



**WP/21/201**

# **IMF Working Paper**

---

## **Distributional Effects of Monetary Policy**

by Valentina Bonifacio, Luis Brandao- Marques, Nina Budina, Balazs Csonto,  
Chiara Fratto, Philipp Engler, Davide Furceri, Deniz Igan, Rui Mano, Machiko Narita,  
Murad Omoev, Gurnain Kaur Pasricha, and Hélène Poirson

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

**I N T E R N A T I O N A L M O N E T A R Y F U N D**

## IMF Working Paper

Monetary and Capital Markets, Research, and Strategy and Policy Review Departments

### Distributional Effects of Monetary Policy

**Prepared by Valentina Bonifacio, Luis Brandao-Marques, Nina Budina, Balazs Csonto, Chiara Fratto, Philipp Engler, Davide Furceri, Deniz Igan, Rui Mano, Machiko Narita, Murad Omoev, Gurnain Kaur Pasricha, and Hélène Poirson<sup>1</sup>**

Authorized for distribution by Deniz Igan

July 2021

**IMF Working Papers describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

### Abstract

As central banks across the globe have responded to the COVID-19 shock by rounds of extensive monetary loosening, concerns about their inequality impact have grown. But rising inequality has multiple causes and its relationship with monetary policy is complex. This paper highlights the channels through which monetary policy easing affect income and wealth distribution, and presents some quantitative findings about their importance. Key takeaways are: (i) central banks should remain focused on macro stability while continuing to improve public communications about distributional effects of monetary policy, and (ii) supportive fiscal policies and structural reforms can improve macroeconomic and distributional outcomes.

JEL Classification Numbers: D31, E43, E52, E58

Keywords: Income and wealth distribution, Interest rates, Monetary Policy, Central Banks

Authors' E-Mail Addresses: VBonifacio@imf.org; LMarques@imf.org; NBudina@imf.org; BCsonto@imf.org; CFratto@imf.org; PEngler@imf.org; DFurceri@imf.org; DIgan@imf.org; RMano@imf.org; MNarita@imf.org; MOmoev@imf.org; GPasricha@imf.org; HPoirson@imf.org

---

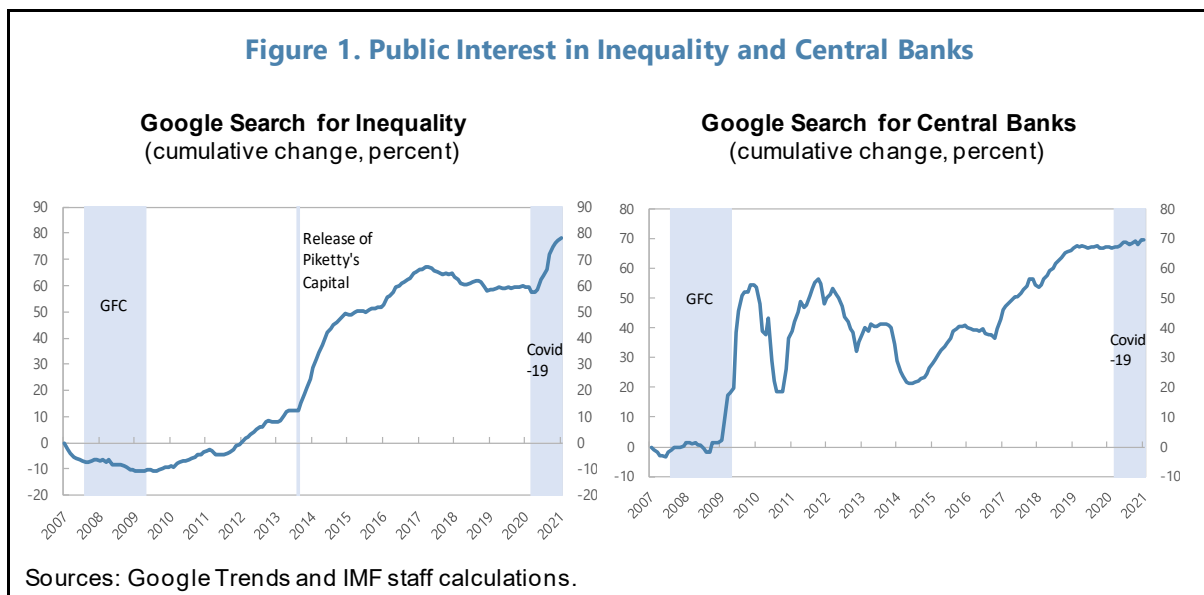
<sup>1</sup> The authors would like to thank Luis Cubeddu, Giovanni Dell'Ariccia, Rupa Duttagupta, Chris Erceg, Gaston Gelos, Florence Jaumotte, Sebnem Kalemli-Ozcan, Petya Koeva Brooks, Maria Soledad Martinez Peria, Sanjaya Panth, and Rafael Portillo for valuable comments, and Jelle Barkema for outstanding research assistance.

## Contents

Abstract.....	<a href="#">2</a>
I. Introduction.....	<a href="#">4</a>
II. Stylized Facts.....	<a href="#">6</a>
III. Channels for Distributional Effects of Monetary Policy.....	<a href="#">9</a>
A. A Stylized Framework.....	<a href="#">9</a>
Income Channels.....	<a href="#">10</a>
Wealth Channels.....	<a href="#">10</a>
B. Exposures to Monetary Policy Shocks.....	<a href="#">12</a>
IV. Distributional Impact of Monetary Policy Shocks .....	<a href="#">16</a>
A. Savings-Redistribution Channel: Microsimulations.....	<a href="#">16</a>
B. Asset Price Channel: Microsimulations .....	<a href="#">17</a>
C. A DSGE Model for the United States.....	<a href="#">19</a>
D. Labor Earnings Channel: Empirical Assessment.....	<a href="#">22</a>
E. Results from Other Studies in the Literature.....	<a href="#">23</a>
V. Policy Implications.....	<a href="#">26</a>
A. Central Bank Mandate.....	<a href="#">26</a>
B. Central Bank Communication .....	<a href="#">29</a>
VI. Conclusions.....	<a href="#">31</a>
References.....	<a href="#">35</a>
Appendix 1. Definition of Variables In Household Surveys.....	<a href="#">41</a>
Appendix 2. Benchmarking “Unhedged Interest Rate Exposures”.....	<a href="#">43</a>
Appendix 3. Benchmarking Distributional Implications of Asset Price Increases.....	<a href="#">44</a>
Appendix 4. The Heterogeneous Agent New Keynesian model of KMV.....	<a href="#">45</a>
Appendix 5. Empirical Strategy and Specification for the Results on Earnings.....	<a href="#">46</a>

## I. INTRODUCTION

The debate on monetary policy and inequality is ongoing. Since the 1980s, income and wealth inequality have risen significantly in advanced economies. Accordingly, public interest in inequality has increased especially after the Global Financial Crisis (GFC). Some have argued that easy monetary policy is behind rising trends in inequality (e.g., Petrou 2021) and that asset purchases and other unconventional monetary policies increased income or wealth inequality (Stiglitz 2015). The onset of the COVID-19 crisis has brought further to the fore the contrast between the disparities in access to health and vulnerability to income and job loss, and the booming financial markets, again following extensive monetary easing. Against this backdrop, the period since the GFC has also been characterized by increasing public interest in what central banks do (Figure 1).



What are then the channels through which monetary policy may have an impact on income or wealth inequality and is there evidence to support economically significant effects? To examine this issue, this paper first establishes some stylized facts about trends in the distributions of income and wealth, global interest rates, and monetary policy easing cycles. A key fact emerges: the increase in inequality and the decrease in interest rates have both been long-term phenomena, likely driven by structural factors (Dabla-Norris et al. 2015). Furthermore, this trend has coincided, since the GFC, with substantial monetary easing in many advanced economies. Given the transient nature of its effects, can monetary policy be a significant driver of this rising trend in inequality? Or is the recent association between rising inequality and monetary easing likely spurious?

Through a critical survey of the literature, complemented with new micro-simulations and empirical and model-based analyses, the paper investigates whether monetary policy has worsened further the trend rise in inequality. Based on our reading of recent theoretical work on the role of agent heterogeneity in shaping macroeconomic dynamics (especially Kaplan et al. 2018), we set up a conceptual framework to explain how monetary policy can affect the distributions of income and wealth. Within the literature on macroeconomics and household

heterogeneity, the studies that look specifically at monetary policy consider two types of channels: income channels and wealth channels. For the income channels, heterogeneity stems from households having diverse sources of income whereas for the wealth channels, it stems from either the dispersion of net worth across households or the heterogeneity of the composition of assets and liabilities in households' balance sheets. A key finding from the theoretical literature is that these two main channels have ambiguous implications for the net distributional effects of monetary policy.<sup>2</sup> This means that the determination of the effects of monetary policy on inequality remains an open empirical question.

When empirically analyzing the channels through which transitory monetary policy actions may affect the distribution of income and wealth, the paper focuses on within-country inequality mostly covering advanced economies, with available high-quality micro data. At the same time, the analysis and the discussion of the conceptual channels are relevant beyond advanced economies, particularly in the current context in which monetary policy was eased significantly in many emerging markets and the relevant literature surveyed here covers some nonadvanced economies. The pre-COVID-19 evidence on the effects of monetary policy on within-country inequality suggests that, once monetary policy shocks are properly identified, monetary accommodation reduces income inequality mostly by reducing unemployment (e.g., Coibion et al. 2017; Furceri et al. 2018). The evidence on the effects on wealth inequality, however, is less clear as it tends to rely on shorter time series.

Studies (pre-COVID-19) that put together several of the above channels (i.e., income and wealth channels) find mixed and often economically negligible net effects of transitory monetary policy easing actions on income inequality, with some variations across countries and between conventional and unconventional monetary policy. On the one hand, quantitative models featuring heterogeneity and a large fraction of hand-to-mouth consumers seem to find overall beneficial effects of monetary easing on inequality mostly because of general equilibrium effects (Ampudia et al. 2018 and Kaplan et al. 2018). Similarly, studies using aggregate data seem to find an overall positive effect, or that monetary easing tends to reduce inequality (e.g., Auclert 2019). In line with these studies, both the micro-simulations done for this paper and the simulation of a heterogeneous agent New Keynesian (HANK) model (Kaplan et al. 2018) confirm that pre-COVID, the net effects of monetary policy easing on inequality are small and temporary (i.e., they dissipate after about 8 quarters). On the other hand, recent work using Danish administrative household-level data finds that large asset price increases induced by monetary policy easing accrue much more to wealthier households and dwarf wage income gains to poorer households, thus raising inequality (Andersen et al. 2020).

Given the empirical and quantitative evidence that monetary policy has not been a meaningful driver of inequality, should central banks take distributional effects into account when formulating monetary policy? The answer is: yes and no. Yes, central banks should increase their communication to address the public's concerns about distributional issues and to clarify

---

<sup>2</sup> For example, heterogeneity in the sources of household income could imply that, everything else equal, wealthier households (who rely relatively more on business income) benefit more from monetary policy easing than poorer households (more reliant on labor income). However, poorer households are also more likely to be able to participate in labor markets or avoid unemployment when monetary policy eases in response to reduced economic activity.

that countercyclical monetary policy can enhance welfare. Importantly, they should rely on counterfactuals to explain how monetary policy can improve outcomes. Central banks should also understand better and factor in differences among households within their existing policy frameworks, including by modelling and analysis of the distributions of income and wealth, as these affect monetary policy transmission. However, monetary policy should remain focused on macroeconomic stability as burdening monetary policy with other objectives risks reducing its effectiveness and may undermine central bank independence.

At the onset, several caveats apply. The paper does not cover the net welfare effects of monetary policy. In other words, it does not discuss the welfare impact of monetary policy easing relative to a counterfactual scenario, taking into account, in a unified framework, its aggregate effects on output, inflation, and unemployment as well as possible distributional effects. Also, the distributional effects of post-COVID extraordinary monetary policy measures are not covered here empirically. Notwithstanding the increased recourse to unconventional monetary policy measures, the limited time since the crisis outbreak and the current high degree of uncertainty would render any assessment of potential distributional effects premature. The effects of the secular decline in the natural rate of interest on inequality and the potential impact of inequality on the natural rate of interest are also not covered in this paper. Finally, the distributional effects of cross-border monetary policy spillovers are also not covered.

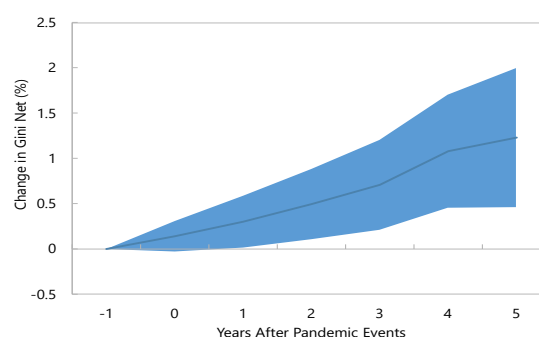
The rest of the paper is structured as follows: Section II highlights key stylized facts to motivate the discussion. Section III includes a discussion of the conceptual channels through which transitory monetary policy actions may affect the distribution of income and wealth, also illustrating their potential importance using data from the United States and Europe, with extensions to other OECD countries. Section IV quantifies some of the channels and puts different channels together to assess the distributional impact of monetary policy. Section V concludes with policy implications.

## II. STYLIZED FACTS

Inequality moved center stage in the post-GFC era, and was further fueled by the COVID-19 shock. Inequality tends to increase during pandemics (Figure 2),<sup>3</sup> and the severity of the COVID-19 crisis implied that close to 95 million more people have fallen into extreme poverty in 2020 (IMF 2021). As such, it “has thrown into stark relief the high and rising economic inequality in the United States and elsewhere” (Qureshi 2020).

Corresponding evidence from the euro area also suggests the COVID-19 pandemic has worsened income inequality because its adverse

**Figure 2. Inequality in the Aftermath of COVID-19**

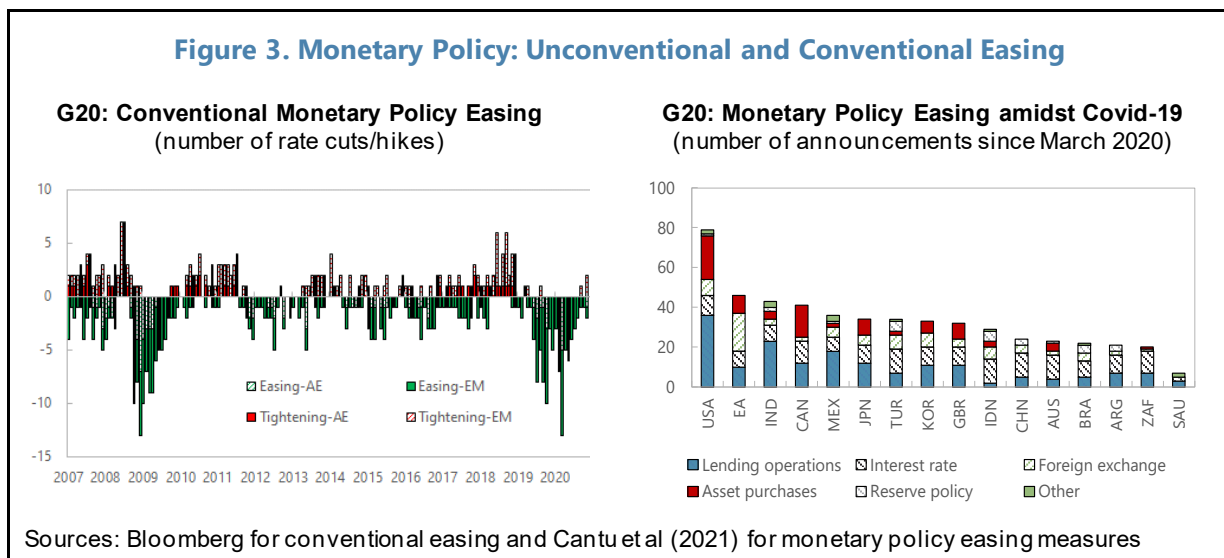


Source: Furceri et al. (2020).

<sup>3</sup> The authors look at the evolution of inequality in the aftermath of SARS (2003), H1N1 (2009), MERS (2012), Ebola (2014), and Zika (2016).

consequences are particularly pronounced for young workers, women, and households with lower income (Schnabel 2020 and Dossche et al. 2020).

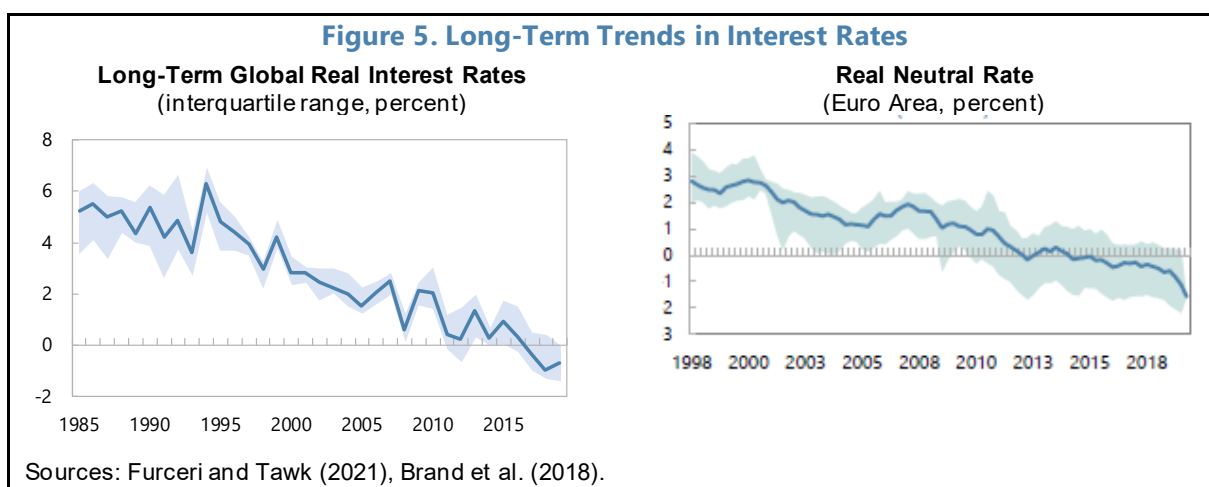
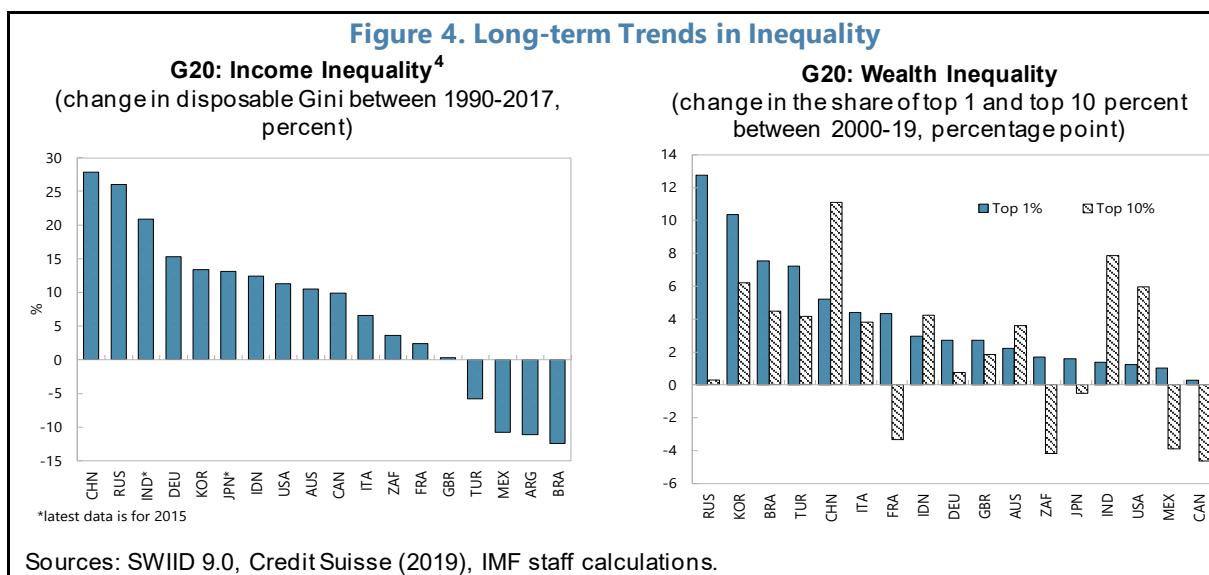
Major central banks have embarked on aggressive monetary easing in response to both the GFC and the COVID-19 crisis (Figure 3). While easing mostly took the form of policy rate cuts at the peak of the GFC, the protracted nature of the crisis and, in some cases, the policy rate hitting the zero-lower bound, presented new challenges. As a result, many central banks had to resort to unconventional monetary policy. Another extensive round of monetary loosening was unleashed amidst the COVID-19 shock. The heavy reliance on monetary policy accommodation, including unconventional monetary policy, contributed to the sharp increase in public interest in central banks in the aftermath of the GFC and the steady increase since 2014 (see Figure 1).



Decades of widening income and wealth disparities coincided at least in part with the prolonged monetary easing in the post-GFC era, particularly the unconventional measures. Within-country income inequality has been trending up in advanced economies (AEs) over the last few decades. While the picture is mixed within the emerging markets (EMs), they started off from higher inequality levels. Wealth inequality has been on the rise as well. For example, in the G20 countries, the share of wealth of the top 1 percent has increased over the past two decades (Figure 4).

Global real interest rates have also been on a declining trend over the past 30 years, though the decline in the real neutral rate accelerated after the GFC (Figure 5). The secular decline in interest rates implies that, irrespective of the business cycle, central banks have had to accommodate the lower level of interest rates. In other words, the decline in interest rates has also reflected a declining neutral rate.

Both long-term developments have been driven by several structural factors, such as trade and financial integration, automation, and demographics. For example, for a sample of almost 100 AEs and emerging market and developing economies (EMDEs) over the period of 1980-2012,



Dabla-Norris et al. (2015) found greater financial openness and technological progress and the easing of labor market regulations to be associated with rising within-country income inequality, while trade openness was found to have a negative relationship with inequality. At the same time, the authors show differential impacts of financial deepening across country groups. The decline in real interest rates has also been attributed to several factors, including globalization (Natal and Stoffels 2019), potential growth (Pescatori and Turunen 2015) and demographics (Han 2019). These factors themselves are evolving in the current environment as COVID-19 not only lays bare some of the structural factors that drive inequality but might also put added pressure on interest rates if there are persistent changes to consumption and savings preferences (Jordà et al. 2020).

<sup>4</sup> For a description of the SWIID database, see Solt (2020). Measurement of inequality, especially for wealth, is challenging and different metrics and different databases may paint different pictures. For some countries like China, for example, the SWIID data imply a larger increase in inequality than other sources like the World Bank. Notwithstanding some criticism of the SWIID database (Jenkins 2015), it provides comprehensive data on income inequality across countries.



The secular rise in inequality and the (more) recent prolonged monetary accommodation have triggered a public debate about whether monetary easing exacerbated inequality. The debate has been made more intense by the public backlash against central banks, including the Occupy Wall Street protests. Most recently, the disconnect between buoyant financial markets (a boon for the rich) and a struggling real economy (bad news for everybody but particularly for poorer households) has reinvigorated the debate about the distributional effects of aggressive monetary easing policies in response to COVID-19 (Igan et al. 2020), with the potential to create political tensions, posing in turn risks to central bank independence. In response, central bankers have increased communications on distributional effects of monetary easing, pointing out that monetary policy easing led to more positive outcomes relative to the counterfactual.<sup>5,6</sup>

### III. CHANNELS FOR DISTRIBUTIONAL EFFECTS OF MONETARY POLICY

This section introduces a stylized yet comprehensive presentation of the channels through which monetary policy affects the distribution of income, wealth, and consumption, and highlights their potential importance using data from the United States and Europe, with extensions to other OECD countries.

#### A. A Stylized Framework

The literature has highlighted several channels for distributional effects, leaning on the newer theoretical models that integrate sticky prices, incomplete markets, and heterogeneity among households (and firms). Representative agent models make the implicit assumption that heterogeneity has little impact on aggregate macro dynamics. Further, many consider monetary policy to be “neutral” (or close to neutral) especially in the long run (Bernanke 2015). In the discussion that follows, we focus on monetary policy shocks—that is, unexpected changes in the monetary policy stance. The aggregate transmission channels are standard: monetary policy alters interest rates, asset prices, and exchange rates.

The building blocks of all distributional channels of monetary policy are the various dimensions of household heterogeneity: income and wealth, age, skill level, sector of employment, marginal propensity to consume, access to finance, etc. These dimensions often overlap. For instance, skill level is correlated with income while wealth evolves through an individual’s life cycle (and, hence, their age). Similarly, those in the lower end of the income distribution tend to have a higher marginal propensity to consume while those with more assets to use as collateral have easier access to finance. One could thus think of income and wealth as the main channels reflecting and capturing various dimensions of heterogeneity.

As a result of these heterogeneities in the level and composition of income and wealth, different households can be affected differently by a given monetary policy action. In other words, they

---

<sup>5</sup> “Bernanke chides Occupy Wall Street ‘misconceptions,’” CNN Money, November 3, 2011, [https://money.cnn.com/2011/11/02/news/economy/bernanke\\_occupy\\_wall\\_street/index.htm](https://money.cnn.com/2011/11/02/news/economy/bernanke_occupy_wall_street/index.htm). “Draghi Says ECB Policy Has Helped Reduce Inequality,” Wall Street Journal, June 26, 2017, <https://www.wsj.com/articles/draghi-says-ecb-policy-has-helped-reduce-inequality-1498499845>

<sup>6</sup> Moreover, policymakers have often stressed that the increase in inequality and the decrease in interest rates are both long-term phenomena.

have different *exposures* to monetary policy shocks. Further, the same policy action can have potentially offsetting effects for the same household via different channels.

The distributional implications of these channels can vary across countries and through time. They may depend on country characteristics, such as reliance on capital markets versus banks; the initial composition of household balance sheets; labor bargaining powers and broader labor market flexibility; openness and the industrial structure of the economy. The time dimension over which the effects play out will also be shaped by these heterogeneities, in conjunction with rigidities like slow responses of prices and wages. The state of the business cycle may have a bearing on the various dimensions of heterogeneity and the strength of the related channels.

We next discuss the mechanisms through which different dimensions of heterogeneity generate distributional effects.

### Income Channels

Households differ in terms of their primary source and level of income. Monetary policy can have distributional effects if these different sources of income and levels of earnings react differently to monetary policy shocks.

- **Income composition channel.** Richer households receive a larger share of their income from business and financial (capital) income, which is typically more responsive to monetary policy than labor income (Gornemann et al. 2016). As a result, under the *income composition channel*, monetary policy easing may benefit richer households more and increase income (and possibly consumption) inequality.
- **Earnings distribution channel.** Households also differ in terms of where their earnings fall in the overall distribution. Wages and employment prospects of low-income households are typically more sensitive to monetary policy and business cycles (Heathcote et al. 2010). For instance, less-skilled, lower-income workers are more likely to lose their job during a recession. Under the *earnings distribution channel*, monetary policy easing may reduce income and consumption inequality by stimulating economic activity and lessening the impact of an economic downturn.

### Wealth Channels

Households differ not only by their wealth level (including whether their net wealth is positive or not) but also by what they own and what they owe (their wealth portfolio composition). By changing the value of the underlying assets and liabilities as well as inflation expectations, monetary policy may redistribute wealth among households.

- **Balance sheet composition channel.** Household balance sheets can differ substantially both on the asset and the liability side. On the asset side, a fall in the interest rate affects different assets (real estate, bonds, stocks) differently, depending on their type and duration. On the liability side, how unexpected reductions in interest rates and their associated impact on exchange rates affect debt service and balance of loans also depends on these liabilities' type (including currency denomination) and maturity. The

net effect of asset and liability side effects on wealth then is ambiguous. Under the *balance sheet composition channel*, monetary policy easing may decrease or increase wealth and consumption inequality.

- **Savings redistribution channel.** Households differ in terms of their level of wealth. Some households are borrowers with negative net wealth, others are savers with positive net wealth. Unexpected decreases in real interest rates favor borrowers and hurt savers. Further, borrowers typically are less patient and have a greater marginal propensity to consume. Under the *savings redistribution channel*, monetary policy easing may reduce wealth and consumption inequality.

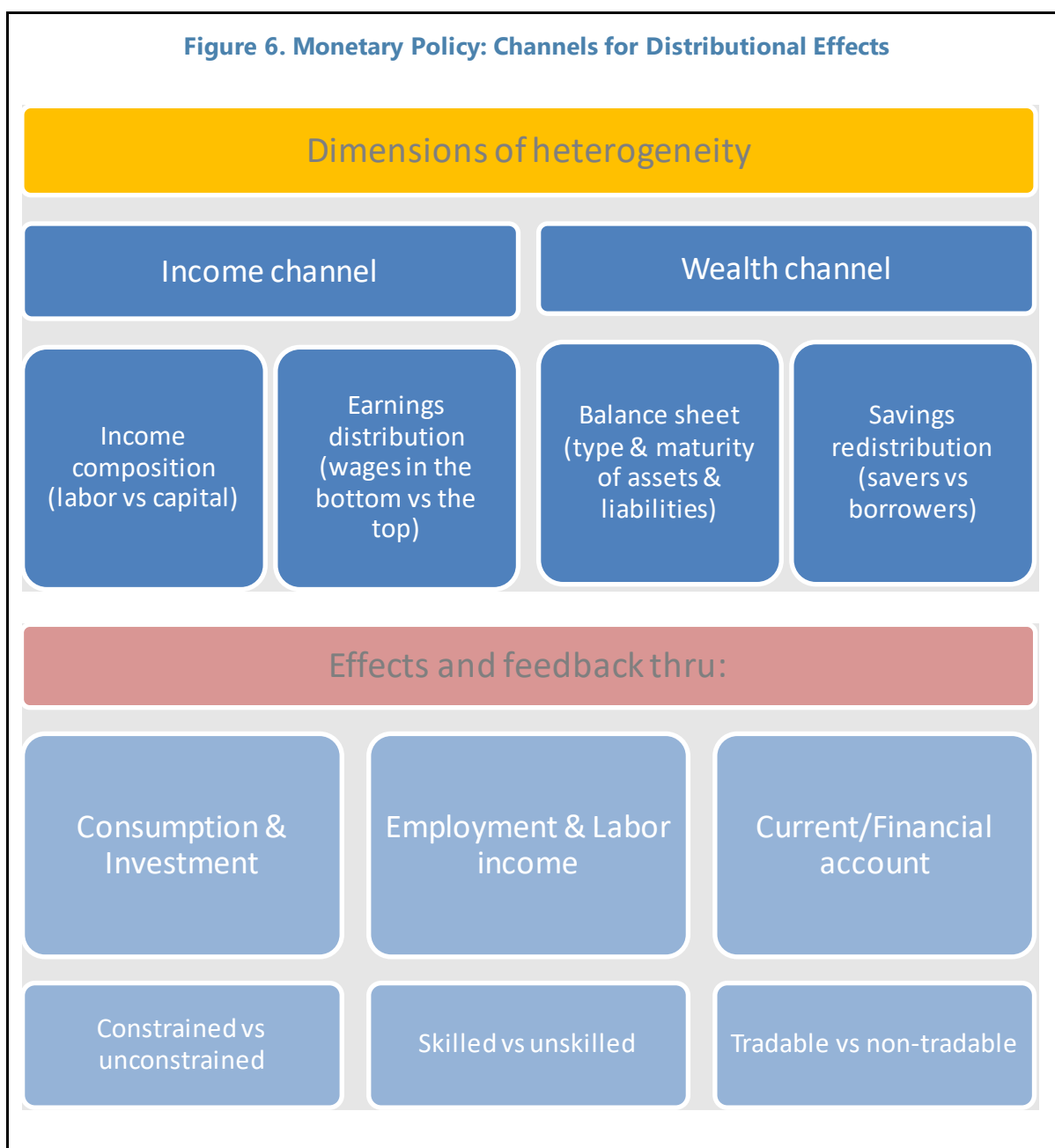
A couple more specific channels are mentioned in the literature. One is the inflation channel whereby the relevant dimension of household heterogeneity is cash holdings and nominally fixed debt (Erosa and Ventura 2002; Doepke and Schneider 2006). The other is the interest rate exposure channel whereby the measure of a household's balance sheet exposure to interest rates is the difference between all maturing assets and liabilities at a given point in time (Auclert 2019). In our simplified framework, these additional channels would be classified as wealth channels as they relate to differences across households in their assets and liabilities and their net wealth positions.

Figure 6 summarizes these dimensions of heterogeneity and illustrates how they generate different responses to monetary policy changes both *on impact* and through *general equilibrium feedback*. Note that the latter effects occur via consumption and investment, employment and labor income, as well as movements in the current and financial accounts. Such general equilibrium effects are likely to be observed over a longer time horizon and may offset over the business cycle. Their ultimate direction and size again depend on heterogeneities across households, and firms. As noted earlier, many of these heterogeneities are correlated with and are reflected in heterogeneity across income and wealth dimensions, as can be illustrated with some specific examples.

- Financial constraints of households and firms matter for their consumption and investment decisions. This then shapes their response to monetary policy changes.
- The incomes of skilled and unskilled workers face different sensitivities to monetary policy both on the extensive margin—captured by employment—and on the intensive margin—captured by wages.
- Tradable and non-tradable sectors respond differently to current account developments, with implications for their profits and the wages of households they employ.

In the rest of the paper, we first highlight the potential on-impact responses using measures of households' exposure to monetary policy. Then, we use a model to shed light on the general equilibrium feedback and the ultimate effects on inequality.

Figure 6. Monetary Policy: Channels for Distributional Effects



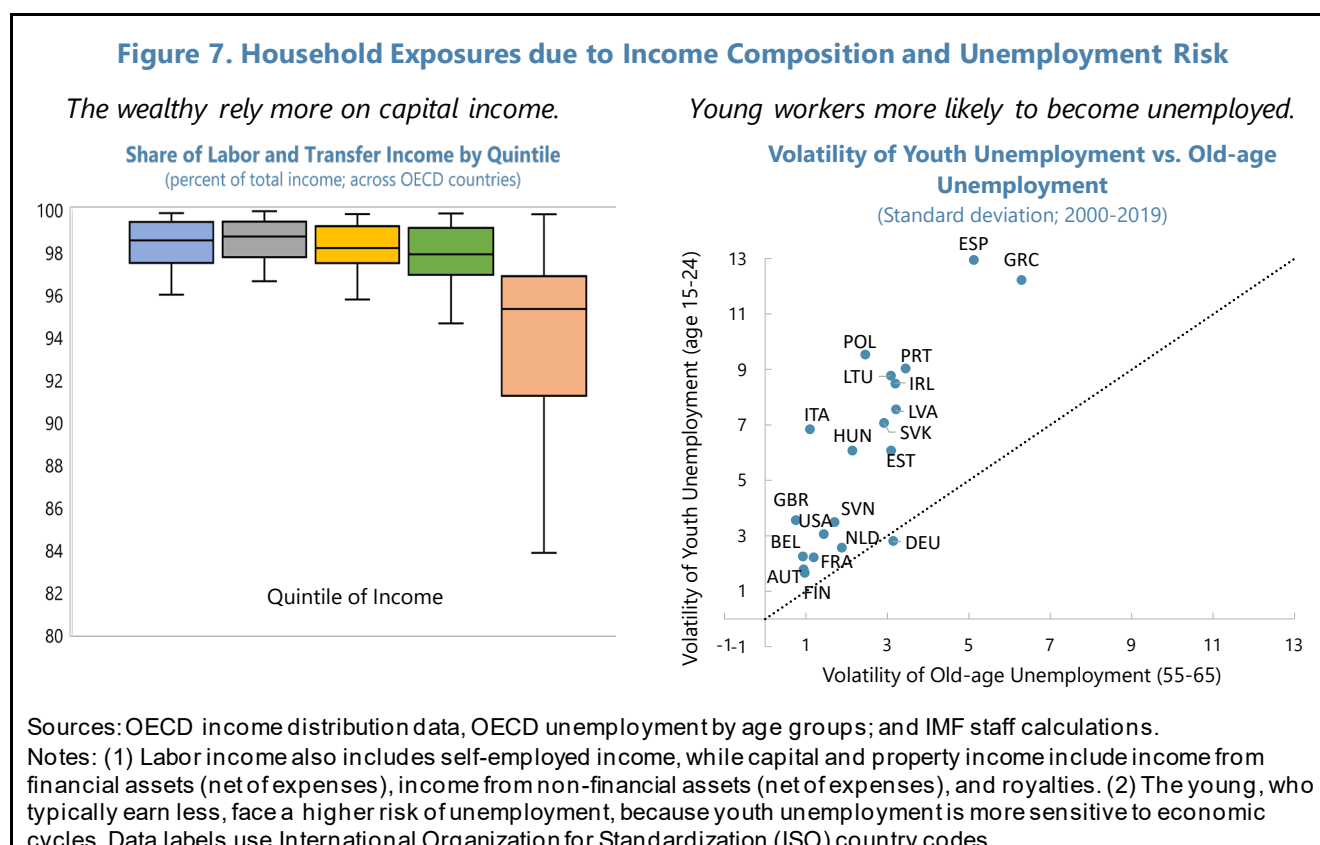
## B. Exposures to Monetary Policy Shocks

Following the conceptual discussion about various distribution channels of monetary policy easing actions, this section illustrates the potential on-impact responses via household exposures to monetary policy shocks. Specifically, we illustrate the potential importance of the main income and wealth channels by documenting household exposures based on data from the United States and Europe, with extensions to other OECD countries.

As highlighted in the previous section, a monetary policy easing action can have distributional effects via the *income composition channel*. To gauge the intensity of this channel, we illustrate

household exposures by the variations in the relative importance of labor and transfer income, and capital income across quintiles of disposable income distribution, using OECD's survey-based income distribution database (IDD) for OECD countries over 2014–17.

On average for OECD countries, the share of labor income and transfers varies significantly across quintiles (Figure 7). These variations reflect differences in the relative importance of capital income, and the concentration and composition of wealth. For instance, in the United States, capital income is especially concentrated at the very top, particularly at the top 1 and top 10 percent of the income distribution (Bivens and Mishel 2013; Saenz 2017). In the euro area, rich households are also more likely to derive a higher share of income from capital, as they hold more financial assets (stocks, bonds), while households at the bottom benefit from relatively more generous transfer systems.<sup>7</sup> Other differences, including different cyclical positions, demographics, quality of labor market institutions, and the ability of fiscal policy to redistribute resources also contribute to these differences across countries.



A monetary policy easing action can also have distributional effects via the *earnings distribution channel*. In OECD countries, workers at the low end and middle of the earnings distribution face higher unemployment risk than those at the top. Over 2000–19, unemployment among young workers, that earn less on average, has been much more volatile, compared to unemployment among old-age workers, that earn comparatively more, indicating

<sup>7</sup> See Lenza and Slacalek (2018), for 17 euro area countries, using HFCS (2016) and Amberg and others, 2021 for Sweden..

that the young face much higher unemployment risk as their employment is more sensitive to economic cycles. Worse yet, countries whose youth unemployment is particularly volatile also have high average youth unemployment rates.<sup>8</sup> Through this channel, monetary policy easing mitigates the effects of recessions on unemployment, disproportionately benefiting younger, less experienced, and lower-paid workers, and thereby reducing labor earnings disparities. In the absence of monetary policy easing, which boosts activity and reduces firms operating costs and thereby supports their employment, the low-income and low-skilled, particularly the young, would have been more likely to lose their jobs. This is the most powerful channel via which monetary policy easing actions can reduce inequality (e.g., Carney 2016 for the United Kingdom, Draghi 2016 for the euro area, and Amberg and others, 2021 for Sweden). However, monetary policy easing can also induce a skill-premium channel, which tends to offset in part the inequality reducing effect of earnings distribution channel, as high-skilled labor benefits relatively more due to capital-skill complementarity in production (Dolado et al. 2021, based on a New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model).

A monetary policy easing action has distributional effects via the *balance sheet channel*, which we illustrate by assessing household exposures *due to composition of wealth* using the 2016 Survey of Consumer Finances (SCF) for the United States (US) and the 2016 Household Finance and Consumption Survey (HFCS) for the European Union (EU). Both surveys have a wealth of information on household balance sheets, which is used to illustrate variations in the composition of assets and liabilities across different wealth levels (Appendix 1). In the US and the EU, capital income tends to matter most for the wealthiest households because they hold more financial assets (Figure 8). This is especially the case in the US, where almost two-thirds of the wealthiest 10 percent's assets are in bonds (16 percent) and stocks (46 percent). Except for this group, real estate accounts for the largest share of assets for most households in both the US and the EU. This means that monetary easing may have more equitable effects via house prices than through capital income, and households with mortgages also benefit from lower debt payments.

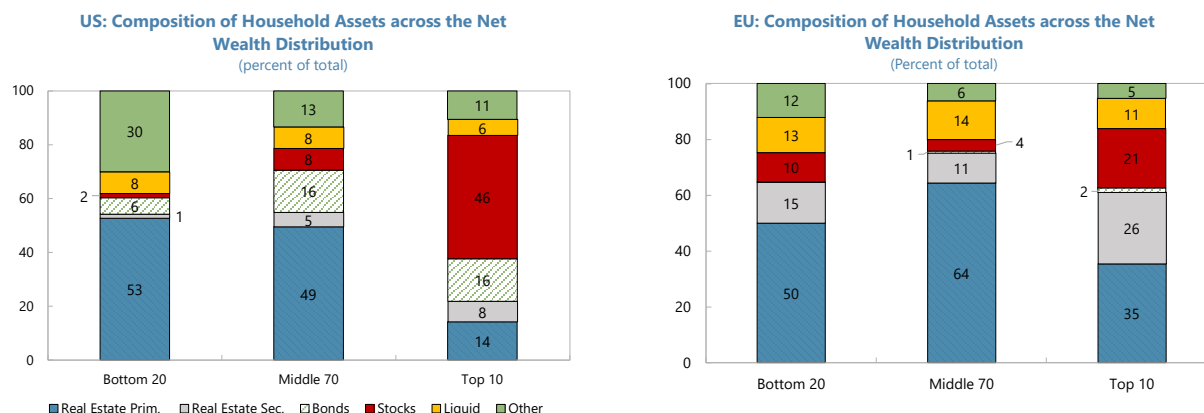
Differences in size and composition of household liabilities across the wealth distribution are important as well. Households' balance sheets are dominated by borrowing against real estate, which primarily takes the form of long-term nominal debt mortgages (Figure 9). So, for example, by lowering debt service on mortgage debt, monetary policy easing directly affects household disposable incomes through this effect. The quality of the liabilities is also likely to vary across the distribution. For example, mortgage liabilities for the bottom 20 percent in the US are likely to be of subprime quality. Terms on these loans may be more sensitive to a tightening of financial conditions, e.g., because they are more likely to be adjustable-rate loans or lenders cut down on the marginal borrowers first as they become more risk averse. Since those in the bottom have higher marginal propensity to consume, a monetary policy easing shock that leads to lower debt service payments on lower-quality ARMs would actually lead to an increase in other types of loans such as car loans (Di Maggio et al. 2017).

---

<sup>8</sup> For instance, in Italy, the youth unemployment rate among young workers was about 40 percent in 2014, above the national average and the unemployment rate among older workers (7 percent). As the economy recovered, the youth unemployment rate fell by 5 percentage points by 2016, while unemployment rate among older workers remained broadly unchanged over the same period (Marino and Nunziata 2017).

**Figure 8. Household Exposures due to Composition of Assets**

*Households in different parts of the wealth distribution own different assets.*

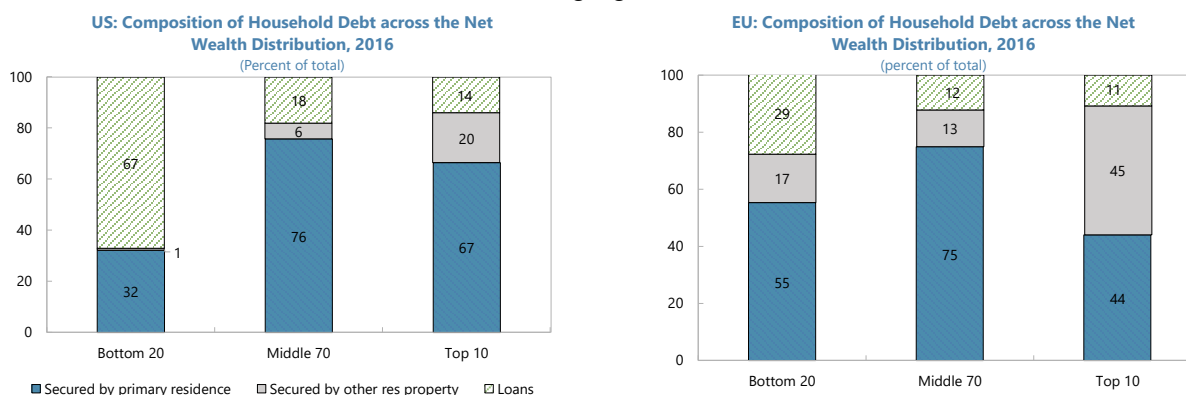


Sources: Survey of Consumer Finances (2016) for the United States; Household Finance and Consumption Survey (2016) for the European Union; and IMF staff calculations.

Notes: The EU group comprises Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, and Spain. See Appendix 1 for variable definitions.

**Figure 9. Household Exposures due to Composition of Liabilities**

*Household liabilities dominated by borrowing against real estate, except for the poor in the US.*



Sources: [SCF](#) (2016) for the US, [HFCS](#) (2016) for the EU, and IMF staff calculations.

Notes: The EU group comprises Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, the Slovak Republic, Slovenia, and Spain.

How monetary easing affects income distribution will depend on the relative importance of these different channels, which in turn may vary based on different country characteristics. In countries with higher levels of financial inclusion, for instance, poor households have easier access to credit, and are more likely to be able to take out mortgages to buy houses—thereby benefiting from lower interest rates. In other countries, households tend to buy homes in cash and would not benefit from lower rates. In countries with bank-based financial systems, rich households who hold their savings in bank deposits and are not in debt could lose out from monetary easing through the savings redistribution channel (Section IV). In countries with more extensive social protection, the reduction of unemployment risk for lower-income

workers from monetary easing may be more muted than in countries with less extensive social protection.

#### IV. DISTRIBUTIONAL IMPACT OF MONETARY POLICY SHOCKS

The previous section has discussed exposures one at a time. However, the same household is typically exposed to several channels which may have offsetting effects. This section quantifies some of the channels and puts different channels together to assess the distributional impacts of monetary policy.

##### A. Savings-Redistribution Channel: Microsimulations

This section uses microsimulations to illustrate distributional effects of monetary policy shocks via the *savings redistribution channel*. Using a welfare metric capturing household exposures to changes in real interest rates, “unhedged interest rate exposures” (UREs), we simulate the impact of a monetary policy easing shock, equivalent to an interest rate fall of 100 bps to illustrate the hypothetical gains/losses across broad economic classes and age cohorts. Following Auclert (2019) and Tzamourani et. al. (2019), the URE metric is benchmarked using micro data for households from the United States and the European Union (Appendix 2). The findings are in line with the literature, but the precise magnitude is sensitive to the assumptions.<sup>9</sup>

Results confirm heterogeneities across broad social classes and age cohorts in the US, EU, and in selected euro area countries. The UREs vary across age cohorts (prime age households (20–55 years old) and older households (56–85) and wealth levels (defined as bottom 20 percent, middle 70 percent, and top 10 percent of the net wealth distribution). These trends are broadly similar across the income distribution and more refined age groups.

Overall, poor and middle-class households with large debts and little financial assets tend to have larger negative UREs, therefore likely to benefit relatively more from a fall in interest rate. UREs tend to increase with income and age, with older, particularly rich households having the largest positive UREs, as documented by Auclert (2019). However, within the EU, cross-country variations are substantial with UREs positive across all income groups, on average for Germany and Austria, and negative for a substantial part of income and net wealth distribution in Cyprus, Ireland, Netherlands, Portugal, and Spain (Tzamourani 2021, based on 2010 HFCS data).

Illustrative results for the income effects from a monetary policy easing shock, proxied by a fall in the real interest rate by 100 bps, reveal that gains/losses for the US and the EU vary by wealth levels and age cohorts, reflecting individual’s life cycle (Figure 10):

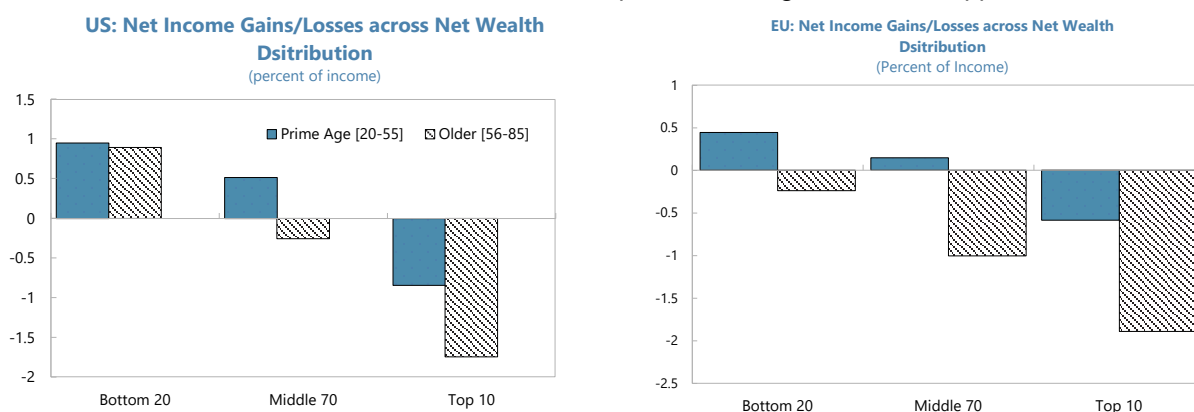
---

<sup>9</sup> While different maturity assumptions can lead to different results, our results are in line with those found in Auclert (2019) and Tzamourani (2019). By analyzing changes in net interest income, Dossche et al. (2019) find that due to the reduction in the interest rate an average euro area net borrower has gained close to EUR 2,000 per year in lower interest payments during 2007-17, whereas an average net saver has lost close to EUR 700 per year.



**Figure 10. Microsimulations: Income Effects from Net Interest Rate Exposures**  
(an illustrative scenario: 100 bps fall in interest rate)

*Income effects from net interest rate exposure are negative on the upper end.*



Sources: [SCF](#) (2016) for the US, [HFCS](#) (2016) for the EU, and IMF staff calculations.

Notes: The EU group comprises Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, the Slovak Republic, Slovenia, and Spain.

- The poor, as well as the younger middle-class households with large debts (negative URE), benefit from a negative interest rate shock. However, these income gains could vary significantly within the EU, as they may not materialize in countries where net interest rate exposures are positive across all income groups (e.g., Austria and Germany), while in some countries these gains may be substantial across the wealth distribution, given that the UREs are negative for a substantial part of income and net wealth distribution in Cyprus, Ireland, Netherlands, Portugal, and Spain (Tzamourani 2021, based on 2010 HFCS data).
- The wealthy and middle-income older households with little debt and large fixed income investments, e.g., bank savings, with positive UREs are disadvantaged by the negative interest shock. However, it is important to stress that the wealthy would benefit from the resulting rise in equity prices when real interest rates decline as these simulations do not include the effect of a prolonged monetary policy easing on equity prices in the form of unrealized capital gains, which typically benefit the wealthy but might not be immediately reflected in households' income.

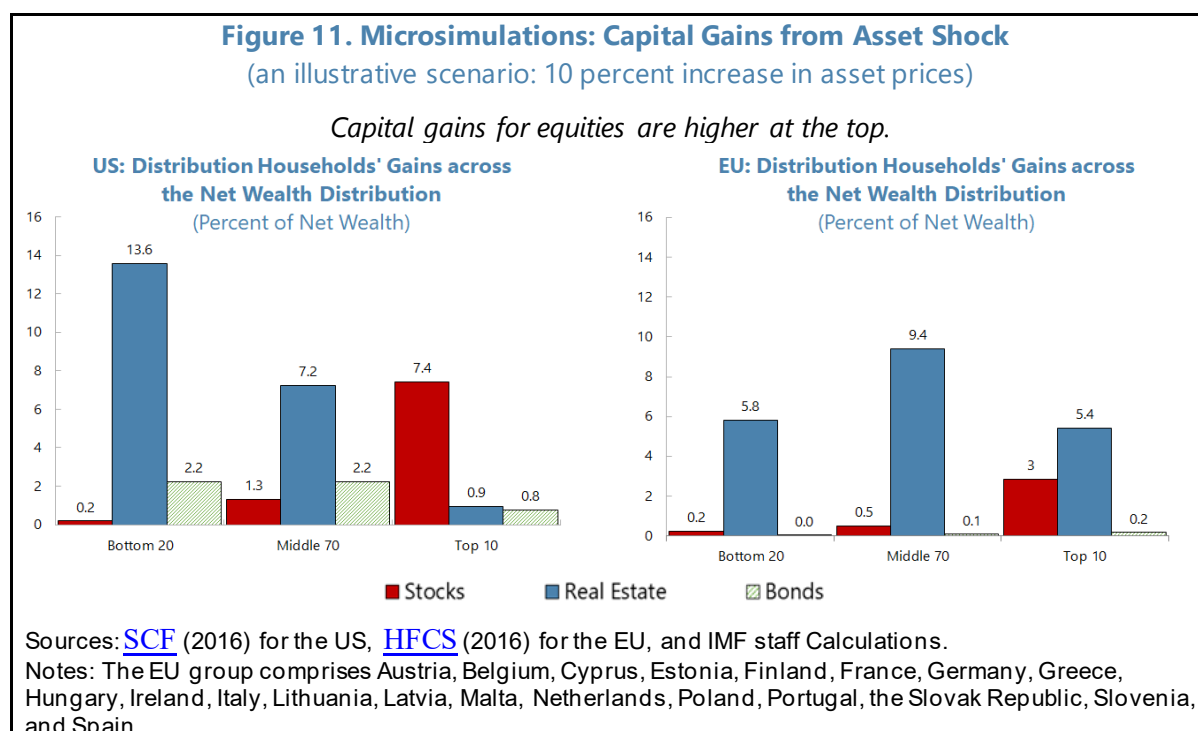
Therefore, it is important to put the different channels together, and assess the net effects, as the same household might lose through one channel, but gain through another channel.

## B. Asset Price Channel: Microsimulations

This section illustrates the impact of an asset price shock induced by expansionary monetary policy across the wealth distribution in the US and the EU. To this end, we simulate the impact of a 10 percent increase in asset prices (stocks, real estate, and bonds) on the distribution of capital gains relative to net wealth for the same three groups of households as in the previous section: bottom 20 percent, middle 70 percent, and top 10 percent. The methodology follows

Adam and Tzamourani (2016), who study the distributional consequences of housing, bond, and equity price increases for EA households using data from the 2016 HFCS (Appendix 3).

Illustrative results show that a monetary policy easing action that leads to a 10 percent increase in asset prices has several partially offsetting effects on wealth distribution. Specifically: (i) higher equity prices favor wealthier households in both regions, (ii) increases in real estate prices favor mostly the bottom part of the distribution in the US and the middle part of the wealth distribution in the EU, while (iii) bond price increases leave the net wealth distribution largely unchanged. Capital gains on equities are the largest at the top of the distribution, though in the US the wealthy derive more than double the gains in the EU (7.4 and 3 percent, respectively; Figure 11). In the US, the net wealth gains from housing price increases are skewed toward the poorer households with the bottom twenty percent gaining 13.6 percent, compared to a 5.8 percent gain in the EU. Overall, the wealthy in the US derive larger gains from equity holdings (7.4 percent), while the wealthy in the EU derive relatively larger gains from real estate assets (5.4 percent), which may reflect the relatively higher importance of capital markets in the US and/or preferences of the EU households for real estate.



Our results for the EU are broadly in line with the findings of Adam and Tzamourani (2016). In particular, equity prices benefit the top end of the net distribution, while housing prices show a hump shaped distribution of gains, with the middle class benefitting the most. That said, it is important to keep in mind that the magnitude of the results depends on the level of wealth (i.e., even tiny changes could look large in percentage terms for households with very low levels of

net wealth). In this respect, the result for the US that the bottom 20 percent benefit the most from monetary policy induced house price increases should be taken with caution.<sup>10</sup>

These findings suggest that the distributional impact of monetary policy varies across asset classes, with gains in different asset prices having different implications for the net wealth dispersion. The capital gains in equity co-vary with the households' net wealth position, while housing price increases significantly reduce net wealth inequality. The results also imply that different asset returns would affect household consumption differently, and, hence, have important distributional effects on welfare with often opposite signs.

### C. A DSGE Model for the United States

This section uses Kaplan, Moll, and Violante's (2018) model—KMV henceforth—to assess the distributional effects of conventional monetary policy shocks. In this model, portfolio effects are very strong and tend to dominate the responses of income and wealth inequality, while the responses of wages and fiscal policy affect primarily the distribution of consumption. These conclusions stem in part from the assumption of rigid prices but flexible wages. A detailed discussion of the model is in Appendix 4.

When referring to a monetary policy loosening, we use an exogenous shock to the inflation-targeting Taylor rule of 100 bps in annualized terms. The distributional effects of such a shock are evaluated through impulse response functions (IRFs) of Gini indices of income, net wealth, and consumption. The benchmark calibration used here assumes that the fiscal space generated by a monetary policy easing shock is used to pay down debt,<sup>11</sup> which is not KMV's baseline specification.

As shown in Figure 12, a monetary policy loosening under our benchmark calibration of KMV leads to:

- Higher *income* inequality as the rich benefit from higher total returns to assets (green line) and thus the portfolio effect outweighs any positive impacts on labor income.
- Roughly unchanged *wealth* inequality despite rising income inequality. This is due to wealth at the bottom being very responsive to increases in income, while wealth at the top is not. The average household holds assets worth 3 times their income. At the top of the wealth distribution, the assets-to-income ratio is larger than 12, while at the bottom it is essentially zero.

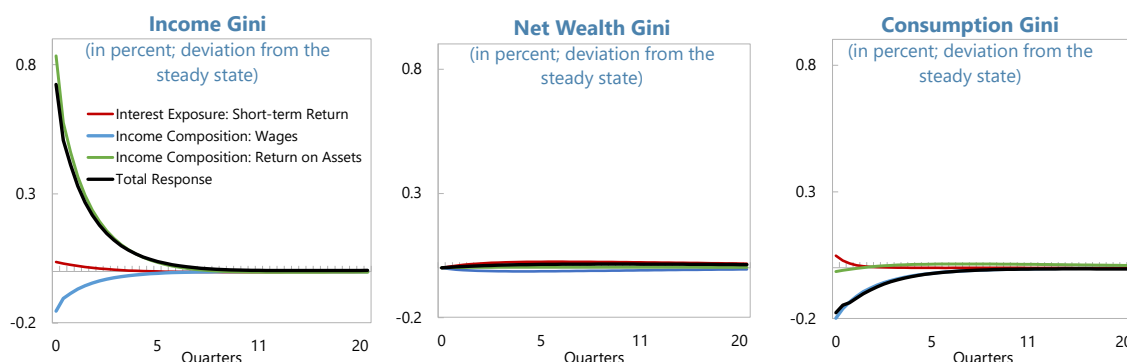
---

<sup>10</sup> This simple simulation focuses on within cohort heterogeneity. However, it is also important to note that, even though higher house prices benefit households at the bottom of the distribution, rising house prices may have negative effects on young and middle-aged households that plan to purchase or increase their housing stock to accommodate a growing family. These intergenerational aspects, not explicitly discussed here, matter for wealth inequality (Bielecki et al. 2021).

<sup>11</sup> See KMV, Table 8, column 4.

- Lower *consumption* inequality. Rising wages support the consumption of the poorest (blue line), while consumption of the rich barely moves because their permanent income is roughly unchanged.

**Figure 12. IRFs of Three Key Inequality Measures under the Benchmark Calibration**



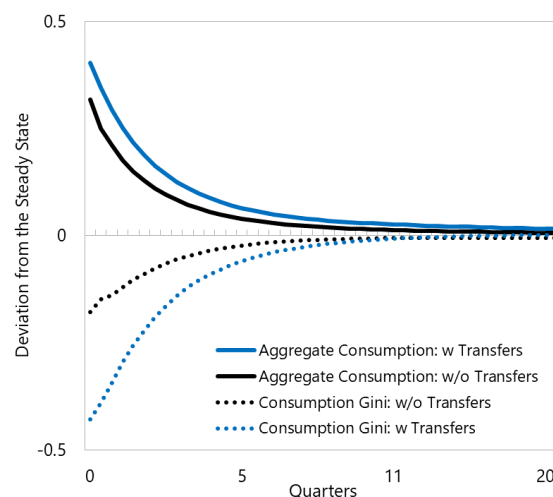
Source: IMF staff calculations.

The role of fiscal policy is assessed by comparing results from the benchmark specification above with a version of the model where the increased fiscal space generated by monetary loosening is used to adjust transfers.<sup>12, 13</sup> KMV find that combining transfers and monetary loosening helps improve the aggregate transmission of monetary policy shocks.

Figure 13 shows that distributional outcomes are also better, particularly when measured in terms of consumption inequality, which is the most relevant measure of inequality from a welfare perspective. Higher transfers lead to increased demand, which raises wages. Both effects disproportionately support the poorest households and thus reduce inequality. It is hard to disentangle the wage and transfer channels separately as the two reinforce each other: higher wages themselves create fiscal space through higher tax revenues, which can then be further distributed through transfers.

We also explore the role of different initial wealth parametrizations. KMV calibrate wealth and income distributions to those of the US. To study the role of the initial wealth distribution in driving results, we adjust some

**Figure 13. IRFs when Combining Monetary Policy Loosening with Fiscal Transfers**



Source: IMF staff calculations.

<sup>12</sup> This is the baseline specification in KMV.

<sup>13</sup> See Section IV.D for a detailed discussion.

underlying parameters that govern the steady-state distributions of liquid and illiquid asset holdings. Table 1 shows the degree of inequality of asset holdings in the baseline (column 1) and across three different alternative parametrizations (columns 2–4). The corresponding Gini indices for France and Germany, calculated using HFCS (2016), are presented for comparison (columns 5 and 6, respectively).

Table 1. Initial Inequality in Holdings of Liquid and Illiquid Assets (Gini index, in percent)						
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	Higher lending spread	Higher cost of using illiquid account	Higher neutral rate	France	Germany
Liquid	0.98	0.83	0.93	0.72	0.77	0.71
Illiquid	0.81	0.82	0.73	0.83	0.70	0.82

In the first alternative parametrization (column 2), we assume higher borrowing costs by increasing the wedge between lending rates and policy rates (8 percent compared to 4 percent in the baseline).<sup>14</sup> Under this specification, the distribution of liquid assets is understandably most affected, reducing sharply the fraction of households that have negative net wealth. However, the IRFs of the different Gini indices for income, consumption, and net wealth are all very similar to the ones in the baseline. This specification is closer to the actual data for Germany (column 6), which has an illiquid wealth inequality similar to the US but lower liquid wealth inequality.

In the second alternative parametrization (column 3), the cost of using the illiquid account is higher than in the baseline.<sup>15</sup> The aggregate effects of the same monetary policy shock under this specification are slightly larger, while consumption and income inequality's IRFs are similar, and there is slightly less net wealth inequality. This specification reduces the initial illiquid net wealth inequality to closer to that of France (column 5).

In the third alternative parametrization (column 4), we raise the equilibrium long-run real interest rate,  $r^*$ , to 4 percent. In this specification, monetary policy is less effective as MPCs are much lower because liquid wealth is higher, and few households borrow. The distributional impacts are similar regarding consumption and income inequality, but this specification produces larger net wealth inequality driven by the direct interest rate channel. This calibration is very close to the data for Germany (column 6).

Short of a full recalibration, we cannot take the above results as representative for either Germany or France, even if the Gini indices of net wealth in those countries may be similar to those under the alternative parametrizations we analyzed. Other measures of inequality beyond the wealth Gini would be critical to calibrate, like the share of households with negative net worth, the share of households with little or no liquid wealth or the distribution of labor earnings.

<sup>14</sup> See KMV Online Appendix, Table E.1, column 4.

<sup>15</sup> See KMV Online Appendix, Table E.2, column 5.

## D. Labor Earnings Channel: Empirical Assessment

Labor market outcomes are key drivers of changes in income inequality (Bivens 2015). Displaced workers experience a 30 percent immediate loss in annual earnings compared to non-displaced workers, and 20 percent even after 15–20 years (Von Wachter, Song, and Manchester 2009). Hence, policy actions affecting labor market dynamics are bound to have large and long-lasting effects on inequality.

This section studies the distributional effects of monetary policy easing shocks via the labor market channel, disentangling the intensive from the extensive margin. Specifically, we decompose the overall effect into heterogeneous effects on employment status (drawing on Albrizio et al. 2021) and wages.<sup>16</sup> Such an assessment has important implications for policy as it can shed light on whether changes in labor market disparities reflect broadening the pool of workers by including those that are less productive, or changes in wage disparities within the same pool of workers (see Appendix 5 for the empirical framework and estimations).

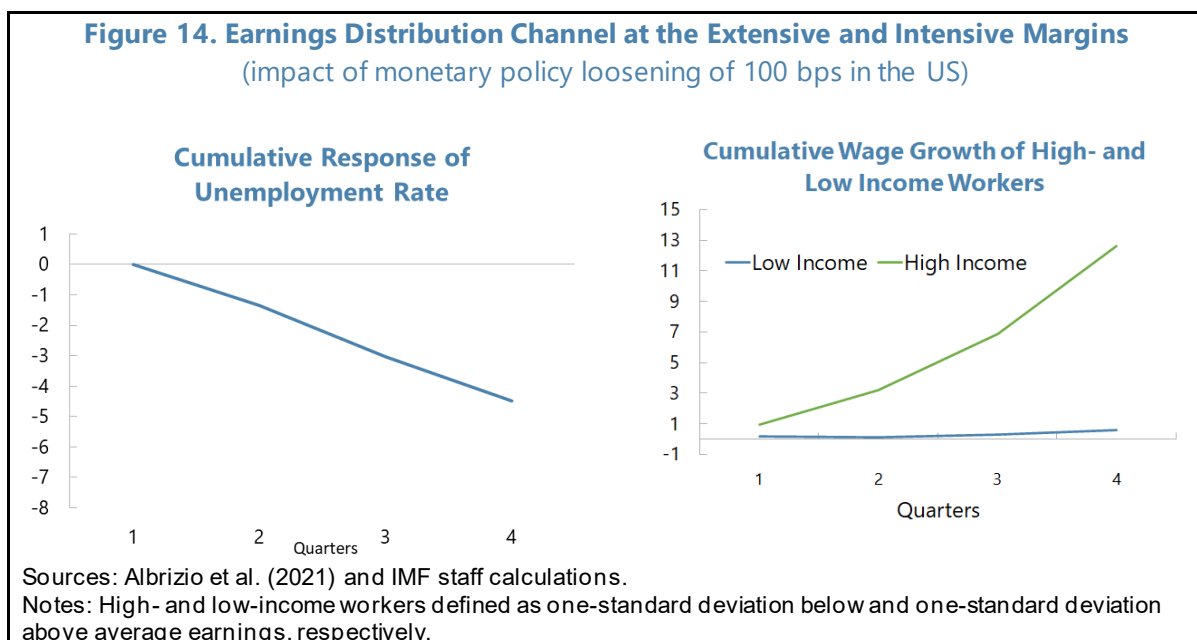
**Unemployment effects.** Monetary policy easing mitigates the effects of recessions on unemployment, disproportionately benefiting younger, less experienced, and lower-paid workers. Figure 14 (left-hand side) presents the cumulative impulse response for unemployment rate after a monetary loosening of 100 bps. After four quarters, there is a 4 percentage-point drop in unemployment. These results are in line with recent reduced-form evidence from Germany (Broer et al. 2020) and the U.S. (Alves et al. 2019), estimating that individual with lower earnings are particularly sensitive to aggregate fluctuations or monetary policy shocks.

**Wage effects.** Using individual-level data from the Current Population Survey (CPS), we find that, for those who stay employed, wages at the top rise disproportionately more than those at the bottom of the distribution following monetary loosening, offsetting in part the unemployment effect (Figure 14, right-hand side). Moreover, earnings at the top of the distribution are mainly affected by changes in hourly wages, while earnings at the bottom of the distribution are mainly affected by changes in hours worked and employment status (in line with Heathcote, Perri, and Violante 2009). This highlights the importance of studying jointly their response to have a full picture of the phenomenon.

The overall distributional effect of a monetary policy shock via the earnings distribution channel is small and inequality-reducing, given that its effect via unemployment is larger and is partially offset by its effect via earnings (see, for instance, Shimer 2005 for a similar finding). These results suggest that policymakers should consider the distributional impact of monetary policy actions via the labor market both at the extensive and intensive margin. These results are in line with the literature on the relationship between labor markets and the business cycle, and on the identification of the categories of workers that suffer the most during recessions (Hoynes et al. 2012; Hoynes 2000; Devereux 2001).

---

<sup>16</sup> The effect on wages is analyzed separately for hourly wages and hours worked. We do not find evidence of an effect on hours worked. Hence, the latter results are not shown for sake of brevity.



The results for earnings conditional on being employed allow us to abstract from issues connected to changes in the pool of workers, while the results for unemployment reflect a compositional effect. For instance, suppose that expansionary monetary policy makes it possible to hire less productive workers. If less productive workers are paid their marginal product, then the newcomers will be paid less than the incumbents. This is not monetary policy increasing inequality among existing workers, but rather the pool of workers now having more variation in terms of productivity and therefore becoming unequal in terms of pay.

Disentangling the composition effect from the effect conditional on remaining employed is also important to draw policy implications. In particular, increased earnings inequality may not be an undesirable outcome if this is the result of a more diversified labor force. If overall earnings inequality were to increase only as a result of the fact that the newcomers are less productive, the increase in inequality would be a good thing: the direct consequence of a larger, more inclusive, labor market.

## E. Results from Other Studies in the Literature

Existing research investigating the distributional effect of monetary policy has relied on the three main approaches used so far in this paper: (i) micro-simulations; (ii) modeling; and (iii) empirical analyses.<sup>17</sup>

Before we summarize the literature results for each one of these approaches in detail, it is worth noting the challenges common to all. First, the measurement of inequality itself remains a difficult task hindered by the availability, quality, and timeliness of comprehensive, granular household surveys. Second, studies differ widely in how they measure monetary policy and most employ simple proxies rather than exogenous, well-identified shocks.

<sup>17</sup> See Colciago et al. (2018) for a more comprehensive stocktaking on the theoretical and empirical literature on monetary policy and inequality.

**Micro-simulations** combine the response of key macroeconomic variables to monetary policy shocks with household exposure to these macroeconomic variables. For instance, they identify winners and losers across net wealth distributions by assessing the sensitivity of capital gains on various assets (real estate, equities, and bonds) to a 10 percent increase in the prices of these assets, as a monetary policy easing shock would typically push up the prices of risky assets (see the exercises we present in Section 3B). Given data availability constraints, this type of studies tends to focus on a single or a few countries (typically, United States and the euro area). Looking at income inequality in 8 OECD countries between 2007 and 2012, O’Farrell et al. (2016) report that expansionary monetary policy reduced inequality in Canada, the Netherlands, and the United States but increased it in most European countries through the income composition and earnings distribution channels. But these effects are negligible in magnitude. By contrast, focusing on the earnings distribution channel in 4 European countries between 1999 and 2016, Lenza and Slacalek (2018 and 2021) find a *negative* effect of expansionary policy on income inequality. For wealth inequality, they report negligible effects. Similarly, Adam and Tzamourani (2016) find a negligible impact of asset purchases on wealth inequality in the euro area. Others point to differences across countries and asset classes. Adam and Zhu (2016) find that an expansionary policy reduces wealth inequality in most of the euro area but increases it in Austria, Germany, and Malta. O’Farrell et al. (2016) report that increases in equity and bond prices in response to an accommodative monetary stance increase wealth inequality while house price increases reduce it, but, again, these effects are estimated to be small.

**Macroeconomic modeling analyses** involve a large set of macroeconomic and financial variables calibrated to data from a particular country. They then employ scenario analyses to compare outcomes under different assumptions on monetary policy actions. Doepke and Schneider (2006) use data from the United States, Meh et al. (2010) from Canada, and Casiraghi et al. (2018) from Italy. Overall, they tend to report that: (i) income inequality increases in the short run but declines in the medium run, with insignificant effects in the long run, (ii) wealth inequality increases but this is short-lived, (iii) consumption inequality decreases both in the short and the medium run. When assessing the distributional implications of different strategies, Feiveson et al. (2020) find that the improvements in macroeconomic outcomes from adopting an inflation make-up strategy are potentially more significant in models that take distributional considerations more seriously. By reducing the severity of ELB recessions, alternative strategies have potential longer-run beneficial effects on economic inequality.

**Empirical analyses** estimate directly the reduced-form effects of exogenous monetary policy shocks on household income and consumption inequality (studies of wealth inequality are rare given even more binding data availability constraints). Commonly used techniques are multivariate time-series (vector autoregressions or local projections) and panel-data analysis. Expansionary monetary policy is reported to reduce inequality in the euro area (Guerello 2018, Samarina and Nguyen 2019), Italy (Casiraghi et al. 2018), the United Kingdom (Mumtaz and Theophilopoulou 2015, 2017), the United States (Coibion et al. 2017, Albrizio et al. 2021), and in a panel of advanced and emerging market economies (Furceri et al. 2018). This is consistent with the findings of earlier studies documenting the inequality-reducing impact of



inflation (e.g., Albanesi 2007). A few studies find adverse effects of monetary policy easing on inequality in Denmark (Andersen et al., 2020), the United Kingdom (Cloyne et al. 2016), and Japan (Saiki and Frost 2014)<sup>18</sup> but caution that the analysis focuses on a single channel (e.g., the impact on mortgagors), that the time series they use are short, or that specific country characteristics could explain the findings. The ambiguity of the overall impact on inequality in these studies is in line with a U-shaped effect where monetary easing lifts both the low-end (through the earnings distribution channel) and the high-end of the income distribution (through the balance sheet composition channel).<sup>19</sup> The magnitude of the reported effects is similar for conventional and unconventional monetary policy (e.g., Albrizio et al. 2021)<sup>20</sup> and is generally small (except for those reported by Andersen et al. 2020).

The evidence in this paper is broadly in line with the results in the literature. While the literature is still evolving, and a consensus has not yet fully emerged, the key takeaways can be summarized as follows (Figure 15):

- (i) The magnitude of the net distributional effect is small compared to the trend evolution in inequality within countries.
- (ii) Monetary policy easing may even reduce, not increase, inequality of income and consumption in the medium term.
- (iii) In the short term, wealth and perhaps income inequality may rise in response to monetary policy easing.

Three additional points are noteworthy.

First, some empirical studies show that a reduction in the policy rate increases income inequality. The problem with at least some of those studies is that changes in policy rates capture both exogenous monetary policy actions and systematic response to economic conditions; so, what they are capturing is the response of inequality to both policy shocks and changes in economic conditions. As shown by Furceri et al. (2018), while expansionary exogenous shocks reduce inequality, the systematic response of policy rates to worsening economic conditions is associated with increased income inequality. That said, some more recent, carefully executed analyses paying attention to endogeneity still find large adverse effects of monetary policy accommodation on inequality (e.g., Andersen et al. 2020). Thus, additional research is clearly needed.

---

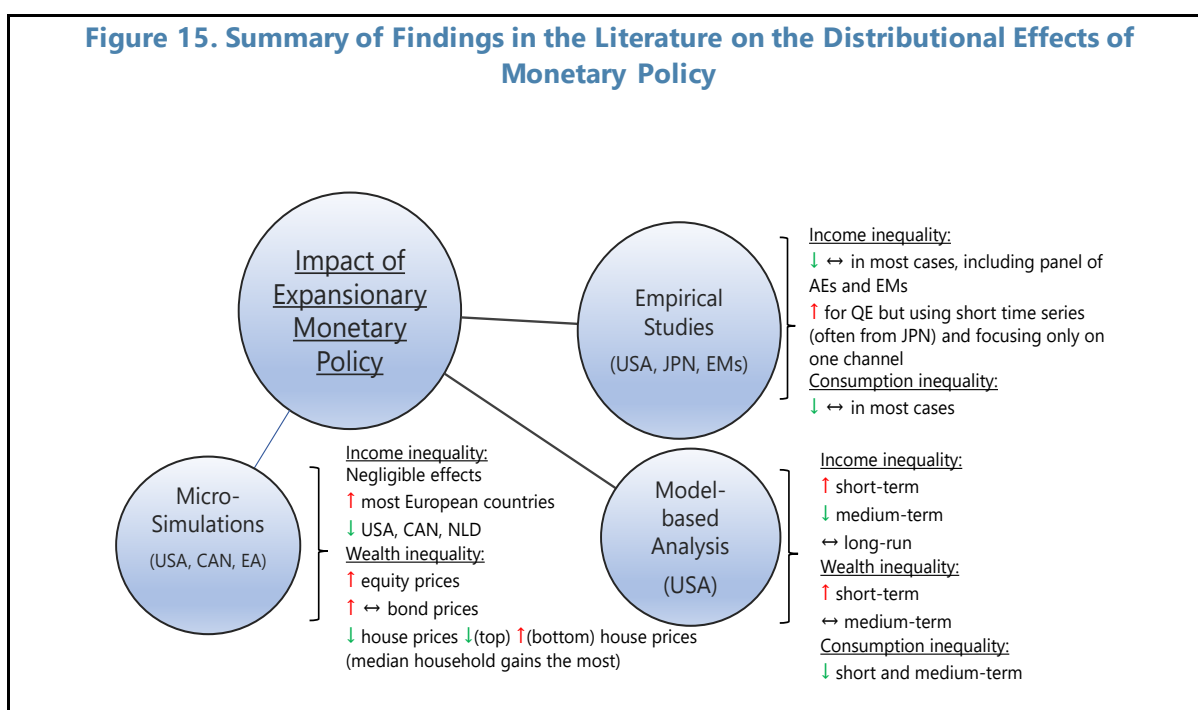
<sup>18</sup> By contrast, Inui et al. (2017) find that monetary policy shocks do not significantly affect income and consumption inequality when using Japan's data during the 2000s.

<sup>19</sup> Amberg et al. (2021); also see Di Casola and Stockhammar (2021).

<sup>20</sup> Albrizio et al. (2021) investigate the distributional effects of U.S. monetary policy for the pre- and post GFC periods. In the latter period, monetary policy actions were mostly expansionary, took place in a period of weak economic activity, and were mostly unconventional measures. The results suggest that monetary policy expansion tends to increase employment and output and has small effects on income and consumption inequality and could even reduce inequality over the medium term. The effects are not statistically different between conventional and unconventional monetary policy, but tend to be larger for tightening than easing, confirming earlier results on asymmetric effects (Tenreryo and Thwaites 2016).

Second, microsimulations offer only a partial equilibrium exercise primarily capturing on-impact distributional responses by combining reduced-form estimates of the effects of monetary policy shocks on key macroeconomic and financial variables with the sensitivity of the income and wealth distribution to these effects. Notably, rather than identifying a direct link between monetary policy and inequality, they offer insights on the potential distributional channels. And their validity, as that of empirical studies, relies on the ability to identify exogenous monetary policy actions in addition to the plausibility of the simplifying assumptions they make about the balance sheet composition of households and the response function of households to changes in interest rates and asset prices.

Last but not least, specific country cases may vary. Such differences may reflect structural issues such as labor market flexibility and constraints on mobility or the structure of credit markets (in particular, mortgages)—one of many country characteristics that could affect the distributional effects of monetary policy, as mentioned earlier in the conceptual framework discussion.



## V. POLICY IMPLICATIONS

### A. Central Bank Mandate

There are clear benefits to central banks developing a coherent and transparent monetary policy framework (IMF 2015). In such a framework, the central bank has a clear mandate, often involving the primacy of the goal of price stability and adopting an explicit inflation target to promote macroeconomic stability. Adding more objectives to the central bank's mandate has a number of drawbacks, most of them general in nature and not specific to distributional concerns.

Burdening monetary policy with other objectives is not desirable as it may reduce its overall effectiveness. It may not be credible as monetary policy alone may not be able to effectively handle multiple goals, especially when the goals come into conflict. Under those circumstances, having a clear primary mandate for price stability will help anchor inflation expectations and facilitate the management of tradeoffs. Multiple goals may even be counterproductive, decreasing welfare, if other policies that are more likely to be effective at addressing distributional effects become less likely to be implemented as the result of central banks taking on the burden of achieving distributional objectives. Finally, multiple objectives raise a potential risk to central bank independence and can complicate communications of monetary policy (Box 1).

This is not to say that policymakers should ignore distributional considerations altogether in the conduct of monetary policy. Within the existing policy frameworks, central banks should factor in heterogeneity among economic agents, including by modeling the distributions of income and wealth in their analysis and disseminating the results, as these affect monetary policy transmission. For example, the transmission of monetary policy depends on the heterogeneity of household balance sheets, notably through the collateral effects of real estate wealth.<sup>21</sup> Income heterogeneity also affects monetary policy transmission because it gives rise to different marginal propensities to consume across agents (Auclert 2019). In addition, accounting for heterogeneity increases the impact of forward guidance on aggregate consumption and inflation, particularly in a liquidity trap (Ferrante and Paustian 2019).

Even for a central bank with a price stability mandate, distributional considerations could also guide the choice of monetary policy targets. For example, the redistributive effects of unanticipated inflation are different between inflation targeting and price-level targeting (Meh, Rios-Rull, and Terajima 2010). In addition, for central banks with a dual mandate, when heterogeneity is taken into account, most households would prefer a larger weight on unemployment stabilization at the expense of price stability because it would increase the provision of consumption insurance (Gornemann, Kuester, and Nakajima 2016).

Still, monetary policy cannot be the only tool used for macroeconomic stabilization, provided there is room to use other tools. Countercyclical fiscal policy, in particular, has an important complementary role to play as it improves the tradeoffs faced by central banks, especially when interest rates are close to the effective lower bound (McKay and Reis 2021).<sup>22</sup> Furthermore, the two policies can complement each other in other ways: monetary loosening creates fiscal space which, if used to provide targeted transfers, could improve both macro and distributional outcomes, as illustrated with model simulations in Figure 13. This is particularly relevant in countries with weak social safety nets and/or limited fiscal space, where monetary policy can be a powerful complement to fiscal policy—a situation that has been borne out during the COVID crisis.

---

<sup>21</sup> See, for example, Aladangady (2014), Kaplan et al. (2014), Kaplan et al. (2018), Cloyne et al. (2019), Gelos et al. (2019), and Dossche, Slacalek, and Wolswijk (2021).

<sup>22</sup> More generally, even if monetary policy is unconstrained and can handle macroeconomic stabilization on its own, fiscal policy tools such as automatic stabilizers are useful as providers of social insurance.

### Box 1. Can Central Banks Handle Multiple Policy Objectives?

Monetary policy may not be able to effectively handle multiple goals as a single monetary policy instrument cannot achieve multiple independent policy goals (Tinbergen 1952). While this concern can be addressed by increasing the number of instruments, adding additional goals to the central bank's mandate may reduce welfare in the context of multiple policymakers and multiple frictions. This is because making the central bank the residual claimant of all macroeconomic problems may make other policymakers, some of whom may be better placed to deal with distributional issues (e.g., fiscal policymakers), less likely to act or encourage them to engage in behavior that is not welfare enhancing (Davig and Gürkaynak 2015).<sup>1/</sup>

Multiple objectives may threaten central bank independence. An independent central bank has long been seen as an advantageous way of solving time inconsistency in monetary policy (Kydland and Prescott 1977; Barro and Gordon 1983; and Rogoff 1985). In theory, a central banker insulated from political pressure and who places a large (but finite) weight an inflation target should be able to overcome the inflationary bias that afflicts governments more concerned with short-term goals. In practice, there is substantive empirical evidence that credibly links central bank independence (with accountability) to lower inflation (Klomp and De Haan 2010). Multiple objectives sap central bank independence because they make the central bank more susceptible to pressure from political or special interest groups.

Having multiple objectives also complicates communication and makes the central bank less transparent and less accountable. A single quantitative objective for an indicator such as medium-term inflation—one that the central bank can to a large extent influence—for example, will be easy to monitor and can be used to benchmark the central bank's performance. Having one goal also simplifies central bank communication and makes it less likely that central bank announcements will foster confusion, hinder decision-making in the private sector, and lead to inferior outcomes (Eusepi and Preston 2010; Reis 2013).

Still, such objectives can often be complementary and even central banks that explicitly target inflation still care about economic growth, financial stability, and financial inclusion and development. Meeting complementary goals for real economic goals, for example, can be justified if there is a short-run tradeoff between inflation and unemployment that the central bank can exploit or in the absence of Blanchard and Gali's (2007) "divine coincidence" (Reis 2013). However, a multiplicity of objectives is more likely to generate difficult tradeoffs when the objectives come into conflict.

Therefore, additional monetary policy targets must meet certain pre-conditions to be included in the central bank mandate (Reis 2013). First, it needs to be measurable in an unambiguous way. Second, monetary policy must be useful in attaining it. Third, it must give rise to a tradeoff with the other goals in a way that achieving one (e.g., price stability) does not guarantee achieving the other (less inequality) and requires a change in policy. While it is quite possible that tradeoffs exist between price stability and distributional objectives, it is difficult to argue that inequality can be unambiguously measured as it has many dimensions (e.g., consumption, income, and wealth inequality). Furthermore, as argued before in this paper, if any, monetary policy has weak effects on inequality.

<sup>1/</sup> Even if it were impossible to add more instruments to the central bank's toolkit, it is fairly straightforward that assigning a loss function to the central bank that mimics the social loss function (i.e., one that could include a distributional term) would yield monetary policy that is optimal conditional on the toolkit and the state variables. However, the key point made by Davig and Gürkaynak is that "optimal monetary policy" may not be "optimal policy."

Importantly, any distributional impact can be addressed with policies specifically designed for this purpose. Many of these policies can also address group-specific concerns arising from the cyclical impact of monetary policy. Well-targeted redistributive fiscal policies across households as well as across regions can reduce inequality of disposable incomes can best address group-specific concerns. Other government policies, including training and education reforms and labor market policies that can address skill gaps, can help reduce inequality (IMF 2014 and IMF 2019).<sup>23</sup>

Central banks and financial regulators have other tools besides monetary policy which could have more targeted effects on inequality. For example, policies directed at fostering financial development and financial inclusion can have important beneficial distributional consequences (Carstens 2021). Reducing the costs of participating in capital markets can decrease wealth inequality (Favilukis 2013). Increased access to payments, savings, and insurance also tends to be associated with reductions in inequality, but access to credit can either increase or reduce inequality, depending on the quality of regulation and supervision, and the relative importance of different channels (Cihak et al. 2020).

## **B. Central Bank Communication**

Clear communication from central banks is needed to help fill the gaps in perception and to allow monetary policy to remain focused on macroeconomic stabilization. Regardless of the overall effects of monetary policy on distribution, persistently low interest rates can create the perception of increased inequality as counterfactuals are unobservable, while high asset prices, or low returns on savings are highly visible. As Bank of England's Haldane said (Haldane 2018): "When it comes to evidence on the distributional impact of monetary policy, there are wide gaps in understanding and even wider gaps in perception." There are three things, in particular, that central banks can do.

First, central banks need to clearly state their objectives and mandate. They should also explain how their conduct of monetary policy helps achieve those objectives. Clarifying to the public what the central bank can and cannot do helps with accountability. A clear understanding of the objectives of monetary policy by the public fosters trust in the institution, and ultimately serves to reduce political pressure for central banks to take on additional objectives that could reduce the efficacy of monetary policy.

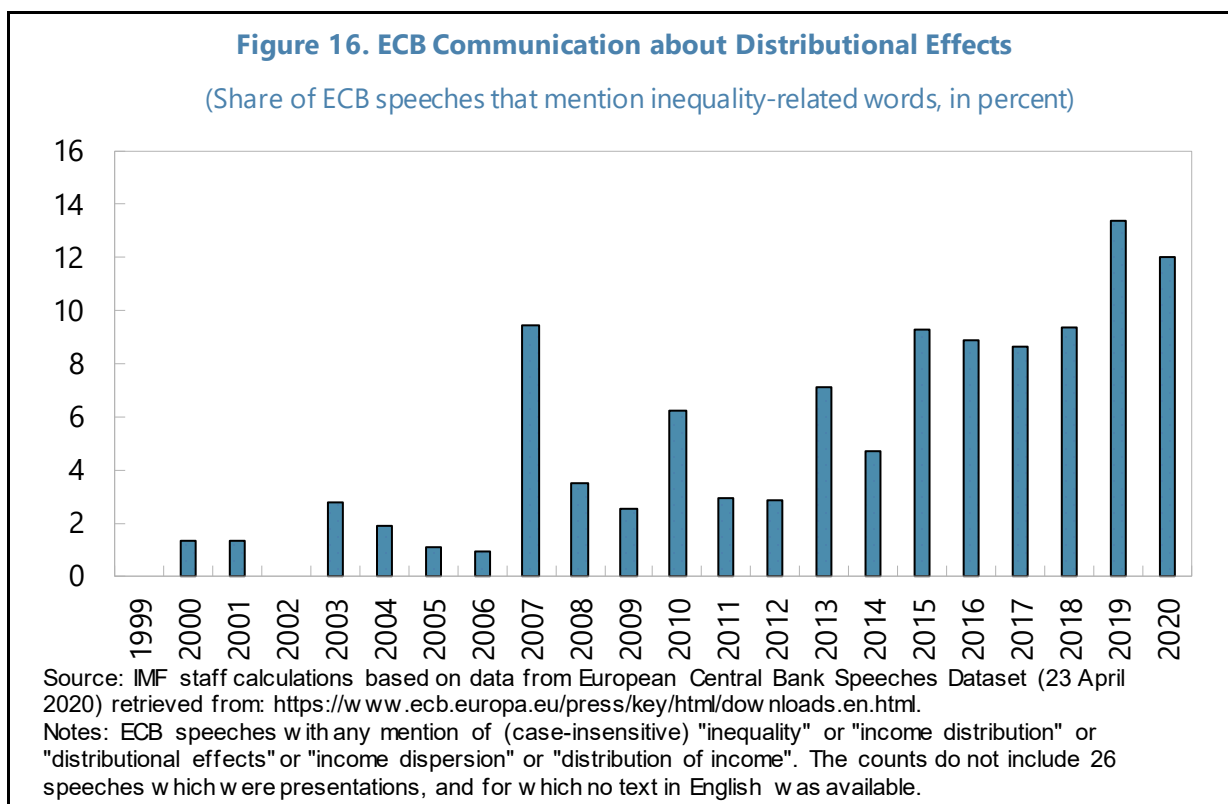
Second, central bankers can emphasize that monetary policy is a blunt tool to address group-specific concerns. This is not a new issue for central banks. For example, spikes in food and energy prices—when core inflation is low—can have disproportionate effects on certain groups. In addition, unemployment can be temporarily high for certain groups or regions due to sector-specific shocks.

Finally, central banks need to recognize and discuss public concerns of any distributional effects of monetary policy (see also Honohan 2019). Given their access to data and research

---

<sup>23</sup> The policies need to be designed carefully because some policies can rather have adverse distributional effects (Fabrizio et al. 2017). For example, making labor market flexible tends to increase inequality (e.g., Kahn 2012, Ostry et al. 2021).

expertise, central banks are in a good position to measure and clarify the distributional effects of their policies on income and wealth. Some central banks have done this in recent years. For example, mentions of distributional effects or inequality were largely non-existent in ECB speeches prior to 2006, but in recent years these issues are increasingly discussed by ECB officials (Figure 16; specific examples include , Constâncio 2017, Lane 2019, and Schnabel 2020). The ECB has also tried to gauge how inequality shapes the transmission channel of monetary policy to consumption.<sup>24</sup>



One way to address the public concerns about distributional effects of monetary policy is to highlight counterfactuals. Central banks can mention inequality would likely have been worse without monetary policy accommodation. Importantly, they can argue that monetary policy actions are welfare increasing, notwithstanding possible distributional effects.<sup>25</sup> For example, former ECB President Mario Draghi said in 2016 (Draghi 2016): “In short, monetary policy is today protecting the interests of savers by ensuring a faster closing of the output gap and preserving the economic potential on which savers’ income depends.” Another way to address public concerns about distributional effects of monetary policy is to emphasize that structural factors are behind the secular increase in inequality and long-run decline in interest rates.

<sup>24</sup> Slacalek, Tristani, and Violante (2020) add the various income and balance sheet channels together and find that the effects on labor income benefit all households—particularly “hand-to-mouth households”—and quantitatively outweigh the effects on financial income.

<sup>25</sup> Evidence from the United States suggests that, without quantitative easing in response to the GFC, unemployment would have been persistently higher through the end of 2018, hurting households at the lower end of the distribution the most (Eberly et al. 2019). Similarly, unconventional monetary policy evidently increased GDP through 2014-18 in the euro area and potentially lowered the unemployment rate (Rostagno et al. 2019).

Chile and Sweden provide two illustrative examples of how central banks have dealt with distributional concerns by employing different communications strategies (Box 2). In both countries, the central bank follows an inflation targeting framework. Still, Chile and Sweden have very different income distributions. Given Chile's historically high inequality, public debate on inequality has not focused on monetary policy but on structural reforms. In Sweden, historically low levels of inequality and preference for equality, combined with rising prices of homes and other assets in a period of persistently negative policy rates after the global financial crisis, led to a robust policy debate on the impact of monetary policy on the distribution of income and wealth. Both central banks have emphasized the importance of monetary policy focusing on macroeconomic stabilization and highlighted counterfactuals, in their communication about distributional issues.

## VI. CONCLUSIONS

Monetary policy has not been a driver of the rise in inequality that many advanced economies have experienced in recent decades. Income and wealth inequality have steadily risen in the United States and Europe, for example, since the 1980s while monetary policy has gone through various tightening and easing cycles. Some structural factors driving the rise in inequality have also pushed the neutral real interest rate ( $r^*$ ) to very low levels, to which central banks had to respond by lowering policy rates. With the COVID-19 shock, monetary policy space has narrowed further, including in EMDEs. The low  $r^*$  made it increasingly difficult for monetary policy to play its countercyclical role using conventional tools but the use of unconventional monetary policy tools after the GFC has been controversial in many circles. In part, the debate has centered on the association between easy monetary policy since 2007 and the observed increase in wealth inequality. This debate has gained new strength with the COVID-19 crisis and its disproportionate impact on health and economic security of the most disadvantaged segments of the population.

The existing literature reviewed in this paper is still evolving but mostly find small net effects of monetary policy on inequality. Monetary policy easing mostly reduces income inequality through the labor income channel. The beneficial distributional effects come from a reduction of unemployment and increased participation in the labor force by the unskilled and younger workers. The effects on the wealth distribution are less clear and depend on the composition of assets and liabilities of households' balance sheets. The size of the distributional effects of monetary easing depends on the relative importance of different channels and should vary based on country characteristics. The simulations presented in this paper are broadly in line with these findings, although more work is needed to calibrate the results to different countries and jurisdictions.

Although central banks have adapted their communication strategies to include distributional issues, our current state of knowledge indicates that these considerations should not change their mandates. Monetary policy should remain focused on macroeconomic stabilization and price stability remains an appropriate primary goal. An additional mandate for the central bank to reduce inequality could also have important adverse implications for central bank accountability and independence and reduce the effectiveness of monetary policy to achieve its primary target of price stability. We argue in this paper that other policies (e.g., fiscal policy) are better suited to address distributional issues and group-specific concerns.

At the same time, central banks should better understand and factor in differences among households within their existing policy frameworks, including through modeling and analysis of the distribution of income and wealth, which affects monetary policy transmission. The key role for central banks in the inequality debate—including during COVID-19—is to ensure clear communication through various outlets, including speeches by central bank officials, official reports, and community outreach events, addressing the public’s concerns about the distributional effects of monetary policy actions.

Several aspects of the relationship between monetary policy and inequality require further study. The effects of unconventional monetary policy, including asset purchases by central banks, are less clearly understood than those of conventional tools and are not fully addressed in this paper. Furthermore, the unprecedented response of central banks around the world to the COVID-19 crisis may have different distributional effects than those previously observed or may work through different channels. The distributional consequences of monetary policy, if any, are also largely unknown for EMDEs where social safety nets are less robust and the exchange rate channel of monetary policy is more important. Finally, the ongoing review of the monetary policy frameworks of major central banks could have important implications for our understanding of how central banks should deal with inequality issues. Investigating some of these issues should be a fertile ground for further research.



## Box 2. Central Bank Communication on Distributional Issues: The Cases of Chile and Sweden

### Chile

Chile has historically had a high level of income inequality, in line with other countries in Latin America (Figure 2.1), and similar levels of wealth inequality to that of some advanced economies (e.g., the United States or Germany). Chile has also seen a monetary policy easing cycle lasting several years: the monetary policy rate was at a historically low level of 0.5 percent in December 2020.

In October 2019, a raise in subway fares triggered a series of protests and violent demonstrations against high inequality, increased cost of living, and inadequate pensions and access to health and education. Central bank policies were not a target of the protestors, possibly because of the success of the Central Bank of Chile's (BCdC) inflation targeting framework in stabilizing inflation. Trust in the central bank to stabilize inflation remained high, as deviations of long-term inflation expectations from target were lowest among emerging economies and even some advanced economies. Following the start of the social unrest, the central bank provided liquidity and foreign exchange to the financial system and monetary stimulus to the extent allowed by its mandate of inflation targeting.

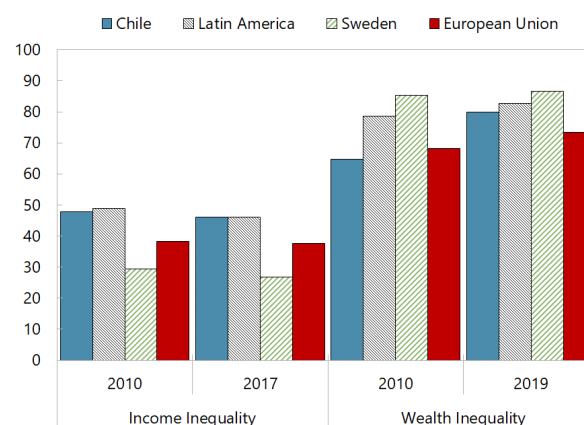
The BCdC's communication has long been focused tightly on its core mandate of price stability. Within this mandate, the BCdC has communicated on the adverse impact of high inflation and unemployment on inequality, and therefore, on the importance of having monetary policy focus on macroeconomic stabilization. During his address to the Senate on December 5, 2019 following the release of the Monetary Policy Report, Governor Mario Marcel noted that high inflation and unemployment hurt the poor and increase inequality. The Governor provided a counterfactual of high inflation (6 percent) and unemployment (10 percent) and said that in this scenario, inequality would rise to levels not seen in 27 years, mostly through rising unemployment.

In its communications, the BCdC has also underscored that the conduct of monetary policy should consider heterogeneities in the labor market. In the December 2018 monetary policy report, the central bank published a special report on the labor market, which used disaggregated data to present some stylized facts on the Chilean labor market and analysis of the economic adjustment in response to macroeconomic shocks via the intensive margin (for example, via changes in composition between salaried and self-employed, changes in participation rates, wage flexibility in hired work, etc.).

### Sweden

Sweden has one of the lowest levels of income inequality among advanced economies, but higher and rising wealth inequality (Figure 2.1). However, relative to people from other countries, Swedes have a stronger preference toward equality, and have shown greater increase in dissatisfaction with

**Figure 2.1. Wealth and Income Inequality in Chile and Sweden (Gini coefficients)**



Sources: Credit Suisse, ECLAC - Economic Commission for Latin America and the Caribbean; WID, World Inequality Database, and IMF staff calculations.

### Box 2. (concluded)

the existing level of inequality (Bublitz 2016; Medgyesi 2013). Since the global financial crisis, Sweden has also faced persistently low inflation (even negative inflation) which has prompted the Swedish central bank, the Sveriges Riksbank, to keep interest rates extraordinarily low. The Riksbank cut its main policy rate to negative territory in February 2015 (where it remained until December 2019) and introduced an asset purchase program.

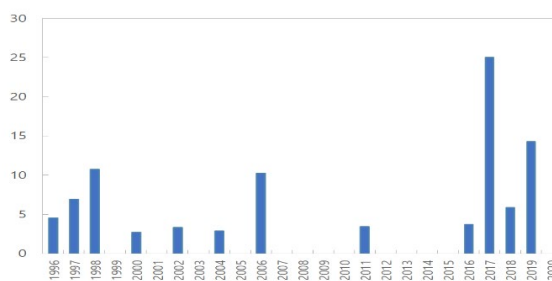
Rising prices of homes and other assets in a period of persistently negative policy rates, as well as a preference for greater equality, combined to lead to a robust policy debate on the impact of monetary policy on the distribution of income and wealth. The terms of reference, set in 2016, for the review of monetary policy framework and the Sveriges Riksbank Act by the Riksdag Committee on Finance included an assessment of whether monetary policy should take distributional considerations into account. The committee concluded that the distributional consequences of monetary policy since the global financial crisis have been small, and if anything, have ameliorated income differences through lower unemployment. It also concluded that the distributional effects of its own proposals were small.

Prior to the global financial crisis, the Riksbank made some references in public to the distributional effects of monetary policy (Figure 2.2). However, the pre-2006 references highlighted the negative impact of high inflation on distribution of income and wealth.

For example, in the Sveriges Riksbank Act of 1999, the price stability mandate of the central bank is also grounded on the beneficial effects of low inflation in terms of reducing arbitrary redistributions of income between savers and borrowers. Between the global financial crisis and 2016, the Swedish central bank did not communicate about the distributional effects of monetary policy (Figure 2.2). Starting in 2016, the Riksbank has included the distributional effects of monetary policy in its communications. This has been mostly through public statements from central bank officials, but not exclusively. For example, at the urging of the Riksdag Committee on Finance, since 2017 the central bank has also included a section on the distributional effects of monetary policy in its annual Accounts of Monetary Policy, which are submitted to the Committee. The November 2020 Monetary Policy Report also included an article on the distributional effects of the Riksbank's measures.

The Riksbank's communications have emphasized that while expansionary monetary policy contributes to higher asset prices in the short term, benefitting certain groups more than others, it also leads to higher employment and stronger growth, which equalize incomes and wealth. It has also emphasized that high and volatile inflation has distributional effects, that a monetary policy focused on an inflation target counteracts. In addition, central bank officials highlighted the need to reform housing and tax policies to counteract the steep rise in housing prices and the redistribution of wealth between owners and rentals and existing homeowners and first-time buyers.

**Figure 2.2. Riksbank Speeches Mentioning Distributional Issues (percent of total)**



Sources: Sveriges Riksbank and IMF staff calculations.

Notes: The analysis was performed on speeches available at <https://www.riksbank.se/en-gb/press-and-published/speeches-and-presentations/>, as of 31 Jan 2020. The chart plots the share of speeches by Riksbank officials per year that mention (case-insensitive) inequality, distributional effects, distribution of income, income dispersion or income distribution.

## REFERENCES

- Adam, K. and P. Tzamourani, 2016, “Distributional Consequences of Asset Price Inflation in the Euro Area,” *European Economic Review* 89: 172–192.
- Adam, K. and J. Zhu, 2016, “Price-Level Changes and the Redistribution of Nominal Wealth across the Euro Area,” *Journal of European Economic Association* 14 (4): 871–906.
- Aladangady, A., 2014, “Homeowner Balance Sheets and Monetary Policy,” FEDS Working Paper No. 2014–98.
- Albanesi, S., 2007, “Inflation and Inequality,” *Journal of Monetary Economics* 54 (4): 1088–1114.
- Albrizio, S., J. Estefania, and D. Furceri, 2021, “Non-linear Macro and Distributional Effects of US Monetary Policy,” forthcoming IMF Working Paper.
- Alves, F., G. Kaplan, B. Moll, and G. Violante, 2019, “A Further Look at the Propagation Mechanism of Monetary Policy Shocks in HANK,” Mimeo, Princeton University.
- Amberg, N., T. Jansson, M. Klein, A. Rogantini Picco, 2021, “Five Facts about the Distributional Income Effects of Monetary Policy,” Sveriges Riksbank Working Paper No. 403.
- Ampudia, M., D. Georgarakos, J. Slacalek, O. Tristani, P. Vermeulen, and G. Violante, 2018, “Monetary Policy and Household Inequality,” ECB Working Paper No. 2170.
- Andersen, A. L., N. Johannesen, M. Jørgensen, and J-L. Peydró, “Monetary Policy and Inequality,” CEPR Discussion Paper No. 15599.
- Auclert, A., 2019, “Monetary Policy and the Redistribution Channel”, *American Economic Review* 109(6): 2333–2367.
- Bank for International Settlements, 2021, “A Global Database on Central Banks' Monetary Responses to Covid-19.”
- Barro, R. J. and D. B. Gordon, 1983, “Rules, Discretion, and Reputation in a Model of Monetary Policy,” *Journal of Monetary Economics* 12 (1): 101–121.
- Bernanke, B., 2015, “Monetary Policy and Inequality,” Brookings Blog, June 1.
- Bielecki, M., M. Brzoza-Brzezina, and M. Kolasa, 2021, “Intergenerational Redistributive Effects of Monetary Policy,” *Journal of European Economic Association*, forthcoming.
- Bivens, J. and L. Mishel, 2013, “The Pay of Corporate Executives and Financial Professionals as Evidence of Rents in Top 1 Percent Incomes,” *Journal of Economic Perspectives* 27 (3): 57–78.
- Brand, C., M., Bielecki, and A. Penalver, 2018, “The Natural Rate of Interest: Estimates, Drivers, and Challenges to Monetary Policy,” ECB Occasional Paper No. 217.
- Broer, T., J. Kramer, and K. Mitman, 2020, “The Curious Incidence of Shocks Along the Income Distribution,” Mimeo, Institute for International Economic Studies, Stockholm University.

- Bublitz, E., 2016, “Misperceptions of Income Distributions: Cross-Country Evidence from a Randomized Survey Experiment,” HWWI, Hamburg Institute of International Economics (HWWI) Research Papers No. 178.
- Cantú, C., Cavallino, P., De Fiore, F., and Yetman, J., 2021, “A global database on central banks' monetary responses to Covid-19”, No. 934. Bank for International Settlements.
- Carney, M., 2016, “The Spectre of Monetarism,” Speech at the Roscoe Lecture, Liverpool John Moores University, December 5.
- Carstens, A., 2021, “Central Banks and Inequality,” Remarks at the Markus’ Academy, Princeton University’s Bendheim Center for Finance, May 6.
- Casiraghi, M. E. Gaiotti, M.L. Rodano, and A. Secchi, 2018, “A “Reverse Robin Hood”? The Distributional Implications of Non-Standard Monetary Policy for Italian Households,” *Journal of International Money and Finance* 85: 215-235.
- Cihak, M., R. Sahay, A. Barajas, S. Chen, A. Fouejieu, and P. Xie, 2020, “Finance and Inequality,” IMF Staff Discussion Note No. 20/01.
- Cloyne, J., C. Ferreira, and P. Surico, 2016, “Monetary Policy when Households Have Debt: New Evidence on the Transmission Mechanism,” Bank of England Staff Working Paper No. 589.
- Cloyne, J., K. Huber, E. Ilzetzki, and H. Kleven, 2019, “The Effect of House Prices on Household Borrowing: A New Approach,” *American Economic Review* 109 (6): 2104–2036.
- Coibion, O., Y. Gorodnichenko, L. Kueng, and J. Silvia, 2017, “Innocent Bystanders? Monetary Policy and Inequality,” *Journal of Monetary Economics* 88: 70–88.
- Colciago, A., J. de Haan, and A. Samarina, 2019, “Central Bank Policies and Income and Wealth Inequality: A Survey,” *Journal of Economic Surveys* 33 (4): 1199–1231.
- Constâncio, V., 2017, “Inequality and macroeconomic policies,” European Economic Association, Lisbon.
- Credit Suisse, 2019, “Global wealth databook,” October.
- Dabla-Norris, E., K. Kochhar, F. Ricka, N. Suphaphiphat, and E. Tsounta, 2015, “Causes and Consequences of Income Inequality: A Global Perspective,” IMF Staff Discussion Note No. 15/13.
- Davig, T. and R. S. Gürkaynak, 2015, “Is Optimal Monetary Policy Always Optimal?” *International Journal of Central Banking* 11 (4): 353–382.
- Devereux, P. J., 2001, “The Cyclicity of Real Wages within Employer-Employee Matches,” *ILR Review* 54 (4): 835–850.
- Di Casola, P. and P. Stockhammar, 2021, “When domestic and foreign QE overlap: evidence from Sweden,” Sveriges Riksbank Working Paper No. 404.
- Di Maggio, M., A. Kermani, B. J. Keys, T. Piskorski, R. Ramcharan, A. Seru, and V. Yao, 2017, “Interest Rate Pass-Through: Mortgage Rates, Household Consumption, and Voluntary Deleveraging,” *American Economic Review* 107 (11): 3550–3588.

- Doecke, M., and M. Schneider, 2006, “Inflation and the Redistribution of Nominal Wealth,” *Journal of Political Economy* 114 (6): 1069–1097.
- Dolado, J. J., G. Motyovszki, and E. Pappa, 2021, “Monetary Policy and Inequality under Labor Market Frictions and Capital-Skill Complementarity,” *American Economic Journal: Macroeconomics* 13 (2): 292–332.
- Dossche, M., J. Hartwig, B. Pierluigi, and A. Velasco, 2019, “The Redistribution of Interest Income in the Euro Area, 2008-2018,” Mimeo, European Central Bank.
- Dossche M., A. Kolndrekaj, and J. Slacalek, 2020, “COVID-19 and Income Inequality,” Mimeo, European Central Bank.
- Dossche, M., J. Slacalek, and G. Wolswijk, 2021, “Monetary Policy and Inequality,” ECB Economic Bulletin Issue No. 2/2021.
- Draghi, M., 2016, “Stability, Equity, and Monetary Policy,” Text of the 2nd DIW Europe Lecture at the German Institute for Economic Research (DIW), Berlin, October 25.
- Eberly, J. C., J. H. Stock, and J. H. Wright, 2019, “The Federal Reserve's Current Framework for Monetary Policy: A Review and Assessment,” NBER Working Paper No. 26002.
- Erosa, A. and G. Ventura, 2002, “On Inflation as a Regressive Consumption Tax,” *Journal of Monetary Economics* 49 (4): 761–795.
- Eusepi, S. and B. Preston, 2010, “Central Bank Communication and Expectations Stabilization,” *American Economic Journal: Macroeconomics* 2 (3): 235–271.
- Fabrizio, S., D. Furceri, R. Garcia-Verdu, B. G. Li, Lizarazo, S. V., M. M. Tavares, F. Narita, and A. Peralta-Alva, 2017, “Macro-Structural Policies and Income Inequality in Low-Income Developing Countries,” IMF Staff Discussion Note No. 17/01.
- Favilukis, J., 2013, “Inequality, Stock Market Participation, and the Equity Premium,” *Journal of Financial Economics* 107 (3): 740–759.
- Feiveson L., N. Goernemann, J. Hotchkiss, K. Mertens, and J. Sims, 2020, “Distributional Considerations for Monetary Policy Strategy,” FRB Finance and Economics Discussion Paper No. 2020-073
- Ferrante, F. and M. O. Paustian, 2019, “Household Debt and the Heterogeneous Effects of Forward Guidance,” FRB International Finance Discussion Paper No. 1267.
- Furceri, D., P. Loungani, and A. Zdzienicka, 2018, “The Effects of Monetary Policy Shocks on Inequality,” *Journal of International Money and Finance* 85: 168–186.
- Furceri, D., P. Loungani, and J.D. Ostry, 2020, “How Pandemics Leave the Poor Even Farther Behind,” IMFBlog, May 11.
- Furceri, D. and N. Tawk, 2021, “Lower-for-Longer: Challenges and Opportunities for Asian Economies,” forthcoming IMF Working Paper.
- Galbraith, J.K., 1998, “The Affluent Society,” 40<sup>th</sup> Anniversary Edition, Mariner Books/Houghton Mifflin Company.

- Gelos, G., F. Grinberg, S. Khan, T. Mancini-Griffoli, M. Narita, and U. Rawat, 2019, “Has Higher Household Indebtedness Weakened Monetary Policy Transmission?” IMF Working Paper No. 19/11.
- Gertler, M. and P. Karadi, 2015, “Monetary Policy Surprises, Credit Costs, and Economic Activity,” *American Economic Journal: Macroeconomics* 7 (1), 44–76.
- Gornemann, N., K. Kuester, and M. Nakajima, 2016, “Doves for the Rich, Hawks for the Poor? Distributional Consequences of Monetary Policy,” International Finance Discussion Paper No. 1167.
- Granger, C. and T. Teräsvirta, 1993, *Modelling Non-Linear Economic Relationships*, Oxford University Press.
- Guerello, C., 2018, “Conventional and Unconventional Monetary Policy vs. Households’ Income Distribution: An Empirical Analysis for the Euro Area,” *Journal of International Money and Finance* 85: 187–214.
- Haldane, A., 2018, “How Monetary Policy Affects your GDP,” Finch Lecture at the University of Melbourne, April 10.
- Han, F., 2019, “Demographics and the Natural Rate of Interest in Japan,” IMF Working Paper No. 19/31.
- Honohan, P., 2019, “Should Monetary Policy Take Inequality and Climate Change into Account?” PIIIE Working Paper No. 19-18, October.
- Heathcote, J., F. Perri, and G. Violante, 2010, “Unequal We Stand: An Empirical Analysis of Economic Inequality in the United States, 1967-2006,” *Review of Economic Dynamics* 13(1): 15–51.
- Hoynes, H. W., 2000, “Local Labor Markets and Welfare Spells: Do Demand Conditions Matter?” *Review of Economics and Statistics* 82 (3): 351-368.
- Hoynes, H., D. L. Miller, and J. Schaller, 2012, “Who Suffers during Recessions?” *Journal of Economic Perspectives* 26 (3): 27–48.
- Igan, D., D. Kirti, and S. Martinez Peria, 2020, “The Disconnect between Financial Markets and Real Economy,” IMF Research Special Notes Series on COVID-19, August 26.
- International Monetary Fund, 2014, “Fiscal Policy and Income Inequality,” Policy Paper.
- \_\_\_\_\_, 2015, “Evolving Monetary Policy Frameworks in Low-Income and Other Developing Countries,” Policy Paper.
- \_\_\_\_\_, 2019, “G-20 Report on Strong, Sustainable, Balanced, and Inclusive Growth.”
- \_\_\_\_\_, 2021, *World Economic Outlook: Managing Divergent Recoveries*, April.
- Inui, M., N. Sudo, and T. Yamada, 2017, “Effects of Monetary Policy Shocks on Inequality in Japan,” Bank of Japan Working Paper No. 17-E-3.
- Jordà, O., 2005, “Estimation and Inference of Impulse Responses by Local Projections,” *American Economic Review* 95 (1): 161–182.
- Jordà, O., S. R. Singh, and A. M. Taylor, 2020, “Longer-Run Economic Consequences of Pandemics,” Federal Reserve Bank of San Francisco Working Paper No. 2020-09.

- Kahn, M. L., 2012, “Labor Market Policy: A Comparative View on the Costs and Benefits of Labor Market Flexibility,” *Journal of Policy Analysis and Management* 31 (1): 94–110.
- Kaplan, G., G. Violante, and J. Weidner, 2014, “The Wealthy Hand-to-Mouth,” *Brookings Papers on Economic Activity* 1:77–138.
- Kaplan, G., B. Moll, and G. L. Violante, 2018, “Monetary policy according to HANK,” *American Economic Review* 108 (3): 697–743.
- Klomp, J. and J. de Haan, 2010, “Inflation and Central Bank Independence: A Meta-Regression Analysis,” *Journal of Economic Surveys* 24 (4): 593–621.
- Kydland, E. Finn, and E. C. Prescott, 1977, “Rules rather than Discretion: The Inconsistency of Optimal Plans,” *Journal of Political Economy* 85 (3): 473–491.
- Lane, P., 2019, “Households and the transmission of monetary policy,” Central Bank of Ireland/ECB Conference on Household Finance and Consumption, Dublin.
- Lenza, M. and J. Slacalek, 2018, “How does monetary policy affect income and wealth inequality? Evidence from the Euro Area,” ECB Working Paper No. 2190.
- Lenza, M. and J. Slacalek, 2021, “How Does Monetary Policy Affect Income and Wealth Inequality? Evidence from Quantitative Easing in the Euro Area,” Mimeo, European Central Bank.
- Marino, F. and L. Nunziata, 2017, “The Labor Market in Italy, 2000–2016,” *IZA World of Labor*, Evidence-based policy making.
- McKay, A. and R. Reis, 2021, “Optimal Automatic Stabilizers,” *The Review of Economic Studies*, forthcoming.
- Meh, C., J. Rios-Rull, and Y. Terajima, 2010, “Aggregate and Welfare Effects of Redistribution of Wealth under Inflation and Price-Level Targeting,” *Journal of Monetary Economics* 57 (6): 637–652.
- Montecino, J. A. and G. Epstein, 2015, “Did Quantitative Easing Increase Income Inequality?” Institute for New Economic Thinking Working Paper No. 28.
- Mumtaz, H. and A. Theophilopoulou, 2017, “The Impact of Monetary Policy on Inequality in the UK. An Empirical Analysis,” *European Economic Review* 98: 410–423.
- Natal, J.-M. and N. Stoffels, 2019, “Globalization, Market Power, and the Natural Interest Rate,” IMF Working Paper No. 19/95.
- O’Farrell, R., Ł. Rawdanowicz, and K. I. Inaba, 2016, “Monetary policy and Inequality,” OECD Economics Department Working Paper No. 1281.
- Ostry, D. J., A. Berg, and S. Kothari, 2021, “Growth-Equity Trade-offs in Structural Reforms,” *Scottish Journal of Political Economy* 68 (2): 209–237.
- Pescatori, A. and J. Turunen, 2015, “Lower for Longer: Neutral Rates in the United States,” IMF Working Paper No. 15/135.
- Pinto, P.R., 2016, “The Inequality Debate: Why Now, Why Like This?” Social Science Research Council Blog, September 20.

- Qureshi, Z., 2020, “Tackling the Inequality Pandemic: Is There a Cure?” Brookings Institution Report, November 17.
- Reis, R., 2013, “Central Bank Design,” *Journal of Economic Perspectives* 27(4): 17–44.
- Rogoff, K., 1985, “The Optimal Degree of Commitment to an Intermediate Monetary Target,” *The Quarterly Journal of Economics* 100 (4): 1169–1189.
- Rostagno, M., C. Altavilla, G. Carboni, W. Lemke, R. Motto, A. S. Guilhem, and J. Yiangou, 2019, “A Tale of Two Decades: the ECB’s Monetary Policy at 20,” ECB Working Paper Series No. 2346.
- Saez, E., 2019, “Striking it Richer: The Evolution of Top Incomes in the United States (Updated with 2017 final estimates),” March 2.
- Saiki, A. and J. Frost, 2014, “Does Unconventional Monetary Policy Affect Inequality? Evidence from Japan,” *Applied Economics* 46 (36): 4445–4454.
- Schnabel, I., 2020, “Narratives about the ECB’s monetary policy – reality or fiction?” Juristische Studiengesellschaft.
- Samarina, A. and A. Nguyen, 2019, “Does Monetary Policy Affect Income Inequality in the Euro Area?” DNB Working Papers No. 626.
- Slacalek, J., O. Tristani, and G. Violante, 2020, “Household Balance Sheet Channels of Monetary Policy: A Back of the Envelope Calculation for the Euro Area,” *Journal of Economic Dynamics & Control* 115(C): 103879.
- Tenreyro, S. and G. Thwaites, 2016, “Pushing on a String: US Monetary Policy Is Less Powerful in Recessions,” *American Economic Journal: Macroeconomics* 8 (4): 43–74.
- Tzamourani, P., 2021, “The Interest Rate Exposure of Euro Area Households,” *European Economic Review* 132: 103643.
- Von Wachter, T., J. Song, and J. Manchester, 2009, “Long-Term Earnings Losses due to Mass Layoffs during the 1982 Recession: An Analysis using US Administrative Data from 1974 to 2004,” unpublished paper, Columbia University.



## APPENDIX 1. DEFINITION OF VARIABLES IN HOUSEHOLD SURVEYS

The **Survey of Consumer Finances (SCF)** is a triennial cross-sectional survey of US families conducted by the Federal Reserve Board. It includes information on families' balance sheets, pensions, income, and demographic characteristics. The 2016 SCF covers more than 6,500 households.

### Assets

Real Estate Prim = Real Estate Primary Residence

Real Estate Sec. = Real Estate Secondary Residence

Stocks = directly held stock + stock mutual funds + other managed asset (50%) + Business

Bonds = directly held bonds + bond mutual funds + savings bonds + other managed assets (50%)

Liquid Assets = transaction accounts + CDs + Quasi-liquid retirement accounts (79%)

### Liabilities

Secured by Primary Residence: Mortgages Secured by Primary Residence

Secured by Secondary Residence: Mortgages Secured by Secondary Residence

Loans: Education loans + Vehicles loans + Other installments loans + Other loans

The **Household Finance and Consumption Survey (HFCS)** is a survey coordinated by the European Central Bank. It collects information on assets, liabilities, income, and consumption of households. The survey is based on 84,000 interviews in 18-euro area countries (Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Portugal, Slovak Republic, Slovenia, and Spain) as well as Poland and Hungary.

### Assets

Real Estate Prim = Real Estate Primary Residence

Real Estate Sec. = Real Estate Secondary Residence

Stocks = shares publicly traded + self-employment business + mutual funds (80%) + managed accounts (50%)

Bonds = bonds + mutual funds (20%) + managed accounts (15%)

Liquid Assets = deposits + money owed to households + voluntary/whole life insurance

### Liabilities

Secured by Primary Residence: Mortgages Secured by Primary Residence

Secured by Secondary Residence: Mortgages Secured by Secondary Residence

Loans: installment loans + credit line + credit card debt

To illustrate the decomposition of assets, we classify them into the following categories: real estate primary, real estate secondary, bonds, stocks, liquid, and others. Similarly, we classify liabilities into three categories: mortgages secured by primary residence, mortgages secured by other residence, and loans.

The SCF and the HFCS do not include the same variables. Hence, several simplifying assumptions are made in order to break down both assets and liabilities in the above broad

categories. For example, for the US, we split the variable “other managed assets” equally into bonds and assets. Then we assume that 79 percent of the variable “quasi-liquid retirement accounts” is liquid assets. For the EU, we assume that 80 percent of the mutual funds are hold in stocks and the remaining 20 percent in bonds. Finally, for the variable “managed account,” 50 percent was allocated to assets while 15 percent to bonds.

Then we rank households according to their position in the net wealth distribution and we divide them into three groups: households in the bottom 20 percent of the distribution (the poor), households in the middle 70 percent of the distribution (the middle class), and households in the top 10 percent of the distribution (the rich).

## APPENDIX 2. BENCHMARKING “UNHEDGED INTEREST RATE EXPOSURES”

Microsimulations are based on a welfare metric, “Unhedged Interest Rate Exposures” (UREs), capturing households’ exposures to changes in real interest rates, which has been proposed by Auclert (2019) and applied for the United States and Italy. Tzamourani et al. (2019) follow the same approach to derive the URE metric for euro area households. Their findings suggests that a fall in interest rate can affect income distribution, redistributing away from households with large positive UREs (e.g., with large share of short-term fixed-income investments such as certificates of deposits and/or fixed-rate mortgages) towards households with large negative UREs (e.g., with large share of long-term bond investments and/or adjustable-rate mortgage liabilities). Auclert (2019) defines URE as:

$$URE = Y - T - C + A - L$$

where  $Y-T$  is net annual disposable income,  $C$  is a consumption measure that includes durable and non-durable goods as well as interest and principal payments.  $A$  and  $L$  are the remaining assets and liabilities maturing in a year, respectively.

*Data.* We use micro data surveys of consumer finances for the US and the EU, namely, the 2016 Survey of Consumer Finances (SCF) for the US and the 2016 Household Finance and Consumption Survey (HFCS) for the EU (see Appendix 1 for details on coverage and data processing).

*Caveats.* The simulations are based on several simplifying assumptions related to the type and maturity of various assets and liabilities, as in Auclert (2019). For the US, simulations also use the 2016 Survey of Consumer Expenditures to benchmark household consumption in the 2016 SCF. For the EU, simulations use broadly similar assumptions, except that household consumption data are directly observable in the HFCS while household disposable income is proxied by gross income due to data availability. Simulations also do not include the effect of a prolonged monetary policy easing on asset prices resulting from unrealized capital gains from higher assets prices, which typically benefit the wealthy but might not be immediately reflected in households’ income. Further, the simulations do not account for the effect of higher real estate prices on debt levels and home affordability, particularly at the bottom of the distribution. Also, given that our results are based on the 2016 survey data (latest available), potential changes in household income and finances since then can potentially alter the results. Finally, the results are subject to measurement error, a common caveat with survey data.

Given these caveats, the results are for illustration only, as different assumptions may lead to different results. Nevertheless, our broad findings are in line with Auclert’s results for the US and Tzamourani’s results for the EU.

### **APPENDIX 3. BENCHMARKING DISTRIBUTIONAL IMPLICATIONS OF ASSET PRICE INCREASES**

Microsimulations are based on the 2016 Survey of Consumer Finances (SCF) for the US, and the 2016 Household Finance and Consumption Survey (HFCS) for the EU. We first compute household net wealth, defined as the difference between household asset and liabilities, using portfolio information available from the 2016 SCF for the US and the 2016 HFCS for the EU, and then scale household holdings of bond, real estate, and equities by their net wealth position. Further, we compute household capital gains on each asset by multiplying the relevant asset-to-net wealth ratio with a hypothetical 10 percent price increase.

For the EU, housing wealth includes households' real estate and holdings of mutual funds that predominately invest in real estate. Bond holdings are defined as the sum of the direct bond holdings, mutual funds predominantly investing in bonds and 79 percent of private pension holdings. Equity holdings are the sum of stocks and business wealth, and equity mutual funds, and 21 percent of private pension holdings. For the US, real estate includes primary residence, other residential property, and 16 percent of other assets. Bond holdings are defined as the sum of savings bonds, bonds, 20 percent of pooled investment fund, 79 percent of retirement accounts, and 15 percent of other assets. Equity holdings are the sum of stocks, business wealth, 80 percent of pooled investment funds, and 21 percent of other assets.

Capital gains are scaled by the net wealth in line with the broadly agreed, but not uncontested, principle of scale invariance, which requires the inequality measure to be invariant to equi-proportional changes in initial net wealth. For example, assuming the net wealth of the original distribution to be 1 unit for one bracket and 20 units for another and multiplying both of these by a factor of 100, the resulting distribution of 100 and 2000 would imply that inequality did not change. However, the same result would also mean that the top bracket would receive more than 95 percent of total new wealth of 2079, i.e., the top bracket wealth would increase by 1980 units, while the bottom bracket—by 99 units).

#### APPENDIX 4. THE HETEROGENEOUS AGENT NEW KEYNESIAN MODEL OF KMV

*Main features.* The Heterogeneous Agent New Keynesian (HANK) model of Kaplan, Moll and Violante, 2018 (KMV) combines a rich cross-sectional household heterogeneity under incomplete markets with standard New Keynesian features of price rigidities, monopolistic competition, and a Taylor rule. In the model, agents can save in two assets: a low-return short-dated asset and a high-return long-dated asset subject to transaction costs.

The model is calibrated to the US to match key micro data, including (i) net wealth inequality, with about 60 percent of households either in debt or holding close to zero cash; (ii) inequality in asset holdings, with the wealthiest decile holding 88 and 75 percent of all long- and short-dated assets respectively; and (iii) inequality in labor earnings, with 32 percent of labor earnings accruing to the wealthiest decile.

These features allow the model to create a large endogenous aggregate marginal propensity to consume (MPC), making consumption much more responsive to monetary policy shocks through general equilibrium effects, or what KMV call “indirect effects.” A monetary policy loosening incentivizes an immediate increase in consumption, particularly for agents facing a borrowing constraint. Increased demand for goods leads to larger labor demand and wages, which reinforce the effects on consumption.

*Caveats.* In this model, the portfolio channel is very strong and typically swamps the direct and other channels through which monetary policy affects *income* inequality. That is because wages are assumed to be flexible but not prices, and thus profits contract after a monetary expansion which lowers the price of equity and thus raises the subsequent returns to equity. If wages were also rigid, households would not see a significant rise in their labor income following a monetary policy shock, which would suppress the *income* and *consumption* of the poorest the most. At the same time, profits could become procyclical under sufficient wage rigidity, and thus asset returns would not rise as much as under flexible wages. Thus, moving to wage rigidity would support the *wealth* of the rich but suppress their *income*, while their *consumption* would be roughly unaffected due to stable permanent income. The KMV model puts some channels together but like any model it does not capture all relevant channels. Gornemann et al. (2016) build a HANK model featuring the crucial employed-unemployed margin, not modeled in KMV. They find that looser monetary policy reduces not only consumption but also income inequality, the latter being the opposite of the response in KMV. Note that Gornemann et al. (2016) abstract from the liquid/illiquid assets dichotomy that KMV argue is crucial to understand monetary policy transmission.

## APPENDIX 5. EMPIRICAL STRATEGY AND SPECIFICATION FOR THE RESULTS ON EARNINGS

The empirical analysis of monetary policy easing on unemployment is based on Albrizio et al. (2021), who use the local projection method of Jordà (2005), augmented with the smooth transition regression approach of Granger and Teravistra (1993) to allow state-dependent responses. The analysis uses the US macro and household data at quarterly frequency over 1980–2016, which allows looking at monetary policy actions in the pre- and post-2008 periods to account for potential changes in distributional effects.

To quantify the effects of monetary policy shocks on wages, we estimate the following equation for labor market outcomes:

$$w_{i,t+4} - w_{i,t} = \alpha X_{it} + \sum_{q=1}^4 \beta_q (FFR_{t+q} - FFR_{t+q-1}) + \sum_{q=1}^4 \gamma_q (FFR_{t+q} - FFR_{t+q-1}) w_{it} + \delta w_{it} + \varepsilon_{it}, \quad (1)$$

where  $w_{it}$  is demeaned earnings for individual  $i$  in quarter  $t$  and  $FFR_t$  is the Federal Fund Rate.<sup>26</sup> The vector  $X_{it}$  consists of the following controls: a second-order polynomial in age, state fixed effects, occupation fixed effects, industry fixed effects, education fixed effects (10 categories), seasonal fixed effects (12 categories), gender, race, individual relationship to the household's head (4 categories). The parameter  $\gamma_q$  are our parameters of interest. If large and significant, it suggests a heterogeneous impact of monetary policy shocks on labor market outcomes.

Monetary policy shocks (i.e., changes in the FFR) are identified by exploiting high-frequency variations in interest rate futures within a narrow time window around Federal Open Market Committee (FOMC) announcements, following Gertler and Karadi's (2015) framework. The response of futures to FOMC announcements is a proxy of the investors' surprise around monetary policy announcements. If the announcement was in line with investors' expectations, then future prices would not shift around the announcement. By contrast, surprisingly tighter or surprisingly looser monetary policy will result in shifts in future prices proportional to the size of the surprise. In the first stage, we regress changes in the FFR on surprises in futures in response to the FOMC announcements.

We use individual-level data on earnings and wages from the Current Population Survey (CPS). The CPS data is a well-established source of data for labor market indicators. However, it is important to note that data are top-coded. Therefore, we are not able to observe the dynamics at the upper end of the distribution.

The results of second stage regressions in response to changes in the FFR instrumented by surprises in futures are reported in Table 2. Both columns include the full set of control

<sup>26</sup> Demeaned earnings are defined as  $\log wage_{i,t} - 1/N \sum_i \log wage_{i',t}$ .

variables.<sup>27</sup> Column (1) reports the dynamic effect of an exogenous quarterly change in the FFR on the year-on-year (yoy) change in wages. In particular, a 100 bps increase in the FFR decreases yoy average wages by 0.6 percent in the first quarter after the monetary policy shock, compared to 1.1 percent in the fourth quarter. Column (2) reports the same regression introducing interaction terms for the initial level of wages (one year ago). The results confirm significant heterogeneity in labor market outcomes in response to a monetary policy shock. Given that individual-level wages in the controls are demeaned using quarter-specific wage averages, the point estimate for coefficients on the change in the FFR is unchanged by construction.<sup>28</sup>

**Appendix Table 1. Second Stage Estimates of Changes in Earnings in Response to Changes in the FFR**

	(1)	(2)
$\Delta FFR_{t+1}$	-0.0058*** (0.0012)	-0.0058*** (0.0012)
$\Delta FFR_{t+1} * \text{wages}_{it}$		-0.0050*** (0.0017)
$\Delta FFR_{t+2}$	-0.0051*** (0.0011)	-0.0051*** (0.0011)
$\Delta FFR_{t+2} * \text{wages}_{it}$		-0.0102*** (0.0015)
$\Delta FFR_{t+3}$	-0.0082*** (0.0012)	-0.0082*** (0.0012)
$\Delta FFR_{t+3} * \text{wages}_{it}$		-0.0076*** (0.0015)
$\Delta FFR_{t+4}$	-0.0112*** (0.0017)	-0.0112*** (0.0017)
$\Delta FFR_{t+4} * \text{wages}_{it}$		-0.0123*** (0.0023)
$\text{wages}_{it}$	-0.5401*** (0.0007)	-0.5430*** (0.0008)
N	1,553,880	1,553,880
R <sup>2</sup>	0.3	0.3
Standard errors in parentheses.		
* p<.1, ** p<.05, ***p<.01		

<sup>27</sup> The inclusion of a linear trend among the controls does not alter the results.

<sup>28</sup> A possible consideration is that the empirical specification above does not allow for enough flexibility in the functional form, restricting the heterogeneous effect to be linear in the wage, while it could have a different, possibly more complex, relationship. As a robustness check, we interact the change in the FFR with a dummy for people with a wage larger than the (year-specific) average. This alternative specification does not alter our conclusions. Results are available upon request.