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.

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* 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.

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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.

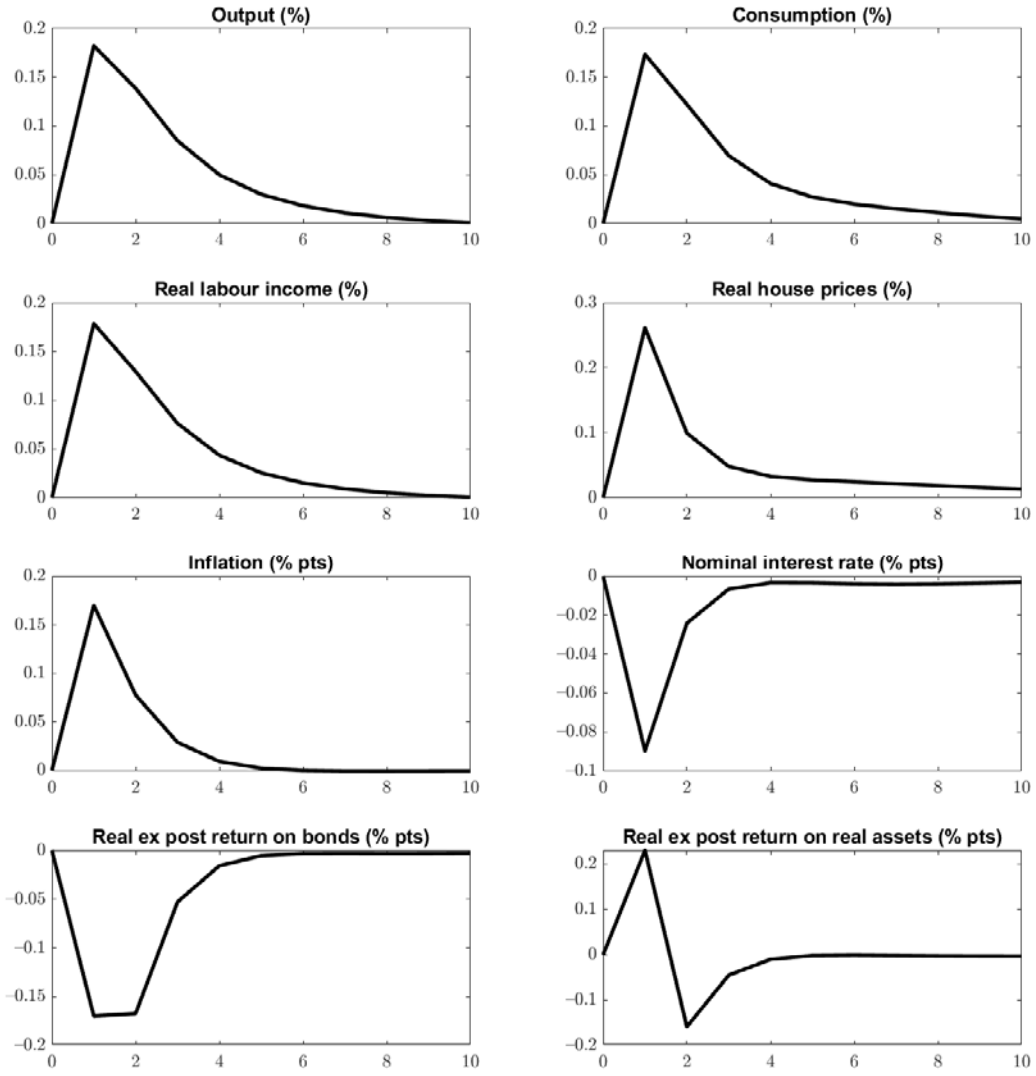
3.1 Aggregate effects

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



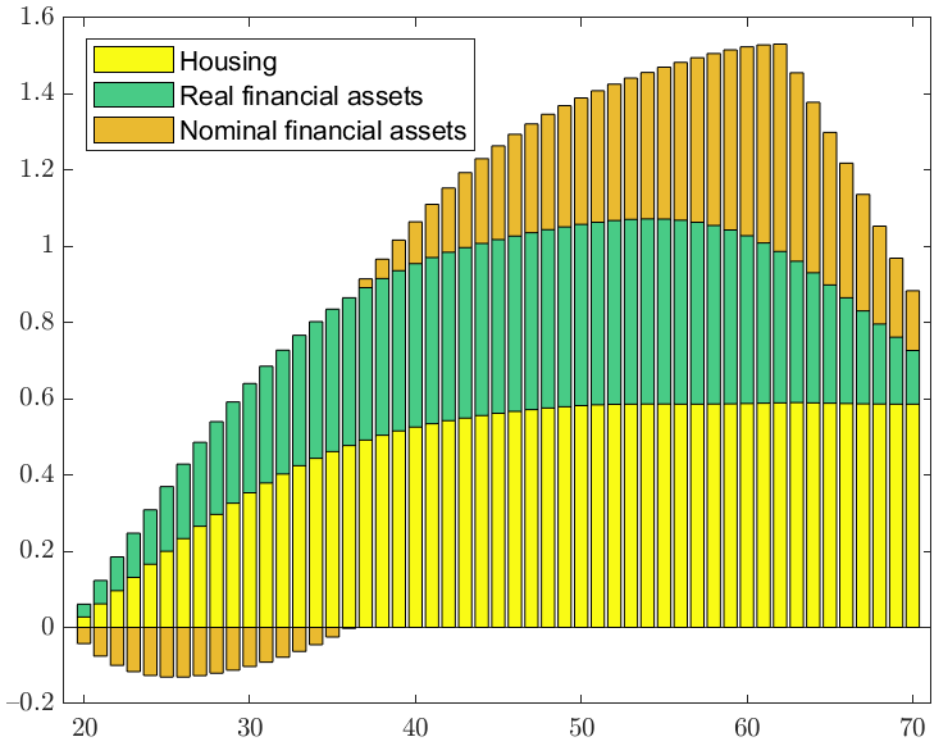
3.2 The impact on welfare

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.

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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.

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