate channel is influenced by several factors. Within the context of households, government-supported financing programmes reduce the sensitivity of borrowing costs to policy rate changes.

Conversely, private sector firms are more influenced by policy rate changes, as their borrowing costs are often tied to market rates. Empirical evidence suggests that the pass-through effect of policy rate changes in Saudi Arabia is limited (IMF (2022)). This is attributed to the role of countercyclical fiscal policy, which offsets economic fluctuations and plays a key role in supporting aggregate demand and economic activity, while the central bank's policies are designed to maintain monetary and financial stability to ensure sustainable economic growth.

Credit channel

The credit channel, the mechanism through which monetary policy influences the availability of credit within the economy, operates through two primary subchannels:

- The bank lending channel: this channel reflects how monetary policy impacts the capacity of banks to provide loans to firms and households.
- The balance sheet channel: this channel functions by influencing firms' borrowing capacity in response to changes in their net worth caused by monetary policy adjustments.

In Saudi Arabia, the credit channel is particularly significant due to the dominance of banks in the provision of credit. As interest rates change, banks will typically adjust loan prices accordingly. Government-led initiatives, such as the Kafalah programme, have improved access to credit for SMEs. The availability of credit is further shaped by the role of specialised credit institutions, which contribute to financing priority sectors and advancing economic diversification.

Asset price/wealth channel

The asset price/wealth channel functions through the impact of monetary policy on asset prices, including real estate, equities and bonds. When the central bank reduces interest rates, asset prices typically rise, resulting in an increase in household wealth. This wealth effect boosts consumer spending, as individuals feel more confident about their financial stability.

In Saudi Arabia, the effectiveness of this channel is moderated by government initiatives, such as housing programmes that provide mortgage subsidies. In recent years, however, this channel has become more prominent as real estate ownership levels have grown along with rising prices, thus benefiting property owners. Asset prices in Saudi Arabia have historically been characterised by a stronger relationship with developments in oil markets and fluctuations in public spending. Periods of elevated oil income often result in liquidity surges, leading to increased investments in domestic assets. This dynamic tends to drive up equity and real estate prices, alongside higher levels of consumption. Heightened public expenditure also overshadows the impact of interest rates, boosting aggregate demand and improving investment sentiment (Abdou et al (2024)).

Exchange rate channel

The exchange rate channel plays a major role in open economies, where currency fluctuations can significantly affect trade and inflation. The effectiveness of this channel is influenced by a country's exchange rate regime, the degree of exchange rate pass-through to prices, and the extent of economic openness to international markets.

Saudi Arabia's fixed exchange rate regime serves as a cornerstone of macroeconomic stability and long-term economic planning. Anchoring the exchange rate to the US dollar minimises the impact of exchange rate volatility, fostering stable trade conditions in an open economy where imports of goods and services averaged 28.5% of GDP between 2000 and 2023. Empirical evidence affirms that the exchange rate regime has limited the impact of external inflationary pressures on the economy (Fareed et al (2023)). As such, inflation in Saudi Arabia has averaged around 2% over more than two decades, which compares favourably against inflation levels witnessed in several emerging market economies.[1]

The role of household heterogeneity in monetary policy transmission

Households in Saudi Arabia exhibit notable heterogeneities in their responsiveness to monetary policy adjustments, driven by disparities in inflation exposure, credit access and financial literacy. While credit availability plays a pivotal role in influencing household consumption and investment behaviour, the deposit structure of the banking system reflects a sizeable share of non-remunerative deposits. This acts to dampen the monetary transmission mechanism by reducing banks' sensitivity to policy rate changes. Additionally, fiscal policy, particularly government expenditure, exerts a relatively stronger impact on inflation dynamics by influencing domestic aggregate demand within the Saudi economy, reflecting the key role of public expenditures, whereas the fixed exchange rate moderates the transmission of imported inflation.

[1] Source: IMF data portal for average consumer prices, including G20 emerging market economies.

Moreover, financial inclusion and literacy remain essential for enhancing households' capacity to respond to changes in credit conditions. Recent improvements in access to financial services, primarily via digitalisation, public awareness campaigns and provision of savings products, may have increased households' sensitivity to changes in interest rates. Further analysis of households' heterogeneities is necessary to optimise the efficacy of monetary policy tools for the economy, where fiscal policy often dominates macroeconomic conditions.

Income distribution

Income disparities significantly influence household heterogeneity in monetary policy transmission. Different household segments may not benefit uniformly from rising asset valuations. Geographic disparities further exacerbate these dynamics. Urban households, particularly in major cities, tend to have better access to financial services compared to rural households. Moreover, urban populations are generally more financially aware and sophisticated, enabling them to respond to interest rate conditions. Financial literacy levels vary, with less financially literate households exhibiting weaker responsiveness to changes in interest rates and credit conditions.

Addressing these disparities requires targeted programmes, such as financial education initiatives, to enhance the inclusivity and overall effectiveness of monetary policy. Saudi Vision 2030 programmes include concerted efforts to address these gaps by promoting financial inclusion and enhancing access to formal financial services.

The composition of household income in Saudi Arabia also influences the transmission of monetary policy. Reliance on stable income stabilises consumption, whereas reliance on investment returns or business revenues, which are more sensitive to economic cycles, could leave households more vulnerable to cost of living adjustments.

Labour market dynamics further compound these effects. As of the second quarter of 2024, 66% of the workforce in Saudi Arabia was employed in the private sector, compared to just 19% in the public sector, while the remaining workers are classified as "others".[2] Notably, expatriates comprise 79% of private sector employees, potentially dampening the impact of monetary policy on aggregate demand due to lower remittance retention (NLO (2024)). Among Saudi nationals, however, 49.1% are employed in the public sector, where greater job stability provides increased financial security.

Household spending and consumption

The close alignment between income and consumption levels indicates that a significant share of household spending in Saudi Arabia is directed towards consumption. Furthermore, stable inflation supports the purchasing power of households, while high inflation risks eroding it. Given that Saudi Arabia operates as an open economy under a fixed exchange rate regime, household consumption is

[2] Source: General Authority for Statistics (2024). Other sectors include non-profit organisations, domestic workers, regional and international organisations.

indirectly affected by external factors such as imported inflation, which is mitigated to a large degree by the fixed exchange rate policy.

Cultural and demographic factors such as age, family size and regional disparities further influence household financial behaviour in Saudi Arabia. Moreover, younger households and larger families tend to save less, prioritising consumption due to higher dependency ratios, while households in urban areas generally exhibit higher savings due to greater financial literacy and better access to financial services (Alsedrah (2024)).

Initiatives such as expanding access to savings products and encouraging private savings vehicles aim to build a more robust and resilient saving culture across all households.

Household debt levels

Inflation expectations and credit access influence household borrowing decisions, particularly in anticipation of price increases. However, improved availability of granular data in Saudi Arabia is needed in order to enable a more accurate assessment of household heterogeneity in borrowing behaviour, particularly the relationship between inflation expectations and credit access, and its impact on monetary policy transmission.

Household wealth

The composition of household wealth affects the transmission of monetary policy. Housing represents an important component of household wealth in Saudi Arabia, shaped by cultural priorities and government policy initiatives. The Housing Program launched in 2018 aims to expand home ownership through public-private partnerships and streamline access to housing through affordable financing options. These measures have enabled greater household access to the housing market, which has enhanced wealth accumulation through real estate and will foster a more stable asset base in the future.

Certain household segments are more likely to diversify their portfolios through financial assets, whereas other segments often rely on informal saving mechanisms. This disparity underscores the critical role of financial literacy in saving behaviour and household wealth, and their variation across different household segments.

The role of firm-level heterogeneity in monetary policy transmission

Firm-level heterogeneity plays a pivotal role in the transmission of monetary policy, as firms' responses to interest rate changes are shaped by their size and sectoral composition. In Saudi Arabia, SMEs face relatively higher borrowing costs and limited access to credit markets compared to larger firms.

Sectors such as manufacturing and tourism tend to exhibit higher sensitivity to credit availability and interest rate adjustments due to their reliance on bank lending, cyclical demand conditions and broader economic activity. On the other hand, firms in sectors heavily reliant on government spending, including construction and renewable energy, experience weak transmission of monetary policy due to their dependence on public expenditures.

Empirical studies have found that firm-specific characteristics, including age, size and sectoral affiliation, determine their vulnerability to monetary policy adjustments. Younger and smaller firms are asymmetrically affected by interest rate hikes, reflecting their reliance on limited funding sources. In contrast, larger, well established firms benefit from economies of scale and superior access to credit, with diverse funding sources. Furthermore, high-growth firms often bypass traditional credit markets, relying on alternative financing mechanisms and thereby reducing the risk of interest rate shocks (Thurwachter (2022)).

Measures to address heterogeneity

Owing to the role of fiscal policy, the Saudi government has implemented a range of targeted initiatives to address economic heterogeneity. Programmes such as the Beneficiaries of Social Welfare Program provide financial assistance to individuals and families in need, ensuring access to basic necessities and promoting social welfare. The Hafiz Program delivers financial support and training to unemployed Saudis, enhancing employability and fostering workforce participation. Similarly, the SANED Program, an unemployment insurance scheme, mitigates income shocks by offering temporary financial assistance and facilitating re-employment opportunities. Moreover, to alleviate the financial burden on certain household segments, the Citizen's Account Program safeguards Saudi households from the adverse impact of economic reforms by offsetting the cost of living through targeted cash transfers. Collectively, these programmes aim to narrow economic disparities and enhance support for low-income households.

Meanwhile, SAMA promotes savings and financial literacy through targeted campaigns and strategic partnerships with financial institutions. Efforts to improve access to financial services include the promotion of digital payments, the expansion of digital banking, and initiatives to foster financial awareness. To ensure sustainable household borrowing, SAMA actively monitors debt levels and has established clear guidelines for responsible lending, which were introduced in 2018. Moreover, government-backed initiatives have played a pivotal role in reducing the adverse impact of interest rate fluctuations on SMEs.

Through these coordinated measures, SAMA and the government aim to address financial inequalities, promote inclusive credit access and strengthen financial stability.

Conclusion

In Saudi Arabia, interest rate transmission to the real economy remains limited, largely due to structural factors. In contrast, the exchange rate channel has proven effective in restraining inflation and there is a measurable pass-through from the credit channel to the real economy. Fiscal policy plays a dominant role in driving economic activity, supported by ongoing economic reforms.

Heterogeneity across households and firms is often overlooked in monetary policy decision-making, despite its growing importance in understanding the differentiated impacts of policy measures across economic segments. More granular data that capture such heterogeneities would help in developing economic policies that better address the diverse behaviour of economic agents.

References

Abdou, H, A Elamer, M Abedin and B Ibrahim (2024): "The impact of oil and global markets on Saudi stock market predictability: a machine learning approach", *Energy Economics*, vol 132, April, 107416.

Al-Jasser, M (2008): "Monetary policy transmission mechanism in Saudi Arabia", in "Transmission mechanisms for monetary policy in emerging market economies", *BIS Papers*, no 35, January.

Alsedrah, I (2024): "Determinants of the personal savings rate in the Kingdom of Saudi Arabia using time savings deposits, 2012–2022", *Heliyon*, vol 10, no 3, February.

Capital Market Authority (2024): *Statistical Bulletin Q2 2024*.

Cevik, S and K Teksoz (2013): "Lost in transmission? The effectiveness of monetary policy transmission channels in the GCC countries", *Middle East Development Journal*, vol 5, no 3, January, 1350018.

Fareed, F, A Rezghi and C Sandoz (2023): "Inflation dynamics in the Gulf Cooperation Council (GCC): what is the role of external factors?", *IMF Working Papers*, no 23/263, December.

General Authority for Statistics (2024): *Labor Force*.

IMF (2022): "Saudi Arabia: selected issues", *Country Reports*, no 2022/275, August.

Svensson, E (2013): "Regional effects of monetary policy in Sweden", *Working Papers*, no 2012:9, Lund University, School of Economics and Management, Department of Economics.

The role of household and firm heterogeneity in the South African Reserve Bank's monetary policy deliberations

South African Reserve Bank

1. Monetary policy transmission channels

The various channels of monetary policy transmission all seem to be active and relatively strong in South Africa. These channels are: savings-investment; cash-flow; balance sheet; bank lending; exchange rate; expectations. It is difficult to say whether activities or pricing decisions are more affected.

Households especially, but also firms, typically borrow at floating rates linked to the policy rate, chiefly for mortgages and vehicle loans. Pass-through is therefore rapid and complete, for both household and corporate borrowing.

On the balance sheet channel, South African households mostly save contractually, with pension savings then inaccessible until retirement (although this relationship has loosened recently, with the adoption of the Two-Pot system in late 2024). This arrangement may weaken households' willingness to raise consumption in response to wealth gains affecting these savings, given that this wealth is relatively inaccessible.

The exchange rate channel is significant, although since the introduction of inflation targeting pass-through from exchange rate movements to inflation appears to have declined to low levels (below 0.2)(Kabundi and Mbelu 2016; Miyajima 2019). This may reflect better anchoring of inflation expectations to the target (discussed further below). It is also worth noting that savings-investment imbalances, especially for a low-saving economy like South Africa, will tend to manifest in current account strain that prompts rand weakness (an example is the 2013 taper tantrum). Strictly speaking, this is a saving-investment problem, but inflation manifests through an exchange rate channel.

Regarding output and the exchange rate, exports have not been responsive to a relatively weak rand over an extended period (most of the time since about 2014). This may reflect a shared cause, where exchange rate weakness is caused by other growth-negative factors. For instance, "state capture" phenomena such as the "Nenegate" crisis, when the finance minister was abruptly removed, caused rand depreciation and simultaneously depressed household and consumer confidence.

Inflation expectations have become an important intermediate target for monetary policy. The South African Reserve Bank (SARB) has sponsored a comprehensive survey of inflation expectations for more than two decades (Reid, von Fintel, and Foresto 2024). This valuable data source shows how expectations have become more centred on the target, over time, with the distribution of expectations

also narrowing. Expectations unfortunately still show a significant backward-looking component.

2. Role of household heterogeneity

The SARB has studied household heterogeneity in some depth, although this work is not revisited routinely at Monetary Policy Committee (MPC) meetings.

South Africa is marked by high levels of inequality. This has several consequences for monetary policy transmission and for understanding inflation:

- While South Africans across the income spectrum use debt, it is only relatively rich South Africans – those in the upper two deciles of the income distribution – whose debt tracks the policy rate closely. This is because these groups account for almost all mortgage, vehicle and credit card lending. Poorer South Africans are much less exposed, at least directly, to changes in the policy rate. (By contrast, poorer South Africans are highly exposed to inflation.)
- South Africa's economy has been relatively skill-intensive, and skills shortages have constrained growth. In understanding employment dynamics, it is therefore often useful to compare employment rates for skilled, semi-skilled and unskilled workers separately. These metrics are tracked routinely by the statistics department.
- The consumer price index uses "plutocratic" rather than "democratic" weights, and the basket it tracks therefore reflects the consumption patterns of a relatively rich household (around the 95th percentile of the income distribution).

The data on household debt patterns are incomplete. The National Credit Regulator data do not capture unregistered credit providers. They are also reported using nominal income brackets that have not been updated for many years. Given inflation, this means the brackets no longer correspond to the income groups they were originally chosen to distinguish. The NIDS database provides better insights into household finances, but the survey is not conducted regularly (the last one was undertaken in 2020). There is no Public Credit Register, although the various relevant regulators have signed a memorandum of understanding to establish one (International Monetary Fund. Monetary and Capital Markets Department 2022).

3. Role of non-financial firm heterogeneity

Heterogeneity of non-financial firms is not a subject that receives significant attention in monetary policy setting.

South Africa is remarkable for its relatively low degree of business informality for its income level (Asmal et al. 2024). Although this has some disadvantages, it also means a relatively large proportion of businesses are part of the formal sector and participate in the financial system. This tightens connections to monetary policy.

As the National Treasury has argued in a recent review, the desirable direction of financial development is to move beyond a system where almost everyone has a bank account, and where unsecured credit is widely available, mainly to support consumption, to a system where the financial system helps build and protect wealth (National Department of Treasury. Republic of South Africa 2023). For instance, credit is more readily available to private individuals than to small businesses, and entrepreneurs must sometimes rely on personal loans to finance their enterprises. (South Africans also tend to underinvest in insurance that would protect assets, although funeral insurance is widespread.) These are not monetary policy concerns, in the narrow sense.

4. Heterogeneity and monetary policy decisions

The SARB's models, used to advise the MPC, do not capture heterogeneity in firms and households.

Surveys, such as our survey of inflation expectations, capture different social groups (such as trade unions, households and businesses) but do not reflect more fine-grained distinctions.

Heterogeneity analysis has not been influential in individual monetary policy decisions.

Senior policymakers, such as the Governor, have given speeches centred on heterogeneity subjects, such as the relationship between inequality and monetary policy (See links in the next section). Heterogeneity rarely features in MPC statements or the biannual *Monetary Policy Reviews*.

5. Distributional effects of monetary policy

Monetary policymakers have been at pains to communicate that inflation hurts the poorest South Africans especially, and that an inflation-fighting monetary policy is therefore pro-poor.

It is difficult to say whether distributional effects or transmission effects of heterogeneity have received more emphasis. The two themes have often been interwoven.

The central bank's mandates do not explicitly incorporate distributional effects. The constitutional mandate obliges the SARB to protect the value of the currency in the interests of balanced and sustainable growth. "Balanced" growth could, arguably, include considerations of distribution. That said, the SARB has given effect to its constitutional mandate using a flexible inflation targeting framework, which simplifies decision-making into a relatively straightforward Taylor rule-type decision-making system. The SARB has argued that delivering on its inflation target, over time, is necessary but not sufficient for achieving balanced and sustainable growth, and other policy areas must also contribute to achieve economic flourishing. As noted above,

the SARB has also emphasised that low inflation has benefits for poorer South Africans.

The themes raised above have been communicated publicly in speeches and research pieces. (Kganyago 2018, 2024; Loewald & Makrelov 2020; Singh & Fowkes 2019)

6. Measures to address heterogeneity

We have not identified monetary policy tools that address heterogeneity. South African monetary policy is made using a conventional short-term interest rate tool to deliver on an inflation target (in a flexible way). However, the SARB has attempted to apply a layered communication strategy to reach different stakeholders, for instance through "Talk to the SARB" forums throughout the country and through social media postings, with mixed success. To the extent that monetary policy communication affects inflation expectations, these communications can also be thought of as a monetary policy tool.

Since the Covid-19 pandemic, with the support of the SARB the National Treasury has deployed a series of loan guarantee schemes (LGS). These were aimed, variously, at supporting businesses through the pandemic; helping rebuild after Covid (and after the Kwazulu-Natal civil unrest of 2021); and in encouraging solar power generation to mitigate electricity shortages. However, these schemes had low uptake; there was also declining uptake over each new LGS iteration. This may point to failures in scheme design, insufficient risk appetite from the fiscal authority or an incorrect diagnosis of market failures (so that private markets successfully met needs without government intervention). Given these failings, LGS initiatives are unlikely to become a fixture of the policy landscape.

References

Asmal, Z., Haroon B., Lochmann A., Martin L., and Shah K. (2024). 'Supply-Side Economics of a Good Type: Supporting and Expanding South Africa's Informal Economy', *Development Policy Research Unit. University of Cape Town*.

International Monetary Fund. Monetary and Capital Markets Department. (2022). 'South Africa: Financial Sector Assessment Program-Technical Note on Banking Regulation and Supervision'.

Loewald, C. and Makrelov, K. (2020). 'The impact of inflation on the poor'.

Kabundi, A., and Mbelu. A., (2016). 'South African Reserve Bank Working Paper Series: Has the Exchange Rate Pass - Through changed in South Africa?'.

Kganyago, L., (2018). 'Inequality and Monetary Policy in South Africa'. 2018.

Kganyago, L., (2024). 'Monetary Policy and Inequality: The Post Pandemic Experience'.

Singh, K. and Fowkes, D. (2019). Monetary policy and borrowing costs for different household income groups'.

Miyajima, K. (2019). 'IMF Working Paper: Exchange Rate Volatility and Pass-Through to Inflation in South Africa'.

National Department of Treasury. Republic of South Africa. 2023. 'Inclusive Financial Sector for All'.

Reid, M., von Fintel, D., and Foresto, A., (2024). 'South African Reserve Bank Working Paper Series: From deliberate sample to representative sample: pilot study for the BER inflation expectations survey'.

Monetary policy and household heterogeneity

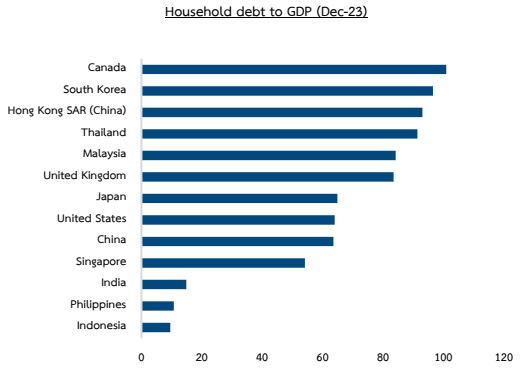
Bank of Thailand

Introduction

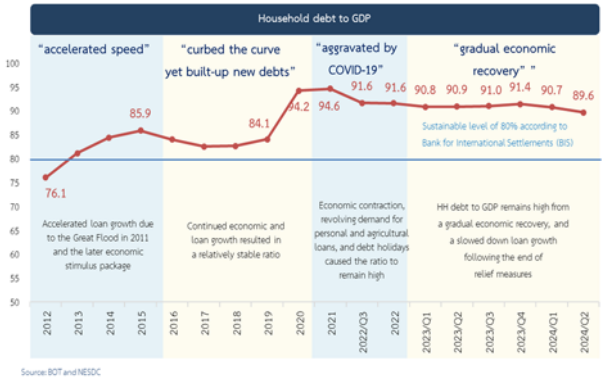
While the Monetary Policy Committee (MPC) has no mandate to address inequality directly, the Bank of Thailand has long used heterogeneity data to supplement decision-making. We view the issue of heterogeneity through the lens of financial stability, ensuring that potential imbalances do not abruptly affect the real economic outlook in both the short and medium terms. In addition, we want to make sure that our analyses are inclusive and comprehensive, as well as representative of the entire economy.

We understand that in some circumstances, vulnerable households and firms can trigger large cascading effects on the aggregate economy through financial linkages with other economic agents. It is therefore imperative to identify and monitor vulnerable populations and limit the possible expansion of these fragile groups at an early stage. These potential onsets of financial stability issues can be tackled using the policy interest rate and other targeted financial measures.

Graph 1a: Cross-country household debt-to-GDP ratio comparison



Graph 1b: Thailand's household debt-to-GDP ratio over time



Using the household debt-to-GDP ratio as a metric reveals that Thailand is one of the more indebted countries in the world. The government's stimulative measures in the early 2010s following the Great Flood in 2011 caused an acceleration in household debt. The substantial incentives to buy a first car and a first home pushed the household debt-to-GDP ratio surpassed 80% in 2013. After a brief period of a relatively stable ratio, the Thai household sector was hard hit by the onset of the COVID-19 pandemic. Higher levels of debt combined with lower incomes led to an all-time-high household debt-to-GDP ratio of almost 95% in 2021. Not only is the aggregate number already quite high, composition of the debt itself is problematic,

with a higher proportion of credit cards and personal loans for consumption in Thailand than in peer countries. MPC members have been very concerned about this issue, particularly its effects on financial stability and long-term growth. They have communicated a strong desire to bring down this ratio through an orderly debt deleveraging process.

Against this backdrop, this note aims to describe the usage of household heterogeneity data in the monetary policy decision-making process. The next section lays the groundwork by describing the sources of data and the different dimensions we can evaluate using them. The section following examines how the balance sheet of vulnerable households and their financial conditions weaved its way into monetary policy deliberations in 2024. The next sections continue with discussions of other financial measures being rolled out to target these vulnerable households and conclude with our final thoughts.

Sources of granular household data

Surveys

Our main sources of granular data for households are a few key surveys. The most important is the household socio-economic survey from the National Statistical Office. The survey contains results of in-depth interviews with roughly 60,000 households annually across all geographic regions. The first survey was done in 1957; however, the survey was not conducted at an annual frequency until 2006. Even with just the annual frequency, this is one of the older heterogeneous data sets available. The content of the survey focuses on the balance sheets of households. This is the only data source with access to both the asset and liabilities of households, as well as incomes broken down by sources, and expenditures broken down into categories.

However, socio-economic survey has many limitations. First, the level of detail of the survey comes at the cost of its lower frequency. While the survey is useful for looking at long-term trends, it is not sufficiently up to date for us to make reactive policy decisions based on the latest data points. Second, we know from cross-checking with other surveys and administrative data that this data set is biased and skewed toward lower income households. While this is not ideal and makes it harder to generalise any result and analysis onto the entire population, it does allow us to do in-depth studies on one key target group: vulnerable low-income households.

In addition to the socio-economic survey, we use other surveys regularly to assess different aspects of household heterogeneity. The National Statistical Office's labor force survey allows us a quarterly look at sectoral employment and salaries. In addition, we can judge consumer confidence from the monthly Consumer Confidence Index (produced by the Ministry of Commerce) and the monthly Relationship Manager Sentiment Index (managed by the Bank of Thailand). The former is based on direct consumer surveys, while the latter uses the opinions of bank relationship managers from the two most important state-owned specialised financial

institutions.[1] These two data sets allow us to look at sentiment across income levels and professions.

Administrative data

As the regulator for financial institutions, we receive an array of data from these institutions at different frequencies across many dimensions, many of which are useful to monitor household heterogeneity. On the asset side, we can track the monthly changes in aggregated number of accounts and deposits outstanding for different brackets of deposit amounts. On the liabilities side, we have ready access to credit data with different dimensions .

Not all financial institutions are under the purview of the Bank of Thailand. Therefore, we also coordinate with the National Credit Bureau to get a fuller picture of household credit. Credit growth and credit quality are two regularly used metrics to monitor financial conditions across different loan types and incomes.

The situation in 2024

Questions that we want to answer

In the context of 2024, Thailand just finished its policy normalisation in the third quarter of 2023. The economy's recovery trajectory was flatter than past recessions and seemed to have settled at growth rates below those before COVID-19. As mentioned in the introduction, the household debt-to-GDP ratio is starting to decline but has remained very elevated. Discussion in 2024 MPC meetings centred on (i) setting the policy interest rate not too low to avoid creating incentives for unhealthy debt creations and disrupting debt deleveraging and (2) subsequently lowering the interest rate to recalibrate the policy stance. This recalibration is needed for the monetary policy stance to remain neutral; given tightened credit conditions, the macroprudential costs of reducing the policy rate is now lower.

In terms of household heterogeneity, MPC's focus was on the delicate act of keeping a healthy deleveraging process going. Vulnerable groups were mentioned often, with questions such as (i) who they are and are they expanding, (ii) how much the higher rate resulting from policy rate normalisation meaningfully alters the fragile state of their balance sheets, (iii) whether their financial conditions have deteriorated further, and (iv) how monetary policy and other measures should be integrated to shore up their balance sheets and alleviate their financial conditions.

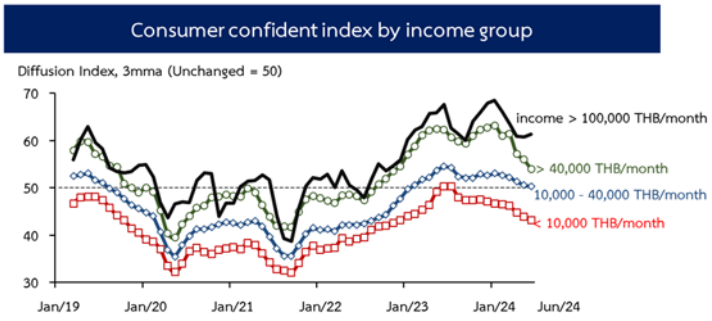
The evidence

We show the evidence surrounding the issue of vulnerable households in 2024. First, we gauged the sentiment of different income groups through the Consumer

[1] Government Savings Bank and Bank for Agriculture and Agricultural Cooperatives.

Confidence Index. With the diffusion index, any value above 50 represents positive sentiment. Graph 2 shows that (i) higher income households are typically more confident of the economy; (ii) the COVID-19 shock decreased confidence across all income spectrums; (iii) confidence rose between mid-2021 during the last major lockdown and 2023; and (iv) there is a downward trend in 2024. The downward trend is more concerning for the lowest income group, as it represents many consecutive months of negative confidence with values below 50.

Consumer Confidence Index — Graph 2



Note: Data is based on a 3-month moving average (3mma). A level of 50 or above indicates positive consumer confidence in the economic condition

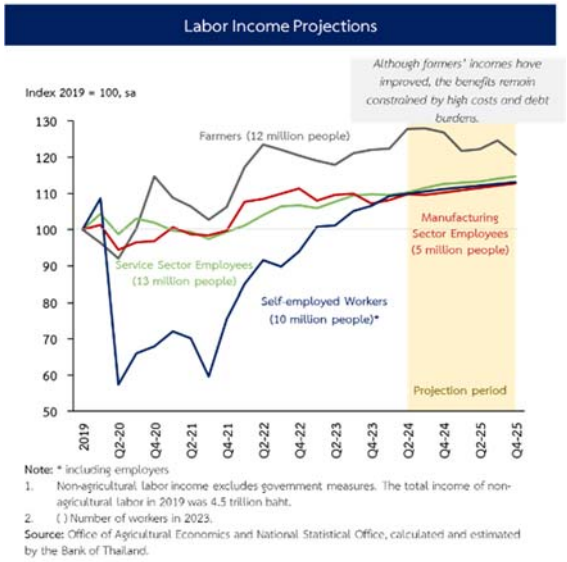
Source: Ministry of Commerce, BOT calculations

Graph 3 shows the income recovery path for different professions. In the second quarter of 2020, income fell in all sectors following the first lockdown. Social distancing was largely not an issue for workers in the agricultural sector, whose incomes rebounded quickly and remain elevated compared to other groups. Workers in the services and manufacturing sectors may have had their hours worked fall or become temporarily laid off, but the index never dipped much below 100. In contrast, self-employed individuals were hit hard. Day labourers, taxi drivers and delivery drivers were the most affected by lockdowns as they have no stable income to fall back on. While the index started to catch up with workers in the services and manufacturing sectors in 2024, these self-employed individuals never made up lost ground for the income lost in 2020–23. In terms of profession, the self-employed became the group that we closely monitored.

We also considered the asset side of the vulnerable group's balance sheet. Lower income and self-employed were targets of government stimulus cash transfers in 2020–21. This can be observed through excess savings. We compared outstanding amounts of deposits against its trend growth before COVID-19. We used this metric across different deposit buckets as proxy for low-, middle- and high-income households. We found that all groups saved more in 2020, and excess savings increased. For low-income households, we attributed this to a combination of government stimulus and precautionary savings. High-income households were able to maintain this excess savings through 2024. In contrast, low-income households drew down this excess savings and are now below pre-COVID trends in 2024.

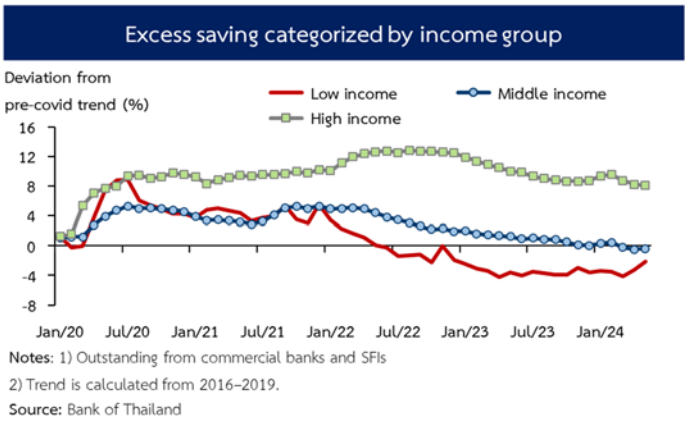
Income recovery path

Graph 3



Excess savings

Graph 4

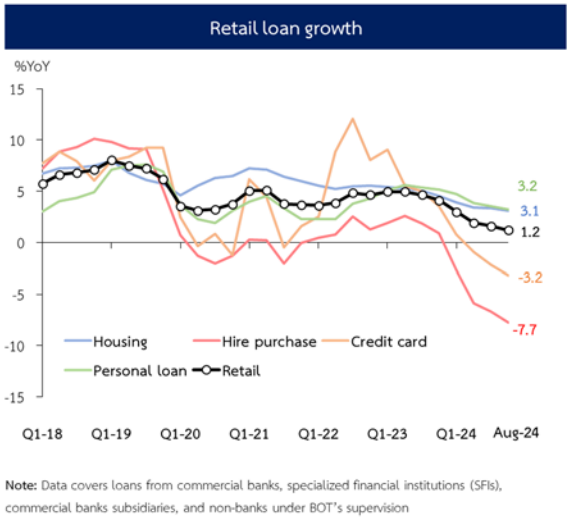


The last dimension we considered was the credit conditions of low-income households. Data in Graph 5.A shows a gradual decline in loan growth across all household portfolios. Loan growth shrank considerably in the hire purchase and credit cards segment, which has sector-specific explanations in addition to changes in economic activity. One of the main factors that depressed demand for hire purchase loans was the arrival of cheap Chinese electric vehicle imports. Higher competition brought down prices both at the dealers and in the second-hand markets. The lower price in the resale market creates a negative feedback loop, as new buyers typically fund their purchases through sales of their current cars. This shock is compounded by worse credit quality in the sector, partially due to eased lending standards during the pandemic. For credit cards, a higher minimum payment (reversion to pre-COVID regulation) may partially explain the downward slope.

Sector-specific explanations cannot erase the aggregate decline for growth in all segments, however, and concerns remained.

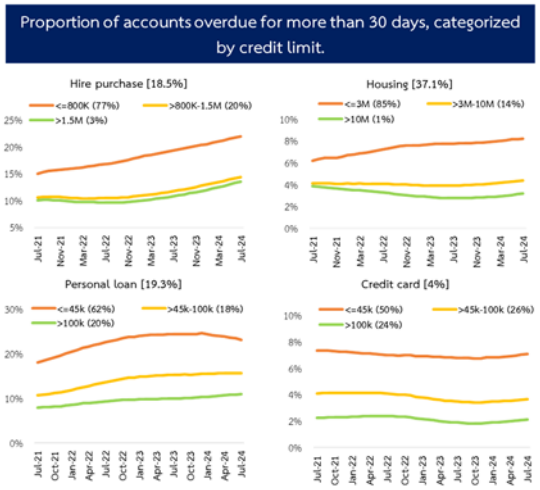
Loan quality, measured by the proportion of loans with a balance greater than 30 days past due are shown in Graph 5.B. Each loan portfolio is shown in its own separate graph with three lines representing different levels of contract amounts (proxy for income). The low- income households have a higher proportion of accounts with 30 days past due. In some segments—namely, hire purchase and housing—we observed a widening difference between the low- and high-income households.

Graph 5a: Credit growth by portfolio



Note: Data covers loans from commercial banks, specialized financial institutions (SFIs), commercial banks subsidiaries, and non-banks under BOT's supervision

Graph 5b: Credit quality by income



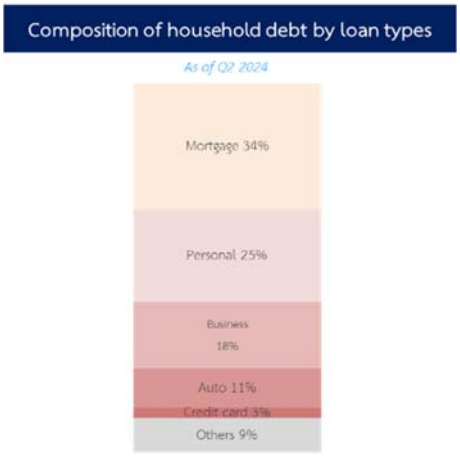
Note: NCB data as of July 2024 and 12-month moving average.; Data in [ ] represents the proportion of outstanding loans in each portfolio relative to total retail loans.; ( ) Data in ( ) represents the proportion of accounts by credit limit group.

Monetary policy deliberation

With many households lacking access to formal channels of finance, the informal sector plays a role in credit and somewhat dampens the effect of monetary policy transmission. The two most tangible transmission channels for households in Thailand are the interest rate channel and the cash-flow channel. The effect of the interest rate channel for households can be quantified using the socio-economic survey; however, with the limitations mentioned earlier, the estimates only offer a rough guidance.

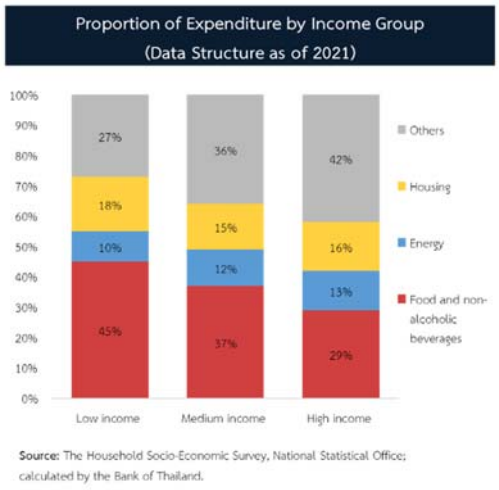
The quantification of transmission of monetary policy through the cash-flow channel, at least for bank loans, can be estimated with better precision. Mortgages represent the largest share of household debt, as shown in Graph 6. While most mortgages in Thailand are floating rate loans, the instalments are fixed. When the interest rate decreases, the payment is unchanged, but the duration of payment is shortened. Hire purchase and credit card loans are fixed rate and mostly unaffected by monetary policy. Personal and business-related loans are mostly floating rate and can benefit from changes in monetary policy.

Composition of household debt Graph 6

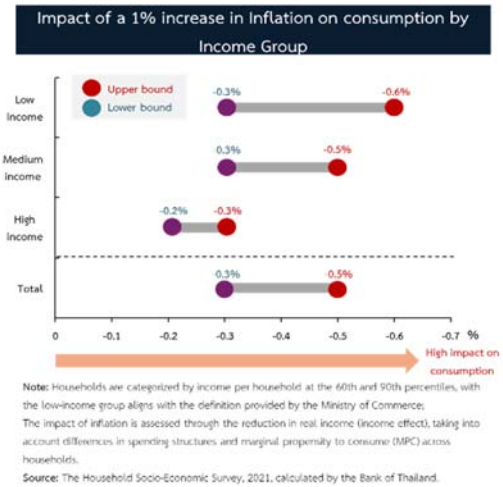


Household heterogeneity is a recurring issue discussed extensively throughout recent MPC meetings. During normalisation, discussions focused on the impacts of inflation and rising interest rates on low-income households and the effects on aggregate inequality. Graph 7.A shows the composition of expenditures by income groups, suggesting that low-income households spend significantly more on food and non-alcoholic beverages, which, in turn, leads to relatively higher declines in consumption after a positive inflation shock, as shown in Graph 7.B.

Graph 7a: Composition of household expenditures



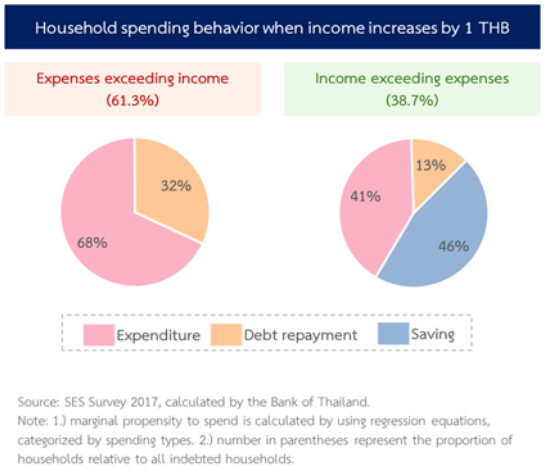
Graph 7b: Impacts of inflation on consumption



In Graph 8, we estimate marginal propensity to consume for two groups: those with less income than expenditures (hand-to-mouth) and others. The marginal propensity to consume is 27% higher for the former, implying that the hand-to-mouth group will also decrease consumption more after a rate increase. After a rate increase, therefore, the low-income population gets more benefit from decreases in inflation but is also more affected by decreases in income. On the whole, the latter

will always have a net negative short-run impact on consumption. The analyses and following discussions thus contributed to "gradual and measured" policy rate hikes that made it more manageable for fragile groups to adapt to the increase in interest burden.

Marginal propensity to consume for hand-to-mouth Graph 8



Source: SES Survey 2017, calculated by the Bank of Thailand.
Note: 1.) marginal propensity to spend is calculated by using regression equations, categorized by spending types. 2.) number in parentheses represent the proportion of households relative to all indebted households.

Back to the issue in 2024, amidst high household debt and a worsening sentiment and financial conditions for vulnerable groups, we had to evaluate how a change in policy rate would affect household balance sheets in the short and long terms. In the long run, lower rates will slow down the household debt deleveraging process; in the short run, lower rates can alleviate the debt service burden. The extent of the gains is arguable, as our aggregate quantitative model showed that the immediate impacts of a change in policy rate to household debt service burden may be small in terms of amount and contribution to GDP. However, what the model does not show is that it may be have an impact on vulnerable groups, the hand-to-mouth part of the population for which every marginal baht matters. The MPC members also pointed out that a growing "vulnerable" population can potentially create outsized impacts beyond their own GDP contribution because of adverse nonlinear macro-financial linkages they have with other economic agents in the economy.

The MPC decreased its policy rate in October 2024. While household heterogeneity itself was not the primary reason for the policy rate decrease, discussions of the analyses above played a significant role. The low-income households were becoming more pessimistic as their debt-ladened balance sheets worsened from slower income recovery. Their credit conditions tightened more than other segments', and many committee members expressed the view that any help to these vulnerable groups is better than no help, especially when the lowered rate aligns with the outlook of the economy and does not derail debt deleveraging.

Targeted measures and final thoughts

Targeted measures

Targeted measures for households require the involvement of financial institutions. The MPC meets semi-annually with the Financial Institutions Policy Committee to jointly discuss issues pertaining to both committees, such as household debt. The Bank of Thailand has adopted many measures to address the issue of high household debt. A press release in January 2024 summarised this into three main pillars: (i) debt restructuring; (ii) creditor assistance to speed up debt repayment for persistent debt; and (iii) fairer debtor protection that includes limits and eliminations of fees. For 2025, jointly with the Ministry of Finance, the Bank of Thailand plans to issue additional debt relief measures to support vulnerable debtors through suspension of interest and reduction on principal payments for three years.

Part of the heterogeneity in the economy comes as a result of financial access issues, with the lower income population having limited access to financial services. The Bank of Thailand wishes to minimise financial access gaps in the economy. With the planned launch of virtual banks in 2025, the use of diverse types of data will provide better access to financial services for the unserved and underserved segments of households and stipulate competition among the Thai financial institution system. In addition, we also support the mechanism for "Open Banking Data for Consumer Empowerment," which allows financial service providers to access and use data and key digital infrastructure with standardised processes and connections. This will reduce redundancy and lead to lower costs, better service and greater financial access.

Final thoughts

We wish to touch upon many findings from the Heterogeneous Agent New Keynesian (HANK) framework. First, changes in income and wealth distributions can have profound impacts on the strength of monetary policy transmission, as shown by Kaplan et al (2018). This is one of many reasons we wish to understand heterogeneity better. As summarised by Violante (2021), the consumption response of hand-to-mouth households to monetary policy is very strong because of the indirect effect of changes in employment and wages. As we move toward households with more income, the direct effect of intertemporal substitution dominates until we reach the very top of the wealth distribution, when the negative income effect starts to play a role.

Violante (2021) pointed to three other lessons from HANK that we can relate to. First, macroeconomic shocks can be amplified or dampened depending on income and wealth distributions. This amplification can possibly provide justification for nonlinearities resulting from macro-financial linkages. Second, every policy has redistributive properties, and fiscal policies are better suited to offer welfare-improving redistributive outcomes. Thus, central banks should not solely use the blunt interest rate tool to tackle inequality but instead should work closely with fiscal authorities where possible. Third, the HANK framework requires that central banks have access to rich micro-level data. This lesson strikes a chord with us, as we have

also started to implement a HANK model and have run into the issues of data calibration. Some of the impulses looked odd and we suspect this may be partly due to the calibration against the socio-economic survey, with its known limitations discussed earlier.

A HANK-type framework can assist in our attempt to more comprehensively consider heterogeneity in the Thai economy. In addition to recognising how vulnerable groups are affected by monetary policy in the short term and the potential nonlinearities created by the amplification mechanisms resulting from a biased wealth distribution, we also would like to better understand the interactions between monetary policy, inequality and economic growth in all horizons. One avenue of research we have an interest in pursuing is how inequality that is created/reduced as a by-product of monetary policy affects potential growth in the longer horizon.

References

Acharya, S, E Challe and K Dogra. (2023): "Optimal monetary policy according to HANK", *American Economic Review*, vol 113, no 7, pp 1741–82.

Kaplan, G, B Moll and G L Violante (2018): "Monetary policy according to HANK", *American Economic Review*, vol 108, no 3, pp 697–743.

Violante, G (2021): "What have we learned from HANK models, thus far?", *Beyond the pandemic: the future of monetary policy*, *European Central Bank*, pp 267.

The heterogeneous impact of monetary policy announcements on firms' financial outcomes

Okan Akarsu[*] Mehmet Selman Çolak[+] Hatice Karahan[§] Huzeyfe Torun[†]

Abstract

This study explores the impact of monetary policy surprises on credit usage, credit growth borrowing costs and default probabilities, emphasising key differences across firms based on size, leverage and export orientation. The findings reveal that small and medium-sized enterprises (SMEs) are more vulnerable to monetary policy shocks than larger firms, experiencing sharper declines in borrowing, higher loan interest rates and greater increases in default risk. Additionally, highly leveraged firms exhibit greater sensitivity compared with those with lower leverage. Export-oriented firms, however, demonstrate resilience to monetary shocks, leveraging access to foreign exchange borrowing and diversified revenue streams to mitigate adverse effects. Sectoral analysis identifies the construction sector as the most responsive to monetary policy changes, followed by the services sector. Overall, the study highlights significant variations in firms' reactions to monetary policy shifts, shaped by their size, financial structure, export orientation and sectoral characteristics.

Keywords: monetary policy transmission, monetary policy surprises, credit, firm heterogeneity

JEL Classifications: E12; E24; E52; E58

* Central Bank of the Republic of Türkiye, email: okan.akarsu@tcmb.gov.tr.

+ Central Bank of the Republic of Türkiye, email: selman.colak@tcmb.gov.tr.

§ Central Bank of the Republic of Türkiye, email: hatice.karahan@tcmb.gov.tr.

† Central Bank of the Republic of Türkiye, email: huzeyfe.torun@tcmb.gov.tr.

The views expressed herein are those of the authors and do not necessarily represent the official views of the Central Bank of the Republic of Türkiye.

1. Introduction

Synchronised monetary policy actions across the global economy have played an important role in containing the inflation surge in the post-pandemic period. This was partly a result of strengthened monetary policy frameworks in many emerging market economies, especially after the onset of the 21st century. Conceptual and empirical studies have identified several key mechanisms by which monetary policy exerts its influence: the demand channel, the credit channel, the exchange rate channel, the expectations channel and the asset price channel. The demand channel highlights how monetary policy affects aggregate demand by influencing consumption and investment decisions. Policy tightening, through higher interest rates, increases borrowing costs for households and firms, discouraging spending and investment while encouraging saving. The credit channel highlights how policy tightening amplifies borrowing constraints, especially for smaller, less liquid firms. Firms with weaker balance sheets face higher borrowing costs and reduced credit access as collateral values decline (Bernanke and Gertler (1995)). The exchange rate channel emphasises the impact of interest rate changes on currency values and trade competitiveness. In open economies, monetary tightening leads to currency appreciation, reducing net exports and aggregate demand, leaving export-oriented firms particularly vulnerable (Obstfeld and Rogoff (2001)). For emerging markets, exchange rate pass-through to consumer prices is another key way in which monetary policy influences inflation (Taylor (2000); Dubravko and Klau (2008)). The expectations channel highlights how monetary policy actions influence the forward-looking decisions of economic agents (Woodford (2003); Galí (2008)). Finally, the asset price channel examines how monetary policy adjustments affect asset prices, wealth, and consequently, spending and investment patterns (Brunnermeier and Sannikov (2014); Adrian and Shin (2010)).

While these channels collectively explain monetary policy's impact, there is an important distinction between its effects on households and firms. Firms, as entities producing value added, are directly influenced by credit, exchange rate and asset price channels in particular. Yet, firms differ in terms of size, financial strength and exposure to external shocks, which can lead to varying responses to monetary policy changes. For example, firms with significant debt obligations may be more vulnerable to borrowing cost increases, while those engaged in international trade are expected to be exposed to sudden exchange rate fluctuations. Thus, to fully capture the impact of monetary policy shocks on the economy, it is essential to consider the heterogeneity across firms and their individual characteristics.

One main concern, on analysing the impact of monetary policy actions on financial outcomes, is the endogeneity of the policy actions. Since monetary policy decisions have been made after observing several macro-financial indicators, the outcomes following policy actions might be highly correlated with these macro indicators. Hence, the pure impact of the monetary policy changes might not be disentangled optimally among several other factors impacting the financial outcomes. For this reason, introducing an exogenous monetary policy variable, representing the unexpected part of the policy changes, might help alleviate these concerns. Monetary policy shocks, often viewed as unexpected changes in policy, provide convenient cases to understand the details of the transmission process empirically. These surprises can amplify or mitigate the intended effects of monetary

policy, influencing consumption, investment and overall economic activity in nuanced ways. Unlike the monetary policy decisions which may have been highly correlated with macro-financial variables and already considered by the economic agents, monetary policy surprises almost fully capture the unexpected part of the monetary policy actions and therefore have a stronger exogeneity.

In this paper, we define monetary policy surprises based on forecast errors from Bloomberg expectations and examine the heterogeneous impact of these on firms.[1] For this analysis, we benefit from multiple administrative databases available at the Central Bank of the Republic of Türkiye (CBRT). The data comprise three key sources: (i) annual balance sheet and income statement data submitted by firms to the Revenue Administration; (ii) monthly firm-bank credit data from the Banking Regulation and Supervision Agency; and (iii) annual employment data from the Social Security Institution. To conduct the study, we integrate these data sets into a unified and comprehensive monthly data set using unique firm identifications (IDs). This process ensures consistency and exclusivity across data sources. The resulting data set enables a detailed examination of how monetary policy surprises heterogeneously affect firms' financial outcomes in Türkiye. Our analysis covers the period January 2017–October 2024.

This study investigates how monetary policy surprises impact non-financial corporates' financial outcomes, specifically credit usage, borrowing cost and default probabilities. These outcomes will be analysed by highlighting significant differences among firms based on their size, leverage and export orientation. Our findings indicate that larger firms exhibit lower sensitivity to monetary shocks compared with small and medium-sized enterprises (SMEs). Following a positive monetary policy surprise – such as a more hawkish decision than anticipated – SMEs reduce their borrowing more significantly than larger firms and face relatively higher borrowing costs. Additionally, the default risk increases more substantially among SMEs compared with larger firms. Highly leveraged firms also demonstrate greater responsiveness to monetary tightening than firms with lower levels of leverage. Our findings suggest that exporters demonstrate greater resilience to unexpected monetary policy tightening, likely due to their access to diversified revenue streams. Additionally, we examine sectoral heterogeneity in response to monetary policy announcements. The results indicate that the construction sector is the most sensitive to monetary policy shifts, followed by the services sector.

This paper integrates conceptual insights with empirical evidence to enhance our understanding of the mechanisms driving firm-level heterogeneity in the transmission of monetary policy surprises. The findings offer valuable implications for policymakers seeking to design targeted interventions that address firm-specific vulnerabilities and strengths. Section 2 describes the data set, presents key descriptive statistics and details the construction of monetary policy surprises. Section 3 analyses the effects of monetary policy surprises on firms' financial outcomes and Section 4 explores how changes in the policy rate influence these outcomes using the identified monetary policy surprises. Finally, Section 5 concludes.

[1] Monetary policy surprises have been similarly analysed and constructed in various studies, including those by Pericoli and Veronese (2015), Pescatori (2018), Grigoli et al (2020), Aruoba et al (2021), Tillmann (2023) and Checo et al (2024).

2. Literature review

This study builds upon and extends the existing literature by emphasising the critical roles of firm characteristics, sectoral differences and financial frictions in shaping the transmission of monetary policy. Previous research highlights that unanticipated credit tightening disproportionately impacts firms with limited access to financial markets, as they face higher borrowing costs and stricter lending standards during restrictive financial conditions. Liquidity levels have been shown to help some firms better withstand monetary policy surprises (Almeida et al 2004), while high leverage or indebtedness amplifies firms' sensitivity to unexpected interest rate changes, exacerbating financial distress (Rajan and Zingales (1998)).

In a similar fashion, firm size emerges as a pivotal determinant of firms' responses to monetary policy shocks. Larger firms are better equipped to endure such shocks due to their diversified revenue streams and broader access to capital markets (Ottonello and Winberry (2020); Caglio et al (2021); Cloyne et al (2023)). Conversely, SMEs encounter greater challenges, given their constrained financing options and heightened vulnerability to liquidity constraints (Jiménez et al (2012); Kashyap et al (1994)). Sectoral differences further shape the transmission of monetary policy, with the construction sector identified as particularly sensitive due to its reliance on long-term credit and its close ties to housing markets (Iacoviello and Neri (2010); Bouakez et al (2011)).

Monetary policy surprises can significantly influence credit growth, default probability and the relationship between credit scores and borrowing costs. When monetary policy tightens unexpectedly, borrowing becomes more expensive, dampening credit growth as firms reduce their reliance on debt. Conversely, unexpected monetary easing can boost credit growth by lowering borrowing costs and encouraging lending activity (Gertler and Karadi (2011)). On the other hand, easing surprises tend to narrow the spread between rates offered to high- and low-credit score borrowers (Bernanke and Gertler (1995)). These relationships illustrate how unanticipated monetary shifts can ripple through the credit market, altering borrowing behaviours and risk pricing.

Focusing on monetary policy surprises, extensive research has demonstrated that unexpected policy actions have a significant impact on economic activity and inflation (Bernanke and Blinder (1992); Christiano et al (1996)). Further, Kuttner (2001) provided an introduction to high-frequency identification and improved the ability to isolate policy surprises. Later studies combined high-frequency surprises with structural value at risk (VaR) models to highlight the role of credit spreads and term premia in amplifying policy effects (Gertler and Karadi (2011); Hanson and Stein (2015)). Recent work also distinguishes pure monetary shocks from information shocks embedded in central bank announcements, which can independently affect markets (Jarociński and Karadi, (2020); Nakamura and Steinsson (2018)).[2] In advanced economies, previous research has consistently found that monetary policy exerts significant effects on firms, with the extent and nature of these effects varying across different contexts.

[2] For additional insights and complementary analyses, see Peek et al (1999), Faust et al (2004), Romer and Romer (2000), Gürkaynak et al (2005), Gürkaynak and Wright (2013), Altavilla et al (2019), Bauer and Swanson (2020), as well as Swanson (2021).

For example, studies on US firms (Ippolito et al (2018); Ozdagli (2018); Ottonello and Winberry (2020); Caglio et al (2021); Deng and Fang (2022); Gürkaynak et al (2022); Jungherr et al (2022); Cloyne et al (2023); Jeenas (2023); Anderson and Cesa-Bianchi (2024)) and euro area firms (Durante et al (2022); Ferrando et al (2022)) show that monetary policy surprises –often identified through high-frequency event study methods – produce heterogeneous outcomes.[3] These outcomes are strongly dependent on firm-specific characteristics, such as size, leverage, liquidity and sectoral exposure, suggesting that financial frictions and firm structure play crucial roles in shaping monetary transmission. This heterogeneity highlights the importance of firm dynamics in understanding the broader economic impact of monetary policy.

The current study contributes to this growing body of work by exploring the impact of monetary policy shocks on a rich set of firm outcomes in an emerging market economy. We apply these insights to the Turkish context, which is marked by heightened macroeconomic volatility and unique market dynamics, and examine how firm-specific characteristics and sectoral heterogeneity interact with monetary policy.

3. Data

3.1. Firm-level data sets

Our analysis relies on three key administrative databases provided to the CBRT by relevant institutions: (i) annual balance sheet and income statement data submitted by firms to the Revenue Administration; (ii) monthly firm-bank credit data from the Banking Regulation and Supervision Agency; and (iii) annual employment data from the Social Security Institution. To conduct the study, we integrate these data sets into a unified and comprehensive monthly data set using unique firm IDs. This process ensures consistency and exclusivity across data sources. Our analysis covers the period January 2017–October 2024.

The Revenue Administration provides the CBRT with annual balance sheets and income statements for all firms operating in Türkiye that are liable to pay corporate income tax. These records, prepared in accordance with Türkiye's Tax Procedure Law, pertain exclusively to private non-financial firms. The data set includes incorporated firms, such as limited companies, which are required to submit financial statements under the corporate income tax regime. In contrast, unlimited firms, such as sole proprietorships operating under the personal income tax regime, are only obligated to report if they exceed specified size thresholds. In addition, firm-level annual

[3] Gaiotti and Generale (2002) show that monetary policy disproportionately affects smaller, less liquid Italian firms with limited collateral. Similarly, Albrizio et al (2023) find that in Spain, firms with high marginal revenue product of capital exhibit the strongest response to monetary easing, highlighting the role of financial frictions. Bougheas et al (2006) report that small, young and risky UK firms are more sensitive to tight monetary conditions, while Bahaj et al (2022) examine employment effects in a broad UK sample. Aruoba et al (2021) use monetary policy surprises in Chile in a Bayesian VaR framework to estimate policy impacts.

employment data, provided by the Social Security Institution, allow us to determine firm size and track employment growth over the years.[4]

The final data source is the administrative bank-firm loan level data provided by the Banking Regulation and Supervision Agency and made available to the CBRT. This data set includes detailed firm-bank level information, such as loan interest rates, maturity, amount, credit scores and currency denomination. Additionally, these data capture default events, defined as loan payments overdue by 90 days or more, which are classified as non-performing loans (NPLs). The analysis excludes non-performing loans and non-cash loans, focusing solely on active cash loans.[5] Furthermore, we limit the examination to Turkish lira-denominated flow loans, excluding foreign currency loans. To ensure robustness, we apply a 1% winsorisation on credit amounts and interest rates, controlling for variations at the NACE Rev 2 sector level in each year.

We exclude firm-year observations with inconsistent values, such as negative employment, total assets or net sales, ensuring that the sample consists of economically active firms only. In this sample, firm characteristics derived from balance sheet data and employment vary annually, while other variables fluctuate on a monthly basis. To reduce the potential influence of outliers, we apply a 1% winsorisation to all firm-level variables each year.

3.2. Defining monetary policy shock

We derive monetary policy surprises from financial analysts' predictions gathered by Bloomberg.[6] A crucial requirement for employing analysts' forecasts to identify monetary policy shocks is that these predictions must account for all relevant information available up to the time of the monetary policy committee (MPC) meeting. Traditional professional forecaster surveys often fall short in this regard, as they typically collect analysts' projections at a fixed point in time, sometimes days or weeks before the meeting.[7] This timing gap can result in forecasts that fail to reflect new information – such as sudden economic events or data releases – emerging between the submission date and the policy meeting. Consequently, central banks' responses to these developments may involve endogeneity, undermining the proper identification of monetary policy shocks.

In contrast, Bloomberg enables analysts to submit and revise their policy rate forecasts at any time before the MPC meeting. This flexibility allows analysts to consider the impact of critical data releases or economic developments that could influence policy decisions. Additionally, analysts can update their projections in response to new financial or economic shocks, even on the day of the meeting. Their motivation to provide accurate forecasts is strengthened by the visibility of their

[4] Employees who are employed on the basis of a service contract in accordance with Article 4/a of the Social Security Law No 5510.

[5] When analysing credit market outcomes, we exclude NPLs from the data set. However, when focusing on default events, we reintroduce firm-bank credit observations involving NPLs into the analysis.

[6] Pescatori (2018) and Aruoba et al (2021) adopt a similar methology for constructing monetary policy surprises.

[7] Examples of professional forecaster surveys include the CBRT Market Participants Survey, Blue Chip Financial Forecasts, Consensus Economics and ECB Survey of Professional Forecasters.

company's name to Bloomberg users and the platform's practice of ranking top forecasters.[8]

A monetary policy surprise for a policy meeting at time t is defined as follows:

$$MP_t = i_t^{TR} - E[i_t^{TR}|I_t] \quad (1)$$

where i_t^{TR} represents the announced monetary policy rate decided during the monetary policy meeting at time t, and $E[i_t^{TR}|I_t]$ denotes the mean expectation of respondents in the Bloomberg survey regarding the monetary policy decision at time t, collected immediately prior to each meeting, conditional on the information available just before the release.

We employ an orthogonalisation procedure to ensure the validity and exogeneity of monetary policy surprises, building on the methodology of Bauer and Swanson (2023).[9] Specifically, we regress the initial surprises – derived from forecast errors – on a comprehensive set of macroeconomic and financial variables publicly available before the monetary policy announcement:

$$MP_t = \alpha + \beta news_t + \varepsilon_t \quad (2)$$

where $news_t$ is a vector that includes forward-looking expectations, real economic indicators, price dynamics and financial market conditions. Each variable is expressed as the change between its value one month before and the latest data release available prior to the monetary policy meeting. To capture price dynamics, we include three key indicators: changes in headline inflation and one-year and two-year-ahead inflation expectations.[10] For real economic activity, the vector comprises the capacity utilisation ratio, changes in the industrial production growth rate, the one-year-ahead expected GDP growth rate and the unemployment rate. To account for financial market conditions, we include the percentage change in the exchange rate (measured in Turkish lira against the US dollar), its one-year-ahead expected level and stock market prices. This comprehensive selection of variables provides a robust framework for analysing the broad economic and financial factors shaping monetary policy expectations. The residuals from this regression represent the orthogonalised monetary policy surprises, $MPS_t = \varepsilon_t$, isolating the unexpected component of policy changes that is independent of pre-existing market information or central bank responses to macroeconomic conditions.

[8] Bloomberg publicly shares participants' forecasts, attributing them either to the institution alone or to a combination of the institution and the individual researcher. This transparency allows market participants to evaluate the reliability and track record of each contributor. According to Bloomberg experts, most large organisations prefer to display only their institutional name. This choice reflects an effort to maintain a continuous and coherent forecast history, which is essential for accurately tracking performance over time. This historical record becomes a critical input for Bloomberg's ranking system, which evaluates institutions based on the precision of their forecasts.

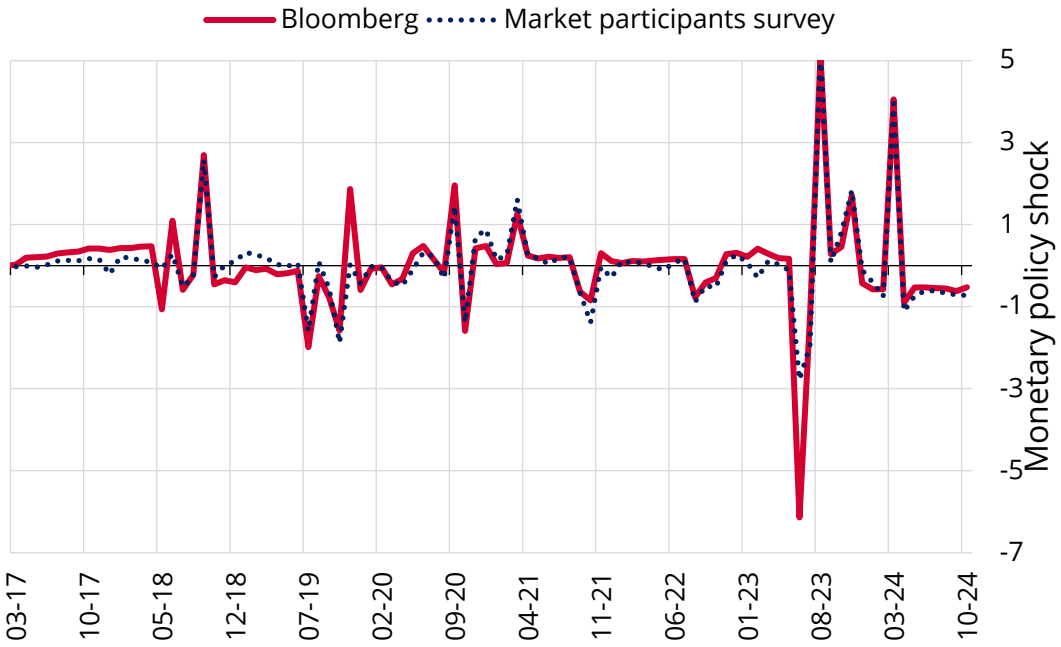
[9] Under the full-information rational expectations (FIRE) assumption, forecast errors should be unpredictable using publicly observable information available at the time the forecasts are made.

[10] Expectations are sourced from the Market Participants Survey conducted by the CBRT, which gathers insights into both short- and long-term expectations for key macroeconomic indicators. These include consumer inflation, exchange rates, the current account balance, GDP growth and interest rates, providing a comprehensive outlook on market sentiment and economic projections.

This approach mitigates two key issues: first, the potential bias introduced by private information held by central banks that could influence market expectations, and second, the predictable components of policy decisions arising from observable economic conditions. By eliminating these endogenous elements, the orthogonalisation process ensures that the surprises reflect true, unexpected monetary policy shifts.

Orthogonalised monetary policy surprises

Graph 1



4. Stylised facts

In this section, we provide some facts on heterogeneity in the transmission of monetary policy shocks across different groups of firms within the Turkish economy. Non-financial firms are classified into various categories based on their size, export status and leverage characteristics. The outcome variables that represent the degree of monetary transmission are primarily related to access to finance, the cost of borrowing and credit risk. Therefore, this paper aims to investigate the differential impact of monetary policy shocks on Turkish lira loan growth, loan interest rates and default rates among groups of non-financial firms. The firm groups are classified according to the following criteria:

- **firm size**: SMEs vs large firms;
- **export status**: firms with non-zero export revenues vs others; and
- **leverage**: firms with a debt-to-asset ratio higher than the median of their NACE Rev 2 sector vs firms with a lower debt-to-asset ratio than the median.

This analysis covers the period 2017–24, with a particular focus on the monetary policy tightening episodes during this time frame. According to our framework on orthogonalised monetary policy surprises, the primary tightening episodes occurred between September 2018 and July 2019 and again from June 2023 until end-2024. While these episodes differ in their context, they provide useful insights into the differential effects of monetary policy on firm-level financial outcomes.

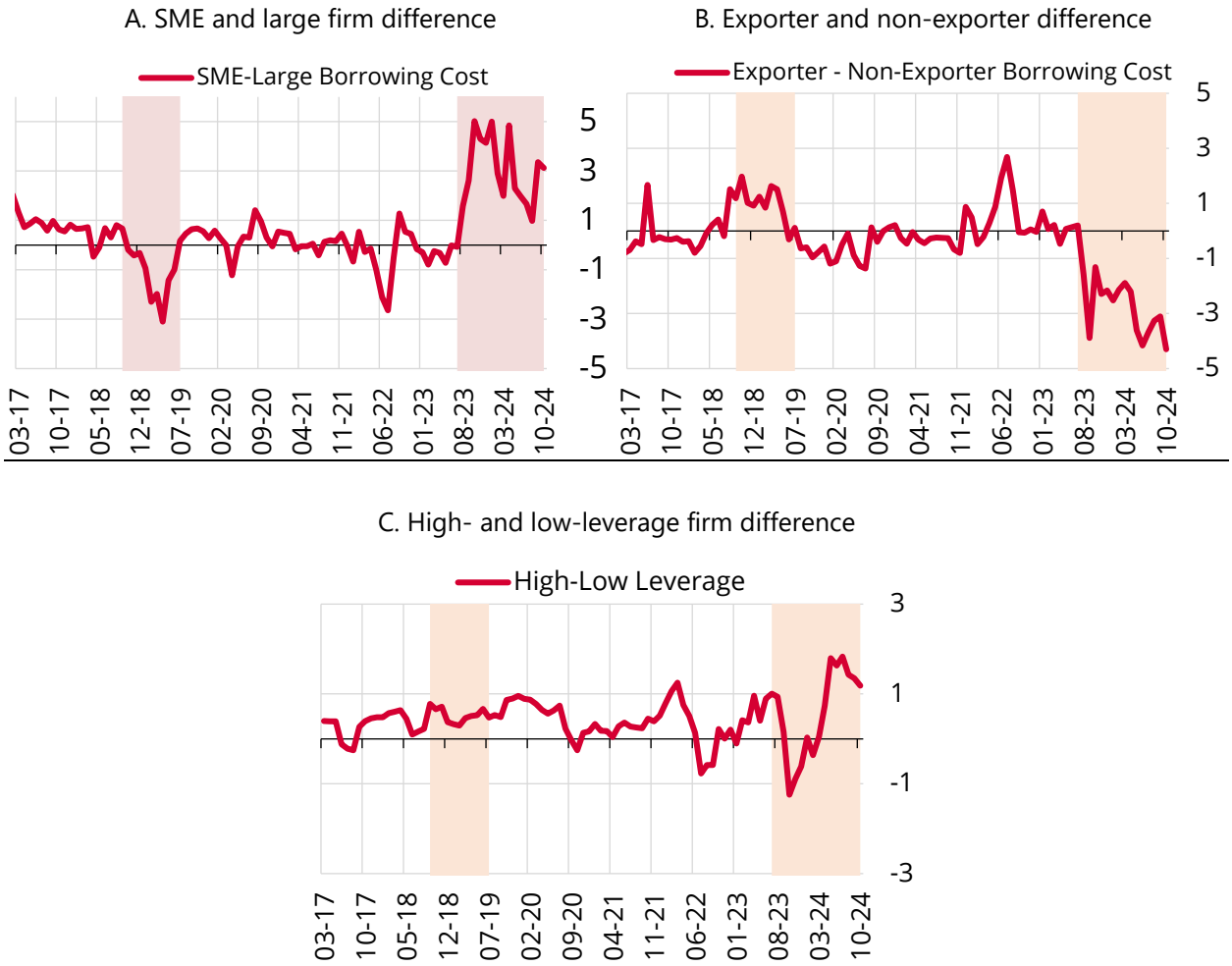
We expect that the immediate impact of monetary policy shocks on firms will manifest through changes in their borrowing costs, as lenders typically adjust loan interest rates in response to central bank actions. Normally, when the central bank raises the policy rate, short-term loan rates increase immediately, while long-term loan rates may be adjusted based on lenders' expectations. Consequently, the overall impact of policy tightening on average loan rates is expected to be upward. However, the extent of transmission on borrowing costs may vary among firms depending on their size, operations and balance sheet structure.

4.1. Heterogeneity in borrowing costs

SMEs are generally expected to face higher borrowing costs due to their higher credit risks and greater likelihood of default compared with larger firms (Beck et al (2008); Fama and French (2005)). However, this expectation may not always materialise, since some factors such as government support, business dynamics and macroeconomic conditions can also influence borrowing costs. For example, governments or public banks often provide SMEs with subsidised loans to offset their disadvantages in terms of collateral and borrowing costs.

In the context of Türkiye, loan rates for SMEs and large firms have been relatively close, except during periods of monetary tightening (Graph 2). During the 2018–19 tightening, even though loan rates increased for all firms, SMEs experienced relatively favourable borrowing terms compared with large firms. The monetary policy tightening during this period, which began in September 2018, followed a sharp depreciation of the Turkish lira against foreign currencies in August 2018. This depreciation caused financial distress for highly foreign exchange (FX)-indebted firms, which were primarily large corporates. As a result, the overall probability of default rose more significantly for large firms than for SMEs, leading to more favourable loan pricing for SMEs. Additionally, public banks provided subsidised loans and credit guarantees to SMEs, as private banks implemented credit rationing due to expectations of rising defaults. These factors led to a heterogeneous impact on borrowing costs, with SMEs benefiting more than large firms.

Loan interest rates by firm size, exporter status and leverage (In percent) Graph 2



The graph presents the differences in borrowing costs (%) across heterogeneous groups. Graph 2.A shows the average difference between SME loan rates and large firm loan rates. Graph 2.B presents the average difference between exporter loan rates and non-exporter loan rates. Finally, Graph 2.C highlights the borrowing cost difference between firms above the 50th percentile and those below the 50th percentile based on their debt-to-asset ratio.

However, during the recent tightening episode that began in June 2023, SMEs appear to have been at a disadvantage in terms of borrowing costs. The main driver of this tightening was not a major financial market shock, but rather persistently high inflation, which affected both firm groups to a similar degree. Moreover, public banks were less active in subsidising SME loans during this period, in contrast to the 2018–19 episode. As a result, in the current tightening case, SMEs saw a larger increase in borrowing costs compared with large firms.

Exporters also represent a group that is expected to access loans at lower rates when the economy tightens. In Türkiye, we observe a heterogeneous transmission of monetary policy impacts on borrowing costs for exporters and non-exporters. However, the direction of this heterogeneity differs across the two tightening episodes under consideration.

In 2018, exporters, who generally have significant amounts of FX-denominated debt, saw their overall balance sheet risks increase, prompting banks to raise loan prices. Furthermore, public banks primarily supported firms serving the domestic market due to contracting domestic demand, meaning exporters did not benefit from subsidised loans during this period. Consequently, exporters faced higher borrowing costs compared with non-exporters. In contrast, during the 2023 tightening episode, exporters benefited from more favourable loan conditions. With the real appreciation of the Turkish lira as part of disinflation policies, the government and public banks provided loan subsidies to exporters to mitigate the negative impacts of exchange rate valuation on export activities. As a result, exporters experienced less severe borrowing cost increases compared with non-exporters in this period.

Highly leveraged firms generally face higher borrowing costs due to their increased exposure to financial risk (Hennessy and Whited (2007)). During the 2018–19 period, there was no significant change in the gap between the borrowing costs of highly leveraged and low-leverage firms compared with the pre-tightening period. However, during the 2023–24 tightening, we observe a marked increase in this gap. The primary factor behind this heterogeneity is the implementation of macroprudential credit growth limits on Turkish lira (TL) commercial loans by the banking sector. With banks subject to upper limits on their monthly commercial loan growth rates, they tend to prioritise lending to firms with lower leverage and greater liquidity. As a result, banks have reduced interest rates for these less leveraged firms in order to entice them to use TL loans.

4.2. Heterogeneity in loan access

This section explores the differential access to loans among various firm groups during tightening periods in the Turkish economy. Loan access is measured as the share of TL loans held by a particular group relative to aggregate TL loans. An increase in the share of loans held by a group suggests a relative advantage (or less disadvantage) in loan access compared with other groups.

With regard to firm size, we do not observe a significant differentiation in loan market share between SMEs and large firms during the major tightening periods. During the 2018–19 tightening, despite receiving subsidised loans with better terms, SMEs were unable to increase their share of the loan market. In the most recent tightening episode, SMEs maintained a strong position in TL loans, despite higher borrowing costs. Similarly, while exporters faced higher borrowing costs in 2018–19, they maintained a share of almost 20% of TL-denominated commercial loans. However, in the current tightening period (2023–24), exporters' borrowing costs have decreased, but their share of TL loans has declined substantially.

Loan share by firm size, exporter status and leverage, (In percent) Graph 3

The graph depicts the loan shares (%) across heterogeneous groups, with the total loan share within each group summing to 100. Panel A illustrates the TL loan share of SMEs within total TL loans. Panel B presents the TL loan share of exporters and Panel C highlights the TL loan share of highly leveraged firms within total TL loans.

The seemingly paradoxical relationship between loan pricing and credit access during both tightening episodes is largely driven by loan supply and demand dynamics. In 2018–19, banks were less willing to lend to large firms and exporters due to their significant exposure to currency risks, which explains the higher loan rates for these groups. However, in response to rising currency risks, large firms and exporters preferred TL loans for financing their operations and reducing their FX debt burden. In contrast, during the recent tightening period, the exchange rate market has remained relatively stable and TL loan rates have been extremely high (hovering above 50% annually). As a result, large firms and exporters have switched to FX loans, despite the relatively cheaper pricing of TL loans for large firms and exporters. These findings suggest that the heterogeneity in credit access during tightening periods is strongly linked to both loan supply and demand dynamics.

Finally, it is observed that highly leveraged firms demonstrated greater loan growth rate (or less contraction in their loan usage) during both tightening episodes,

as their share of total TL loans increased following the start of tightening. This is also very much related to demand dynamics since highly indebted firms are usually less liquid and need external finance to maintain their business. However, low-leverage firms might postpone their use of external finance when financial conditions tighten, as they have liquid assets to finance their working capital. Additionally, highly leveraged firms are more exposed to interest rate changes as they need to reprice a larger amount of debt when interest rates change. Henceforth, during tightening periods both their existing debts and accrued interest amounts increase more than less leveraged firms.

4.3. Heterogeneity in credit risk

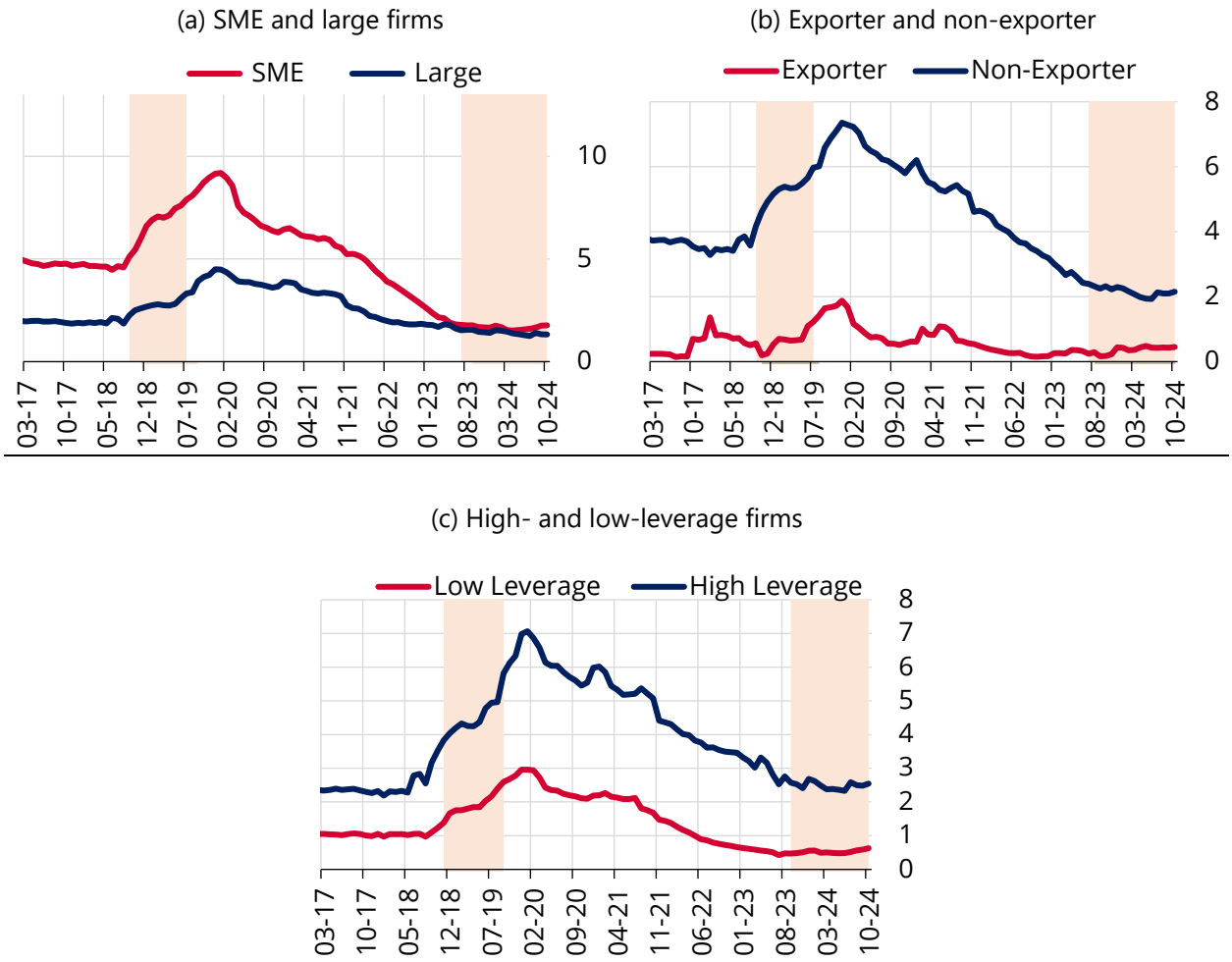
The credit risk outlook of firms is another channel through which monetary policy changes affect non-financial firms. During periods of tightening financial conditions and economic slowdowns, squeezed profits and rising interest burdens generally worsen firms' credit risk outlooks, leading to higher default rates and further tightening of credit conditions for riskier firms. This credit risk channel may operate heterogeneously across firms.

Typically, smaller firms are more vulnerable to tightening financial conditions, as observed during both the 2018–19 and 2023–24 tightening periods. SMEs experienced higher default rates (measured by non-performing loan (NPL) ratios) in both episodes. In 2018–19, despite significant FX risks for large firms, the increase in their NPL ratios was relatively limited, as banks were reluctant to classify the loans of large firms as NPLs due to the potential loss in banking books. In response, several banking groups introduced large loan restructuring programmes aiming to extend the maturity of existing FX debt for large corporates and alleviate their debt burdens. In contrast, SMEs were more likely to default, as restructuring SME loans provided limited benefits to banks.

In contrast to the 2018–19 period, firms entered the recent tightening stage with a strong credit risk outlook and exceptionally low NPL ratios. Although SMEs' NPL ratios have slightly increased, they remain well below historical averages. Exporters also experienced less severe impacts on their credit risk outlooks. In 2018–19, exporters' NPL ratios increased due to their large FX debts, but the increase was less pronounced compared with non-exporters. During the 2023–24 period, both exporters and non-exporters maintained relatively stable credit risk outlooks, largely due to liquidity buffers accumulated during the negative real interest rate environment of 2021–22.

Lastly, highly leveraged firms exhibit default rates significantly higher than those of lower-leveraged firms. In the earlier tightening episode, the pace of defaults increased more rapidly for highly leveraged firms. However, in the current period, the overall credit risk outlook has remained benign for all groups.

Non-performing loan (NPL) ratio by firm size, exporter status and leverage (Percent) Graph 4



The graph illustrates the non-performing TL-denominated loan shares within total TL-denominated loans for each group. Graph 4.A compares the NPL shares between SMEs and large firms. Graph 4.B presents the NPL shares for exporters and non-exporters, while Graph 4.C highlights the NPL shares for highly leveraged firms versus low- leverage firms.

This section examined the heterogeneity in the transmission of tight monetary policy across various financial outcomes for firms. The findings suggest that the degree of heterogeneity in the transmission of monetary policy changes in Türkiye is influenced by macro-financial dynamics and prevailing initial conditions. Overall, the descriptive analysis of firms' financial outcomes reveals mixed results regarding the extent of heterogeneity in monetary policy transmission. For instance, during the 2018–19 tightening period, large firms and exporters experienced higher loan growth and loan rates compared with SMEs and non-exporters. In contrast, the opposite trend was observed during the 2023–24 period. While default rates were more pronounced among SMEs during the earlier tightening, they are now comparable to those of larger firms. To isolate the pure impact of monetary policy changes on firms, a robust empirical framework is needed that accounts for the endogeneity of monetary policy decisions and the role of initial macro-financial conditions in shaping monetary policy transmission. The following sections provide an empirical analysis to

assess the heterogeneous impact of monetary policy changes on firms' credit conditions and default rates.

5. Empirical framework and results

Monetary policy surprises can have significant effects on firm-level credit market outcomes, but these effects are not uniform across all firms. Firms differ in terms of size, financial strength and exposure to external shocks, which can lead to varying responses to unexpected changes in monetary policy. These policy surprises can influence key credit market variables, such as credit amount, credit score and the risk of default. Thus, to fully capture the transmission of monetary policy, it is essential to consider the heterogeneity across firms and their individual characteristics. To empirically examine these effects, we estimate the following regression at the firm-bank level:

$$y_{ibt} = \beta MP_{t-1} + \Gamma X_{iT-1} + \theta Z_t + \alpha_i + \phi_b + \delta_{st} + \varepsilon_{it} \quad (3)$$

where y_{ibt} represents the credit market outcomes for firm i from bank b at year-month t. These outcomes include key measures such as the credit amount, credit growth, borrowing cost and the likelihood of default. The variable MP_{t-1} represents the monetary policy surprises in month (t–1), which are constructed by calculating forecast errors from anticipated monetary policy decisions. We control for annual firm-level characteristics such as controls to capture variations in firm size, financial health and potential constraints that may influence their response to monetary policy. Specifically, we include net sales, leverage, age and return on assets (the net profit to total assets ratio) values in the previous year (T–1). To further control for monthly macroeconomic conditions, we include a vector Z_t, which consists of key national-level variables. This vector includes Türkiye's monthly unemployment rate, the percentage change in the dollar exchange rate and annual inflation, all of which reflect the broader economic environment affecting firms' financial outcomes. In addition to these controls, we account for unobserved heterogeneity at various levels by including firm fixed effects (α_i), bank fixed effects (ϕ_b) and sector-year-quarter fixed effects (δ_{st}). Bank fixed effects capture differences in lending practices, risk preferences and liquidity constraints across banks. Sector-year-quarter fixed effects ensure that we control for time-varying shocks specific to certain industries, such as demand fluctuations or regulatory changes.[11]

[11] We do not include sector-year-month fixed effects in our regression model, as doing so would introduce multicollinearity with our main regressor, policy change, which is measured at a monthly frequency. Instead, we control for sector-year-quarter fixed effects, which allow us to account for time-varying sector-specific shocks at a broader temporal level without compromising the model's ability to estimate the effects of monthly policy changes. To capture monthly variations in macroeconomic conditions that could influence firms' financial outcomes, we include key monthly macroeconomic controls such as Türkiye's unemployment rate, percentage changes in the dollar exchange rate and inflation. This approach ensures that our model remains robust while addressing potential confounding effects from both sectoral trends and high-frequency macroeconomic fluctuations.

The regression results presented in Table 1 demonstrate the heterogeneous effects of monetary policy on various firm-level outcomes, emphasising differences across firm size, leverage and export status. The analysis reveals that large firms are significantly less sensitive to monetary policy shocks compared with SMEs. Specifically, large firms experience a smaller rise in borrowing costs, smaller decline in loan usage and face a lower probability of default in response to monetary tightening compared with SMEs. In contrast, SMEs show greater vulnerability, with pronounced reductions in credit availability and a higher likelihood of default following monetary policy surprises. This disparity aligns with existing literature, which highlights the role of firm size in shaping the transmission of monetary policy through the credit channel (Caglio et al (2021); Elena et al (2022); Cloyne et al (2023)).

Heterogeneous effects of monetary policy shocks on firms' financial outcomes

Table 1

	(1) All sample	(2) Large firms	(3) SMEs	(4) High leverage	(5) Low leverage	(6) Exporter	(7) Non-exporter
Panel A: Borrowing cost							
MP_{t-1}	0.825***	0.799***	0.833***	0.864***	0.741***	0.802***	0.827***
	(0.0074)	(0.0162)	(0.0078)	(0.0125)	(0.0121)	(0.0114)	(0.0073)
R-squared	0.86	0.77	0.87	0.85	0.86	0.82	0.88
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel B: Flow credit							
MP_{t-1}	–0.017***	–0.014**	–0.018***	–0.021***	–0.016***	–0.014**	–0.017***
	(0.0048)	(0.0126)	(0.0047)	(0.0074)	(0.0069)	(0.0119)	(0.0051)
R-squared	0.16	0.11	0.14	0.15	0.17	0.12	0.15
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel C: Monthly outstanding credit growth							
MP_{t-1}	–0.021***	–0.018***	–0.021***	–0.023***	–0.020***	–0.019***	–0.022***
	(0.0001)	(0.0049)	(0.0001)	(0.0003)	(0.0003)	(0.0052)	(0.0002)
R-squared	0.16	0.12	0.16	0.15	0.15	0.13	0.16
Observations	14,454,768	104,753	14,350,015	7,123,819	7,330,949	2,392,874	12,061,894
Panel D: Default							
MP_{t-1}	0.006***	0.004***	0.007***	0.011***	0.003***	0.004***	0.006***
	(0.0008)	(0.0045)	(0.0009)	(0.0014)	(0.0011)	(0.0030)	(0.0009)
	0.17	0.15	0.17	0.19	0.14	0.16	0.18
	15,695,201	61,185	15,634,016	7,866,829	7,828,372	2,505,546	13,189,655
Firm FE	✓	✓	✓	✓	✓	✓	✓
Sector x quarter FE	✓	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓	✓
Macroeconomic controls	✓	✓	✓	✓	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as $log(r_{ibt})$; in Panel B, it is the logarithm of the flow credit amount, $log(credit_{ibt})$, for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as $(log(credit_{it}) - log(credit_{it-1})$; and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. Monetary policy surprises (MP_{t-1}) are represented by orthogonalised monetary policy surprises at year-month (t−1), derived from Bloomberg forecast errors. Firms are categorised as SMEs if they have fewer than 250 employees; otherwise, they are classified as large. Firms are identified as highly leveraged if their leverage ratio exceeds the sector-year median within the same sector. Additionally, firms are considered exporters if they have engaged in export activities for at least one year. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Monetary policy surprises and sectoral variations in firms' financial outcomes Table 2

	(1) Industry	(2) Services	(3) Construction
Panel A: Borrowing cost			
MP_{t-1}	0.802***	0.830***	0.860***
	(0.0056)	(0.0078)	(0.0112)
R-squared	0.86	0.87	0.86
Observations	2,596,747	5,878,831	1,237,116
Panel B: Flow credit			
MP_{t-1}	–0.014***	–0.019***	–0.022***
	(0.0091)	(0.0060)	(0.0151)
R-squared	0.18	0.14	0.17
Observations	2,596,747	5,878,831	1,237,116
Panel C: Monthly outstanding credit growth			
MP_{t-1}	–0.018***	–0.020***	–0.023***
	(0.0004)	(0.0002)	(0.0007)
R-squared	0.15	0.17	0.15
Observations	2,781,632	9,591,771	1,859,480
Panel D: Default			
MP_{t-1}	0.005***	0.006***	0.008***
	(0.0015)	(0.0011)	(0.0034)
R-squared	0.12	0.17	0.12
Observations	3,014,051	10,370,042	2,076,265
Firm FE	✓	✓	✓
Sector x quarter FE	✓	✓	✓
Firm controls	✓	✓	✓
Macroeconomic controls	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as $log(r_{ibt})$; in Panel B, it is the logarithm of the flow credit amount, $log(credit_{ibt})$, for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as $(log(credit_{it}) - log(credit_{it-1})$; and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences, and liquidity constraints across banks. Monetary policy surprises (MP_{t-1}) are represented by orthogonalised monetary policy surprises at year-month (t−1), derived from Bloomberg forecast errors. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

The lower sensitivity of large firms can be attributed to their stronger financial positions, more diversified revenue streams and greater access to capital markets, which collectively enhance their resilience to macroeconomic shocks. Large firms are also often perceived as less risky by financial institutions, resulting in more favourable

credit conditions even during periods of monetary tightening. In contrast, SMEs typically have limited financing options, higher reliance on bank credit and greater exposure to liquidity constraints, making them more vulnerable to changes in interest rates and credit conditions (Jiménez et al (2012)).

Additionally, firms with high leverage or a lack of export orientation exhibit greater sensitivity to monetary policy shocks, reflecting their heightened dependence on domestic credit markets and susceptibility to rising borrowing costs. These findings underscore the critical role of firm-specific characteristics in determining the transmission and impact of monetary policy, highlighting the disproportionate effects on financially constrained and less diversified firms.[12]

Table 2 highlights the heterogeneous effects of monetary policy transmission across different sectors, reflecting the distinct characteristics and channels through which monetary policy impacts them. The construction sector emerges as the most sensitive to monetary tightening, with activity contracting significantly due to its reliance on long-term financing and its direct linkage to the housing market. Rising interest rates increase borrowing costs, reducing mortgage demand and subsequently dampening construction activity, a pattern extensively documented by Iacoviello and Neri (2010), Boukez et al (2011) and Singh et al (2022). The procyclical nature of construction further amplifies its sensitivity, as tighter monetary policy curtails housing and commercial projects during periods of economic contraction. In contrast, the industrial sector shows the lowest responsiveness to monetary policy. This can be attributed to its access to diverse financing sources, including equity markets and retained earnings, which buffer the sector against interest rate hikes (Gertler and Gilchrist (1994)). Additionally, the long-term planning and capital intensity of industrial investments reduce their immediate sensitivity to short-term monetary policy changes. For export-oriented industries, external demand plays a critical role, often offsetting the domestic effects of monetary policy, as noted by Bernanke and Gertler (1995). The services sector exhibits an intermediate level of responsiveness, driven by its dependence on consumer spending and labour-intensive operations. Monetary policy indirectly affects this sector by influencing disposable income, credit availability and employment levels. These findings underscore the significance of the credit channel, the interest rate channel and demand elasticity in explaining the sectoral variation in monetary policy transmission.

[12] Results based on raw monetary policy surprises, derived from Bloomberg forecast errors and the Market Participants Survey, are presented in Appendix B.

6. Further evidence on causality

In the previous section, we demonstrated the heterogeneous effects of monetary policy surprises on firms' financial outcomes, highlighting how unexpected policy shocks influence borrowing behaviour across different firm types and relationships. Building on this analysis, we now shift our focus to examining the causal effect of central bank policy target changes on firms' financial outcomes. Unlike surprises, which isolate the unanticipated component of monetary policy, policy target changes reflect the central bank's broader and systematic adjustments in monetary stance, encompassing both anticipated and unanticipated elements. This perspective allows us to explore how firms respond to the overall monetary policy framework, including its direct and indirect channels, such as credit allocation, leverage adjustments and financial stability.

To identify the causal effect, we use monetary policy surprises as instruments for policy target changes. This instrumental variable approach isolates the exogenous component of policy rate adjustments, ensuring that our estimates are not confounded by the central bank's systematic response to macroeconomic conditions. By doing so, we aim to provide robust causal estimates that reflect the independent influence of monetary policy on firms' financial outcomes. Furthermore, to account for the timing of policy transmission, we estimate the following regression at the firm-bank level, using a one-period lag for policy target changes:

$$y_{ibt} = \beta PolicyChange_{t-1} + \Gamma X_{iT-1} + \theta Z_t + \alpha_i + \phi_b + \delta_{st} + \varepsilon_{it} \qquad (4)$$

where y_{ibt} represents the financial outcomes of firm i borrowing from bank b at time t. $PolicyChange_{t-1}$ denotes the central bank's policy target change in the prior period (t–1), which allows us to capture the lagged effects of policy adjustments as firms and banks typically respond after observing and processing policy announcements.[13] As in the previous section, we control for annual firm-level characteristics to capture variations in firm size, financial health and constraints influencing their response to monetary policy. Specifically, we include net sales, leverage, age and return on assets (net profit to total assets) from the previous year. To account for monthly macroeconomic conditions, we include a vector Z_t comprising Türkiye's monthly unemployment rate, the percentage change in the dollar exchange rate and annual inflation, reflecting the broader economic environment. Additionally, we address unobserved heterogeneity by including firm fixed effects (α_i), bank fixed effects (ϕ_b) and sector-year-quarter fixed effects (δ_{st}).

To address potential endogeneity in the central bank's policy change, we use monetary policy surprises from the previous month (MP_{t-1}) as an instrument for the policy change. Monetary policy surprises capture the unanticipated component of policy announcements – deviations from market expectations – that are exogenous

[13] The choice of (t–1) as the timing reflects the realistic lag in the transmission of monetary policy to firm-level financial decisions. Firms and banks typically adjust their credit and financial strategies based on policy announcements after observing and processing the changes, making the effects more likely to materialise in the subsequent period. This approach ensures that our estimates capture the causal effect of the policy target changes after firms have had the opportunity to react, avoiding potential simultaneity issues that may arise if contemporaneous policy changes (t) are used.

to macroeconomic conditions. By leveraging this exogeneity, we isolate the causal impact of policy changes on firms' financial outcomes. The use of the previous month's surprises ensures that the instrument aligns temporally with the policy change, reflecting the central bank's immediate adjustments following the unexpected shocks.[14]

Table 3 presents the estimated causal effects of central bank policy rate changes on key firm-level financial outcomes, including credit amount, credit growth, borrowing costs and default probability. The results indicate that a 100 basis point increase in the policy rate leads to a 1.2% reduction in the credit amount, reflecting a significant contraction in firms' access to credit. Additionally, credit growth declines by 0.02 percentage points, suggesting that higher policy rates dampen the pace at which firms can expand their borrowing. Borrowing costs increase by 83 basis points, highlighting the direct pass-through of policy rate hikes to firm-level financing conditions. Finally, the default probability of firms increases by 0.008, indicating that tighter monetary policy raises financial distress risks for borrowers. In other words, the observed rise in default probability aligns with the notion that higher financing costs and reduced credit availability strain firms' ability to meet debt obligations, increasing the likelihood of defaults.

Table 3 further reveals the heterogeneous effects of monetary policy changes on firms' financial outcomes across firm characteristics such as size, leverage and export status. Larger firms are less sensitive to policy rate changes compared with SMEs, reflecting their stronger financial positions and greater access to credit markets. Specifically, a 100 basis point increase in the policy rate results in a 0.8% decline in credit amount for larger firms, while SMEs experience a sharper reduction of 1.3%. Similarly, borrowing costs for larger firms rise by 75.9 basis points, whereas SMEs face a more substantial increase of 83.5 basis points. This disparity highlights the challenges smaller firms face due to their limited collateral, weaker credit histories and greater dependence on bank financing. As monetary policy tightens, credit-constrained SMEs are more likely to face higher interest rates and stricter lending terms, amplifying their financial burden compared with larger firms, which typically have better credit access and diversified financing sources.

[14] Moreover, using the surprises from the prior month aligns with the temporal dynamics of monetary policy transmission. Firms and banks require time to process policy announcements and adjust their behaviours accordingly. By incorporating the previous month's surprises, we account for the lagged effects of monetary policy adjustments, ensuring that the instrument reflects the most relevant exogenous variation for explaining the observed policy changes.

Heterogeneous impact of policy rate change on firms' outstanding credits Table 3

	(1) All sample	(2) Large firms	(3) SMEs	(4) High leverage	(5) Low leverage	(6) Exporter	(7) Non-exporter
Panel A: Borrowing cost							
$PolicyChange_{t-1}$	0.833***	0.759***	0.835***	0.873***	0.813***	0.742***	0.833***
	(0.0026)	(0.0155)	(0.0026)	(0.0035)	(0.0037)	(0.0153)	(0.0028)
R-squared	0.20	0.16	0.20	0.21	0.22	0.18	0.21
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel B: Flow credit							
$PolicyChange_{t-1}$	–0.012***	–0.008**	–0.013***	–0.015***	–0.011***	–0.010**	–0.012***
	(0.0048)	(0.0126)	(0.0047)	(0.0074)	(0.0069)	(0.0119)	(0.0051)
R-squared	0.08	0.11	0.08	0.12	0.12	0.09	0.08
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel C: Monthly outstanding credit growth							
$PolicyChange_{t-1}$	–0.023***	–0.016***	–0.024***	–0.026***	–0.019***	–0.016***	–0.025***
	(0.0003)	(0.0062)	(0.0003)	(0.0007)	(0.0008)	(0.0048)	(0.0005)
R-squared	0.14	0.10	0.15	0.17	0.19	0.12	0.13
Observations	14,454,768	104,753	14,350,015	7,123,819	7,330,949	2,392,874	12,061,894
Panel D: Default							
$PolicyChange_{t-1}$	0.008***	0.006***	0.008***	0.012***	0.007***	0.005***	0.008***
	(0.0014)	(0.0079)	(0.0016)	(0.0024)	(0.0029)	(0.0124)	(0.00015)
R-squared	0.18	0.15	0.18	0.21	0.23	0.16	0.19
Observations	15,695,201	61,185	15,634,016	7,866,829	7,828,372	2,505,546	13,189,655
Firm FE	✓	✓	✓	✓	✓	✓	✓
Sector x quarter FE	✓	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓	✓
Macroeconomic controls	✓	✓	✓	✓	✓	✓	✓

[1] This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. 〖PolicyChange〗_(t-1) is instrumented by orthogonalised monetary policy surprises (〖MP〗_(t-1)) at year-month (t−1), derived from Bloomberg forecast errors. Firms are categorised as SMEs if they have fewer than 250 employees; otherwise, they are classified as large. Firms are identified as highly leveraged if their leverage ratio exceeds the sector-year median within the same sector. Additionally, firms are considered exporters if they have engaged in export activities for at least one year. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

The results also highlight differences based on firms' leverage levels. Highly leveraged firms are more affected by policy changes, with a 100 basis point increase causing a 1.5% reduction in credit amount and a 0.019 percentage point decrease in credit growth. In comparison, low-leverage firms experience a smaller reduction in credit amount (1.1 percentage points) and credit growth (0.016 percentage points). Moreover, borrowing costs for highly leveraged firms increase by 87.3 basis points, compared with an 81.3 basis point increase for their low-leverage counterparts. This indicates that firms with greater financial fragility are disproportionately impacted by tighter monetary conditions. Accordingly, highly leveraged firms, which already have significant existing debt burdens, face disproportionately higher costs and constraints when monetary policy tightens. When policy rates increase, borrowing costs rise for all firms; however, the impact is particularly severe for firms with high leverage. These firms are viewed as riskier by lenders due to their greater probability of financial distress, so banks and other financial institutions impose a higher risk premium on the loans they extend. The sharper rise in borrowing costs amplifies the financial pressure on highly indebted firms. Intuitively, this outcome can be understood through the lens of credit risk and lender behaviour. When monetary conditions tighten, lenders become more cautious and selective, particularly towards firms that already have significant debt obligations. For highly leveraged firms, even small increases in interest rates can translate into substantial additional costs due to their large debt stock, leading to deteriorating financial health. This forces them to either reduce their demand for credit or allocate a larger portion of their cash flows to servicing existing debt, leaving less room for investment and operational spending.

The heightened borrowing costs for highly leveraged firms also signal their vulnerability in times of economic uncertainty. With tighter monetary conditions, their ability to roll over existing debt or secure new loans becomes more expensive and challenging, increasing the likelihood of defaults. Lenders, anticipating this higher risk, further tighten credit terms, creating a feedback loop that exacerbates the financial fragility of these firms. This dynamic highlights how monetary policy can disproportionately affect firms with weaker balance sheets, amplifying financial constraints and limiting their ability to navigate economic shocks.[15]

Finally, the analysis in Table 3 highlights the differences between exporting and non-exporting firms in their response to monetary policy changes. Exporting firms are relatively less affected by tighter monetary conditions, experiencing a 1% decline in credit amount following a 100 basis point increase in policy rates, compared with a 1.2% reduction for non-exporting firms. Similarly, borrowing costs for exporters increase by 74.2 basis points, whereas non-exporters face a sharper rise of 83.3 basis points. This lower sensitivity among exporting firms can be attributed to their diversified revenue streams and access to external markets, which provide a buffer against domestic monetary tightening. Exporters often generate income in foreign currencies, which helps mitigate the impact of rising domestic interest rates on their cash flows. Additionally, their ability to tap into international financing channels may reduce their reliance on domestic credit markets, making them less vulnerable to domestic monetary shocks. By contrast, non-exporting firms are more dependent on

[15] The results based on raw monetary policy surprises, derived from Bloomberg forecast errors, are presented in Appendix C.

local demand and domestic credit, leaving them more exposed to rising borrowing costs and tighter financial conditions.

Policy rate change and sectoral variations in firms' outstanding credits Table 4

	(1) Industry	(2) Services	(3) Construction
Panel A: Borrowing cost			
$PolicyChange_{t-1}$	0.814***	0.849***	0.893***
	(0.0047)	(0.0032)	(0.0072)
R-squared	0.18	0.20	0.21
Observations	2,596,747	5,878,831	1,237,116
Panel B: Flow credit			
$PolicyChange_{t-1}$	–0.010***	–0.013***	–0.018***
	(0.0025)	(0.0053)	(0.0097)
R-squared	0.11	0.10	0.10
Observations	2,596,747	5,878,831	1,237,116
Panel C: Monthly outstanding credit growth			
$PolicyChange_{t-1}$	–0.019***	–0.022***	–0.027***
	(0.0007)	(0.0003)	(0.0009)
R-squared	0.10	0.13	0.08
Observations	2,781,632	9,591,771	1,859,480
Panel D: Default			
$PolicyChange_{t-1}$	0.007***	0.008***	0.011***
	(0.0045)	(0.0016)	(0.0124)
R-squared	0.15	0.19	0.17
Observations	3,014,051	10,370,042	2,076,265
Firm FE	✓	✓	✓
Sector x quarter FE	✓	✓	✓
Firm controls	✓	✓	✓
Macroeconomic controls	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. 〖PolicyChange〗_(t-1) is instrumented by orthogonalised monetary policy surprises (〖MP〗_(t-1)) at year-month (t−1), derived from Bloomberg forecast errors. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Table 4 highlights significant sectoral differences in how firms' financial outcomes respond to policy rate changes. A 100 basis point increase in the policy rate

leads to a reduction in credit amounts of 1% for industry firms, 1.3% for service firms and 1.8% for construction firms, while credit growth decreases by 0.019, 0.022 and 0.027 percentage points, respectively. Borrowing costs also rise notably, with the largest increase observed in construction (89.3 basis points), followed by services (84.9 basis points) and industry (81.4 basis points). Default probabilities also increase across all sectors, with construction firms showing the greatest sensitivity.

These findings underscore the particular vulnerability of the construction sector, driven by its reliance on credit-intensive financing and sensitivity to rising interest rates. Higher borrowing costs disproportionately affect construction firms, which lenders perceive as riskier, leading to higher risk premiums and greater financial strain. This dynamic forces these firms to scale back borrowing or allocate more resources to debt servicing, limiting their capacity for investment and operational spending. The cumulative effects of rising borrowing costs, reduced credit access and elevated default probabilities exacerbate financial constraints for construction firms, illustrating how monetary policy changes can unevenly impact sectors with varying levels of credit dependence and financial fragility.

7. Conclusion

This paper examines the heterogeneous effects of monetary policy surprises on firms, with a focus on credit usage, default probability and credit scores. By leveraging rich administrative data from Türkiye, we aim to provide a granular understanding of how monetary policy transmission varies across firms with different characteristics, such as size, leverage and export status, as well as across sectors. We also discuss sectoral heterogeneity, highlighting the differential impacts of monetary policy on the construction, industrial and services sectors, driven by their unique financial structures and economic roles. The study contributes to the growing literature on monetary transmission by emphasising firm-level heterogeneity and providing new insights into the dynamics of credit markets in an emerging market economy context.

Our findings reveal significant heterogeneity in how firms respond to monetary policy shocks. Large firms are less sensitive to monetary policy surprises compared with SMEs. They maintain more stable access to credit, experience smaller declines in credit scores and face lower default probabilities. These results align with existing research, which attributes the resilience of large firms to their diversified revenue streams, stronger financial positions and broader access to capital markets. In contrast, SMEs, characterised by greater financial constraints and limited credit options, are more adversely affected by monetary tightening. Additionally, firms with higher leverage exhibit greater sensitivity to monetary policy, while exporters appear less affected due to their access to diversified external markets.

At the sectoral level, we find that the construction sector is the most responsive to monetary policy shocks, driven by its reliance on long-term financing and its direct link to housing markets. The industrial sector exhibits the lowest responsiveness, owing to its access to alternative financing sources and long-term investment planning. The services sector falls in between, reflecting its dependence on consumer spending and labour-intensive operations.

Overall, this paper underscores the importance of accounting for firm-level and sectoral heterogeneity when analysing monetary policy transmission. These findings have important policy implications, suggesting that a one-size-fits-all approach to monetary policy may overlook significant differences in how firms and sectors respond to policy changes. Future research can build on these insights by exploring additional dimensions of firm heterogeneity and their implications for economic stability and policy design.

References

Adrian, T., & Shin, H. S. (2010). Financial intermediaries and monetary economics. In B. Friedman & M. Woodford (Eds.), *Handbook of Monetary Economics* (Vol. 3, pp. 601–650). Elsevier.

Albrizio, S., González, B., & Khametshin, D. (2023). A tale of two margins: monetary policy and capital misallocation. *Bank of Spain Working Papers*, (No. 2302).

Almeida, H., Campello, M., & Weisbach, M. (2004). The cash flow sensitivity of cash. *Journal of Finance*, 59(4), 1777–1804.

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R., & Ragusa, G. (2019). Measuring euro area monetary policy. *Journal of Monetary Economics*, 108, 162–179.

Anderson, G., & Cesa-Bianchi, A. (2024). Crossing the credit channel: credit spreads and firm heterogeneity. *American Economic Journal: Macroeconomics*, 16(3), 417–446.

Aruoba, S., Fernández, A., Guzmán, D., Pastén, E., & Saffie, F. (2021). Monetary policy surprises in Chile: measurement and real effects. *Central Bank of Chile Working Paper*, (No. 921).

Bahaj, S., Foulis, A., Pinter, G., & Surico, P. (2022). Employment and the residential collateral channel of monetary policy. *Journal of Monetary Economics*, 131, 26–44.

Bauer, M. D., & Swanson, E. T. (2023). An alternative explanation for the "Fed Information Effect". *American Economic Review*, 113(3), 664–700.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2008). Financing patterns around the world: are small firms different? *Journal of Financial Economics*, 89(3), 467–487.

Bernanke, B. S., & Blinder, A. S. (1992). The federal funds rate and the channels of monetary transmission. *American Economic Review*, 82(4), 901–921.

Bernanke, B. S., & Gertler, M. (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives*, 9(4), 27–48.

Bouakez, H., Cardia, E., & Ruge-Murcia, F. (2011). Durable goods, inter-sectoral linkages and monetary policy. *Journal of Economic Dynamics and Control*, 35(5), 730–745.

Bougheas, S., Mizen, P., & Yalcin, C. (2006). Access to external finance: theory and evidence on the impact of monetary policy and firm-specific characteristics. *Journal of Banking and Finance*, 30(1), 199–227.

Brunnermeier, M., & Sannikov, Y. (2014). A macroeconomic model with a financial sector. *American Economic Review*, 104(2), 379–421.

Caglio, C., Darst, R., & Kalemli-Özcan, S. (2021). Collateral heterogeneity and monetary policy transmission: evidence from loans to SMEs and large firms. *NBER Working Paper*, (No. 28685).

Checo, A., Grigoli, F., & Sandri, D. (2024). Monetary policy transmission in emerging markets: proverbial concerns, novel evidence. *BIS Working Papers*, (No. 1170).

Cloyne, J., Ferreira, C., Froemel, M., & Surico, P. (2023). Monetary policy, corporate finance, and investment. *Journal of the European Economic Association*, 21(6), 2586–2634.

Deng, M., & Fang, M. (2022). Debt maturity heterogeneity and investment responses to monetary policy. *European Economic Review*, 144, 104095.

Durante, E., Ferrando, A., & Vermeulen, P. (2022). Monetary policy, investment, and firm heterogeneity. *European Economic Review*, 148, 104251.

Fama, E., & French, K. (2005). Financing decisions: who issues stock? *Journal of Financial Economics*, 76(3), 549–582.

Faust, J., Rogers, J. H., Wang, S.-Y. B., & Wright, J. H. (2007). The high-frequency response of exchange rates and interest rates to macroeconomic announcements. *Journal of Monetary Economics*, 54(4), 1051–1068.

Ferrando, A., Popov, A., & Udell, G. (2022). Unconventional monetary policy, funding expectations, and firm decisions. *European Economic Review*, 149.

Gaiotti, E., & Generale, A. (2002). Does monetary policy have asymmetric effects? A look at the investment decisions of Italian firms. *Giornale degli Economisti e Annali di Economia*, 61(1), 29–59.

Galí, J. (2008). *Monetary policy, inflation, and the business cycle: An introduction to the New Keynesian framework*. Princeton University Press.

Gertler, M., & Gilchrist, S. (1994). Monetary policy, business cycles, and the behaviour of small manufacturing firms. *Quarterly Journal of Economics*, 109(2), 309–340.

Gertler, M., & Karadi, P. (2011). A model of unconventional monetary policy. *Journal of Monetary Economics*, 58(1), 17–34.

Gürkaynak, R. S., & Wright, J. H. (2013). Identification and inference using event studies. *Manchester School*, 81(S1), 48–65.

Gürkaynak, R. S., Karasoy-Can, H., & Lee, S. S. (2022). Stock market's assessment of monetary policy transmission: the cash flow effect. *Journal of Finance*, 77(4), 2375–2421.

Gürkaynak, R. S., Sack, B., & Swanson, E. (2005). Do actions speak louder than words? The response of asset prices to monetary policy actions and statements. *International Journal of Central Banking*, 1(1), 55–93.

Hanson, S. G., & Stein, J. C. (2015). Monetary policy and long-term real rates. *Journal of Financial Economics*, 115(3), 429–448.

Hennessy, C. A., & Whited, T. M. (2007). How costly is external financing? Evidence from a structural estimation. *Journal of Finance*, 62(4), 1705–1745.

Iacoviello, M., & Neri, S. (2010). Housing market spillovers: evidence from an estimated DSGE model. *American Economic Journal: Macroeconomics*, 2(2), 125–164.

Ippolito, F., Ozdagli, A., & Perez-Orive, A. (2018). The transmission of monetary policy through bank lending: the floating rate channel. *Journal of Monetary Economics*, 95(C), 49–71.

Jarociński, M., & Karadi, P. (2020). Deconstructing monetary policy surprises: the role of information shocks. *American Economic Journal: Macroeconomics*, 12(2), 1–43.

Jiménez, G., Ongena, S., Peydró, J.-L., & Saurina, J. (2012). Credit supply and monetary policy: identifying the bank balance-sheet channel with loan applications. *American Economic Review*, 102(5), 2301–2326.

Jeenas, P. (2023). Firm balance sheet liquidity, monetary policy shocks, and investment dynamics. *Working Papers*, 1409, Barcelona School of Economics.

Jungherr, J., Meier, M., Reinelt, T., & Schott, I. (2022). Corporate debt maturity matters for monetary policy. *CRC TR Discussion Paper Series*, (No. 224).

Kashyap, A. K., Lamont, O. A., & Stein, J. C. (1994). Credit conditions and the cyclical behavior of inventories. *Quarterly Journal of Economics*, 109(3), 565–592.

Kuttner, K. N. (2001). Monetary policy surprises and interest rates: evidence from the Fed funds futures market. *Journal of Monetary Economics*, 47(3), 523–544.

Mihaljek, D., & Klau, M. (2008). Exchange rate pass-through in emerging market economies: what has changed and why? In Bank for International Settlements (Ed.), *Transmission mechanisms for monetary policy in emerging market economies* (Vol. 35, pp. 103–130). BIS Papers.

Nakamura, E., & Steinsson, J. (2018). High-frequency identification of monetary non-neutrality: the information effect. *Quarterly Journal of Economics*, 133(3), 1283–1330.

Obstfeld, M., & Rogoff, K. (2001). The six major puzzles in international macroeconomics: is there a common cause? *NBER Macroeconomics Annual*, 15, 339–412.

Ottonello, P., & Winberry, T. (2020). Financial heterogeneity and the investment channel of monetary policy. *Econometrica*, 88(6), 2473–2502.

Ozdagli, A. K. (2018). Financial frictions and the stock price reaction to monetary policy. *Review of Financial Studies*, 31(10), 3895–3936.

Peek, J., Rosengren, E. S., & Tootell, G. M. B. (1999). Is bank supervision central to central banking? *Quarterly Journal of Economics*, 114(2), 629–653.

Pericoli, M., & Veronese, G. (2015). Forecaster heterogeneity, surprises and financial markets. *Bank of Italy Working Papers*, (No. 1020).

Pescatori, A. (2018). Central bank communication and monetary policy surprises in Chile. *IMF Working Papers*, (No. 156).

Rajan, R. G., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, 88(3), 559–586.

Romer, D., & Romer, C. (2000). Federal Reserve information and the behaviour of interest rates. *American Economic Review*, 90(3), 429–457.

Singh, A., Suda, J., & Zervou, A. (2022). Monetary policy, labor market, and sectoral heterogeneity. *AEA Papers and Proceedings*, 112, 491–495.

Swanson, E. T. (2021). Measuring the effects of Federal Reserve forward guidance and asset purchases on financial markets. *Journal of Monetary Economics*, 118, 32–53.

Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review*, 44(7), 1389–1408.

Tillmann, P. (2023). Macroeconomic surprises and the demand for information about monetary policy. *International Journal of Central Banking*, 19(2), 351–388.

Woodford, M. (2003). Interest and prices: Foundations of a theory of monetary policy. Princeton University Press.

Appendix A: Descriptive statistics

Descriptive statistics

Table A.1

	All sample		Large		SMEs		High leverage		Low leverage		Exporter	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Credit market outcomes												
Flow credit	0.50	0.53	1.39	0.74	0.47	0.51	0.46	0.52	0.53	0.55	0.82	0.63
Borrowing cost (%)	23.29	13.36	20.48	11.98	23.38	13.39	23.59	13.37	22.14	13.34	21.27	13.04
Outstanding credit growth	3.41	31.42	8.94	48.13	3.39	31.37	3.21	32.21	3.59	32.30	5.04	33.86
Default	0.09	0.39	0.08	0.56	0.09	0.39	0.11	0.45	0.07	0.33	0.05	0.36
Balance sheet outcomes												
Net sales (billion TL)	0.11	1.86	1.53	7.91	0.05	0.67	0.08	1.23	0.12	1.86	0.26	2.48
Total assets (billion TL)	0.10	1.01	1.31	4.97	0.04	0.22	0.07	0.75	0.09	1.09	0.21	1.76
Capital (K) (billion TL)	0.02	0.25	0.25	1.14	0.01	0.06	0.01	0.18	0.02	0.24	0.03	0.28
Exports (billion TL)	0.02	0.58	0.29	1.91	0.01	0.36	0.02	0.63	0.03	0.31	0.21	2.06
Number of employees	74.72	526.41	904.47	1245.89	26.46	39.25	47.64	313.16	60.91	569.81	100.81	549.01
Age	14.43	10.31	23.74	14.43	12.68	9.72	11.97	9.57	14.09	10.48	14.13	11.53

The table presents the descriptive statistics for the sample. Flow credits are expressed as the logarithm of the flow of credit, while borrowing cost represents the borrowing costs for flow credits, expressed as percentages. Outstanding credit growth is calculated as the logarithmic difference in outstanding credits. Finally, default is a binary variable that takes a value of one if the outstanding credit is classified as a non-performing loan (NPL) and zero if the credit remains active.

Appendix B: Robustness check for the impact of monetary policy surprises

Heterogeneous effects of monetary policy shocks on firms' financial outcomes

(using raw monetary policy surprises from Bloomberg forecast errors) Table B.1

	(1) All sample	(2) Large firms	(3) SMEs	(4) High leverage	(5) Low leverage	(6) Exporter	(7) Non- exporter
Panel A: Borrowing cost							
MP_{t-1}	0.825***	0.799***	0.833***	0.864***	0.741***	0.802***	0.827***
	(0.0074)	(0.0162)	(0.0078)	(0.0125)	(0.0121)	(0.0114)	(0.0073)
R-squared	0.82	0.74	0.83	0.80	0.81	0.78	0.81
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel B: Flow credit							
MP_{t-1}	–0.014***	–0.010***	–0.015***	–0.022***	–0.012***	–0.013***	–0.015***
	(0.0062)	(0.0101)	(0.0063)	(0.0098)	(0.0094)	(0.0121)	(0.0063)
R-squared	0.14	0.10	0.15	0.17	0.16	0.19	0.15
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel C: Monthly outstanding credit growth							
MP_{t-1}	–0.018***	–0.015***	–0.018***	–0.021***	–0.017***	–0.015***	–0.018***
	(0.0002)	(0.0056)	(0.0002)	(0.0003)	(0.0004)	(0.0062)	(0.0002)
R-squared	0.07	0.04	0.07	0.08	0.06	0.08	0.07
Observations	14,454,768	104,753	14,350,015	7,123,819	7,330,949	2,392,874	12,061,894
Panel D: Default							
MP_{t-1}	0.004***	0.003***	0.004***	0.006***	0.003***	0.001***	0.004***
	(0.0029)	(0.0082)	(0.0031)	(0.0039)	(0.0035)	(0.0069)	(0.0030)
	0.17	0.15	0.17	0.20	0.18	0.24	0.18
	15,695,201	61,185	15,634,016	7,866,829	7,828,372	2,505,546	13,189,655
Firm FE	✓	✓	✓	✓	✓	✓	✓
Sector x quarter FE	✓	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓	✓
Macroeconomic controls	✓	✓	✓	✓	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as $log(r_{ibt})$; in Panel B, it is the logarithm of the flow credit amount, $log(credit_{ibt})$, for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as $(log(credit_{it}) - log(credit_{it-1})$; and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. Monetary policy surprises (MP_{t-1}) are represented by monetary policy surprises at year-month (t−1), derived from Bloomberg forecast errors. Firms are categorised as SMEs if they have fewer than 250 employees; otherwise, they are classified as large. Firms are identified as highly leveraged if their leverage ratio exceeds the sector-year median within the same sector. Additionally, firms are considered exporters if they have engaged in export activities for at least one year. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Monetary policy surprises and sectoral variations in firms' financial outcomes

(using raw monetary policy surprises from Bloomberg forecast errors) Table B.2

	(1) Industry	(2) Services	(3) Construction
Panel A: Borrowing cost			
MP_{t-1}	0.802***	0.830***	0.860***
	(0.0056)	(0.0078)	(0.0112)
R-squared	0.79	0.82	0.81
Observations	2,596,747	5,878,831	1,237,116
Panel B: Flow credit			
MP_{t-1}	–0.010***	–0.013***	–0.018***
	(0.0025)	(0.0053)	(0.0097)
R-squared	0.11	0.10	0.10
Observations	2,596,747	5,878,831	1,237,116
Panel C: Monthly outstanding credit growth			
MP_{t-1}	–0.016***	–0.018***	–0.020***
	(0.0003)	(0.0002)	(0.0006)
R-squared	0.06	0.07	0.07
Observations	2,781,632	9,591,771	1,859,480
Panel D: Default			
MP_{t-1}	0.002***	0.002***	0.005***
	(0.0024)	(0.0031)	(0.0054)
R-squared	0.12	0.20	0.15
Observations	3,014,051	10,370,042	2,076,265
Firm FE	✓	✓	✓
Sector x quarter FE	✓	✓	✓
Firm controls	✓	✓	✓
Macroeconomic controls	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. Monetary policy surprises (〖MP〗_(t-1)) are represented by monetary policy surprises at year-month (t−1), derived from Bloomberg forecast errors. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Heterogeneous effects of monetary policy shocks on firms' financial outcomes

(using raw monetary policy surprises from Market Participants Survey's forecast errors) Table B.3

	(1) All sample	(2) Large firms	(3) SMEs	(4) High leverage	(5) Low leverage	(6) Exporter	(7) Non-exporter
Panel A: Borrowing cost							
MP_{t-1}	1.156***	0.967***	1.159***	1.175***	1.035***	0.985***	1.161***
	(0.0016)	(0.0101)	(0.0016)	(0.0022)	(0.0023)	(0.0068)	(0.0018)
R-squared	0.86	0.77	0.87	0.85	0.86	0.82	0.88
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel B: Flow credit							
MP_{t-1}	–0.025***	–0.018***	–0.026***	–0.029***	–0.024***	–0.020***	–0.027***
	(0.0053)	(0.0098)	(0.0054)	(0.0077)	(0.0081)	(0.0125)	(0.0054)
R-squared	0.15	0.09	0.15	0.16	0.15	0.19	0.15
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel C: Monthly outstanding credit growth							
MP_{t-1}	–0.018***	–0.015***	–0.018***	–0.021***	–0.017***	–0.015***	–0.018***
	(0.0002)	(0.0056)	(0.0002)	(0.0003)	(0.0004)	(0.0062)	(0.0002)
R-squared	0.07	0.04	0.07	0.08	0.06	0.08	0.07
Observations	14,454,768	104,753	14,350,015	7,123,819	7,330,949	2,392,874	12,061,894
Panel D: Default							
MP_{t-1}	0.004***	0.003***	0.004***	0.006***	0.003***	0.001***	0.004***
	(0.0029)	(0.0082)	(0.0031)	(0.0039)	(0.0035)	(0.0069)	(0.0030)
	0.17	0.15	0.17	0.20	0.18	0.24	0.18
	15,695,201	61,185	15,634,016	7,866,829	7,828,372	2,505,546	13,189,655
Firm FE	✓	✓	✓	✓	✓	✓	✓
Sector x quarter FE	✓	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓	✓
Macroeconomic controls	✓	✓	✓	✓	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. Monetary policy surprises (〖MP〗_(t-1)) are represented by monetary policy surprises at year-month (t−1), derived from Market Participants Survey's forecast errors. Firms are categorised as SMEs if they have fewer than 250 employees; otherwise, they are classified as large. Firms are identified as highly leveraged if their leverage ratio exceeds the sector-year median within the same sector. Additionally, firms are considered exporters if they have engaged in export activities for at least one year. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Monetary policy surprises and sectoral variations in firms' financial outcomes

(using raw monetary policy surprises from Market Participants Survey's forecast errors) Table B.4

	(1) Industry	(2) Services	(3) Construction
Panel A: Borrowing cost			
MP_{t-1}	1.124***	1.181***	1.201***
	(0.0030)	(0.0021)	(0.0045)
R-squared	0.85	0.86	0.85
Observations	2,596,747	5,878,831	1,237,116
Panel B: Flow credit			
MP_{t-1}	–0.020***	–0.024***	–0.028***
	(0.0082)	(0.0055)	(0.0094)
R-squared	0.21	0.16	0.18
Observations	2,596,747	5,878,831	1,237,116
Panel C: Monthly outstanding credit growth			
MP_{t-1}	–0.016***	–0.018***	–0.020***
	(0.0003)	(0.0002)	(0.0006)
R-squared	0.06	0.07	0.07
Observations	2,781,632	9,591,771	1,859,480
Panel D: Default			
MP_{t-1}	0.002***	0.002***	0.005***
	(0.0024)	(0.0031)	(0.0054)
R-squared	0.12	0.20	0.15
Observations	3,014,051	10,370,042	2,076,265
Firm FE	✓	✓	✓
Sector x quarter FE	✓	✓	✓
Firm controls	✓	✓	✓
Macroeconomic controls	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. Monetary policy surprises (〖MP〗_(t-1)) are represented by monetary policy surprises at year-month (t−1), derived from Market Participants Survey's forecast errors. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Appendix C: Robustness check for the causal impact of policy rate

Heterogeneous impact of policy rate change on firms' outstanding credits

(using raw monetary policy surprises from Bloomberg forecast errors) Table C.1

	(1) All sample	(2) Large firms	(3) SMEs	(4) High leverage	(5) Low leverage	(6) Exporter	(7) Non- exporter
Panel A: Borrowing cost							
$PolicyChange_{t-1}$	0.942***	0.913***	0.945***	0.957***	0.918***	0.894***	0.943***
	(0.0032)	(0.0205)	(0.0032)	(0.0044)	(0.0048)	(0.0153)	(0.0033)
R-squared	0.18	0.15	0.19	0.21	0.20	0.16	0.19
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel B: Flow credit							
$PolicyChange_{t-1}$	–0.018***	–0.013***	–0.019***	–0.021***	–0.015***	–0.014**	–0.019***
	(0.0043)	(0.0117)	(0.0044)	(0.0069)	(0.0067)	(0.0108)	(0.0044)
R-squared	0.12	0.11	0.12	0.13	0.13	0.11	0.12
Observations	9,861,811	310,038	9,551,773	4,914,613	4,947,198	552,941	9,308,870
Panel C: Monthly outstanding credit growth							
$PolicyChange_{t-1}$	–0.015***	–0.009**	–0.013***	–0.022***	–0.011***	–0.008**	–0.016***
	(0.0002)	(0.0053)	(0.0002)	(0.0003)	(0.0003)	(0.0016)	(0.0009)
R-squared	0.10	0.14	0.10	0.16	0.18	0.15	0.11
Observations	14,454,768	104,753	14,350,015	7,123,819	7,330,949	2,392,874	12,061,894
Panel D: Default							
$PolicyChange_{t-1}$	0.007***	0.004**	0.007***	0.010***	0.006***	0.004***	0.007***
	(0.0010)	(0.0024)	(0.0010)	(0.0016)	(0.0017)	(0.0014)	(0.0012)
R-squared	0.18	0.15	0.18	0.21	0.23	0.16	0.19
Observations	15,695,201	61,185	15,634,016	7,866,829	7,828,372	2,505,546	13,189,655
Firm FE	✓	✓	✓	✓	✓	✓	✓
Sector x quarter FE	✓	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓	✓
Macroeconomic controls	✓	✓	✓	✓	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. 〖PolicyChange〗_(t-1) is instrumented by orthogonalised monetary policy surprises (〖MP〗_(t-1)) at year-month (t−1), derived from Bloomberg forecast errors. Firms are categorised as SMEs if they have fewer than 250 employees; otherwise, they are classified as large. Firms are identified as highly leveraged if their leverage ratio exceeds the sector-year median within the same sector. Additionally, firms are considered exporters if they have engaged in export activities for at least one year. Standard errors, clustered by firm, in parenthesis. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

Policy rate change and sectoral variations in firms' outstanding credits

Table C.2

	(1) Industry	(2) Services	(3) Construction
Panel A: Borrowing cost			
$PolicyChange_{t-1}$	0.914***	0.940***	1.014***
	(0.0047)	(0.0032)	(0.0072)
R-squared	0.15	0.16	0.18
Observations	2,596,747	5,878,831	1,237,116
Panel B: Flow credit			
$PolicyChange_{t-1}$	–0.015***	–0.017***	–0.023***
	(0.0029)	(0.0045)	(0.0085)
R-squared	0.18	0.21	0.20
Observations	2,596,747	5,878,831	1,237,116
Panel C: Monthly outstanding credit growth			
$PolicyChange_{t-1}$	–0.013***	–0.015***	–0.023***
	(0.0004)	(0.0002)	(0.0005)
R-squared	0.09	0.12	0.07
Observations	2,781,632	9,591,771	1,859,480
Panel D: Default			
$PolicyChange_{t-1}$	0.006***	0.007***	0.010***
	(0.0023)	(0.0012)	(0.0028)
R-squared	0.15	0.19	0.17
Observations	3,014,051	10,370,042	2,076,265
Firm FE	✓	✓	✓
Sector x quarter FE	✓	✓	✓
Firm controls	✓	✓	✓
Macroeconomic controls	✓	✓	✓

This table presents the estimation results for equation (3), with the unit of observation varying across panels. In Panels A and B, the unit of observation is firm-bank-year-month, where the outcomes are derived from flow credits. In Panels C and D, the unit of observation is firm-year-month, focusing on outstanding credits. The dependent variable differs across panels: in Panel A, it is the borrowing cost of loans for firm i from bank b at time t, expressed as log(r_ibt); in Panel B, it is the logarithm of the flow credit amount, log(credit_ibt), for firm i from bank b at time t; in Panel C, it is the monthly logarithmic difference in outstanding credits for firm i at time t, calculated as (log(credit_it)-log(credit_(it-1)); and in Panel D, it is the default probability, defined as one if the credit is in default and zero if the loan is active. Panels A, B and C include only active credits, while Panel D includes both active and non-performing loans (NPLs). Additionally, Panels A and B incorporate bank fixed effects to control for variations in lending practices, risk preferences and liquidity constraints across banks. 〖PolicyChange〗_(t-1) is instrumented by orthogonalised monetary policy surprises (〖MP〗_(t-1)) at year-month (t−1), derived from Bloomberg forecast errors. Sample: 2017M1–2024M10. ***p<0.01, **p<0.05, *p<0.1.

The Heterogeneity of Banks, Businesses and Households in the Monetary Policy Transmission Mechanism

State Bank of Vietnam

1. Overview

The post-Covid-19 period and the surge in global inflation have prompted central banks worldwide to tighten monetary policy (MP) to control inflation. However, the persistence of inflation in many countries has raised questions about the effectiveness of MP transmission in recent times. Numerous studies have demonstrated that the impact of MP transmission varies across countries, depending on the structural characteristics of their economies. This derives from the observation and comparison among different countries. But what about within a single country? Do differences in the characteristics of businesses, households or banks within the same economy influence the MP transmission mechanism? In other words, is there heterogeneity in how MP affects different entities within the same group (households, businesses or banks) in the economy? Research findings and practical experiences suggest that the diversity or heterogeneity of households and businesses, especially non-financial businesses, significantly affects MP's ability to influence macroeconomic variables. In return, these entities are also affected by economic fluctuations. In Vietnam, some studies have shown that MP can have uneven effects on different groups of banks and businesses. Large banks, for instance, are less sensitive to MP adjustments than smaller banks. For businesses, evidence suggests that domestic enterprises are more affected by MP than foreign direct investment (FDI) enterprises. Moreover, businesses with high leverage ratios are more sensitive to MP changes than those with lower debt levels. For households, preliminary observations by the State Bank of Vietnam (SBV) indicate differences in their responses to MP. However, the limitations in availability of empirical data remains a significant challenge for further research.

2. International evidence

Some recent studies, such as ECB research in 2022 (Thürwächter, 2022) which examined the determinants of enterprises' sensitivity to MP changes, highlight that firm age and size are two critical factors. The findings reveal that for newly established and small enterprises, investment spending significantly declines under tight MP conditions. However, this effect diminishes as the firm's age and size increase. Moreover, regardless of age or size, enterprises with higher growth rates (driven by high labour productivity) are less affected by MP changes than low-growth enterprises (with low productivity). High-growth enterprises benefit from stronger positions and better investment opportunities. Additionally, the reallocation of

resources from inefficient to more efficient enterprises makes high-growth enterprises more independent in investment decisions when financial conditions shift. Conversely, a study by Sun et al (2021) in China found the opposite result: large enterprises' investments are more sensitive to loose MP than small enterprises but are less sensitive under tight MP conditions. This is primarily because large enterprises tend to borrow from large banks, which are less affected by tight MP than smaller banks that provide loans to small enterprises. When the central bank eases MP and liquidity conditions improve, large enterprises with stronger financial capabilities and less vulnerability to policy reversals are more motivated to expand investments than smaller enterprises.

Another study by the Bank of Canada (Alves et al., 2022) indicates that household heterogeneity in income, assets and risk aversion influences MP transmission effectiveness. Additionally, enterprises with higher bad debt risks face greater financial costs and require more significant stimulus measures to encourage investment. The aforementioned findings emphasise the impact of household and non-financial firm heterogeneity on MP transmission.

Tran (2024) examined three ASEAN countries – the Philippines, Indonesia and Thailand – and found evidence that MP affects household consumption differently depending on household characteristics. Specifically, in countries with a larger proportion of "hand-to-mouth" consumers, the transmission of tight MP is more pronounced and quicker. The reason for this is because such households lack savings to buffer against economic challenges during tight MP, forcing them to cut consumption. In contrast, households with savings can reduce their savings to maintain spending levels. However, this study did not clarify whether the effects under loose MP are consistent with those under tight MP. In practice, loose MP and improved economic conditions do not necessarily lead to a faster increase in consumption among hand-to-mouth households. This suggests that household heterogeneity creates asymmetrical effects under tight versus loose MP scenarios.

3. The heterogeneity of households and non-financial enterprises in MP transmission in Vietnam

Empirical studies suggest that the heterogeneity of banks and enterprises significantly influences the transmission of MP in Vietnam.

First, the impact of MP on different groups of banks is not uniform. In Vietnam, banks are the primary source of funding for economic activities due to the underdevelopment of the capital market, which has not yet been able to meet the economy's capital demand. Therefore, banks remain the critical intermediaries in the effective transmission of MP, particularly through interest rate and credit channels.

Vietnam's financial system comprises 49 banks, including the Big 4 group (one fully state-owned commercial bank and three state-controlled joint stock banks); the rest are private banks and foreign banks, which are significantly smaller than the Big 4 banks. The Big 4 group accounts for approximately 40% of total assets in the banking system and nearly 50% of the market share in deposits and credit. This disparity in financial capacity and market share leads to differences in the

transmission effects of MP among these bank groups. According to Nguyen and Tran (2021), large banks with higher profitability are more likely to take risks than smaller banks. Consequently, when MP tightens and corporate risk increases, larger banks are slower to raise interest rates or reduce credit than smaller banks. Furthermore, in a less developed capital market, smaller banks face higher competitive pressure to maintain market share and sustain their deposit base for lending activities. As a result, when the central bank raises interest rates to tighten MP, smaller banks tend to increase rates more rapidly and aggressively. This sometimes triggers rate wars, amplifying the MP transmission effect excessively and causing liquidity volatility in the money market as deposits shift among banks in response to these rate wars. Conversely, under loose MP smaller banks are slower to respond than larger banks. They maintain higher interest rates to attract depositors and compete for market share. This behaviour results in an asymmetric MP transmission effect: tightening MP often amplifies its impact due to rate wars among smaller banks while easing MP typically has a weaker transmission effect because smaller banks delay rate cuts to maintain competitiveness.

Second, the impact of MP on enterprises is also heterogeneous. For non-financial enterprises, sensitivity to MP adjustments depends on factors such as capital structure, debt composition, size, years of operation and industry. Insights gathered from enterprises during Bank – Enterprises Connection Conferences indicate that non-financial enterprises respond differently to MP changes. For example, regarding capital sources, domestic businesses in Vietnam tend to rely more heavily on domestic financing (due to limited access to international capital), making them more sensitive to MP changes. In contrast, foreign-invested enterprises are less sensitive to domestic MP adjustments as they generally have independent financing sources. This partially explains the relatively low MP transmission effect in Vietnam, where FDI enterprises play a significant role in economic production as they account for over 70% of export turnover and approximately a quarter of annual GDP.

Regarding financial leverage, enterprises with higher leverage are more sensitive to changes in interest rates and credit conditions, whereas those with lower leverage are less affected. Consequently, easing MP helps these enterprises alleviate financial cost pressures, providing resources and conditions for expanding production and business activities. Conversely, when inflation rises and the economy overheats, tighter MP disproportionately affects these highly leveraged enterprises, causing their investments to contract more rapidly than those less dependent on leverage. Additionally, regarding debt structure, enterprises and households with fixed rate loans or deposits are less sensitive to short-term MP fluctuations than those which predominantly use floating rate loans or deposits.

Third is the impact of MP on households. In principle, changes in MP affect households' decisions regarding spending, borrowing, saving and investment. How different household groups respond to policy changes varies, depending on factors such as income levels, asset ownership, asset liquidity, and risk aversion attitudes to economic fluctuations. The middle-class group typically holds a variety of financial assets such as stocks, bonds, bank deposits and real estate, which are highly sensitive to changes in monetary and financial conditions. As a result, this group is more likely to be affected by MP adjustments through the wealth effect channel. Meanwhile, low-income households generally own fewer financial assets and rely more on stable monthly income (wages and fixed income) with limited saving capacity. Particularly,

hand-to-mouth households are less affected by the wealth effect but are affected more through the income effect, leading to reduced consumption when interest rates rise and the economy weakens, as suggested by Tran's (2024) study of Thailand, the Philippines and Indonesia. This indicates that middle-class households, which hold financial assets, will respond more quickly to MP changes than low-income households. The latter group tends to react only after a delay, when the economy starts to show tangible effects, and household income is affected. Unfortunately, no published data on household consumption by income group are available in Vietnam, preventing further empirical studies to test this hypothesis in the Vietnam context.

The rapid expansion of Vietnam's economy in recent years, along with rising household incomes, has led to the growth of the middle class. Additionally, the financial market has become increasingly diversified, enabling investors to access profitable investment channels more easily and facilitating efficient capital mobilisation. These developments have increased the share of financial assets in the portfolios of households and non-financial enterprises. Consequently, MP's impact on economic agents has undergone significant changes compared with previous periods, requiring the SBV to continue monitoring and conducting in-depth research on these effects in the future.

4. Challenges in incorporating the heterogeneity of households and non-financial enterprises into MP implementation

It is evident that the heterogeneity among MP's target groups affects the effectiveness of its transmission. Some argue that unconventional MP could be employed to target specific groups, thereby achieving the desired transmission effects. However, further comprehensive research and robust data are needed to evaluate this perspective fully. The SBV has identified two critical issues for consideration.

First, heterogeneity and diversity are inherent characteristics of markets, fostering competition and development while also reflecting market imperfections. Utilising policy measures to address and compensate for market failures is necessary; however, the frequency and timing of such interventions must be carefully considered to avoid adversely affecting market competition and development dynamics. While MP can address short-term issues, structural challenges require systemic restructuring as a long-term solution. For example, in Vietnam the differential responses of large and small banks to MP do not imply that the SBV should adopt different policies for these groups. Instead, the solution lies in accelerating the restructuring of the banking system to reduce disparities in financial capacity and operational scale among banks, thereby enhancing the overall effectiveness of MP implementation.

Second, introducing numerous tools aimed at addressing the needs of different groups complicates the management of MP. Given limited resources, central banks may face difficulties in fully controlling the effects of these tools. Additionally, such complexity hampers communication efforts and MP transparency, which are key

factors influencing the effectiveness of policy transmission. In practice, enhancing communication strategies to increase the transparency and accountability of MP to the public may yield more effective transmission outcomes than adopting additional specialised, unconventional tools.

5. Conclusion

In summary, the heterogeneity of economic agents – including banks, businesses and households – affects the transmission of MP. Although comprehensive and thorough analyses of these impacts in Vietnam remain limited due to data constraints, the growing importance of these factors has led the SBV to prioritise further research and collaboration with relevant authorities to develop more comprehensive databases. These efforts aim to gradually incorporate heterogeneity considerations into MP decision-making processes. Nonetheless, under current conditions in Vietnam, addressing this issue will require significant time due to the complexity of constructing micro-level data and forecasting models to simulate heterogeneity. Furthermore, market heterogeneity is a natural feature that promotes competition. Any attempts by the SBV to adjust and address heterogeneity for individual agent undermines inherent competitive mechanisms and the capital allocation process. Thus, careful consideration of heterogeneity is essential when formulating and implementing MP.

References

Alves, F., Bustamante, C., Guo, X., Kartashova, K., Lee, S., Pugh, T., See, K., Terajima, Y., and Ueberfeldt, A. (2022). Heterogeneity and Monetary Policy: A Thematic Review. Bank of Canada Staff Discussion Paper No. 2022-2. Retrieved from https://www.bankofcanada.ca/2022/02/staff-discussion-paper-2022-2/.

Nguyen, T. K. N. and Tran, H. H. (2021). Monetary policy's impacts on the risk tolerance of Vietnamese commercial banks. Industry and Trade Journal – Scientific Research and Technological Applications, No. 7, March 2021. Retrieved from https://tapchicongthuong.vn/tac-dong-cua-chinh-sach-tien-te-den-muc-do-chap-nhan-rui-ro-cua-cac-ngan-hang-thuong-mai-viet-nam-80591.htm.

Sun, G., Zhang, J., and Zhu, X. (2021). Monetary policy transmission with heterogenous banks and firms: the case of China. Retrieved from https://cicm.pbcsf.tsinghua.edu.cn/cn2021/pdf/1621586867405498.pdf.

Thürwächter, C. (2022). Firm heterogeneity and monetary policy transmission. Retrieved from https://www.ecb.europa.eu/press/conferences/ecbforum/shared/pdf/2022/thurwachter_paper.sk.pdf.

Tran, H. T. (2024). Heterogeneous consumption behaviors and monetary policy in three ASEAN economies. Retrieved from https://link.springer.com/article/10.1007/s10368-024-00620-0.

Monetary policy decision-making: how are household and firm heterogeneity incorporated?

Questionnaire for the meeting of Emerging Market Deputy Governors on 17-18 March 2025

Please return the completed questionnaire to depgovs@bis.org by **15 November 2024**.

Your overall response will not be made public. However, specific answers may be quoted or reported in graphs in the BIS background paper with attribution to your central bank. The BIS background paper will be published on the BIS website after the meeting. In case any specific answers need to remain confidential, please let us know. For any answers that your central bank marks as confidential, we will make sure that these are not attributed to your central bank and are only mentioned in the background paper as part of aggregated information.

Please also provide contact details of the colleague in your central bank who could answer any queries about the responses provided to this questionnaire. In case of any questions regarding the questionnaire itself, contact Tirupam Goel (Tirupam.Goel@bis.org).

Central bank:

Name:

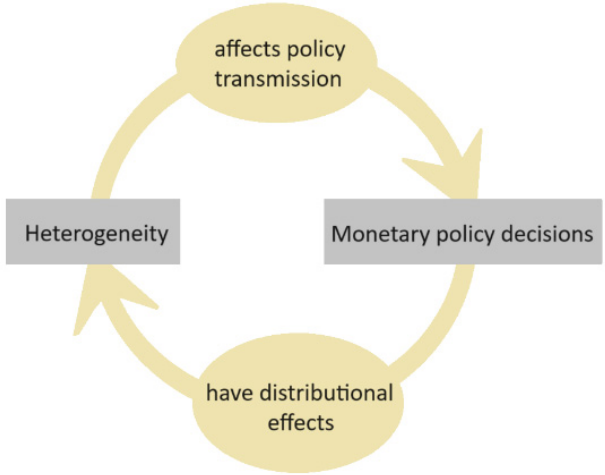
Title or department:

Email:

Phone:

Introduction

Heterogeneity among households and firms can matter for monetary policy decisions in two broad ways. First, different economic agents may react differently to policy actions. This can affect policy transmission and ultimately its effectiveness. As a result, a different policy decision may be required relative to a scenario where heterogeneity across agents is ignored. Second, monetary policy can have distributional effects. For example, to the extent low interest rates boost economic activity, they can benefit poorer/unemployed households more. Taking these distributional effects into account may also justify a different policy decision depending on the mandate of the central bank.



The goal of this questionnaire is to understand whether, why, and how heterogeneity features in the monetary policy decision making process in EME central banks. It raises both qualitative and quantitative questions, building on the proposed set of issues for discussion at the meeting (also circulated along with this questionnaire).

We are aware that answering some of the questions may be difficult (eg due to the lack of statistics). Please provide whatever relevant information you can in these cases. The data collected will help to provide a first detailed overview of this topic from an EME perspective.

We also appreciate that for some central banks the monetary policy framework may be different (eg interest-rate versus exchange-rate focused). In these cases, please feel free to interpret the question in a way that suits the context in your jurisdiction and answer the question accordingly. Feel free to also provide explanatory comments as needed.

Finally, you are asked to include a list of relevant references at the end of the questionnaire. This includes (but is not limited to) reports, speeches, or research papers from your central bank and papers written by academics.

BIS

Part 1: Monetary policy transmission channels

Question 1A: Consider the main monetary policy tools in your economy. What are the channels through which these tools transmit to households and non-financial firms and what is their relative strength? For each cell in the table below, please choose the option that best reflects the reality in your jurisdiction.

Channel	Strength / relevance of the channel for households	Strength / relevance of the channel for non-financial firms	Most channels affect a host of decisions by households and firms, including those related to **activities** (eg consumption, savings, investment) and **prices** (eg wage setting, product pricing). Provide comments on which aspects are most affected. Feel free to provide any other comments too.
Savings-investment channel (also called the interest rate channel): Interest rate changes directly affect incentives to save and invest by households and firms.	Select	Select	
Cash-flow channel: Interest rate changes affect the amount of cash available to economic agents (eg higher deposit rates can increase cash-flow, but higher interest repayment on debt can lower disposable cash-flow).	Select	Select	
Balance sheet channel (also called the wealth channel): Interest rate changes can affect the value of assets and liabilities (via present discounted value of future flows) and thus strengthen or weaken households' and firms' balance sheets.	Select	Select	
Bank lending channel: Changes in the supply of bank loans can affect households and firms differently depending on the availability of alternative sources of credit.	Select	Select	
Exchange-rate channel: Interest rate changes can affect the value of the currency, which can impact demand for exports and imports. Currency movements can thus impact household decisions (eg purchase of imported goods) and business decisions (eg pricing, investment, debt profile, and hedging) and also reinforce the balance sheet channel.	Select	Select	

Channel	Strength / relevance of the channel for households	Strength / relevance of the channel for non-financial firms	Most channels affect a host of decisions by households and firms, including those related to **activities** (eg consumption, savings, investment) and **prices** (eg wage setting, product pricing). Provide comments on which aspects are most affected. Feel free to provide any other comments too.
Expectations channel: Changes in policy stance (eg a change in the policy rate) as well as communication regarding the policy path can change expectations of inflation and other macroeconomic indicators. These can affect activity as well as pricing decisions of agents.	Select	Select	
Any other channels that affect households or firms in your economy (please specify)	Select	Select	

Other comments for part 1, if any:

Part 2. The role of household heterogeneity

Question 2A: Is data on household heterogeneity currently used in your monetary policy analysis?	Select	Comments (if any):
If no, is it something under consideration?	Select	

Please answer the below questions on how various household characteristics are used in monetary policy analysis. Note that some characteristics may be correlated (eg spending patterns and thus inflation experiences may be explained largely by age, income and wealth).

Household characteristics	**Question 2B:** Which of these characteristics are used in the background analysis for monetary policy at your central bank? For example, as a dimension of cross-sectional heterogeneity in DSGE or VAR models.	**Question 2C:** If the characteristic is used, select the type of the primary source. • Surveys (such as those conducted for household expectations) • Administrative (eg tax disclosures) • Market data (eg online spending) • Other sources (please specify in comments column)	**Question 2D:** Based on your analysis and/or experience, what is your understanding regarding the degree to which these characteristics matter for monetary policy transmission (eg how important is each characteristic in shaping a household's reaction to a change in policy)	**Question 2E:** Which transmission channel is affected in particular? If other channel, please specify in the comments column.	**Comments (if any)**
Household specific inflation experiences (eg from credit card spending patterns)	Select	Select	Select	Select	
Heterogeneity in inflation expectations	Select	Select	Select	Select	
Heterogeneity in sentiments (eg pessimistic or optimistic)	Select	Select	Select	Select	
Level, composition and/or riskiness of income (eg wage versus business income vs interest income)	Select	Select	Select	Select	

Household characteristics	**Question 2B:** Which of these characteristics are used in the background analysis for monetary policy at your central bank? For example, as a dimension of cross-sectional heterogeneity in DSGE or VAR models.	**Question 2C:** If the characteristic is used, select the type of the primary source. • Surveys (such as those conducted for household expectations) • Administrative (eg tax disclosures) • Market data (eg online spending) • Other sources (please specify in comments column)	**Question 2D:** Based on your analysis and/or experience, what is your understanding regarding the degree to which these characteristics matter for monetary policy transmission (eg how important is each characteristic in shaping a household's reaction to a change in policy)	**Question 2E:** Which transmission channel is affected in particular? If other channel, please specify in the comments column.	**Comments (if any)**
Level and composition of wealth (eg whether in bank deposits, foreign currency holdings, stocks or housing)	Select	Select	Select	Select	
Level and composition of debt (eg fixed or floating rate mortgage, maturity structure) and/or debt burden (eg debt service to income ratio)	Select	Select	Select	Select	
Share of hand-to-mouth household, one that consumes all their current income	Select	Select	Select	Select	
Financial inclusion (eg those with a bank account may be more affected by an interest rate change)	Select	Select	Select	Select	

Household characteristics	**Question 2B:** Which of these characteristics are used in the background analysis for monetary policy at your central bank? For example, as a dimension of cross-sectional heterogeneity in DSGE or VAR models.	**Question 2C:** If the characteristic is used, select the type of the primary source. • Surveys (such as those conducted for household expectations) • Administrative (eg tax disclosures) • Market data (eg online spending) • Other sources (please specify in comments column)	**Question 2D:** Based on your analysis and/or experience, what is your understanding regarding the degree to which these characteristics matter for monetary policy transmission (eg how important is each characteristic in shaping a household's reaction to a change in policy)	**Question 2E:** Which transmission channel is affected in particular? If other channel, please specify in the comments column.	**Comments (if any)**
Employment status (eg employed in formal or informal sector versus unemployed)	Select	Select	Select	Select	
Heterogeneity in preferences (eg discount rates or intertemporal elasticity of substitution)	Select	Select	Select	Select	
Age (eg pensioners may have different consumption-savings behaviour)	Select	Select	Select	Select	
Financial literacy, rationality and/or information (full vs limited)	Select	Select	Select	Select	
Others (please specify)	Select	Select	Select	Select	

Question 2F: Provide the following data on aspects of household heterogeneity. Please provide estimates or proxies if exact values are not available. In such cases, feel free to indicate this via a comment.

	Latest observation (eg 2024)	An observation from a decade ago (eg 2014)	Comments (if any)
Share of households that hold capital market assets (bonds and stocks)			
Share of hand-to-mouth households (ie those with limited liquid wealth of less than two months of income and tend to consume all their income). Please include both poor and wealthy hand-to-mouth households.			
Share of households with any type of debt			
Share of households that are homeowners (as opposed to renters)			
Share of homeowners with floating rate mortgages			
Share of homeowners with fixed rate mortgages			
Interquartile range of household's debt service to income ratios (or provide standard deviation if range is not available)			
Interquartile range of households' inflation experiences (or provide standard deviation if range is not available)			

Other comments for part 2, if any:

BIS

Part 3: The role of heterogeneity among non-financial firms

Question 3A: Is data on firm heterogeneity currently used in your monetary policy analysis?	Select	Comments (if any):
If no, is it something under consideration?	Select	

Please answer the below questions on how various firm characteristics are used in monetary policy analysis. Note that some characteristics may be correlated.

Firm characteristics	**Question 3B:** Which of these characteristics feature in the background analysis for monetary policy at your central bank? For example, as a dimension of cross-sectional heterogeneity in DSGE or VAR models.	**Question 3C:** If the characteristic is used, select the type of primary source from the drop down. • Surveys (such as those conducted for household expectations) • Administrative (eg tax disclosures) • Market data (eg online spending) • Other sources (please specify in comments column)	**Question 3D:** Based on your analysis and/or experience, what is your understanding regarding the degree to which these characteristics matter for monetary policy transmission (eg how important is each characteristic in shaping a firm's reaction to a change in policy)?	**Question 3E:** Which transmission channels are affected in particular? Choose one channel from the list (insert any additional comments in the last column).	**Comments (if any)**
Size	Select	Select	Select	Select	
Leverage	Select	Select	Select	Select	
Age	Select	Select	Select	Select	
Business sector	Select	Select	Select	Select	

Firm characteristics	**Question 3B:** Which of these characteristics feature in the background analysis for monetary policy at your central bank? For example, as a dimension of cross-sectional heterogeneity in DSGE or VAR models.	**Question 3C:** If the characteristic is used, select the type of primary source from the drop down. • Surveys (such as those conducted for household expectations) • Administrative (eg tax disclosures) • Market data (eg online spending) • Other sources (please specify in comments column)	**Question 3D:** Based on your analysis and/or experience, what is your understanding regarding the degree to which these characteristics matter for monetary policy transmission (eg how important is each characteristic in shaping a firm's reaction to a change in policy)?	**Question 3E:** Which transmission channels are affected in particular? Choose one channel from the list (insert any additional comments in the last column).	**Comments (if any)**
Funding profile (own funds vs bank vs bond vs stocks)	Select	Select	Select	Select	
Domestic currency versus foreign currency debt	Select	Select	Select	Select	
Others (please specify)	Select	Select	Select	Select	

Question 3F: Please provide data on firm heterogeneity. For this question, SMEs are defined as firms with less than or equal to 250 employees. Please report estimated shares relative to the universe of all non-financial firms. Provide estimates or proxies if exact values are not available. In such cases, feel free to indicate this via a comment.

		Latest observation (eg 2024)	An observation from a decade ago (eg 2014)	Comments (if any)
Share of SMEs, in terms of:	revenue			
	employment			

		Latest observation (eg 2024)	An observation from a decade ago (eg 2014)	Comments (if any)
Share of publicly traded firms, in terms of:	revenue			
	employment			
Share of firms in commodity sector, in terms of:	revenue			
	employment			
Share of firms that export, in terms of:	revenue			
	employment			
Share of firms with unhedged financial FX exposure, in terms of:	revenue			
	employment			
Share of jobs where the wage contract is subject to indexation				

Other comments for part 3, if any:

Part 4: Data

Question 4A. If data on heterogeneities is used, which characteristics of such data make them most useful for monetary policy analysis? Rank the characteristics (1 = most useful characteristic, 6 = least useful characteristic).		Representative (eg large sample)
		Longitudinal (ie follow the same entities over time)
		Administrative (as opposed to surveys)
		Detailed (ie cover all relevant dimensions)
		High frequency
		Others (please specify)

Question 4B. What are the impediments, if any, in using granular data in monetary policy analysis? Rank the impediments (1 = most important impediment, 7 = least important impediment). If granular data are not used (because, for instance, they are understood to be not useful), choose "Not Relevant".		The ideal data are not available
		Data are available but central bank access is restricted
		Data are available but privacy concerns limit use
		Historical coverage is limited (eg survey started recently)
		Data are partial (eg not representative or infrequent)
		Reporting lag means that data are out of date
		Others (please specify)
		Not relevant

Other comments for part 4, if any:

Part 5: How is data on heterogeneity incorporated in models and analysis?

Question 5A: Do you use heterogeneous agent models in your monetary policy analysis that are then calibrated using granular data? Choose all that apply.		Yes, two-agent New-Keynesian (NK) / Dynamic Stochastic General Equilibrium (DSGE) model
		Yes, heterogeneous-agent NK / DSGE model (ie multiple or a continuum of agents)
		Yes, another type of model (please specify)
		No

BIS

Question 5B: Do you use granular data in your empirical models for monetary policy analysis? Choose all that apply.	☐	Yes, Vector-Auto-Regression (VAR) models
	☐	Yes, other regression models using specific indicators of heterogeneity (please specify)
	☐	Yes, another type of model (eg machine learning, please specify)
	☐	No
Question 5C: In your monetary policy analysis, how important are data on heterogeneity relative to more traditional aggregate inputs (eg inflation, GDP, and unemployment)?	Select	
Question 5D: How do you think the use of data on heterogeneity would evolve during the next decade?	Globally	At your central bank
	Select	Select
Question 5E: If you expect an increase, what is likely to be the main driver? Rank the drivers (1 = most important driver, 5 = least important driver).		Advances in data availability
		Better methods and algorithms
		More computational power
		Research showing that heterogeneity matters
		Others (please specify)
Question 5F: In your assessment, is the importance of heterogeneity in models state dependent (eg more important during recessions than during booms)?	Select	
If yes, please elaborate.		

Question 5G: In your workhorse models, under the most preferred assumptions, would it be possible to quantify the difference between the ceteris paribus effects (i) of a 100 bp contractionary monetary policy shock on inflation within two years and (ii) of a domestic asset purchase of 10% of GDP (if your economy has such a program) on the yield curve with and without agent heterogeneity? If so, how large would that difference be (in p.p. terms for inflation and bps for yield curve)? If possible, explain briefly which heterogeneity/heterogeneities was/were considered for this example. Note: This question applies only if agent heterogeneity is already considered in modelling at your central bank.

Other comments for part 5, if any:

Part 6: How are policy decisions affected ultimately?

Question 6A: Has incorporating data on household and firm heterogeneity benefitted the background analysis for monetary policy? Choose one of the options from #1, #2, and #3.	☐	1. Data on heterogeneity is not used.
	☐	2. Data on heterogeneity has been considered in the past but its usefulness is limited or uncertain.
	☐	3. Data on heterogeneity is used and found to be beneficial.

If you choose #3 in the previous question, rank the benefits (1 = most important, 4 = least important).		It enhances the **understanding of the economic outlook** (eg knowing the distribution of household savings today may help improve the forecasting of aggregate demand).
		It improves the **understanding of the transmission mechanism** ie helps obtain more accurate predictions of how policy actions impact target variables like inflation (counterfactual scenario analysis).
		It helps **understand the distributional impact** of policy changes.
		Others (please specify)
Provide a recent example that provides context to the ranking you chose above (eg how data on heterogeneity helped with the analysis when inflation surged in 2023).		
Question 6B: Has incorporating heterogeneity in monetary policy analysis led to recent policy decisions in your jurisdiction that are likely **different** from those in a hypothetical scenario where heterogeneity is not considered?	Select	
Provide a recent example of how heterogeneity featured in the policy deliberations, if applicable (eg how heterogeneity mattered during the tightening decisions in 2023 or any pivots in 2024).		
Question 6C: If yes, rank the considerations in terms of what mattered more for the policy decision (1 = most important, 5 = least important).		Heterogeneity affected the transmission of monetary policy
		Distributional implications of policy decisions
		Public's expectations (eg higher inflation may hit the poor harder who may thus demand for more hawkish monetary policy; the unemployed may prefer that the economy runs 'hot' for a while as that may help the unemployed more)
		Considering heterogeneity is part of the mandate
		Others (please specify)

Question 6D: Does heterogeneity need to be considered in central bank deliberations as per law/mandate?	Select	Comments (if any):
If yes, is this a recent development?	Choose one option Select	
If yes, which aspects of heterogeneity need to be considered? (eg household income inequality, firm debt profile)		
Question 6E: If considering heterogeneity is currently not part of the mandate, could this change in the near future in your jurisdiction?	Choose one option Select	
Question 6F: Is the role of heterogeneity in monetary policy communicated to the public? This may include, for example, conveying how such data were used to improve economic projections, how distributional effects are managed, or why heterogeneity justified a bigger/smaller rate cut.	Choose one option Select	
	Please provide links to such publications, if available.	

Other comments for part 6, if any:

Part 7: Use of policy to address heterogeneity

Question 7A. Is addressing heterogeneity (eg reducing inequality among households or reducing financial constraints faced by certain types of firms) a direct objective when calibrating monetary policy?	Choose Select
If yes, which specific monetary policy tools are most used in this respect?	

Question 7B. Has your central bank adopted non-monetary policies with the goal to address household or firm heterogeneities (eg reduce differences in homeownership across households or credit constraints across firms)?	Choose Select

Measures	**Question 7C.** Which of these measures have been adopted with the goal to address household or firm heterogeneity? Choose all that apply.	**Question 7D.** Which of these measures help address heterogeneity indirectly (ie addressing heterogeneity is not the main goal of the measure but the measure has such an impact)? Choose all that apply.	**Question 7E.** If measure was adopted, was this temporary (eg in response to Covid) or was the adoption rather permanent in nature?
Promotion of financial inclusion, financial engagement (eg opening of bank accounts, incentives to use them)	☐	☐	Select
Fostering financial literacy and financial health (eg safe use)	☐	☐	Select
Easier and more relatable communication that can be understood by all stakeholders	☐	☐	Select
Facilitate the development of a robust and effective payment ecosystem	☐	☐	Select
Safeguarding financial stability, such as via macroprudential measures	☐	☐	Select
Special lending facilities for select business sectors	☐	☐	Select
Others (please specify)	☐	☐	Select

Question 7F. If possible, briefly elaborate on the measure from the above list that was considered most important during the last 10 years.

Other comments for part 7, if any:

Part 8: Additional comments

Please use the space below to add any other experience of your central bank regarding heterogeneity and monetary policy which was not already covered above.

Part 9: References

Please provide up to five important references that relate to heterogeneity and monetary policy in your economy (eg central bank research papers, speeches, policy notes or journal articles).