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BANK FOR INTERNATIONAL SETTLEMENTS

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Adapting monetary policy to increasing financial inclusion[1]

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[1] This paper was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.

Adapting monetary policy to increasing financial inclusion

By James Yetman[1]

Abstract

This paper summarises the literature on how an increase in the level of financial inclusion might influence monetary policy choices, highlighting three main ways. First, the central bank may wish to place a higher weight on core inflation in place of headline inflation in its policy decisions. Second, interest rate tools are likely to become more effective vis-à-vis quantities (such as the money supply). Third, central banks may need to adjust their interest rate rule in order to ensure determinacy and policy optimality. Optimal policy is likely to require a greater focus on inflation stabilisation relative to output stabilisation the higher is the level of financial inclusion.

Keywords: financial inclusion; optimal monetary policy; determinacy

JEL classifications: E52, O23.

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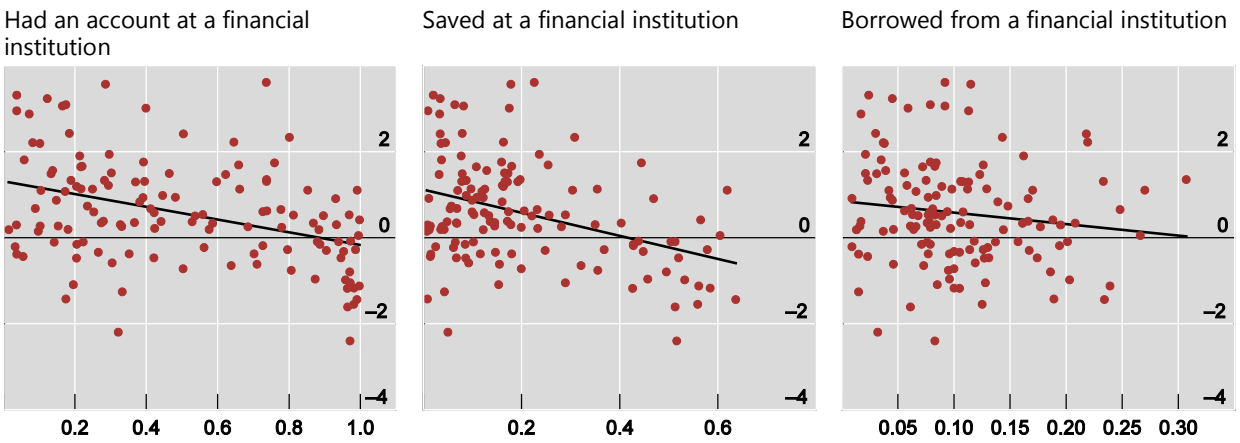
1. Introduction

A change in the level of financial inclusion influences the trade-offs faced by monetary policy makers. One key reason for this is because of the effect that financial inclusion has on consumer behaviour. Graph 1 below displays the relationship between the level of financial inclusion (based on three different measures) and the ratio of the volatility of consumption to the volatility of output for a broad cross section of countries, taken from Mehrotra and Yetman (2014). What is clear in the graph is the negative relationship between the variables: consumption volatility is lower, relative to output volatility, the higher is the level of financial inclusion. This is because financially included consumers are able to smooth their consumption in response to shocks more effectively than those that are financially excluded.

Ratio of consumption variance: output variance and financial inclusion, alternative measures

Graph 1



Note: The vertical axes show the ratio of consumption gap volatility to output gap volatility during 2000–12, in logarithms. The horizontal axes show the share of adults that had an account at a formal financial institution in 2011 (left panel), the share of adults who saved money (middle panel) or share of adults who borrowed money (right panel) at a formal financial institution during the preceding 12 months. Republic of Congo and Zambia, two outliers, are excluded.

Sources: IMF, *World Economic Outlook*; World Bank, *Global Financial Inclusion Database*. Taken from Mehrotra and Yetman (2014).

The ability included consumers to smooth consumption is important for central banks because monetary policy choices reflect a trade-off between different objectives, and changes in the behaviour of consumers generally influence the costs and benefits that society faces from policy decisions. In addition, central banks set policy interest rates that in turn are reflected in the costs of borrowing and the returns to saving in society, and the level of inclusion therefore affects the reach of those policy rates.

In this paper, we outline the different ways in which an increase in the level of financial inclusion influences monetary policy. Section 2 discusses the effect of financial inclusion on the choice of the price level to target. Section 3 discusses the link between inclusion and interest rate effectiveness. Section 4 summarises how the monetary policy rule could be affected: first, how it might need to change in order to ensure determinacy, and second how it should change in order for monetary policy to be optimal. Section 5 then concludes.

2. Financial inclusion and the choice of price level to target

One way in which a change in financial inclusion should be reflected in monetary policy is in terms of the choice of the price stability target. Central banks typically consider a range of different objectives when setting policy. New Keynesian frameworks, for example, are generally interpreted as indicating that the central bank should target the volatility of inflation and the volatility of the output gap (see, for example, Clarida, et al (1999)). More recently, more explicit attention has been paid to how indicators of risks to financial stability should also be included (see Borio (2006) and Gourio et al (2017)). One common element in nearly all frameworks is some measure of inflation, the volatility of which is interpreted as a measure of price stability. This is generally true whether the economy has an explicit inflation target or not.

The question is: which measure of inflation should serve this purpose for monetary policy? In advanced economies, for example, there has been considerable discussion over the years regarding whether the growth rate of the overall CPI index is the best measure, or whether the central bank should instead focus on some measure of "core" inflation, that excludes some of the more volatile (and perhaps mean-reverting) categories of goods from the assessment (eg Bodenstein et al (2008)). Categories of goods that are commonly excluded from core inflation in practice are food and energy.

Anand et al (2015) argue that focusing on core inflation could be an especially poor route to take for an economy that has a low level of financial inclusion. They model the economy as consisting of three sectors: one where prices are flexible (and are therefore likely to be volatile), another where prices are sticky (and relatively stable in response to shocks), and a third sector that is open to international trade. The flexible price sector can be thought of as including agriculture, and the sticky price sector manufacturing.

They suggest that financially excluded consumers differ from included ones in two important respects. First, the excluded consumers are likely to be disproportionately employed in the flexible-price sector. Second, excluded consumers are likely to disproportionately consume goods produced by the flexible-price sector: consumers from both the flexible and sticky price sectors consume a mixture of outputs from each sector, but there is a minimum subsistence level of flex-price sector output that all households must consume, which constitutes a larger share of the total basket for lower-earning, flex-sector employed, workers. These assumptions seem plausible, in light of the prevalence of agriculture and very small enterprises as sources of employment and in the composition of the consumption basket of consumers with low levels of income, who are also likely to be financially excluded (Allen et al (2012)).

In their model, Anand et al (2015) show that optimal monetary policy entails the central bank placing more weight on the behaviour of headline inflation the lower is the level of financial inclusion. In contrast, the higher is the level of financial inclusion, the greater is the weight that the central bank should place on just the relatively stable prices from the sticky price sector. At an intuitive level, this seems reasonable. Taking an extreme example, in an economy with very low levels of inclusion, volatile price goods are likely to constitute a very large share – perhaps even a majority – of the total consumption bundle for the average consumer. Focusing on core inflation in such an environment would imply placing a very low weight on prices of the greatest relevance for the majority of the population.

The take-away here is that, in an economy with a low level of financial inclusion, headline inflation is likely to be the most relevant for the conduct of monetary policy. But, as more consumers enter the financially included sectors in the economy, central banks may be able to improve welfare outcomes by focusing more on core inflation, which is buffeted less by short-term shocks.

3. Financial inclusion and interest rate effectiveness

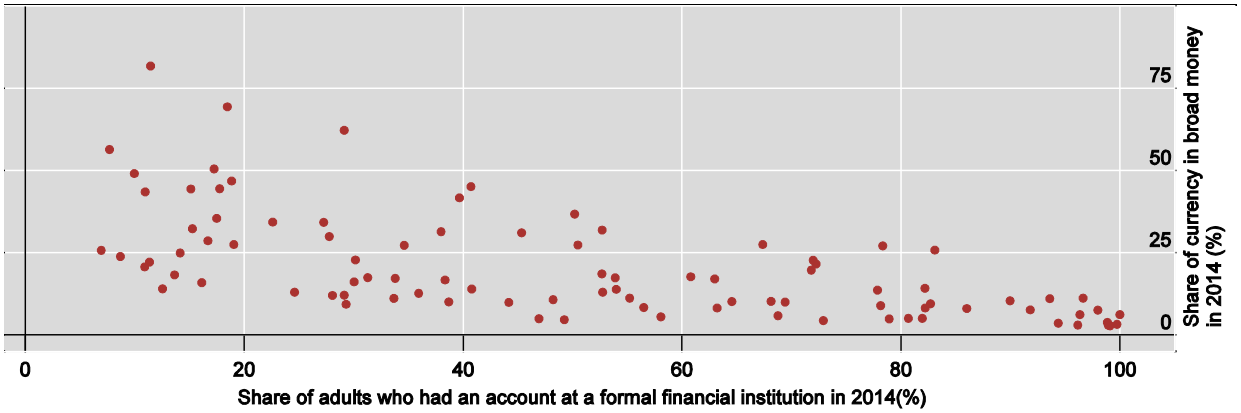
A second way in which the level of financial inclusion may influence monetary policy is in terms of the effectiveness of different policy tools. Loosely speaking, monetary policy tools can be thought of as either price-based (mainly interest rates of various types) or quantity-based (for example, the level of the money supply, or the quantity of credit) (Poole (1970)). Increased financial inclusion is likely to lead to an increase in the potency of interest rate rules at the expense of quantity-based rules, as alluded to in speeches by senior central bankers (see, for example, Khan (2011) and Tombini (2012)).

There are multiple channels by which interest rates may be expected to become more effective policy tools as financial inclusion increases. First, one dimension of financial inclusion is access to credit, the cost of which is an interest rate that is likely to be affected by movements in the policy rate. A decline in the policy rate reduces the cost of credit and so stimulates demand via increased borrowing. In addition, financial inclusion provides a means for business owners to fund investments out of sources other than retained earnings, so changes in interest rates may become a more potent driver of investment, which is itself an important component of aggregate demand.

Second, financially included households may be expected to deposit at least some of their income into interest-bearing bank accounts, again with the interest rate influenced by the policy rate. One simple way to illustrate the effectiveness of this is to look at the share of broad money – that is, the stock of wealth that can be readily used for transacting – that is in the form of currency, as a function of financial inclusion. Graph 2 illustrates this relationship for a broad set of countries, based on data for 2014. There is a clear negative correlation between the two series: high levels of financial inclusion and relatively low levels of currency in circulation seem to go together in this cross-sectional data. Where a larger share of wealth held in a form that is accessible for transacting is affected policy rates, those policy rates are likely to have more leverage in influencing the economy.

Financial inclusion and the money stock

Account ownership and share of currency in broad money[1] Graph 2



[1] Share of currency in broad money is defined as $Currency\ in\ circulation/Broad\ money$.

Sources: IMF, *International Financial Statistics*; World Bank, *Global Financial Inclusion Database*; BIS calculations.

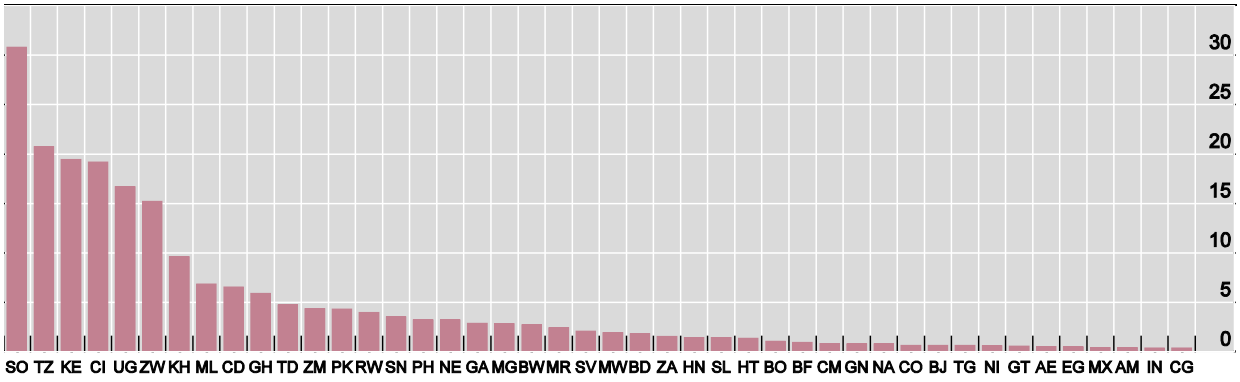
In principle, it is possible that increased inclusion could lead to a reduction in interest rate (and more broadly central bank) effectiveness if that increase in financial access occurred outside of the parts of the financial system that the central bank has direct influence. By this, I mean various forms of mobile money, especially if interest is not paid on the associated deposits, and even alt-currencies like Bitcoin. To date, however, the size of these currencies has been small relative to the total volume of transactions in the economy. For example, M-PESA is commonly used in Kenya in place of conventional money, but total use constituted only 6.6% of total transactions value in 2014.[2]

A related concern is that a large number of households might use alternative currencies only, and so move beyond the influence of monetary policy tools. Again, the evidence is encouraging (see Graph 3). Even in Kenya, around 20% of adults report only having a mobile money account, and Kenya is in the upper tail of the distribution across a broad sample of emerging and developing countries, with the third highest level. Even then, consumption of excluded consumers is likely to be very sensitive to their income. As long as monetary policy has an effect on excluded consumers' income, this indirect channel will help to support monetary policy effectiveness, as we will discuss in the next section.

[2] http://www.cgap.org/blog/10-myths-about-m-pesa-2014-update

Mobile money service

Share of adults having mobile money account only, in per cent — Graph 3



SO=Somalia; TZ=Tanzania; KE=Kenya; CI=Cote d'Ivoire; UG=Uganda; ZW=Zimbabwe; KH=Cambodia; ML=Mali; CD= Democratic Republic of Congo; GH=Ghana; TD=Chad; ZM=Zambia; PK=Pakistan; RW=Rwanda; SN=Senegal; PH=Philippines; NE=Niger; GA=Gabon; MG=Madagascar; BW=Botswana; MR=Mauritania; SV=El Salvador; MW=Malawi; BD=Bangladesh; ZA=South Africa; HN=Honduras; SL=Seirra Leone; HT=Taiti; BO=Bolivia; BF=Burkina Faso; CM=Cameroon; GN=Guinea; NA=Namibia; CO=Colombia; BJ=Benin; TG=Togo; NI=Nicaragua; GT=Guatemala; AE=United Arab Emirates; EG=Egypt; MX=Mexico; AM=Armenia; IN=India; CG=Republic of Congo.

Sources: World Bank, *Global Financial Inclusion Database*; BIS calculations.

4. Financial inclusion and the monetary policy rule

Finally, an increase in the level of financial inclusion is likely to influence the reaction function, or monetary policy rule, that the central bank wishes to pursue. There are two complementary ways in which this questions has been addressed in the academic literature: i) that the monetary policy rule needs to change in order to ensure determinacy; and ii) that the monetary policy rule should change in order to ensure optimality.[3] We address each of these in turn.

4.1 How the monetary policy rule might need to change to ensure determinacy

One important criterion for an effective monetary policy rule is that it does not create instability in the economy. Clear examples of unstable monetary policy rules in the real world are rare, perhaps with the exception of hyperinflations. This could be because central banks are able to observe the consequences of their policy choices in a timely enough manner that they can adjust their course of action if the outcomes are undesirable.

[3] Note also that, since monetary policy works primarily by incentivising consumers to move their consumption inter-temporally, and excluded consumers are less affected by this mechanism, a higher fraction of financially excluded consumers may lead to monetary policy being less desirable relative to fiscal policy.

Within a modelling environment, central banks are often assumed to follow a particular monetary policy rule, regardless of the shocks that the economy faces. In such an environment, a minimal requirement for a desirable rule is that the model remains deterministic, so that the economy moves back towards the equilibrium after being subjected to a shock. Within a very simple New Keynesian model where prices are set in part based on expected future inflation, a common requirement for determinism is that the monetary policy rule satisfies what has become known as the "Taylor Principle", which is the idea that nominal policy rates rise at least one-for-one with inflation so that real interest rates are increasing in the inflation rate (Taylor (1999)). In the original formulation of the Taylor Rule, for example, the coefficient on inflation was around 1.5. Since real interest rates are a key driver of aggregate demand, the Taylor Principle ensures that the policy response to overheating economy helps to slow aggregate demand, and also that expansionary policy in response to a slowdown is sufficient to stimulate demand.

In most such models, the (sometimes implicit) assumption is that all agents and firms are financially included. A number of authors have addressed how the requirement for determinacy varies with the level of financial inclusion. Is the required response stronger, or weaker?

A common framework used to address this issue is Galí et al (2004). In this model, the economy consists of some conventional agents, who have access to financial markets, and others (labelled "rule-of-thumb" consumers), who neither save nor borrow but instead simply consume their full labour income.[4] The authors solve for the range of parameter values for a Taylor-type rule that yield dynamic stability and uniqueness, and show that this depends critically on the share of households with access to financial markets. If the policy rule responds to contemporaneous values of output and inflation, then a greater response to inflation is required in order to generate a unique solution the smaller is the portion of financially included households. And if the policy rule is forward looking, a sufficiently large share of hand-to-mouth consumers may result in no locally unique equilibrium at all.

Many subsequent papers build on Galí et al (2004), and demonstrate directions along which these results are sensitive. One key reason why monetary policy rules may become destabilising as the level of financial inclusion falls is that excluded consumers are not directly affected by interest rates, rendering monetary policy less effective (as discussed in Section 3 above). However, Di Bartolomeo and Rossi (2007) argue that a low level of financial inclusion does not reduce monetary policy effectiveness by as much as one might expect since consumption demand is more income-sensitive for excluded households than included households. Monetary policy affects the consumption of included households, and hence the incomes of excluded households, creating an indirect policy channel that increases policy effectiveness. Such an effect is at work in Bilbiie (2008). In his model, if the portion of financially excluded households is sufficiently high then the "Taylor principle" may even become inverted. In such a case, optimal policy entails a passive monetary policy rule.

Other papers also focus on the implications of financially excluded households for model stability. Ascari et al (2011) and Colciago (2011) show that the presence of

[4] In reality, financially excluded consumers may use informal credit markets in place of banks, which would tend to lessen the difference that the level of financial inclusion has on macroeconomic relationships, and hence monetary policy.

sticky wages helps to restore the Taylor principle as a key factor of determinacy, instead of requiring either a stronger monetary response to inflation (Galí et al, 2004) or a weaker one (Bilbiie, 2008). Finally, Motta and Tirelli (2010) show that Bilbiie's inverted Taylor principle argument returns if habit persistence is included in the utility function, even in the presence of sticky wages. Taken as a whole, this literature demonstrates that there's no simple answer to the question posed earlier: "is the required response stronger, or weaker?" Instead, it depends on a combination of factors.

4.2 How the monetary policy rule should change to ensure optimality

Another way to think about how the monetary policy rule should change with a change in the level of financial inclusion is to focus on optimality. The approach we discuss here is to do welfare analysis within a theoretical model and see how the monetary policy response to variables should change with the level of financial inclusion in order for welfare to be maximised. The discussion below is based on Mehrotra and Yetman (2014); see, also, Bilbiie (2008) for related arguments.

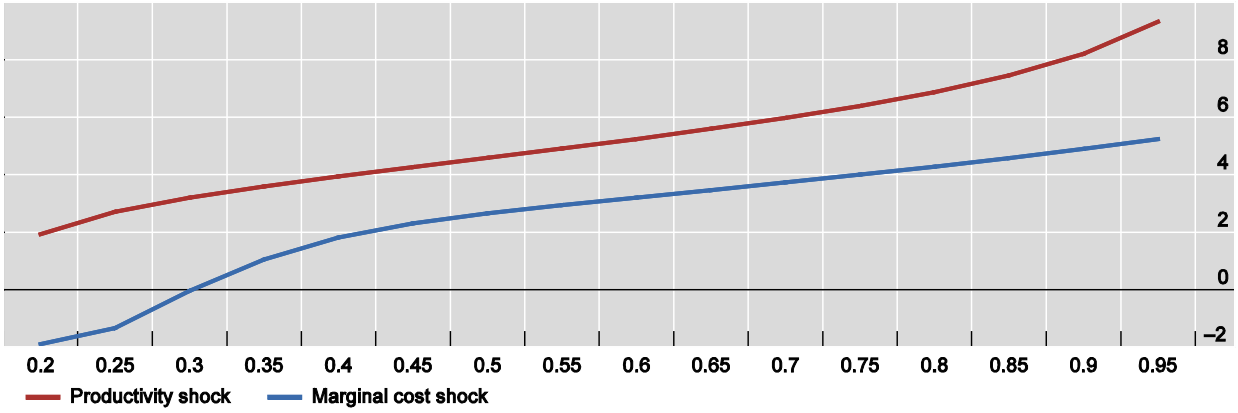
Mehrotra and Yetman (2014) build on the Galí et al (2004) model, in which financial excluded consumers are assumed to simply consume all their income each period, while included consumers have access to financial markets. From a policy perspective, the key difference between the two is that included consumers can smooth their consumption in response to shocks that hit the economy, while excluded consumers cannot. The central bank sets interest rates to maximise the weighted sum of the welfare enjoyed by both included and excluded consumers, with the weight on each depending on their respective share in the population as a whole.

The authors examine the effects of two different kinds of shocks to the economy: a (real) productivity shock, and a (nominal) price shock. Based on a calibration of their model, they are able to show that, in response to either shock, optimal monetary policy implies that there should be a positive relationship between the level of financial inclusion and the ratio of output volatility to inflation volatility, as illustrated in Graph 4 below.

A natural question to ask is: what is driving this relationship? The authors address this by comparing what the relationship between financial inclusion and the same ratio would look like if the central bank followed a simple monetary policy rule instead. The answer, illustrated in Graph 5, is that the lines would be slightly downward sloped instead. So the reason for the upward-sloped lines in Graph 4 is the response of monetary policy.

Optimal ratio of output variance: inflation variance

Graph 4



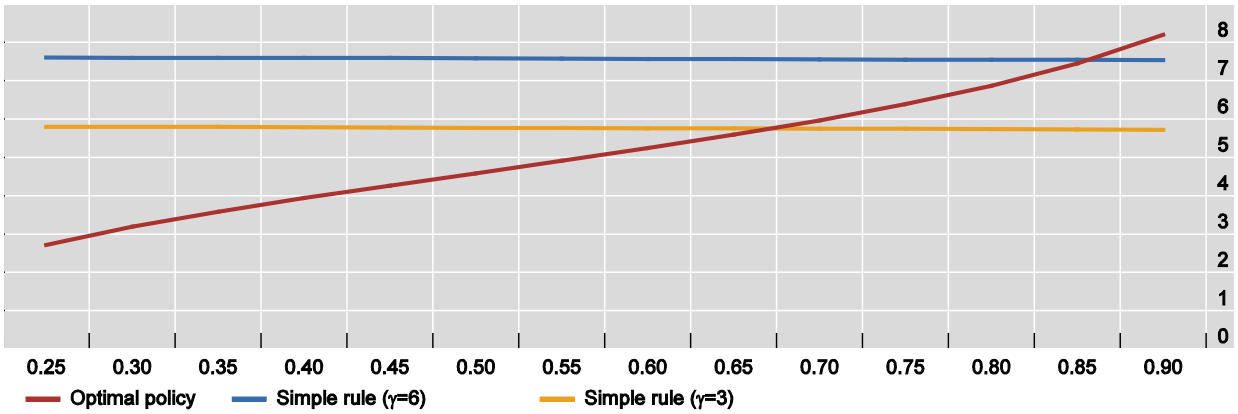
Note: The vertical axis displays the ratio of output volatility to inflation volatility, in logarithms. The horizontal axis displays the share of consumers who are financially included (1-λ).

Source: Mehrotra and Yetman (2014).

Ratio of output variance: inflation variance

Optimal policy vs simple rule

Graph 5



Note: The vertical axis displays the ratio of output volatility to inflation volatility, in logarithms. The horizontal axis displays the share of consumers who are financially included (1-λ).

Source: Mehrotra and Yetman (2014).

There are two complementary reasons why we might expect optimal monetary policy to vary as the share of consumers who are financially included increases. First, this change influences the structure of the economy. More included consumers implies larger changes in investment (which is effectively what adjusts when included consumers adjust their savings in response to shocks), and hence output.

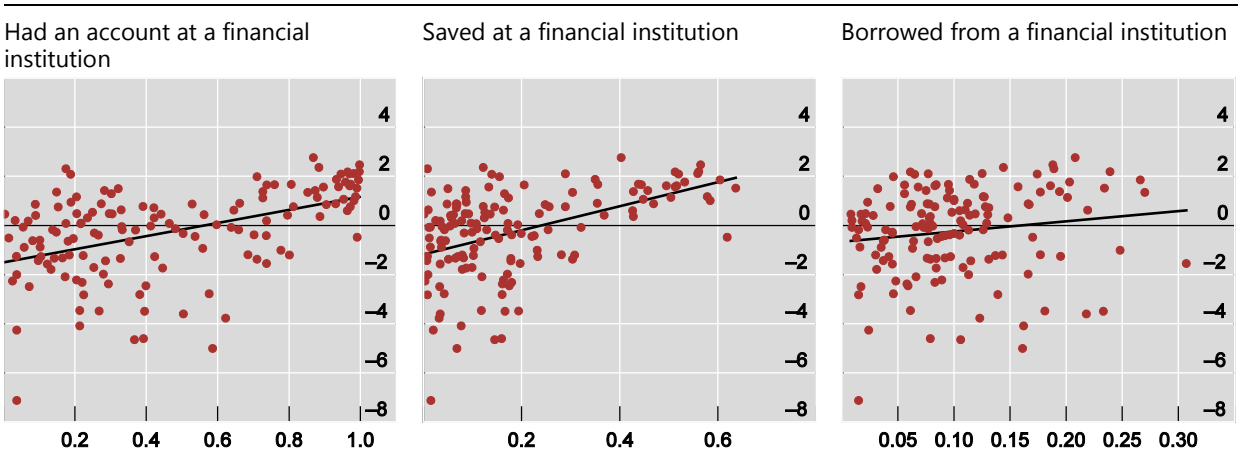
Second, welfare in these models can be thought of as depending on the volatility of both consumption and inflation. For excluded consumers, consumption volatility and output volatility co-move strongly, so reducing consumption volatility requires reducing output volatility. For included consumers, the link between the two is much

weaker, since included consumers can use their access to financial markets to adjust consumption levels relative to income levels. But for all consumers, inflation volatility is costly. Clearly, in such a model, the greater is the share of included consumers, who are able to stabilise their consumption even if output is volatile, the less need there is for the central bank to stabilise output to achieve optimal outcomes. Thus the central bank will adjust its policy rule to increase the stability of inflation, even if it comes at the expense of somewhat higher output volatility.

Mehrotra and Yetman (2014) check to see if the main prediction of their model is reflected in real world data. They consider all economies where annual data on consumption and real GDP are available from 2000 onwards and for which data on financial inclusion are available in the World Bank's Global Findex database (Demirguc-Kunt and Klapper (2012)).

Ratio of output variance: inflation variance and financial inclusion, alternative measures

Graph 6



Note: The vertical axes show the ratio of output gap volatility to inflation volatility during 2000–12, in logarithms. The horizontal axes show the share of adults that had an account at a formal financial institution in 2011 (left panel), the share of adults who saved money (middle panel) or share of adults who borrowed money (right panel) at a formal financial institution during the preceding 12 months. Greece, an outlier, is excluded.

Sources: World Bank, *Global Financial Inclusion Database*. Taken from Mehrotra and Yetman (2014).

Measuring the output gap as the difference between output and HP-filtered output, they construct the ratio of output gap to inflation volatility for the 2000-12 period. The relationship between this ratio and financial inclusion, defined in three different ways, is given in Graph 6. Consistent with their theoretical results, there is a clear upward relationship: an increase in the level of financial inclusion is associated with an increase in output volatility relative to inflation volatility. Further, when they examine the data more closely using regression analysis, they find that this result is largely due to the relatively independent central banks in their sample, who might be expected to have the freedom to set interest rates more optimally as a function of the level of financial inclusion.

The takeaway from this is that the data suggests that an increase in the level of financial inclusion is associated with an increase in the level of output volatility relative to inflation volatility, and the model suggests that, qualitatively at least, this is consistent with what optimal policy would entail.

One implication of this work is that, as government agencies pursue policies intended to enhance increased financial inclusion, and the share of included consumers rises, optimal policy may entail an increasing focus on inflation stabilisation relative to output stabilisation.

5. Conclusions

In this paper, we have focused on the implications of financial inclusion for monetary policy, and have highlighted three ways in which an increase in the level of financial inclusion might influence monetary policy choices.

First, a higher level of financial inclusion might lead to a stronger focus by the central bank on measures of core inflation, that discount prices of goods from sectors that are relatively volatile, instead of headline inflation. If excluded consumers disproportionately work in, and consume the output of, flexible price sectors, then optimal monetary policy will entail an increased focus on headline inflation the larger is the share of excluded consumers in society.

Second, an increase in the level of financial inclusion is likely to increase the effectiveness of interest rate tools relative to quantity-based tools. Financially included consumers are directly affected by changes in interest rates, as they are reflected in their costs of borrowing and returns to savings, so the larger is the share of included consumers, the more potent interest rate tools become.

Third, central banks may wish to adjust their interest rate rule, for one of two reasons. The first reason is that the domain of the parameter space over which the interest rate rule results in deterministic outcomes is sensitive to the level of financial inclusion, although the exact direction of these changes depends on assumptions about the structure of the economy – for example, if the central bank follows a forward-looking or contemporaneous rule, and how sticky wages are. The second reason is that optimal policy is likely to change. Financially included consumers are able to use their access to financial markets to smooth their level of consumption, vis-à-vis their level of income, more effectively than excluded consumers. For a central bank setting interest rates with a view to maximising societal welfare, the desirability of helping consumers smooth their consumption by smoothing output therefore weakens as the share of financially excluded consumers fall. Thus optimal policy will be characterised increasingly by price stability, even at the expense of slightly higher levels of output volatility, the higher is the level of financial inclusion.

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Marrakech, Morocco, 14 July 2017

Adapting monetary policy to increasing financial inclusion[1]

James Yetman,
Bank for International Settlements

[1] This presentation was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.

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Adapting monetary policy to increasing financial inclusion

James Yetman

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14 July 2017

Disclaimer: the views expressed are those of the presenter and are not necessarily shared by the BIS

Financial inclusion and monetary policy

- **Choice of price index to target may change**
  - Excluded consumer tend to earn and consume in flex price sector (eg agriculture)
  - Central bank should put more weight on flexible prices (that affect excluded consumers) the more excluded consumers there are
  - As inclusion increases, weight on core inflation increases and weight on headline inflation falls

Anand, Prasad and Zhang (2015)

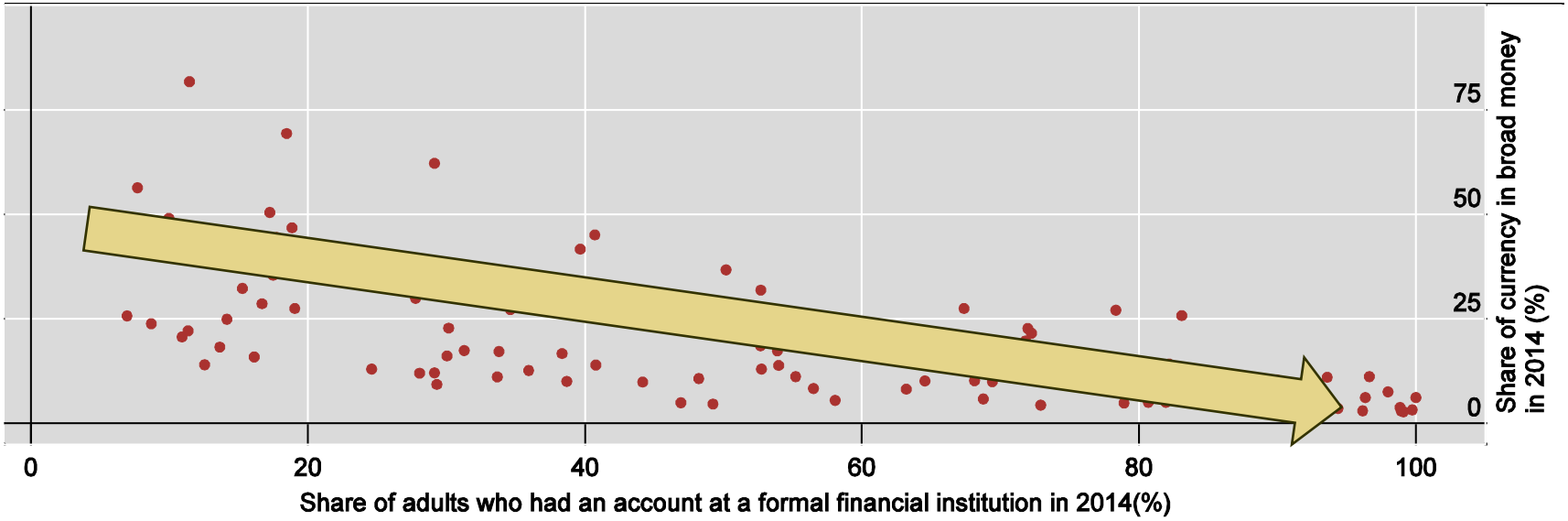
Financial inclusion and monetary policy

- Choice of price index to target may change
- **Interest rate effectiveness increases**
  - Khan (2011); Tombini (2012)

Financial inclusion and interest rate effectiveness

Financial inclusion and the money stock

Account ownership and share of currency in broad money[1] Graph 6



[1] Share of currency in broad money is defined as $Currency\ in\ circulation/Broad\ money$.

Sources: IMF, *International Financial Statistics*; World Bank, *Global Financial Inclusion Database*; BIS calculations.

Could growth of mobile money lead to loss of monetary policy effectiveness?

- **Inclusion can happen outside of the formal financial system**
- **Similarities with "free-banking" era?**
  - Procyclical money supply (Goodhart 1988)
  - Risks of shock to confidence of electronic money
- **Natural limits to size?**
  - M-PESA (Kenya): 6.6% of total payments*

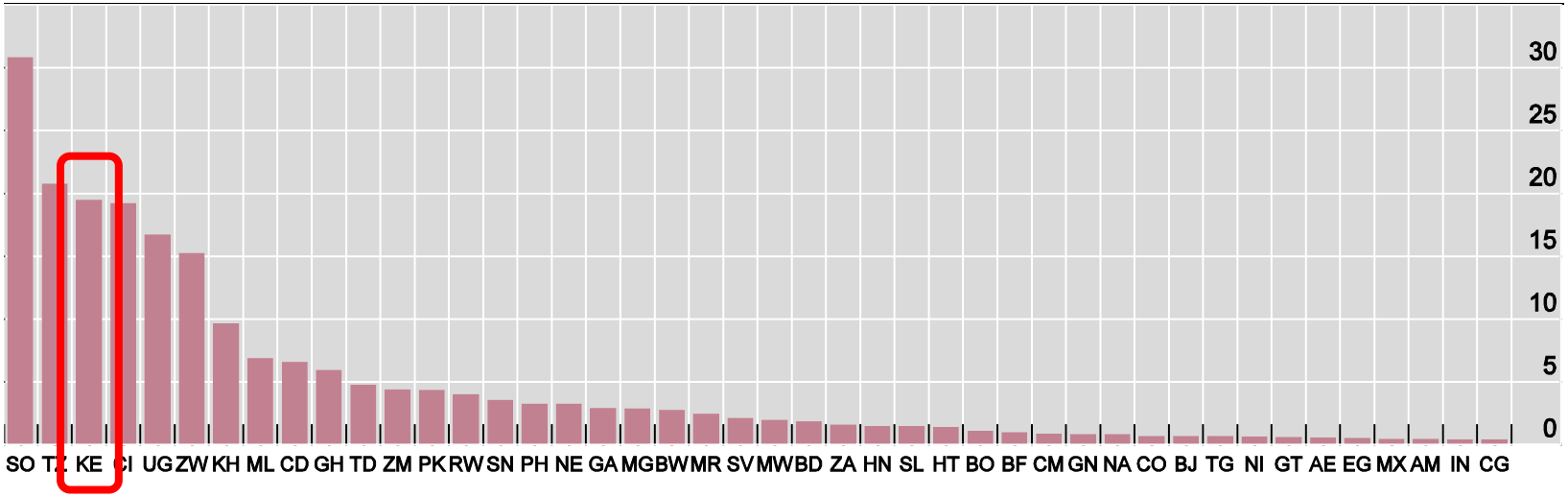
* http://www.cgap.org/blog/10-myths-about-m-pesa-2014-update

Could growth of mobile money lead to loss of monetary policy effectiveness?

Mobile money service

Share of adults having mobile money account only, in per cent

Graph 7



SO=Somalia; TZ=Tanzania; KE=Kenya; CI=Cote d'Ivoire; UG=Uganda; ZW=Zimbabwe; KH=Cambodia; ML=Mali; CD= Democratic Republic of Congo; GH=Ghana; TD=Chad; ZM=Zambia; PK=Pakistan; RW=Rwanda; SN=Senegal; PH=Philippines; NE=Niger; GA=Gabon; MG=Madagascar; BW=Botswana; MR=Mauritania; SV=El Salvador; MW=Malawi; BD=Bangladesh; ZA=South Africa; HN=Honduras; SL=Seirra Leone; HT=Taiti; BO=Bolivia; BF=Burkina Faso; CM=Cameroon; GN=Guinea; NA=Namibia; CO=Colombia; BJ=Benin; TG=Togo; NI=Nicaragua; GT=Guatemala; AE=United Arab Emirates; EG=Egypt; MX=Mexico; AM=Armenia; IN=India; CG=Republic of Congo.

Sources: World Bank, *Global Financial Inclusion Database*; BIS calculations.

Financial inclusion and monetary policy

- Choice of price index to target may change
- Interest rate effectiveness increases
- **The policy rule needs to change (for determinacy)**
  - Does the Taylor Principle hold?
  - Should the response be stronger? Weaker?
  - Answer: it depends:
    - Policy rule forward looking or contemporaneous?
    - Wages sticky or flexible?
  - Galí et al (2004); Di Bartolomeo and Rossi (2007); Bilbiie (2008); Ascari et al (2011); Colciago (2011); Motta and Tirelli (2010)

Financial inclusion and monetary policy

- Choice of price index to target may change
- Interest rate effectiveness increases
- The policy rule needs to change (for determinacy)
- **The policy rule should change (for optimality)**

What does the theory say?

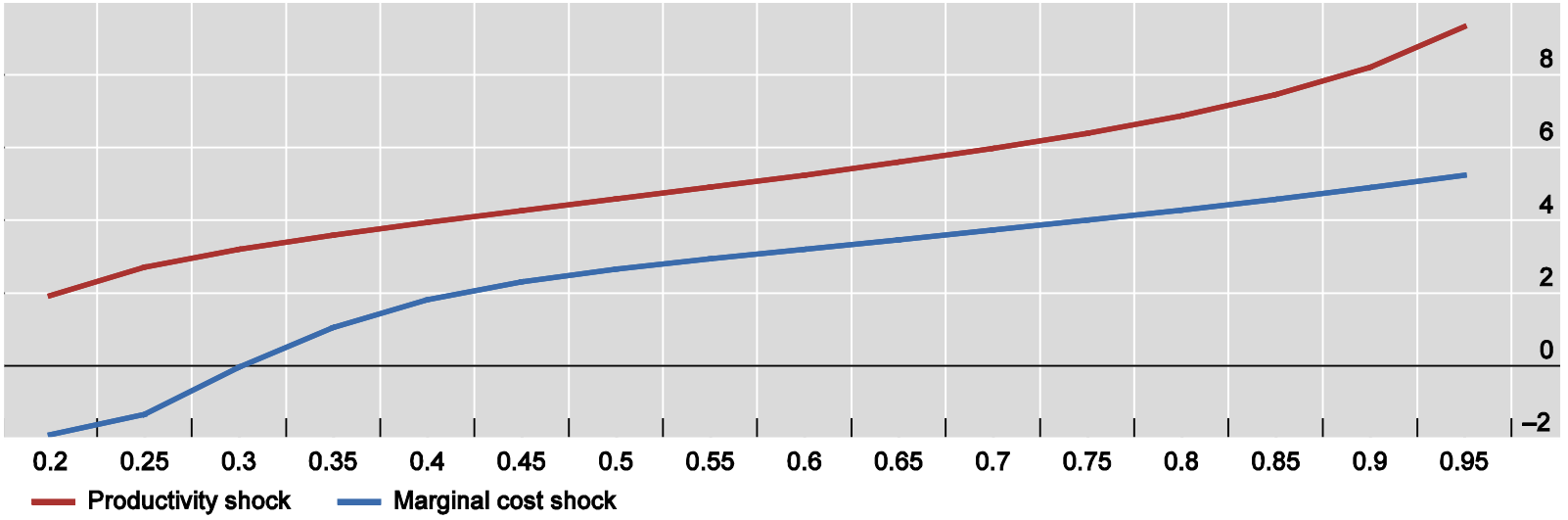
- Included consumers can smooth their consumption on their own in response to economic shocks
- Excluded consumers cannot
- Thus optimal policy SHOULD look different depending on the degree of inclusion

Mehrotra and Yetman (2014)

Optimal output: inflation variance ratios

Optimal ratio of output: inflation variances

Graph 3



Note: The vertical axis displays the ratio of output volatility to inflation volatility, in logarithms. The horizontal axis displays the share of consumers who are financially included (1-λ).

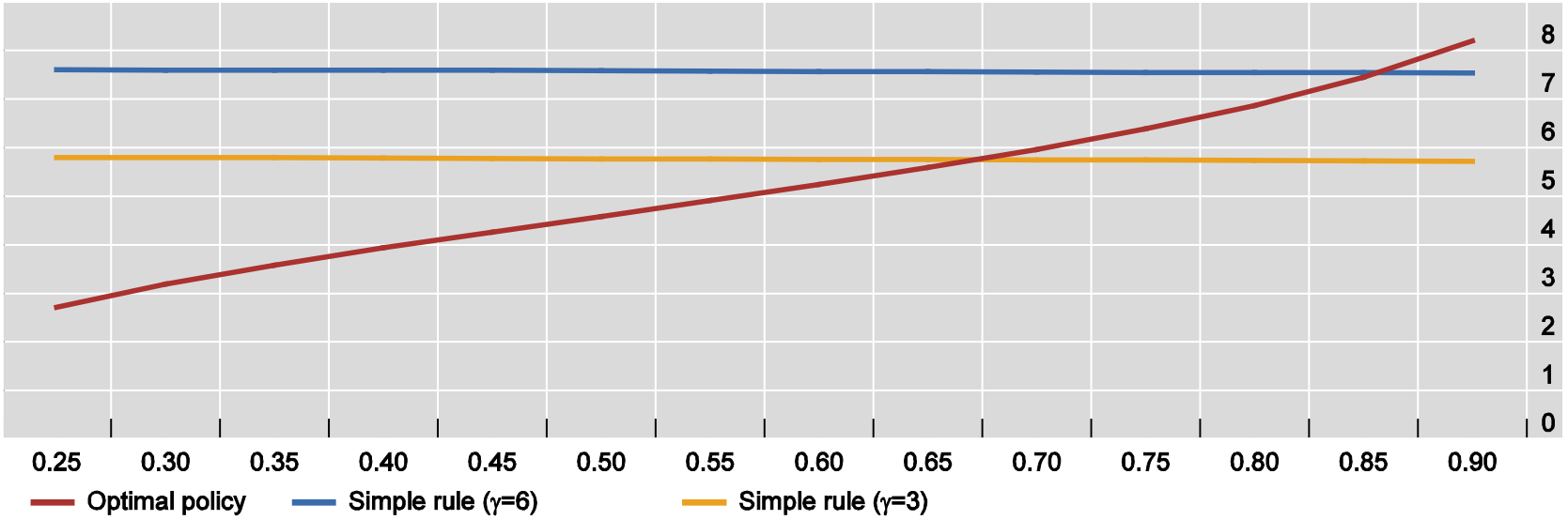
Source: Authors' calculations.

What if monetary policy didn't change?

Ratio of output : inflation variances

Optimal policy vs simple rule

Figure 4



Note: The vertical axis displays the ratio of output volatility to inflation volatility, in logarithms. The horizontal axis displays the share of consumers who are financially included (1-λ).

Source: Authors' calculations.

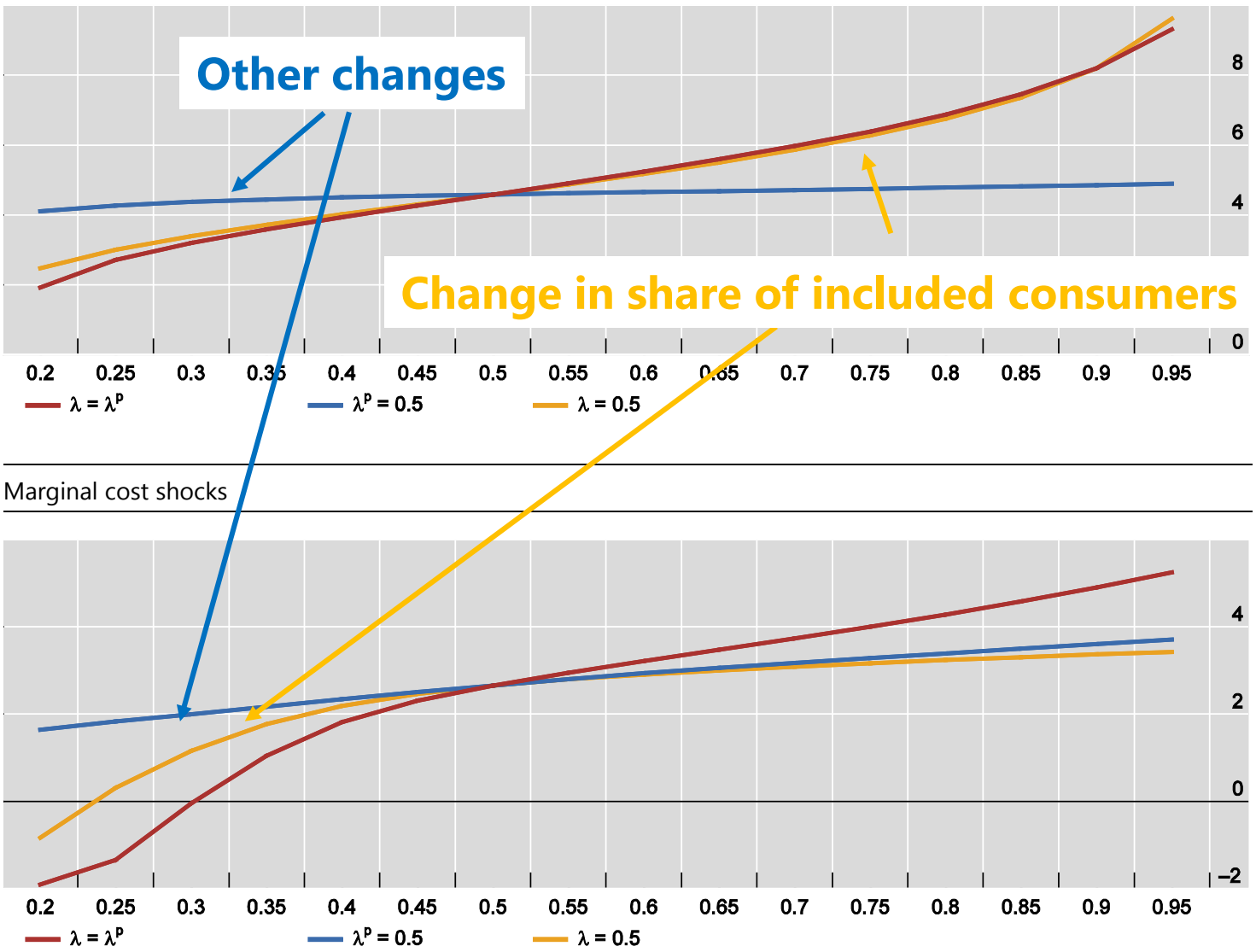
Why does optimal monetary policy change with more financially included consumers?

Three reasons:

- **Welfare depends on consumption and inflation volatility**
  - For excluded consumers, V(output) ⇔ V(consumption)
  - For included consumers, V(output) ≠ V(consumption)
  - For all consumers, V(inflation) is costly
- **The structure of the economy is different**
  - More included consumers implies larger changes in investment and therefore output
- **The relative weight on included consumers is higher**
  - More included consumers implies a higher weight in the welfare function

Decomposition of change in variance ratio

Graph 4



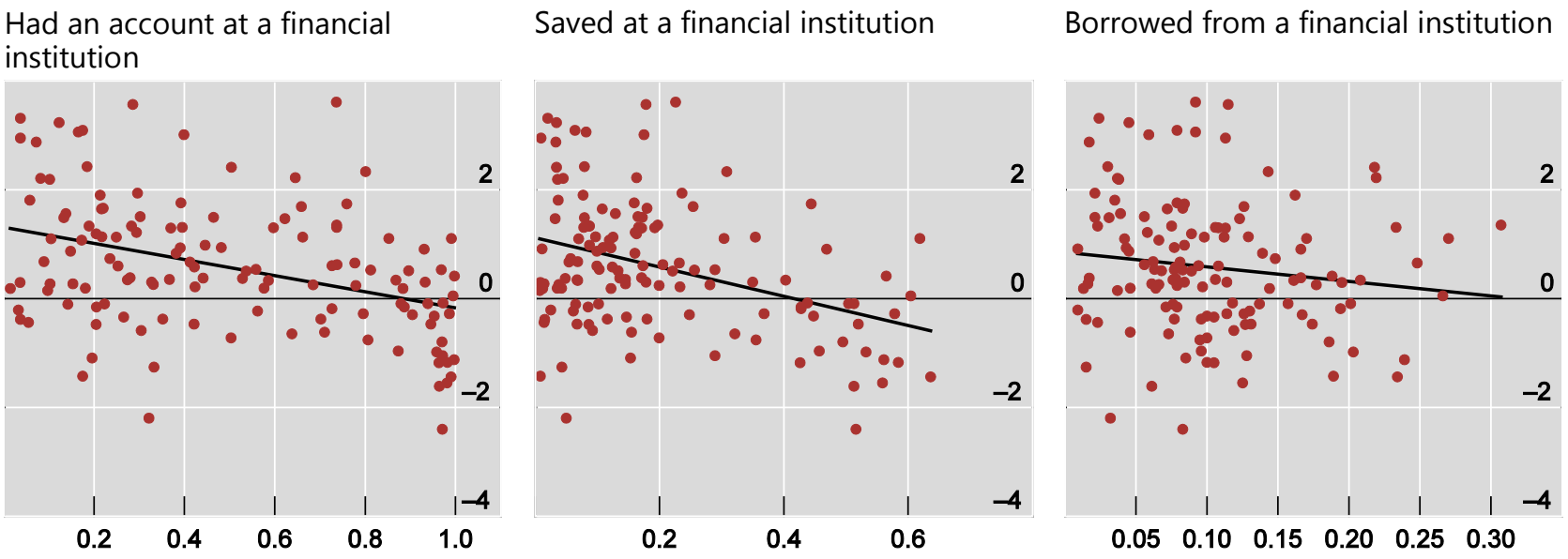
What does the data say?

- Is consumption volatility lower in economies with more inclusion?
- Is ratio of output to inflation volatility higher in economies with more inclusion?

Financially included smooth consumption

Ratio of consumption–output variances and financial inclusion, alternative measures

Figure 7



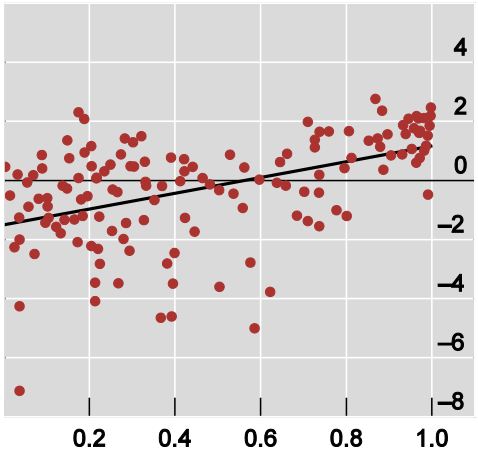
Note: The vertical axes show the ratio of consumption gap volatility to output gap volatility during 2000–12, in logarithms. The horizontal axes show the share of adults that had an account at a formal financial institution in 2011 (left panel), the share of adults who saved money (middle panel) or share of adults who borrowed money (right panel) at a formal financial institution during the preceding 12 months. Republic of Congo and Zambia, two outliers, are excluded.

Sources: IMF, *World Economic Outlook*; World Bank, *Global Financial Inclusion Database*; Authors' calculations.

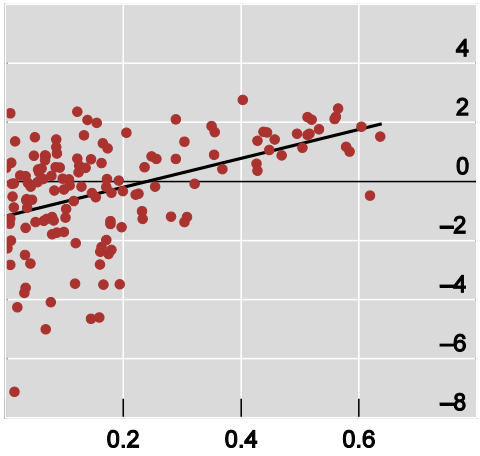
Empirical evidence, variance ratio and inclusion

Ratio of output–inflation variances and financial inclusion, alternative measures Graph 6

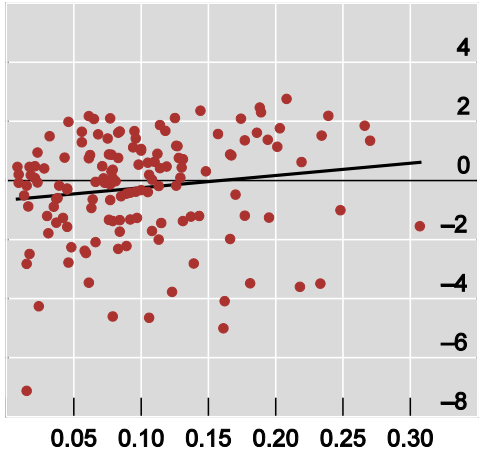
Had an account at a financial institution



Saved at a financial institution



Borrowed from a financial institution



Note: The vertical axes show the ratio of output gap volatility to inflation volatility during 2000–12, in logarithms. The horizontal axes show the share of adults that had an account at a formal financial institution in 2011 (left panel), the share of adults who saved money (middle panel) or share of adults who borrowed money (right panel) at a formal financial institution during the preceding 12 months. Greece, an outlier, is excluded.

Sources: World Bank, *Global Financial Inclusion Database*; Authors' calculations.

Summary: optimal monetary policy and financial inclusion

- **Model results: more inclusion implies greater focus on price stability relative to output stability**
- **Strong empirical support for the model's prediction in the cross-sectional dimension:**
  - Ratio of consumption to output volatility falls as the degree of financial inclusion increases
  - Ratio of output to inflation volatility rises as the degree of financial inclusion increases
- **As developing economies are pursuing policies to enhance inclusion, the weight on inflation stabilisation should increase over time:**
  - Consistent with moves towards inflation targeting as financial inclusion increases

Appendix slides

Estimation results, cross section

Table 2

Dependent variable is log of variance ratio

	(1)	(2)	(3)	(4)	(5)
Financial inclusion variable	Account ownership	Savings in past year	Loans in past year	Account ownership, more autonomous central banks	Account ownership, less autonomous central banks
Coefficient on financial inclusion	2.679***	4.901***	4.160*	2.771***	0.549
	(0.419)	(0.784)	(2.371)	(0.431)	(1.523)
Adj R squared	0.224	0.214	0.015	0.341	–0.043
N	139	142	141	79	22

Source: The table shows the β_1 coefficients of cross-sectional regressions of the type: Log(Variance ratio) = β_1 * financial inclusion+c. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. Standard errors are in parentheses. Intercepts are not shown. Greece, an outlier, is excluded. The variance ratio is computed as the ratio of the variance of the output gap to the variance of inflation over 2000–12. The variables for financial inclusion are from the Global Findex Database. The degree of autonomy of central banks is from Siklos, P L (2008): "No single definition of central bank independence is right for all countries", *European Journal of Political Economy* 24(4), 802–816. "More autonomous" is defined as central banks with values of 0.75 or 1 in the "AUT" category that measures independence/autonomy in making day-to-day monetary policy decisions; "less autonomous" 0.5 or 0 in the same category.

Estimation results, account ownership

Table 3

	(6)	(7)	(8)	(9)	(10)
	Dependent variable is log of variance ratio				
Account ownership	3.480***	3.667***	3.505***	3.780***	2.987**
	(0.537)	(1.192)	(0.540)	(1.232)	(1.129)
Credit-to-GDP		-0.001		-0.002	0.001
		(0.005)		(0.005)	(0.005)
Energy imports, share of GDP			-0.021	-0.020	-0.036
			(0.032)	(0.035)	(0.032)
Adjustment for crises	No	No	No	No	Excluding only crisis years from variance ratio
Adj R squared	0.318	0.268	0.311	0.253	0.345
N	79	76	79	76	76

Source: All estimations are two stage least squares estimations, where regulatory quality is used to instrument for the financial inclusion variable. Other right-hand side variables are used as their own instruments. Only more autonomous central banks are included (see note to Table 2). *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. Standard errors are in parentheses. Intercepts are not shown. Greece, an outlier, is excluded. The variance ratio is computed as the ratio of the variance of the output gap to the variance of inflation over 2000–12. The variables for financial inclusion are from the Global Findex Database.

Optimal policy and redistribution

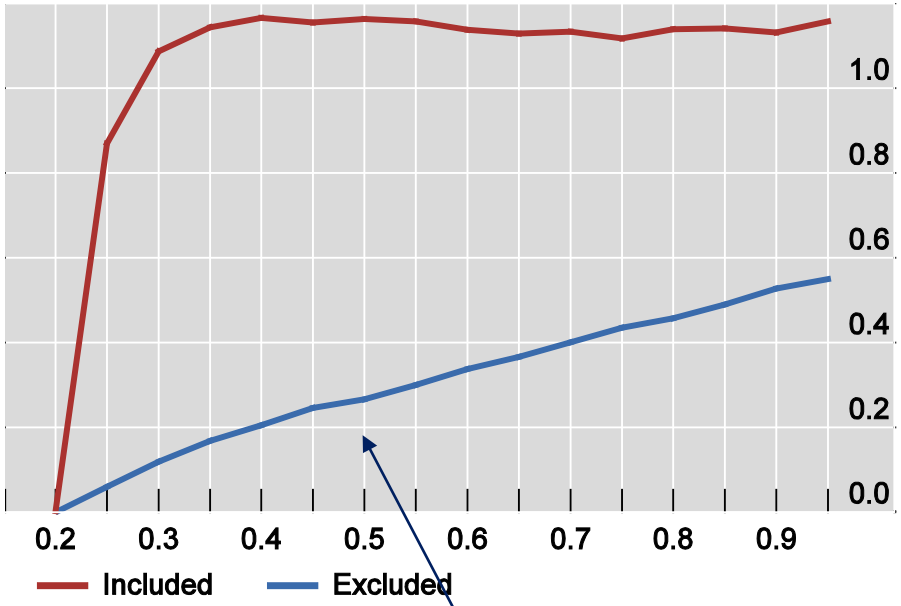
- **Does optimal policy exacerbate inequality?**
- **An example:**
  - What share of their consumption would *excluded consumers be willing to pay* in order for the central bank not to update its objective function relative to optimal policy with 20% financial inclusion?
  - What share of their consumption would *included consumers need to be paid* if the central bank did not update its objective function relative to optimal policy with 20% financial inclusion?

Benefit to included consumers from adjusting monetary policy optimally

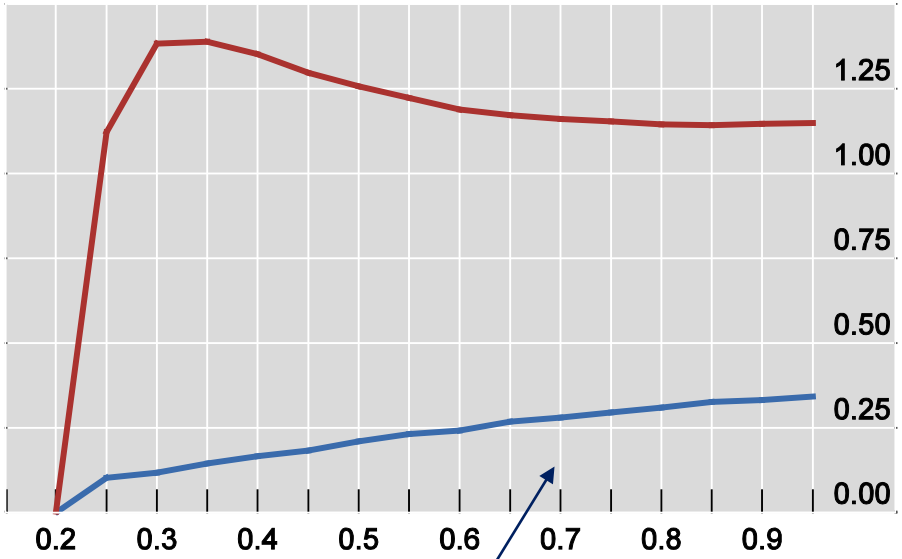
Costs/benefits of not updating objective as a function of financial inclusion

As a percentage of steady state consumption

Real shocks



Nominal shocks



The graph displays the cost (benefit) of the central bank objective function not changing when the share of included consumers increases from 20% for excluded (included) consumers, as a percent of steady state consumption.

Cost to excluded consumers from adjusting monetary policy optimally