Discussion Paper Series

Miguel Ampudia, Dimitris Georgarakos,
Jiri Slacalek, Oreste Tristani,
Philip Vermeulen, Giovanni L. Violante

Monetary policy and household inequality

No 6

Discussion papers

Discussion papers are research-based papers on policy relevant topics, offering a broader and more balanced perspective. While being partly based on original research, they place the analysis in the wider context of the literature on the topic. They also consider explicitly the policy perspective, with a view to develop a number of key policy messages. Their format offers the advantage that alternative analyses and perspectives can be combined, including theoretical and empirical work. The selection and distribution of discussion papers are subject to the approval of the Director General of the Directorate General Research.

This paper was originally published as Working Paper no. 2170.

Abstract

This paper considers how monetary policy produces heterogeneous effects on euro area households, depending on the composition of their income and on the components of their wealth. We first review the existing evidence on how monetary policy affects income and wealth inequality. We then illustrate quantitatively how various channels of transmission—net interest rate exposure, intertemporal substitution and indirect income channels—affect individual euro area households. We find that the indirect income channel has an overwhelming importance, especially for households holding few or no liquid assets. The indirect income channel is therefore also a substantial driver of changes in consumption at the aggregate level.

Nontechnical Summary

The impact of monetary policy, and specifically quantitative easing, on inequality has recently come to public attention. For example, commentators have pointed out that a prolonged reduction in policy interest rates can generate an income loss for savers holding interest-bearing assets, or that expansionary measures supporting financial asset prices are especially beneficial for the savers holding those assets. This paper reviews theoretical findings on the distributional effects of monetary policy on households' income, wealth and consumption and it provides suggestive empirical evidence on their quantitative relevance with special emphasis on euro area countries.

The paper first points out that monetary policy, both of the standard and non-standard types, always produces distributional effects. Empirical evidence available for various countries suggests that a reduction in policy interest rates compresses the distribution of income. Regarding QE-type measures, an analysis focused on the four largest euro area countries finds that the Asset Purchase Program (APP) also led to a reduction of income inequality. The effect can mostly be ascribed to the disproportionately large drop in the unemployment rate of low-income households produced by the APP. However, the overall effects of monetary policy on income inequality are modest, compared to its observed secular trend.

The mechanisms which can produce a heterogeneous impact of standard monetary policy on households are well-understood and can be grouped into two broad categories: direct and indirect effects. Direct effects are produced by changes in households' incentives to save and in households' net financial income. Direct effects can be heterogeneous across households depending, for example, on their net indebtedness. A reduction in policy rates will decrease interest payments for households with net outstanding debt, but it will also reduce interest income for households holding net financial assets. The indirect effect operates through the general equilibrium responses of prices and wages, hence of labour income and employment. After a reduction in policy rates, the direct increase in households' expenditure and firms' investment will lead to an increase in output and it will exert upward pressure on employment and wages. The additional increases in aggregate expenditure induced by higher employment and wages are the essence of the indirect effect. The indirect effect can also be heterogeneous across households to the extent that different sources of earnings—e.g., employee income vs. income from private businesses—or different pools of unemployed workers—e.g., low vs. high skilled—display different elasticities to the change in aggregate expenditure.

To assess the relative importance of direct and indirect effects, the paper analyses how the distributional implications of monetary policy on income and wealth propagate to consumption. Such propagation is nontrivial when the marginal propensity to consume, or MPC, out of transitory income shocks varies across households.

The literature has pointed out that heterogeneity in MPCs is associated with the prevalence of "hand-to-mouth" households, i.e., households that have large spending commitments compared to their regular income and liquid assets. The hand-to-mouth status makes households' discretionary spending highly sensitive to small and temporary changes in income, and thus these households tend to have large MPC. By contrast, households owning non-negligible amounts of liquid assets can

use them to smooth consumption and avoid adjusting their expenditures after small and temporary income changes.

The paper uses available estimates of MPCs to weigh the relative importance of direct and indirect effects on aggregate consumption in the euro area. To gauge the direct effects, it uses, on the one hand, detailed information on households' asset and liabilities exposed to interest rate risk and, on the other hand, estimates of households' saving elasticity to interest rate changes. To assess the indirect effect, it combines estimates of the aggregate impact of monetary policy on unemployment and wages with household-level job finding rates.

The results of this analysis highlight that the direct effects of changes in monetary policy rates differ between "hand-to-mouth" and other households. Hand-to-mouth households are either entirely unaffected or negatively exposed to interest rate risk, i.e. they experience a gain in net financial income after a monetary policy easing. By contrast, the other households suffer an income loss after the monetary easing and they also reduce their saving, due to the lower real returns in the economy. In contrast to direct effects, indirect effects are beneficial for all households (albeit to different extents), because everyone benefits from the increase in wage income following a monetary policy easing. In terms of the overall outcome, indirect effects are quantitatively more important—a result which is in line with those of recent theoretical analyses. All households, even those experiencing a loss of financial income, gain from the increase in wage income and therefore increase their expenditure after the policy easing.

To summarise, the paper finds that low short rates do hurt "savers", i.e. households owning non-negligible amounts of liquid assets, via a direct effect—that is, via the reduction in their income from those assets. Low short rates, however, also benefit savers, like all other households, via an indirect effect—that is, the reduction in their unemployment rate and the increase in their labour income. The indirect effect dominates from a quantitative perspective. The paper also finds that the APP reduced income inequality, mainly through a reduction of the unemployment rate of poorer households. On the whole we find that monetary policy in recent years benefited most households and did not contribute to an increase in wealth, income or consumption inequality.

1. Introduction

The effects of monetary policy are traditionally discussed only in terms of aggregate consumption, investment and GDP. With the advent of non-standard measures, however, the potential re-distributional effects of monetary policy have increasingly gained attention. In view of these developments, this DP reviews theoretical findings on the distributional effects of monetary policy and the empirical evidence on their quantitative relevance in euro area countries.

The first section of the paper reviews the mechanisms through which monetary policy produces heterogeneous effects on households' income and wealth. For standard monetary policy, these mechanisms are well-understood. Following Kaplan, Moll and Violante (2018), they can be grouped into two broad categories.

First, there are direct effects, i.e., the immediate, partial-equilibrium consequences of the change in interest rates on households, holding their employment status and all prices and wages fixed. Direct effects include the impact of the different paths for nominal and real interest rates on households' saving incentives (the intertemporal substitution effect) and on households' net financial income. Direct effects can be heterogeneous across households depending, for example, on the composition of their assets and liabilities portfolios. A reduction in policy rates will decrease interest payments for households with outstanding debts, especially if their loans are at variable interest rate; it will also reduce the financial income of households which are not indebted and hold short-maturity assets, whose real return will temporarily fall.

The indirect effect operates through the general equilibrium responses of prices and wages, hence of labour income and employment. After a reduction in policy rates, the direct increase in household expenditure (and firms' investment) will lead to an increase in output and exert upward pressure on employment and wages. The additional increases in aggregate demand induced by higher employment and wages are the essence of the indirect effect. The indirect effect will also produce heterogeneous consequences to the extent that different sources of earnings—e.g., employee income vs. income from private businesses—or different pools of unemployed workers—e.g., low vs. high skilled—display different elasticities to the change in aggregate expenditures.

In comparison to standard monetary policy actions, the aggregate and distributional effects of quantitative easing are less well understood. From the perspective of households, the channels of transmission should remain unchanged, but their relative strength may vary. For example, the direct effects operating through changes in households' net financial income should become more muted, given that short-term rates, and hence interest payments on debt at variable interest rate, are not modified by the policy. It is therefore reasonable to conjecture that the indirect channel is relatively more powerful for quantitative easing.

The second part of the paper summarises the existing empirical evidence on the distributional effects of monetary policy. It reviews reduced-form results on the effects of standard and non-standard monetary policy on measures of income and wealth inequality, with a special focus on the euro area. As in the case of analyses of the aggregate effects of monetary policy, these studies face the well-known difficulty to disentangle the genuine effects of monetary policy from those produced by exogenous developments to which monetary policy reacts. The established solution for this

problem is to focus on the impact of monetary policy "shocks", i.e., policy decisions that were not anticipated as the reaction to ongoing economic developments.

With respect to standard monetary policy, studies applied to various countries tend to concur that expansionary measures compress the distribution of income. The income of households at the bottom of the distribution experiences a disproportionate increase after a temporary reduction in monetary policy interest rates. However, the overall effects of monetary policy on income inequality are modest, compared to its observed secular trend. Quantifying the impact of expansionary monetary policy on wealth inequality is much more challenging, due to the difficulty of measuring wealth of individual households at high frequencies. Illustrative simulations for the euro area suggest that monetary policy also reduces wealth inequality, but these effects are particularly small.

Turning to non-standard monetary policy, the effects of the ECB's Asset Purchase Programme (henceforth APP) on overall measures of inequality appear to be broadly comparable to those estimated for standard monetary policy. An analysis focused on the four largest euro area countries suggests that the APP led to a reduction of income inequality. The effect can mostly be ascribed to the disproportionately large drop in the unemployment rate of low-income households generated by the APP. The effects on other parts of the income distribution, where the employment status is less cyclical, are more modest. The reduction in unemployment and in income inequality is particularly marked in those countries, such as Spain, where the initial unemployment rate is higher. As in the case of standard monetary policy, the overall reduction in income inequality produced by the APP is moderate. The APP also appears to have reduced wealth inequality (due to its stimulating effects via house prices on home-owners, especially the leveraged ones), but these effects are quantitatively negligible.

The third part of the paper provides illustrative simulations on the relative importance of direct and indirect effects of monetary policy in influencing the level of consumer spending and its inequality in the euro area.

Re-distributional implications of monetary policy on households' income and wealth need not produce any modification of the transmission of monetary policy. The effects on households which enjoy a disproportionate benefit and the effects on households which suffer a relative loss could cancel each other out in the aggregate. Heterogeneity matters if some households display stronger consumption elasticity to a temporary change in their resources than others, i.e., if they have a higher marginal propensity to consume (henceforth MPC). The empirical literature has demonstrated the prevalence of "hand-to-mouth" households, i.e., households that have large spending commitments compared to their regular income and liquid assets. The hand-to-mouth status makes households' discretionary spending highly sensitive to small and temporary changes in income, i.e. these households have high MPC. By contrast, households owning non-negligible amounts of liquid assets can use them to avoid adjusting their expenditure after small and temporary income changes. Because hand-to-mouth households have higher MPCs, they play a disproportionately important role in the transmission of monetary policy.

Our paper uses available estimates of MPCs to assess their implications for the relative importance of direct and indirect effects on aggregate consumption. To gauge the direct effects, it uses detailed

information on households' asset and liabilities exposed to interest rate risk and estimates of households' saving elasticity to interest rate changes. To estimate the indirect effect, it combines estimates of the aggregate impact of monetary policy on unemployment with household level job finding rates.

Our results highlight that the direct effects of changes in monetary policy rates on consumption differ between "hand-to-mouth" and other households. Hand-to-mouth households are rather insensitive or negatively exposed to interest rate risk, in which case they experience a gain in net financial income after a monetary policy easing. By contrast, the other households suffer a loss after the easing and they also reduce their saving, due to the lower real returns in the economy. However, the results also show that indirect effects are quantitatively more important than the direct ones and that they are beneficial for all households.

These simulation results are in line with more direct evidence on the heterogeneous impact of monetary policy on household expenditure which is available for other countries. A notable example is the UK, where evidence suggests that an important dimension of household heterogeneity in the response to monetary policy is the housing status. An increase in interest rates produces differential effects across renters, mortgagors and outright home owners. The differential effects are noticeable on consumer sentiment and on spending on durable goods. Mortgagors are the most affected by the change in interest rates. Mortgagors have large spending commitments compared to their regular income and are therefore typical hand-to-mouth households.

The simulation results are also coherent with theoretical models that realistically account for key dimensions of household heterogeneity. These models also find that the indirect effect is quantitatively much more powerful than the direct one. The impact of monetary policy on incomes, and especially on the income of hand-to-mouth households, whose consumption response is most sensitive to income changes, is a crucial determinant of the transmission of monetary policy.

While the focus of this paper is on the household sector, it is clear that re-distributional effects of monetary policy can also occur within other sectors of the economy. More specifically, we document that considerable heterogeneity also exists across firms. While many firms are net debtors and have a negative exposure to interest rate risk, numerous firms have plenty of liquidity and positive exposure. As for households, this heterogeneity affects the monetary policy transmission mechanism.

To sum up, this paper highlights that all monetary policy decisions tend to have re-distributional consequences. The indirect effect, related to the general equilibrium impact of monetary policy on households' income, is likely to be the most important determinant of the distributional consequences. Empirical findings imply that expansionary monetary policy, both standard and non-standard, tends to reduce inequality. Monitoring the distribution of income, the composition of balance sheets, and the heterogeneous impact of monetary policy on different categories of households is paramount for a better understanding of the monetary policy transmission mechanism.

2. Transmission channels

Textbook treatments of the transmission channel of standard monetary policy all assume a "representative" household. The idea is that this abstraction is convenient to understand the effects of monetary policy on aggregate consumption and inflation, and nothing of substance is lost by ignoring salient household heterogeneity. A new emerging literature takes the opposite view.

As highlighted by recent theoretical developments (e.g., Auclert, 2017; Gornemann, Kuester and Nakajima, 2016; Luetticke, 2017; Kaplan, Moll and Violante, 2018), the monetary transmission channel can be decomposed in direct and indirect effects. Direct effects, such as intertemporal substitution, arise through the immediate, partial-equilibrium consequences of the change in interest rates on households, holding their labour income fixed. Indirect effects operate as a result of the general equilibrium responses of prices, wages and employment, which are initially triggered by the direct channel.
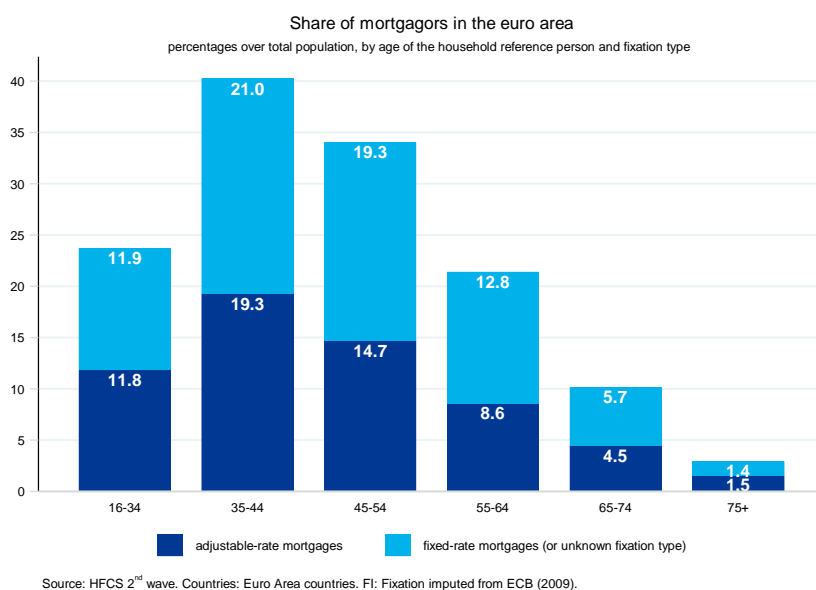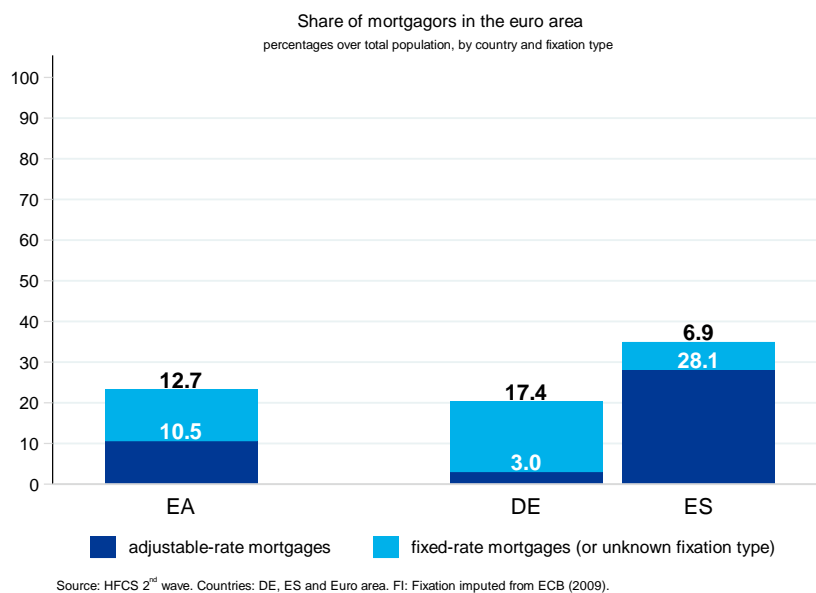
More specifically, the direct effect will include, besides intertemporal substitution, also the change in net income from households' *maturing* assets and liabilities. The importance of focusing on maturing assets is neatly illustrated in Auclert (2017) for the case of a purely temporary change in interest rates.[1] Maturing assets and liabilities include, for example, short-lived assets and variable rate debt. These considerations suggest that heterogeneity in the composition of households' net assets portfolios will be an important determinant of the direct distributional effects of monetary policy. For example, consider an increase in policy rates aimed at curbing mounting inflationary pressures. On the one hand, it increases interest payments for households with outstanding debts, especially if their loans are at variable interest rate. On the other hand, it could well increase the financial income of households which are not indebted and hold a short-term asset, since they will enjoy a temporary rise in real returns. To illustrate the relevance of this dimension of heterogeneity, Figure 1 displays the share of households holding adjustable rate mortgages in the euro area.

The figure shows that mortgagors holding a variable-rate mortgage are only a relatively small fraction of the euro area population, approximately 10.5%. The fraction is quite heterogeneous both across the age spectrum and across countries. The age profile of mortgage debt peaks for the 35-44 age bracket and declines steadily thereafter, reaching its lowest levels for elderly households. Cross-country heterogeneity is also distinctive. For example, in Germany there is an extremely small share of households holding adjustable-rate mortgages; in Spain, instead, households holding variable-rate mortgages reach around 30% of the total population.[2] This evidence suggests that this direct effect on indebted households of a reduction in monetary policy rates should be stronger for the middle-age group and for countries where households are highly indebted at variable rates.

[1] A second important characteristic of the composition of households' asset portfolio is its denomination. Nominal assets and liabilities will also experience a change of real value associated with any surprise change in the price level induced by the monetary policy move. This "Fisher effect" is small for the type of policy changes considered here and we therefore ignore it for ease of exposition.
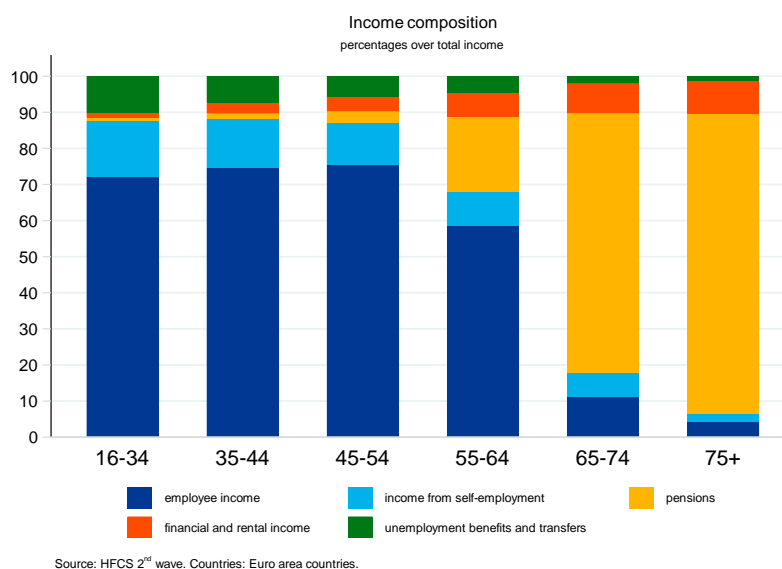
[2] The HFCS provides data on fixation of mortgages for all euro area countries (except for Lithuania). However, below we focus on euro area population breakdowns and on comparison of Spain and Germany, which represent two countries with a low and a high share of adjustable-rate mortgages (a characteristic which affects the nature of the transmission of monetary policy), respectively.

Figure 1: Incidence of adjustable- and fixed-rate mortgages

Share of mortgagors in the euro area

percentages over total population, by country and fixation type

Source: HFCS 2nd wave. Countries: DE, ES and Euro area. FI: Fixation imputed from ECB (2009).

Share of mortgagors in the euro area

percentages over total population, by age of the household reference person and fixation type

Source: HFCS 2nd wave. Countries: Euro Area countries. FI: Fixation imputed from ECB (2009).

The relevance of the direct channel can easily be recognised and calculated by each household, as it is immediately visible in the change of mortgage repayments. In comparison, the indirect effect is mediated by many factors, and thus it is more difficult to measure in practice. By definition, the indirect effect emerges as a result of a complex chain of events. Lower policy rates will initially stimulate households' consumption (through intertemporal substitution) and firms' investment (through the lower cost of funds), leading to an increase in output, employment and wages. In turn, higher employment and wages will produce additional increases in aggregate demand, thus a new increase in output, employment, wages, and so on and so forth. This type of (Keynesian) equilibrium multiplier effects is the essence of the indirect channel.

Figure 2: Income composition of euro area households

Income composition
percentages over total income

Legend:
- employee income
- income from self-employment
- pensions
- financial and rental income
- unemployment benefits and transfers

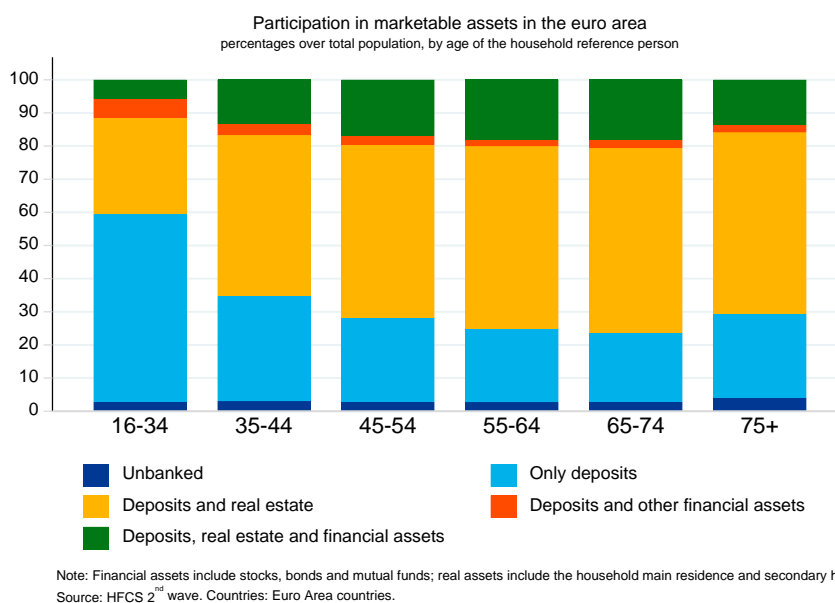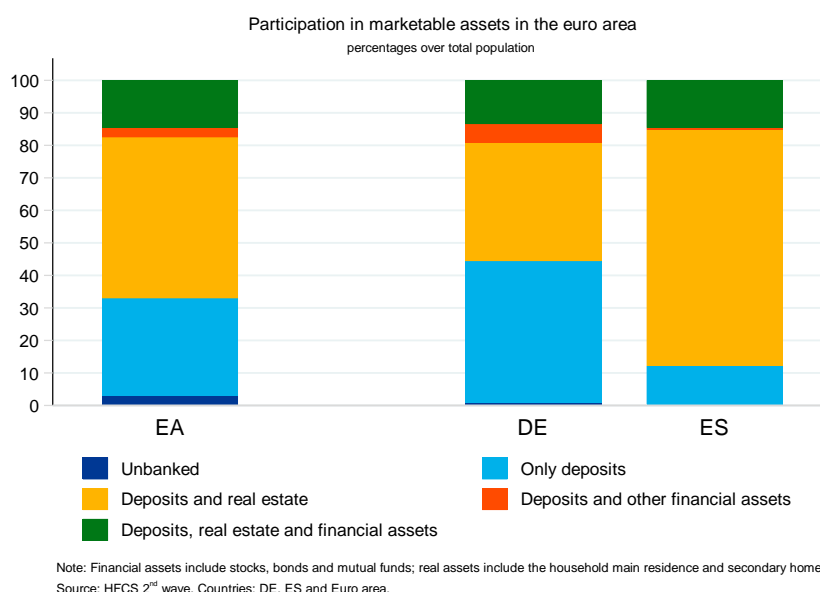Source: HFCS 2nd wave. Countries: Euro area countries.

Clearly, the strength of the indirect channel can also be heterogeneous across the population. For example, less skilled workers may benefit more strongly from the indirect effect of a monetary policy easing, because the demand for this type of jobs is more cyclical. In general, different sources of income are likely to react differently to cyclical changes in aggregate demand induced by a monetary policy shock. For example, pensions may remain unchanged after a change in monetary policy interest rates, while self-employment income is more likely to react to cyclical conditions. Financial income, including dividends, is also quite cyclically sensitive. The impact of monetary policy on any household will therefore depend on its main source of income. Figure 2 illustrates the heterogeneity in the composition of gross income of euro area households. Unsurprisingly, employee income is more important for the working age population. Unemployment benefits and other transfers are most relevant for young households. Pensions are the prevalent source of income for households 65 or older. The incidence of financial income is also increasing with age and it reaches a peak of around 10% of total income for 75+ households[3].

Since the indirect channel arises as a result of general equilibrium forces, its re-distributional implications are also shaped by fiscal policy. The reason is that changes in the future path of monetary policy interest rates have implications on the amount of taxes, public transfers and government debt that jointly satisfy the intertemporal government budget constraint. For example, lower interest rates reduce the cost of servicing government debt and allow for reduction in taxes, or for an increase in public transfers. The exact way in which the tax cut or the increased transfers are applied across the population will have distributional implications. The fiscal policy reaction to monetary policy moves will thus shape the distributional effects of monetary policy.

[3] Note that the financial income component may also include income coming for interest on deposits, whose changes would be considered as a direct effect of monetary policy.

Figure 3: Share of households owning real or financial assets

Participation in marketable assets in the euro area
percentages over total population

Note: Financial assets include stocks, bonds and mutual funds; real assets include the household main residence and secondary homes.
Source: HFCS 2nd wave. Countries: DE, ES and Euro area.

Participation in marketable assets in the euro area
percentages over total population, by age of the household reference person

Note: Financial assets include stocks, bonds and mutual funds; real assets include the household main residence and secondary homes
Source: HFCS 2nd wave. Countries: Euro Area countries.

Heterogeneity in both direct and indirect effects plays an especially important role in the transmission of monetary policy when it characterises households with higher and lower marginal propensities to consume (MPCs). From the empirical viewpoint, it is useful to distinguish between "hand-to-mouth" and "non-hand-to-mouth" households. Households can be defined as hand-to-mouth when they have large spending commitments compared to their regular income and liquid assets. They can be in this status either if they are asset-poor, or if they hold sizable but illiquid assets, such as residential estate, but they are also highly leveraged through mortgage debt. The hand-to-mouth status makes household consumption highly sensitive to changes in income, because the household has small buffers to face temporary liquidity shocks. By contrast, non-hand-to-mouth households have no need to change consumption, since temporary liquidity shocks do not significantly alter their permanent income. Thus hand-to-mouth households have high MPC out of

small, transitory income changes, while the consumption of non hand-to-mouth households displays very low sensitivity to transient income dynamics.

In comparison to standard monetary policy, both aggregate and distributional effects of non-standard measures, and specifically of large-scale asset purchases, are less well understood. From the perspective of households, the channels of transmission should remain unchanged, but their relative strength may vary. For example, the direct effects operating through changes in households' net financial income should become more muted, given that short-term rates, hence interest payments on debt at variable interest rate, will remain unchanged. The intertemporal substitution of consumption should also be more subdued, since large-scale asset purchases are often implemented when interest rates at short and medium-term maturities are all at zero. These considerations suggest that the indirect channel may be relatively more powerful for quantitative easing, compared to standard monetary policy.

An indirect effect that has received considerable public attention for quantitative easing is the change in the price of financial assets. Figure 3 shows the share of households that own real or financial assets and may therefore have been affected through this indirect effect of the APP. What we see is that euro area households that hold any assets other than bank deposits are mostly 45 or older. Sixty percent of those aged between 16 and 34 and at least one quarter of all other households do not receive direct benefits from capital gains in financial markets. And only 20 percent of households older than 45 hold financial assets (other than deposits) – one or more between stocks, bonds and mutual funds. Home ownership, instead, is somewhat more evenly distributed across age (beyond age 35), but it differs considerably across countries.

Based on the evidence in Figure 3, increases in prices of financial assets after QE-type measures are likely to increase wealth inequality. However, these effects are quantitatively very small. On the one hand, asset prices are highly volatile and their increases in reaction to monetary policy are temporary. On the other hand, the price increase applies to asset holdings that represent a small fraction of household income (around 15% for the average non-hand-to-mouth household). These effects are therefore likely to be dominated by those arising through changes in labour income. Finally, the benefits from capital gains are more widely distributed when real assets are also taken into account, because home ownership rates in most countries are larger than financial asset ownership rates.

3. Empirical evidence on the heterogeneous effects of monetary policy

While the consequences of monetary policy for aggregates economic variables have been studied for several decades, the literature estimating its distributional effects is relatively new. This delay is partly due to more stringent data requirements, since any analysis of the impact of monetary policy on different households requires both the time-series and the cross-sectional information. The time-series dimension of the data is necessary to disentangle the effect of monetary policy from the underlying cyclical fluctuations to which monetary policy responds. Cross-sectional data are obviously necessary to pose any question related to heterogeneity.

As a result of such data requirements, most existing studies of the effects of central bank actions on the distribution of income and wealth focus on standard monetary policy and rely on U.S. or U.K. data, where a longer time-series dimension is available. This section reviews this literature and compares it to recent evidence on the distributional effects of non-standard measures in the euro area. We end the section with a discussion of evidence on the distributional effects of standard monetary policy on household consumption.

As for aggregate analyses of the effects of monetary policy, a key difficulty we face is to disentangle the genuine effects of monetary policy from those produced by exogenous developments to which monetary policy reacts. The established solution for this problem is to focus on the impact of monetary policy "shocks", i.e., policy decisions that were not anticipated as the reaction to ongoing macroeconomic developments. The distributional effects of monetary policy shocks are also the focus of this paper.

Similarly, the paper does not discuss the implications of different, e.g., more or less aggressive, systematic monetary responses to inflationary shocks. This is currently an active research field. Initial results suggest that median-wealth households favour a larger response to unemployment fluctuations, even if at the cost of a small increase in inflation volatility. Better unemployment stabilization reduced consumption risk particularly for those households that risk hitting the borrowing constraint after an extended unemployment spell (Gornemann, Kuester and Nakajima, 2016).

3.1. Standard monetary policy and income heterogeneity

The first systematic empirical study on the distributional effects of monetary policy is Coibion et al. (2017), which combines aggregate and household-level data in a structural VAR to estimate the effects of standard monetary policy on consumption and income inequality in the U.S. over the 1980Q3-2008Q4 period. Using the narrative approach of Romer and Romer (2004), Coibion et al. identify the effects of monetary policy on various summary measures of income inequality, including the Gini coefficient or the ratio between the P90 and P10 percentiles of the income distribution.

Their main finding is that contractionary monetary policy systematically increases inequality in total income, labour earnings and consumption. While this effect tends to be statistically significant, its economic magnitude is moderate, especially in times when inflation is stable (i.e., after the Volcker disinflation). For example, forecast error decompositions indicate that monetary policy shocks

account for less than 5% of the total variance of earnings inequality, 10-15% of the variance of income inequality and around 20% of the variance of consumption inequality.

Coibion et al. (2017) highlights that a key source of heterogeneity in the impact of monetary policy are differences in the source of household incomes. Some households draw most income from labour income (wages or earnings), others from financial income (income from assets), others for government transfers or pensions. These various income sources display different degrees of sensitivity to changes in monetary policy interest rates. Accordingly, the effects on total income inequality are larger than on labour earnings inequality, reflecting differences in the income composition.

Mumtaz and Theophilopoulou (2017) use similar VAR methodology and report parallel findings for the UK: The response of income and consumption at different quantiles suggests that contractionary policy has a larger negative effect on low income households and those that consume the least when compared to those at the top of the distribution.

3.2. Standard monetary policy and wealth heterogeneity

The effects of monetary policy on wealth heterogeneity are more difficult to analyse. Especially complex is the measurement of human wealth, i.e., the present discounted value of expected future incomes, which is for most households the largest component of total wealth. A second challenge is due to the lack of household level wealth data measured at high (e.g., quarterly) frequency. For this reason, the available evidence is scarce.

The prevalent empirical approach is to focus solely on the value of market wealth, i.e., the fraction of household wealth which is invested in financial (bonds, stock, etc.) or real (e.g., housing) assets. It is then possible to use information about developments in the prices of such assets to simulate the evolution of the value of household wealth, based on the assumption of unchanged portfolio shares. Accordingly, changes in asset prices directly translate into changes in the marked-to-market value of the wealth of households holding these assets. The assumption of unchanged portfolio shares appears to be borne by the data. For example, Domanski et al. (2016) argues that, on average, changes in equity prices have been a key driver of changes in wealth inequality in advanced countries since the start of the Global Financial Crisis.

In order to link changes in asset prices to monetary policy, one approach in the literature is to focus on simulated, surprise changes in the price level. Such changes will affect the real value of all nominal assets and liabilities held by households. Differences across households in holdings of such securities will produce different effects of price level changes on real wealth, with an ensuing impact on wealth inequality. Doepke and Schneider (2006) shows that a 10-percent surprise increase in the price level leads to a non-negligible redistribution of wealth for U.S. households. Adam and Zhu (2016) provides evidence for the euro area and highlights how results are also different across countries. By and large, younger, indebted households tend to benefit from an unexpected hike in the inflation rate, while older savers tend to suffer from it. The opposite holds true for surprise deflation. However, these effects are quantitatively very small for single-digit changes in the price level (see HFCN, 2016). A second approach to connect changes in asset prices to monetary policy is to investigate their reaction to a monetary policy shock. A causal effect of monetary policy shocks on

asset prices is well-established in the literature. In general, short-term interest rates decreases have a positive effect on bond, stock and house prices.

Table 1: Estimated change in the Gini coefficient of net wealth following a 100bp cut in interest rates

	Baseline Gini	Gini 1st Scenario	% Change	Gini 2nd Scenario	% Change
AT	0.7311	0.7310	-0.0061	0.7310	-0.0018
BE	0.5887	0.5884	-0.0446	-	-
CY	0.7171	0.7168	-0.0329	0.7171	-0.0026
DE	0.7615	0.7614	-0.0079	0.7615	-0.0037
EE	0.6914	0.6913	-0.0142	0.6910	-0.0480
ES	0.5990	0.5988	-0.0322	0.5987	-0.0514
FI	0.6484	0.6482	-0.0405	0.6483	-0.0257
FR	0.6763	0.6770	0.0959	-	-
GR	0.5985	0.5984	-0.0124	-	-
IE	0.7522	0.7518	-0.0499	-	-
IT	0.6031	0.6030	-0.0098	0.6030	-0.0196
LU	0.6460	0.6459	-0.0204	0.6460	-0.0072
LV	0.7855	0.7853	-0.0254	0.7838	-0.2059
MT	0.5857	0.5856	-0.0243	0.5855	-0.0376
NL	0.6979	0.6974	-0.0642	0.6975	-0.0506
PT	0.6781	0.6779	-0.0261	0.6776	-0.0717
SI	0.6285	0.6284	-0.0189	0.6285	-0.0033
SK	0.4920	0.4919	-0.0171	0.4920	-0.0024

Note: Numbers are rounded to the fourth decimal place.

The rest of this section presents the results from a simple empirical exercise which combines the two aforementioned approaches. Given an assumed 100 basis points cut in monetary policy interest rates, we compute the ensuing reaction of house and stock prices after 1 year based on elasticities taken from the literature. We then apply these changes to the asset portfolios of individual households to compute the impact of the monetary policy move on the Gini of net wealth.

More specifically, we compare wealth Gini coefficients before and after the cut in interest rates. Column 1 of Table 1 shows the wealth Gini coefficients for euro area countries computed using the 2nd wave of the HFCS. Columns 2 and 4 show the wealth Gini coefficients one year after an unexpected 100 basis points interest rate cut, which has an effect on house, stock and bond prices. The house price elasticities are taken from the ECB's Basic Model Elasticities and we use 0.75 % elasticity for stock prices based on several estimates from the literature. In column 2 a euro area average for the house price elasticity is used, while in column 4 individual countries elasticities are used (note that these are missing for four countries of our sample).

For all euro area countries the accommodative rate shock translates into a decrease in wealth inequality, albeit the size of the reduction is very small. The largest decrease observed is of -0.2% for Latvia in the country-specific elasticities scenario. This result is surprising, because asset price increases will tend to benefit the higher part of the net wealth distribution, where homeownership and especially stockownership are more prevalent. The explanation is that relatively poorer homeowners tend to be more leveraged. The effect of the asset price increases on their net wealth is therefore amplified by their leverage ratio. This also explains why the percentage change in the Gini is particularly small in Germany and Italy, i.e., countries where the homeownership rate is either particularly small, or accompanied by very low loan-to-value ratios.

3.3. Heterogeneity and non-standard monetary policy

A key challenge in estimating the effects of non-standard monetary policy on inequality is that non-standard policies have been used for a relatively short period of time (so that only a short data sample is available). To analyse their aggregate impact, several papers rely on the identified VARs methodology. Given that the policy interest rate is constrained by the lower bound, expansionary non-standard policies are typically identified by assuming that they reduce the term spread, the difference between the long-term (10-year) and policy interest rates, and boost real GDP on impact.[4]

Following this approach, Lenza and Slacalek (2018) estimate a large VAR with country-specific variables for four large euro area countries—France, Germany, Italy and Spain—euro area-wide variables and U.S. variables. Such setup is useful because it makes it possible to estimate heterogeneities at the country level in responses to a common euro-area monetary policy. The VAR includes asset prices (house and stock prices) and variables that substantially affect income: unemployment rates and wages.[5]

The size of the shock is normalised to a 30-basis-point drop in the term spread, in line with existing studies on the effects of the ECB's APP. The persistence of the response of financial variables is low. One year after the initial drop, the term-spread returns to its initial level. The response of stock prices is similarly short-lived.

House prices increase in all countries, although with a relevant degree of heterogeneity. For example, in Spain the increase is close to two percent, while in Germany is about a third of that size. The reactions in the labour markets also show a marked heterogeneity across countries. The unemployment rates drop in all countries but, again, the response in Spain is about three times as large as in Germany. The response of wages, instead, also varies in sign, with a slight decrease in Spain and increases in other countries.

Building on these results, Lenza and Slacalek (2018) run a simple simulation to distribute these indirect effects of APP across wealth and income of individual households. To do so, they use individual data on wealth and income components from the Household Finance and Consumption Survey (HFCS).

Consider first how to quantify the effects of non-standard monetary policy on the wealth of individual households. Since the bulk of the effect on wealth occurs via asset prices, it is assumed that the response of individual wealth components to the APP after four quarters mirrors the response of asset prices at that horizon. In other words, it is assumed that households' portfolios remain unchanged. The assumption seems acceptable given the short horizon considered and given the empirical evidence on the sluggishness of adjustment of holdings of real and also financial assets in household portfolios.

---

[4] See, e.g., Baumeister and Benati (2013).

[5] The VAR model includes country-specific variables: real GDP, the GDP deflator, the unemployment rate, nominal wages and house prices. See Lenza and Slacalek (2018) for further details.

The results in Figure 4 show that most quintiles increase by around 1%, but the median net wealth in the lowest quintile increases by 2.5% (though starting from a rather low level), partly driven by the high leverage of these households. The Gini coefficient on net wealth decreases by a tiny amount – it ticks down from 68.09 to 68.07 (after 4 quarters).

Figure 4: Effects of Asset Purchase Programme on the wealth distribution
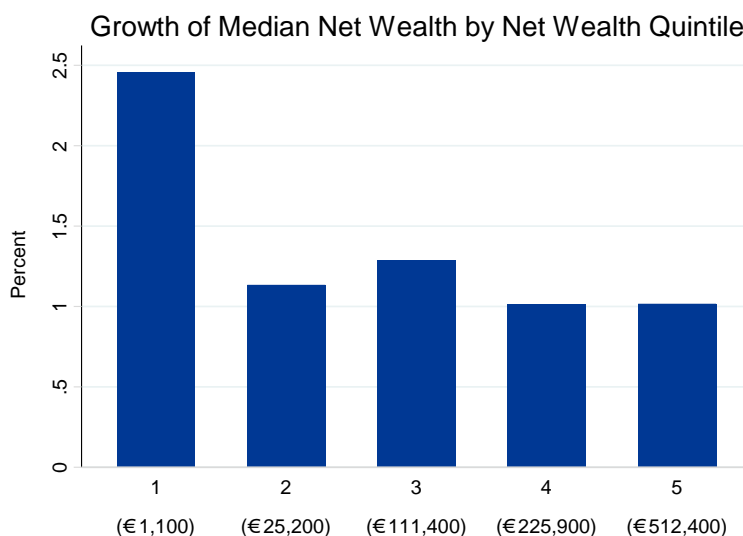
Note: The numbers in brackets show initial median net wealth levels in each quintile. Euro area aggregates are calculated as the total for the four large countries: Germany, Spain, France and Italy.

Figure 5: Decomposition of changes in net wealth into their components
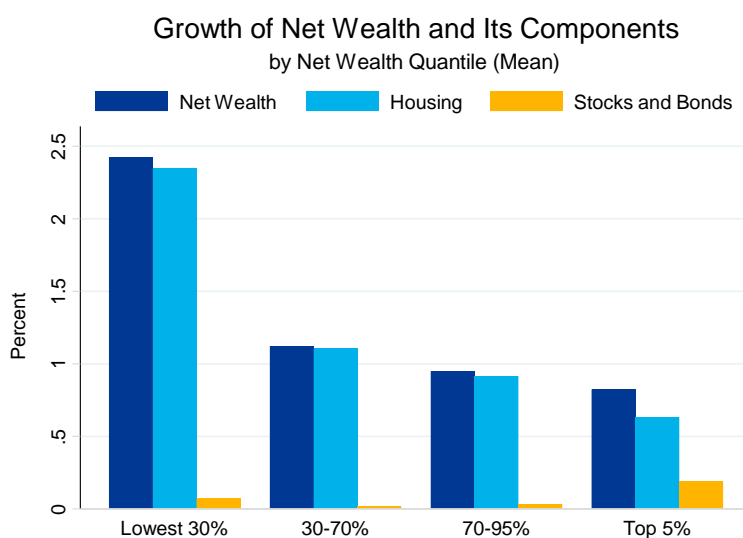
Note: Euro area aggregates are calculated as the total for the four large countries: Germany, Spain, France and Italy.

Figure 5 shows how the main components add into the changes in net wealth across various households.[6] The key fact to take away from the figure is that housing wealth plays an important

---

[6] Adam and Tzamourani (2017) report a similar chart as their Figure 4.

role across the distribution but disproportionately so in its lower part (among the bottom 30% of households). In contrast, financial assets (stock and bonds) are more important among the top 5% of households. However, even for these households, financial assets contribute less to the increase in net wealth than housing because their share on total assets is lower and because stock and bond prices increase less than house prices.

Consider now how the APP affects income of individual households. The impulse responses give information on the evolution of wages and unemployment after the APP intervention. To distribute the decline in the unemployment rate across households depending on their demographics (such as age, education, marital status and the number of children), Lenza and Slacalek (2018) estimate a probit model at the country level with the employment status as the dependent variable. Such a model captures some heterogeneity in the probability of employment across households. The fitted values from the probit model are then used to run a simulation that distributes the aggregate decline in unemployment across households: Unemployed households with higher fitted values from the probit regression are more likely to become employed.

Figure 6 compares the "distributed" impulse responses of the unemployment rates across income quintiles. Two main results can be highlighted. First, the expansionary effects on employment are strongly skewed toward low-income households. The key reason is that the unemployment rate is also heavily skewed toward the bottom income quintile, a fact which holds across all four countries. Consequently, it is not surprising that those who become employed predominantly come from the lower income quintiles.

The second result of Figure 6 concerns the differences in micro impulse response across countries, both the level of the response and the dispersion across income quintiles. For example, for most quintiles the overall reduction in unemployment is much larger in Spain than in Germany.

Figure 6: Response of income to nonstandard monetary policy, by income quintile and country
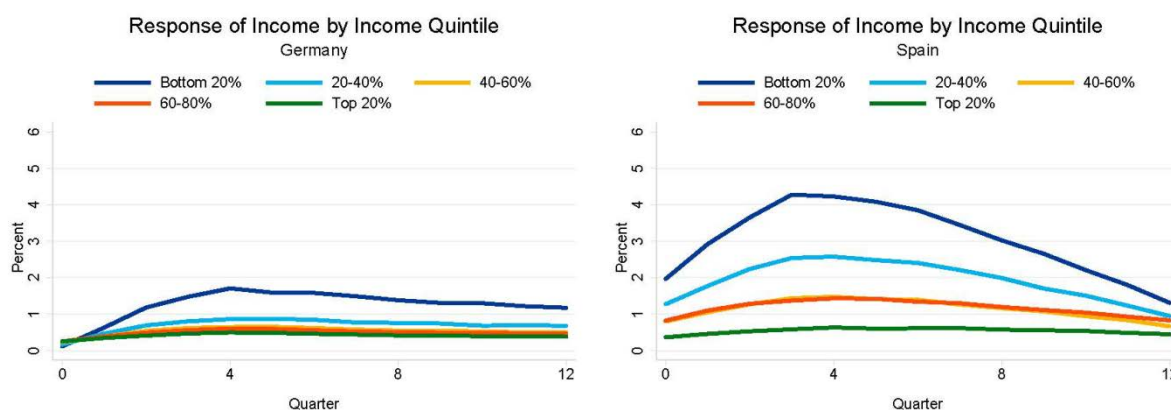
Note: This figure is reproduced from Lenza and Slacalek (2018). The charts show impulse responses of mean income by income quintile. Source: Eurosystem Household Finance and Consumption Survey.

Overall, the results in Lenza and Slacalek (2018) suggest that the APP reduced the unemployment rate among households in the bottom income quintile by 2 percentage points, which boosted their mean income by more than 3 percent. The effects on other parts of the income distribution were

much more modest. The Gini coefficient on gross income decreased from 43.1 to 42.8 percent (after 4 quarters).

There is little existing additional work on nonstandard monetary policy and inequality. The paper by Casiraghi et al. (2018) finds that the effects of nonstandard monetary policy on employment and economic activity outweigh those on financial variables. Overall, the response of net wealth is U-shaped: less wealthy households take advantage of their leveraged positions, wealthier households of their larger share of financial assets. The effects on inequality are negligible.

3.4. Consumption heterogeneity

Distributional implications of monetary policy on households' income and wealth should be accompanied by -distributional effects on household consumption. The effects could be particularly large if some households display stronger consumption elasticity to a temporary change in their resources, i.e., if they have a higher MPC. They would be, instead, simply proportional to the change in income, if households have similar MPCs.

Examining the heterogeneous household consumption response to changes in monetary policy requires disaggregate data in which the same households are traced on a regular basis and over long periods in time. Unfortunately, such data does not exist for the euro area as the current household budget surveys are not panels and are conducted at low-frequency. Instead, one may examine the effect of changes in, e.g., policy rates on consumer self-reported financial situation (sentiment) which represents a measure that is frequently collected in existing household surveys. In particular, fluctuations in consumer sentiment over time are considered a key lead indicator for aggregate consumption dynamics, and they are closely monitored in order to inform policy decisions. Low consumer sentiment has been recently identified as a crucial factor behind the sluggish recovery of the U.S. consumption growth in the aftermath of the Great Recession (see Petev, Pistaferri and Saporta, 2011).

Recent work by Georgarakos and Tatsiramos (2018) examines the heterogeneous transmission of monetary policy onto consumer financial stress (that is self-reported deterioration of financial situation since last year) and spending on durable goods. They use survey data from the British Household Panel Survey (BHPS), a nationally representative panel survey that has been conducted on an annual basis from 1991 to 2008 (i.e. eighteen waves). The disaggregate nature of the data allows exploring asymmetric effects of monetary policy transmission across household groups that differ in housing tenure (i.e. mortgagors, renters, outstanding home owners) and in savings capacity (savers, non-savers). The main empirical challenge is to measure variation in households' interest rates exposure while taking into account the effect of: a) fluctuations in various other macroeconomic factors; and b) household-specific unobserved characteristics that make more likely for a household to belong to a group that is affected by monetary policy (e.g., mortgagors exhibit a stronger propensity to take on debt compared to renters).

To identify the effect of interest, Georgarakos and Tatsiramos (2018) exploit random variation of households' interview dates with respect to the timing of policy rate changes. This allows taking into account in their regression analysis confounding macroeconomic effects and household unobserved characteristics.

Georgarakos and Tatsiramos (2018) find that an increase in Bank of England policy rates deteriorates on average the reported financial situation of mortgagors and renters compared to that of outright home owners. On the other hand, it improves savers' reported financial situation in relation to their counterparts who do not save regularly.

A key feature of mortgagors who do not save regularly is to be "hand-to-mouth", i.e., to have large spending commitments compared to their regular income and liquid assets. The hand-to-mouth status makes households' discretionary spending highly sensitive to small and temporary changes in income. By contrast, households owning non-negligible amounts of liquid assets can use them to avoid adjusting their expenditure after small and temporary income changes. Georgarakos and Tatsiramos (2018) find indeed that hand-to-mouth mortgagors report that they are financially worse off after an interest rate increase compared to their counterparts with access to liquidity (regular savers). Moreover, this group of mortgagors reduces spending on durables when faced with an interest rate increase while the spending of the non-hand-to-mouth mortgagors remains unaffected.

4. Disentangling the direct and indirect effects of monetary policy

This section describes the results of an estimation of the relative importance of direct and indirect effects of monetary policy in the euro area. We begin with a review of the empirical literature on the heterogeneity of MPCs. This evidence is relevant to assess how different households respond to a given change in their resources induced by a monetary policy shock. Based on this evidence, the section reports the results of an illustrative simulation of direct and indirect effects of monetary policy on the expenditures of hand-to-mouth and non-hand-to-mouth households. To measure the direct effects, it uses detailed information on households' asset and liabilities exposed to interest rate risk and estimates of households' saving elasticity to interest rate changes. For the indirect effect, it combines estimates of the aggregate impact of monetary policy on unemployment with household level re-employment probabilities. The results suggest that the indirect effect is quantitatively larger and that hand-to-mouth households play a disproportionately important role in the transmission of monetary policy. This conclusion is consistent both with recent theoretical findings and with international evidence.

4.1. Evidence on heterogeneity in marginal propensities to consume (MPC)

Examining how consumers adjust their consumption to different types of income shocks, as well as understanding which economic models are more consistent with the consumption responses observed in the data, is important for evaluating the macroeconomic implications of a wide range of policy actions, including monetary policy measures. The standard life-cycle permanent income model abstracts from liquidity constraints and implies that lifetime disposable income, rather than current income, determines consumption behavior. The model also predicts that consumers should make the same proportional adjustment in their consumption in response to positive, negative, larger or smaller transitory income shocks. That is, there should be no heterogeneity in their marginal propensity to consume (MPC) with respect to different types of income changes. Instead, more realistic life-cycle models in which agents face liquidity constraints and use savings to buffer random income fluctuations predict that consumption adjustment should be larger with respect to a negative than to an equally-sized positive income shock. They also imply that the size of the

underlying shock matters. More specifically, for negative income shocks, the consumption adjustment should increase with the size of the shock, particularly for consumers with limited liquidity. For positive shocks, consumers facing liquidity constraints should find it easier to overcome them when the shock is larger, so the consumption response to large positive income shocks should be relatively smaller than that triggered by small ones.

Evaluating the validity of these different model predictions has proved challenging. The existing literature has examined a number of real life events to measure the consumption response to various income shocks from survey data. Parker and Souleles (2017) labelled this methodology "revealed preference approach". Some of these studies have measured how consumption responds to positive income shocks (e.g. tax rebates) while others have focused on negative income shocks (e.g. unemployment or disability).[7] However, the estimates of the MPC in these studies are hard to combine as these analyses differ, to a certain extent, in the (observed and unobserved) characteristics of the selected sub-group of consumers that has experienced a given type of a shock, and even in the durability of the shocks. To complicate things further, the estimated MPC often reflects the phase of the business cycle during which the shocks occur. Therefore, it is nearly impossible to find real life situations in which every consumer experiences both a positive and a negative income shock of similar sizes, which would be the ideal scenario to identify and estimate a possibly asymmetric consumption response to shocks that is representative of the entire population and can be used to test competing models.

To address these issues, an alternative methodology, labelled "reported preference approach" by Parker and Souleles (2017) is becoming more and more common. These set of studies design surveys where individuals are asked how their spending would respond in hypothetical or actual scenarios. Christelis et al. (2018) design a special set of questions for an internet consumer survey that is representative of the Dutch population. In particular, consumers were asked how much they would consume out of a one-time bonus unexpectedly received from the government (i.e. an unexpected, transitory and positive income change). The same consumers were also asked how much they would reduce their consumption in response to a one-time tax unexpectedly imposed by the government (i.e. an unexpected, transitory and negative income change). Further, consumers were asked questions that distinguished between relatively small income changes (an increase or reduction equivalent to one month's income) and larger ones (equivalent to three months' income). Christelis et al. (2018) utilized this data to perform a direct comparison between the consumption responses of the same consumer to hypothetical positive and negative (as well as larger and smaller) transitory income shocks, making it possible to estimate effects that are representative for the population as a whole.

According to the results discussed in Christelis et al. (2018), following an increase equivalent to one month's income, a consumer would allocate on average 20% of the additional income to non-

---

[7] See for example Browning and Crossley (2001), Stephens (2001), Souleles (1999; 2002), Browning and Crossley (2001), Misra and Surico (2014), Shapiro and Slemrod (1995; 2003) and Sahm et al. (2010; 2015). Instead, Blundell et al. (2008) examine the impact of income shocks on consumption growth by utilising long panel data and employing a statistical decomposition of income shocks and theory predictions on the joint distribution of income and consumption. Jappelli and Pistaferri (2011) provide a thorough review of the literature.

durable consumption, i.e. consumers would spend it on food, clothes and travel, etc. The response to a drop in income by the same amount is larger, with consumers expecting to reduce non-durable consumption by an average of 24%. Thus, the MPC in response to negative income shocks is, on average, higher than the MPC in response to positive shocks. Consumption responses to larger income shocks, a rise in income equivalent to three months' income would increase non-durable consumption by 14%, while the consumption reduction if income fell by that amount is 24%. Therefore, the MPC gap between positive and negative income changes is wider for larger income shocks (i.e. 24% - 14% = 10%) than for smaller income shocks (i.e. 24% - 20% = 4%). These patterns provide qualitative support for life-cycle models with liquidity constraints and/or buffer stock behavior. Similar results are found by Bunn et al. (2017) for the UK and Fuster, Kaplan, and Zafar (2018) for the US.

Table 2: Calibration of MPCs by households' hand-to-mouth status

	Baseline	Kaplan, Violante, Weidner (2014)	Fagereng, Holm, Natvik (2017)	Christelis et al. (2018)	Jappelli & Pistaferri (2014) / SHIW 2010
Poor hand-to-mouth households	**0.300**	0.243	0.428	0.365	0.618
Wealthy hand-to-mouth households	**0.300**	0.301	0.462	0.389	0.576
Not-hand-to-mouth households	**0.100**	0.127	0.314	0.391	0.435

Results also show that there is considerable evidence of cross-sectional heterogeneity in MPCs. An inverse relation appears to exist between MPC and household resources, which is consistent with models with liquidity constraints and precautionary saving. Jappelli and Pistaferri (2014) document a similar relationship on Italian data. Given the many dimensions of heterogeneity in MPCs highlighted by these results, it is not surprising to observe that the exact MPC values can change depending on the exact experiment used to measure them. This dimension of uncertainty is illustrated in Table 2, which reports the results of a few, selected studies.
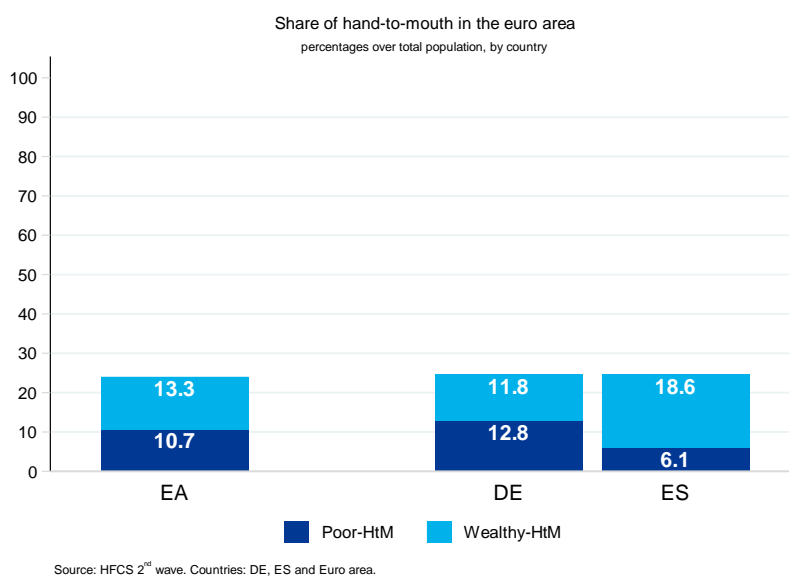
The table collapses the heterogeneity documented by the various studies into the groups of hand-to-mouth and non-hand-to-mouth households that have been defined earlier. The hand-to-mouth group is further divided into two sub-groups (poor and wealthy), for reasons that will become apparent later. Specifically, the poor hand-to-mouth are households who have negligible net worth, while the wealthy hand-to-mouth tend to have positive, but illiquid, net wealth. It should be noted that, with the exception of Kaplan, Violante and Weidner, the other reported MPCs refer to the marginal propensities to spend on both durable and non-durable goods and thus are necessarily inflated. While the exact values of the MPC are different across the various studies, the MPC of hand-to-mouth households tends to be larger. This finding will be used in the next section to study the size of direct and indirect effects for different households in the euro area. The specific values that will be used for this exercise are in the "Baseline" column. Specifically, the MPC of the poor and the wealthy hand-to-mouth is set to 0.3, while the MPC of the non-hand-to-mouth is 0.1. The latter

value is selected mostly based on theoretical considerations (for non-hand-to-mouth households, the annual MPC should be close to the discount rate, thus around 0.05).

4.2. Direct and indirect effects: an illustration for the euro area

This section reports the results of an illustrative simulation of direct and indirect effects of monetary policy on household expenditures. We assume that the bulk of the heterogeneity in the population which is relevant for the monetary policy transmission can be captured by three groups of households: (i) poor hand-to-mouth, (ii) wealthy hand-to-mouth and (iii) non-hand-to-mouth households. Figure 7 shows the shares of the poor and the wealthy hand-to-mouth households in the euro area and the four largest euro area countries. The three groups are defined as in Kaplan, Violante and Weidner (2014) based on their holdings of net liquid and illiquid wealth.[8] The key idea is that hand-to-mouth households face frictions which make their consumption decision insensitive to changes in the interest rate, but highly sensitive to changes in income. One such friction is the existence of a borrowing limit, which prevents households from freely borrowing to smooth the impact on consumption of temporary, negative shocks. A second friction is the spread between saving and borrowing rates, which makes it costlier to borrow.
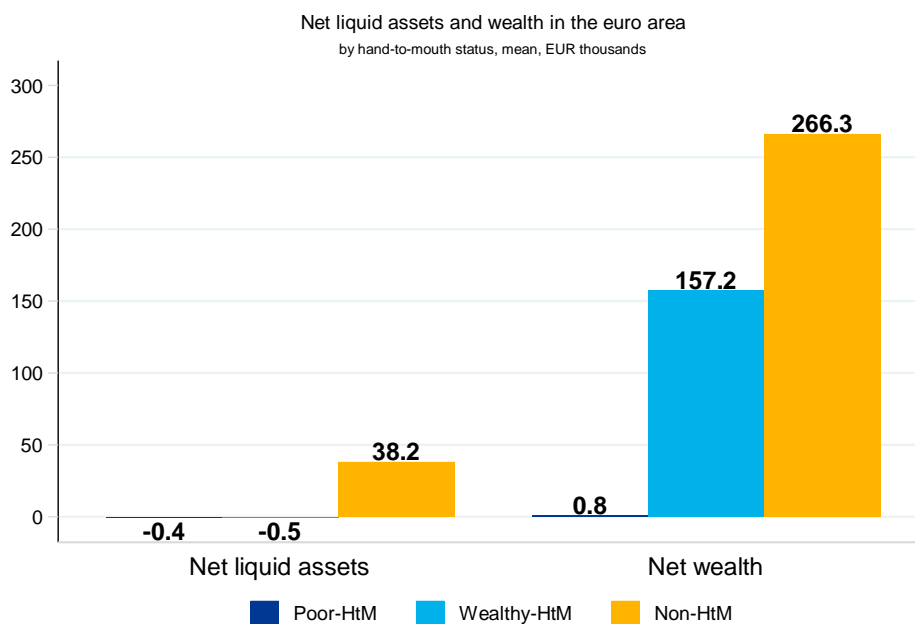
Figure 7: Share of hand-to-mouth households in the euro area

Share of hand-to-mouth in the euro area
percentages over total population, by country

Source: HFCS 2nd wave. Countries: DE, ES and Euro area.

At the euro area level, almost 11% of households are classified as the poor hand-to-mouth and more than 13% of households are wealthy hand-to-mouth. The overall share of hand-to-mouth households is quite stable across the four largest euro area countries.

Figure 8: Mean liquid assets and net wealth of households by hand-to-mouth status

[8] Net illiquid wealth = (housing - mortgage debt + retirement accounts/life insurance); net liquid wealth = (deposits + stocks + bonds + mutual funds - credit card balances and overdraft debt). Poor hand-to-mouth households are those with zero or negative illiquid wealth and net liquid asset close to zero, if positive, and close to the credit limit, if negative. Wealthy hand-to-mouth households have liquid assets defined in the same way, but also have positive holdings of net illiquid assets. In this paper, by "close" we mean no more than half of their monthly disposable labour income away from zero or the credit limit.

Net liquid assets and wealth in the euro area
by hand-to-mouth status, mean, EUR thousands

Source: HFCS 2ⁿᵈ wave. Countries: Euro Area countries.

The three groups of households differ in their holdings of liquid and illiquid assets. As illustrated in Figure 8, the poor hand-to-mouth households hold little net liquid or net illiquid assets.[9] The wealthy hand-to-mouth hold substantial net illiquid assets but small amounts of liquid assets – and consequently they also have limited room to isolate their consumption from shocks (similarly to the poor hand-to-mouth).

Consistently with the evidence summarized in section 4.1, we will assume that the 3 groups differ in their MPCs according to the estimates in the baseline column of Table 2. The three groups also differ in their direct exposure to interest rate risk. Following Auclert (2017), net exposure can be defined as the difference between total maturing assets and liabilities.[10]
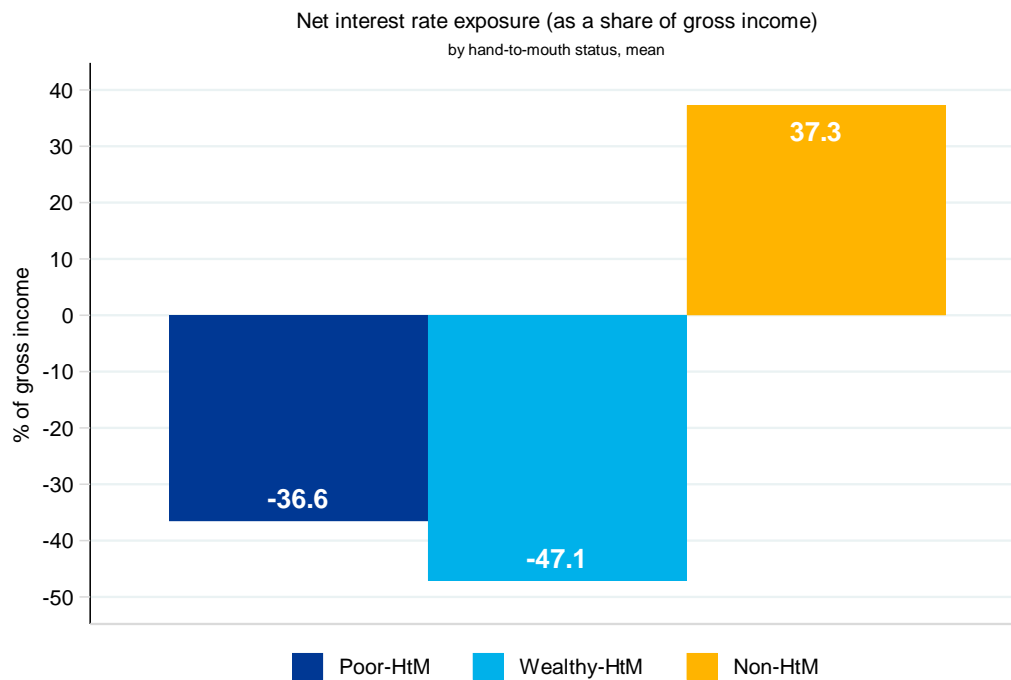
Figure 9 shows mean net interest rate exposure as a fraction of disposable labour income. The exposure is substantially negative for both groups of hand-to-mouth households,[11] while it is positive for non-hand-to-mouth households. Thus, hand-to-mouth households benefit from a reduction in interest rates through this direct channel. Non-hand-to-mouth households, in contrast, are negatively affected by the shock through a loss of financial income.

---

[9] About 10% of poor hand-to-mouth households own a house, but are highly leveraged with a mortgage with the loan-to-value ratio close to or exceeding 100 percent.

[10] Maturing assets are defined as: 25% of value of mutual funds, bonds, shares, managed accounts, money owed to households, other assets + 100% of deposits. Maturing liabilities are defined as: Maturing liabilities = 100% outstanding balance of adjustable-rate mortgages + 100% outstanding balance of other non-collateralized debt. Our definition of net interest rate exposure does not include household savings, so it is somewhat different from the "uncovered interest exposure" in Auclert (2017). Tzamourani (2018) provides detailed estimates of various versions of households' exposures to interest rate risk across euro area countries.

[11] Interest exposure of hand-to-mouth households can be negative because some of them are at or very close to their borrowing limit, where maturing liabilities exceed maturing assets.

Figure 9: Mean net interest rate exposure of households by hand-to-mouth status

Net interest rate exposure (as a share of gross income)
by hand-to-mouth status, mean

Source: HFCS 2nd wave. Countries: Euro Area countries.

Figure 10: Mean net interest rate exposure of households by hand-to-mouth status across countries

Net interest rate exposure (as a share of gross income)
by hand-to-mouth status, mean
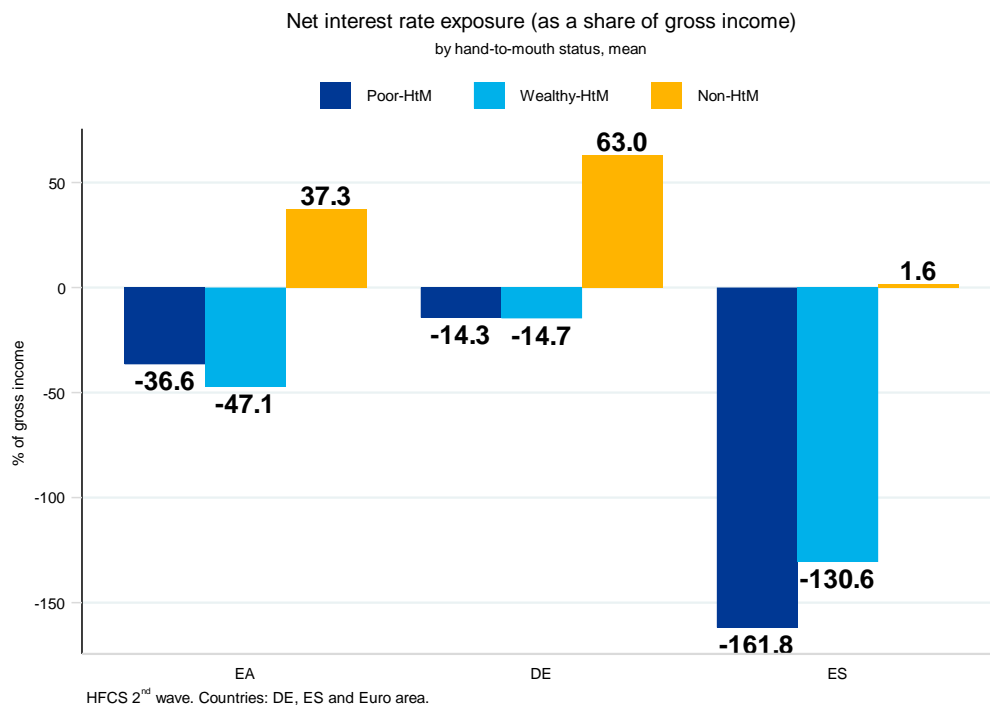
HFCS 2nd wave. Countries: DE, ES and Euro area.

The net interest rate exposures vary substantially across the euro area countries. For example, an important determinant is the fraction of households exposed to variable-rate mortgages. It is well-

known that the bulk of mortgages in Spain are variable-rate, while those in Germany are fixed-rate. Correspondingly, Figure 10 documents that hand-to-mouth households in Spain hold negative interest rate exposures of around 150% of annual income, while in Germany these are only around 15% of income. Similarly, German non-hand-to-mouth households hold substantial positive exposures (around 60% of income), while the interest rate exposures of Spanish households are barely positive on average. These facts imply that households in Spain tend benefit more from the direct effect of an interest rate cut than those in Germany.[12] Cross-country differences may however be somewhat overstated in Figure 10, since households holding fixed rate mortgages may have benefited from refinancing options, which are not taken into account in our analysis.

To assess the implications of direct and indirect effects on households' consumption, we follow Auclert (2017), which shows that the effects of a purely transitory monetary policy shock on individual consumption can be decomposed as follows:

$$\Delta C = \underbrace{MPC \cdot \frac{\text{Net Interest Rate Exposure}}{C} \cdot \Delta R - \sigma \cdot (1 - MPC) \cdot \Delta R}_{\text{Direct Effects}} + \underbrace{MPC \cdot \frac{Y}{C} \cdot \Delta Y}_{\text{Indirect Effect}}$$

where Δx denotes the percentage change in variable X, R stands for the level of interest rates, Y stands for income, σ is the elasticity of intertemporal substitution and MPC the marginal propensity to consume. The first two effects are direct and are due to (i) households' holdings of interest rate-sensitive assets (net of liabilities) and (ii) intertemporal substitution. In addition, the strength of the response of consumption growth is affected indirectly via the income channel, which depends on the size of the response of household income to the rise in aggregate demand induced by the expansionary monetary policy shock.

The equation above is valid at the household level, but we apply it to the three categories of household that we have focused on so far. The equation will hold as written for non-hand-to-mouth households. Consistently with the microeconomic evidence, we use a value of $\sigma = 0.2$ (see, e.g., Havranek, 2015). For hand-to-mouth households we assume that the impact through intertemporal substitution is nil because by definition these households are at a kink in their budget set (either zero or the credit limit).

To provide numerical values for all the terms in the equation, it only remains to specify the size of the change in interest rate response ΔR and income response ΔY associated with a monetary policy shock. We will assume an initial shock of -100 basis points. The implied values of ΔR and ΔY will be given by the average responses of these variables over one year, according to the VAR evidence in Section 3. For ΔR this implies a reduction by 66 basis points, which is common to all households. However, households will differ by the responsiveness of their income to interest rate shocks: the

---

[12] Tzamourani (2018) provides extensive cross-country evidence on the fact that an important determinant of net interest rate exposures is the fraction of households exposed to variable-rate mortgages: whereas mortgagors across many parts of the euro area have a negative interest rate exposure, mortgagors in Germany (where mortgage contracts tend to be of the fixed rate type) have a positive interest rate exposure.

income of hand-to-mouth households is more responsive to interest rate shocks. Following Lenza and Slacalek (2018), an initial 100-basis-point negative shock to policy rates is estimated to increase the income of poor euro area hand-to-mouth households by an average of 1.54%, of wealthy hand-to-mouth households by 0.84% and of non-hand-to-mouth households by 0.46% (see Table 3).

Table 3: Responsiveness of income growth ΔY to interest rate shocks by hand-to-mouth status

	Hand-to-Mouth Status		
	Poor HtM	Wealthy HtM	Non-HtM
Germany	1.31	0.68	0.48
Spain	1.16	0.83	0.47
Euro Area	1.54	0.84	0.46

Note: The table shows the reaction of income growth (in percent) to an initial 100-basis-point cut in interest rate.

Figure 11: Decomposition of the effects of interest rate changes on consumption in the euro area
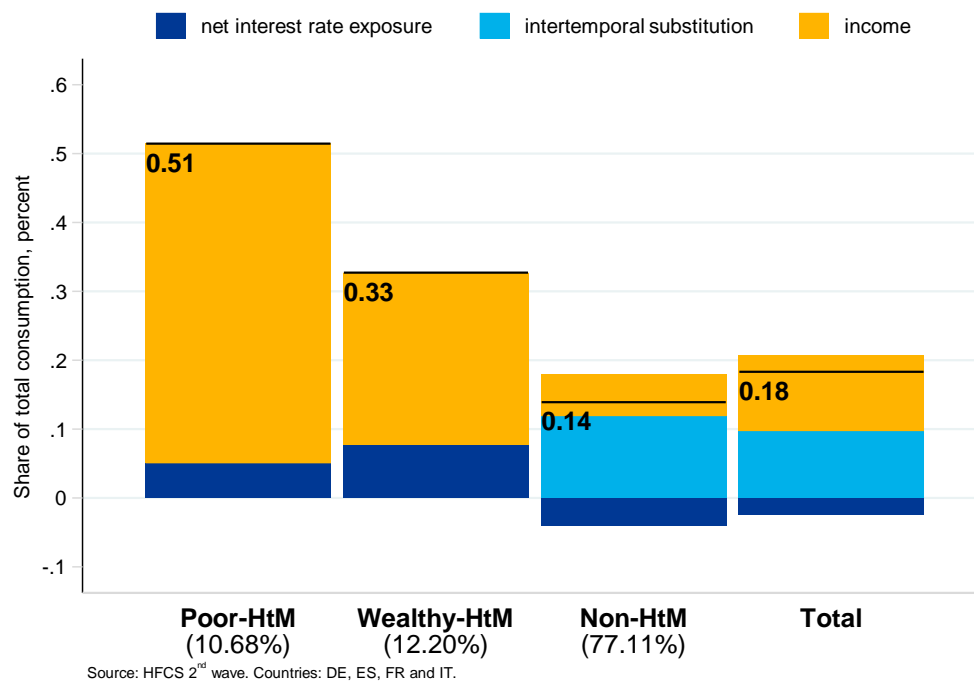
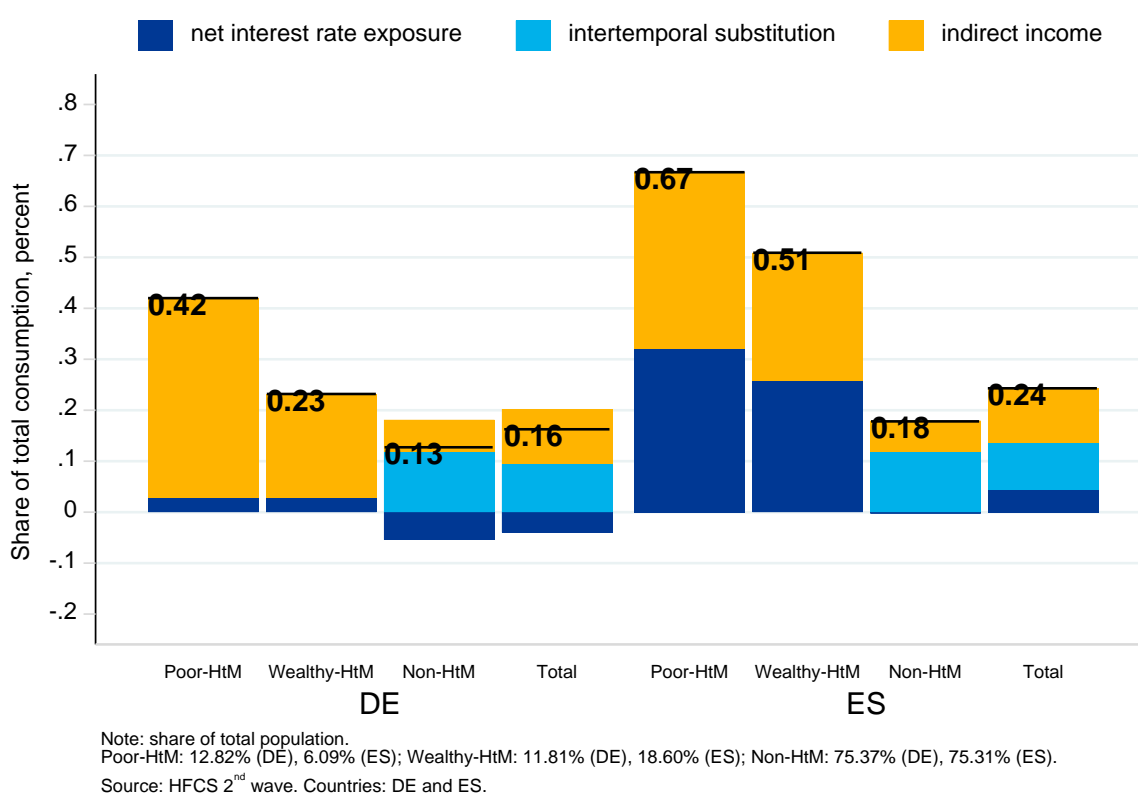Source: HFCS 2nd wave. Countries: DE, ES, FR and IT.

Note: The chart shows a decomposition of the effects of an initial 100-basis-point shock to interest rates on consumption. The total effect consists of 3 parts, the effect of the net interest rate exposure, intertemporal substitution and income; sizes of these effects vary depending on households' hand-to-mouth status. The numbers in the brackets below the bars show the fractions of households by their hand-to-mouth status in the euro area (which here consists of DE, ES, FR and IT).

Figure 11 displays how the three effects contribute to the changes in consumption for the three groups of households and for all households in the euro area economy (following an initial 100-basis-point cut in interest rates).[13] The chart shows substantial differences in how the three groups

[13] In the total, the three groups of households are weighted by their total consumption shares.

of households are affected by the interest rate shock. Hand-to-mouth households adjust their consumption by vastly larger amounts after the shock. The 100 basis-point cut of interest rates results in an increase of consumption of roughly 0.5% for the poor hand-to-mouth and of 0.3% of the wealthy hand-to-mouth, while consumption of the non-hand-to-mouth households rises by 0.14%. Given their disproportionate share in consumption (more than 80%), the non-hand-to-mouth households dominate the total consumption increase of 0.18%.

Figure 12: Cross-country differences in the decomposition of the effects of interest rate changes on consumption

Note: share of total population.
Poor-HtM: 12.82% (DE), 6.09% (ES); Wealthy-HtM: 11.81% (DE), 18.60% (ES); Non-HtM: 75.37% (DE), 75.31% (ES).
Source: HFCS 2nd wave. Countries: DE and ES.

Note: The chart shows a decomposition of the effects of an initial 100-basis-point shock to interest rates on consumption. The total effect consists of three components, net interest rate exposure, intertemporal substitution and indirect income channel; the sizes of these effects vary depending on households' hand-to-mouth status.

The figure also illustrates that the indirect income effect accounts for by far the largest part of the consumption response for the 2 groups of hand-to-mouth households, around 80-90% of the total effect. The income effect also accounts for a substantial part of the overall reaction for the non-hand-to-mouth households. Even if the intertemporal substitution channel is non-negligible for the non-hand-to-mouth households, its impact is dampened by an offsetting reduction in interest income. The total direct channel is therefore small also for non-hand-to-mouth households. All in all, 60% of the total increase in aggregate consumption is due to the indirect income channel even at the aggregate level.

Figure 12 compares how this decomposition varies across two "polar" countries in terms of the prevalence of fixed- vs adjustable-rate mortgages, Germany and Spain. The key difference between

these countries is the role of net interest rate exposures for consumption: Hand-to-mouth households in Spain hold large negative net exposures and thus this channel accounts for about half of the total increase in their consumption. Instead, consumption of German households is somewhat dampened after the interest rate cut because of their positive exposures. Nevertheless, also in Germany all households benefit from the monetary policy easing thanks to the indirect effect through the aggregate demand stimulus of monetary policy.

4.3. Modelling of direct and indirect effects in the literature

A precise assessment of the relative strength of the direct and indirect effects requires a general equilibrium analysis. Kaplan, Moll and Violante (2018) provides such an analysis within a framework that offers a good representation of the microeconomic properties of household consumption and household finances. More specifically, the model allows households to save in two categories of assets, a low-return liquid asset and a high-return illiquid asset that is subject to a transaction cost. This structure implies that some households in the model will be of the hand-to-mouth type, i.e., they will display sizable MPCs out of small resource windfalls.

The main finding in Kaplan, Moll and Violante (2018) is that the direct effects of interest rate shocks are always small compared to the indirect. A key reason is that hand-to-mouth households bear the bulk of the consumption response to changes in monetary policy rates. These households are highly sensitive to labour income shocks but are not responsive to interest rate changes. By contrast, permanent income households are very sensitive to interest rate changes. In response to, for example, an increase in interest rates, the intertemporal substitution motive would lead them to cut consumption. At the same time, however, the rise in the return on their liquid assets will boost their financial income and their willingness to save in such assets. These two economic forces counteract each other and weaken the direct channel of monetary policy.

Table 4: Decomposition of direct and indirect effects for different household types

	P-HtM	W-HtM	N-HtM	All
Share direct	0.0719	0.0235	0.7529	0.5091
Share indirect	0.9281	0.9765	0.2471	0.4909
Consumption share	0.1000	0.1900	0.7100	1.0000

These effects are illustrated in Table 4, which displays the direct-indirect decomposition for different household types in the model (calibrated to the US economy). The model implied magnitudes are quite similar to those estimated in the data. In particular, indirect effects dominate for hand-to-mouth households, wheres the direct channel is what drives the response of the rest of the economy. As for our empirical estimates, in the aggregate, about half of the effect of of the indirect nature.

The empirical analysis in Cloyne, Ferreira and Surico (2017) provides support to the conclusion that the indirect effect of monetary policy is much stronger than the direct effect. Using household panel data on consumption, income, and wealth for the U.S. and the U.K., this study asks whether an increase in monetary policy rates has a stronger impact in the U.K. compared to the U.S.. One would

expect this result because U.K. mortgages are mostly at variable rate, thus sensitive to changes in monetary policy interest rates. By contrast, U.S. mortgages are traditionally originated with fixed rates. The results of this study show that, while the impact on U.K. mortgage repayments is indeed larger, the change in expenditure for mortgagors appears to be of comparable magnitude in both countries. The change in expenditure is also of the same order of magnitude as the mortgagors' expenditure response. These results lend support to the hypothesis that the indirect effects of monetary policy on mortgagors' income, through the aggregate demand stimulus, play a quantitatively larger role than the direct effects on the cash-flow of mortgagors.

5. Other dimensions of heterogeneity in the economy

This paper focuses on households because they are the ultimate owners of all other sectors in the economy. Any profits (or losses) made by other sectors, including financial and non-financial firms and the government, will eventually accrue to certain households in the form of dividends or changes in the stream of government transfers/taxes. However, assessing the impact of these profits (or losses) on household inequality is difficult in the absence of precise information on the ownership of banks and non-financial firms and on the tax/transfers structure in every country.

In this section, we use available information to illustrate how the direct effects of monetary policy are heterogeneous across firms in an analogous as across households.

Also firms are heterogeneous with respect to their short run exposure to interest rate changes. A direct channel of monetary policy operates through the asset and liability maturity structure of firms balance sheets. On the liability side, an increase in policy rate will affect the borrowing conditions of firms. Especially if outstanding debt has short duration, new debt at higher interest rates in replacement of maturing debt will increase the interest burden. On the other hand, on the asset side, firms also often have short-term financial assets that benefit from higher interest rates. It is noteworthy that in the aggregate the net exposure of the non-financial corporate sector is very limited. According to the financial accounts of the non-financial corporations in the euro area, corporations held on their balance sheet (in the third quarter of 2017) 2565 billion euro currency and deposits, while simultaneously borrowing short term for 2695 billion euro.

Aggregate numbers however hide substantial heterogeneity at the firm level. Where some firms borrow substantially at short term, and have little short term assets, other firms have only a small amount of loans outstanding while simultaneously have substantial short term financial assets. One way of measuring this direct channel of the interest rate risk exposure of firms is to calculate the gap between assets and liabilities that mature within a year.[14]

Firm-level balance sheet data allows the identification of assets and liabilities with a maturity below 1 year (called current assets and current liabilities). Using such firm-level data[15] we construct the gap

---

[14] This is analogous to the interest rate risk exposure of banks. Gomez et al. (2016) measure the exposure of banks' cash flow to interest rate risk by measuring the gap between the amount of the banks' assets and liabilities that reprice or mature within a year. They also normalize this gap by total assets.

[15] We use individual balance sheet data from microBACH (Bank for the Accounts of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices). We use a total of over 10 million

between current assets (excluding inventories) and current liabilities and express it as a fraction of total assets of the firm. Firms with a negative (positive) gap have more (less) current liabilities than assets and are therefore negatively (positively) affected by interest rate changes.

Figure 13 presents the distribution of this gap over more than 10 million firm level observations. The distribution is shown separately for large (more than EUR 43 million of total assets), medium (below EUR 43 million but above EUR 10 million) and small firms (below EUR 10 million assets).

Figure 13: Density of the gap between current assets and current liabilities (as fraction of total assets)
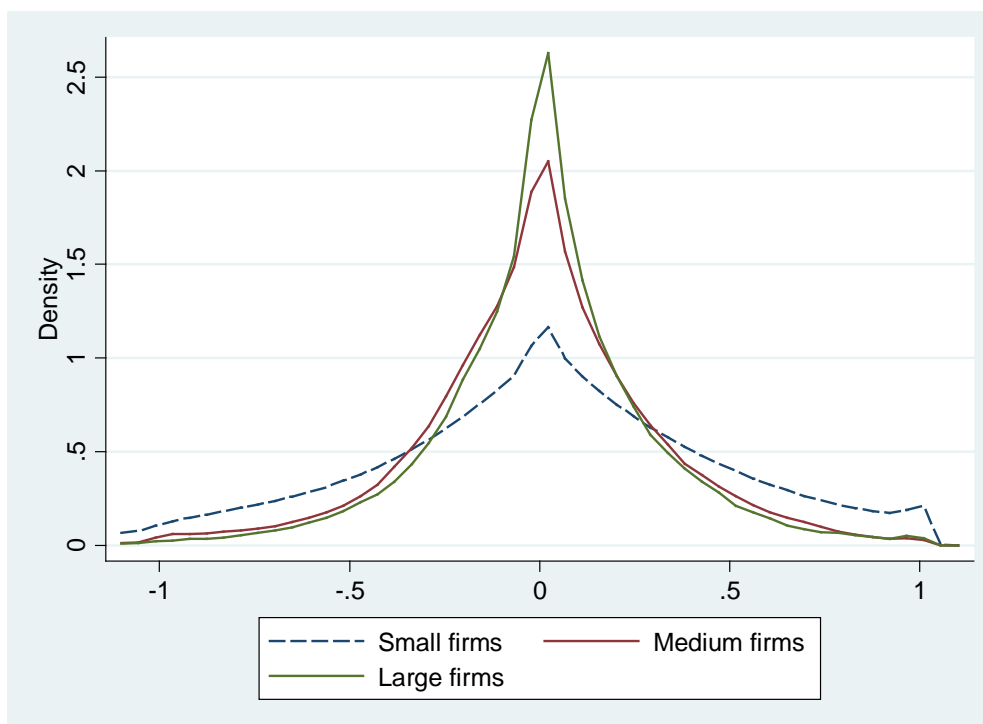
The median firm has a zero gap, and is therefore not affected through this direct channel. However heterogeneity is large, one quarter of the firms has a negative gap larger (in absolute value) than 32 percent of total assets, another quarter of the firms has a positive gap larger than 27 percent of total assets. Interestingly, it is small firms which are more likely to have gaps that are away from zero, both at the positive and negative side.[16] Median and especially large firms are more likely to have gaps closer to zero.

observations of balance sheets for firms from France, Italy, Spain, Belgium, Portugal and Slovakia and observation from the period 2004-2013. The data are heavily unbalanced with most of the observations stemming from the shorter period 2009-2013.

[16] Note also the interesting kink in the density around 1, especially for small firms. These firms only accumulate short term assets and have no short term liabilities. These might also be an indication of financing constraints of some small firms.

This direct channel is only one of the possible mechanisms through which firms are affected by monetary policy. Firms are also influenced by indirect effects, which are however harder to measure. Such an indirect effect operates through changes in general economic activity which impact business demand and cash flows. Also, if banks are differently affected by monetary policy they will change credit availability differently across firms (i.e., the bank lending channel). The bank lending channel implies that banks, faced with a change in deposits modify the quantity of loans offered (i.e., bank loan supply shifts inwards). Bank-dependent firms should be more affected then less-bank-dependent firms.[17] Moreover, due to the interest rate changes, the value of the collateral firms can pledge is altered. Not all firms need to pledge the same amount of collateral to obtain loans. Young, small and opaque firms will especially need to post more collateral. Value changes in their collateral are therefore a more important determinant of the chances of obtaining a loan and therefore of investment (the so called financial accelerator or balance sheet channel, see, e.g., Bernanke, Gertler and Gilchrist, 1999).

Evidence on these different mechanisms can be found throughout the literature. Several existing studies show that firm liquidity and the strength of its balance sheet are key for access to external finance and investment. The challenge in this literature is distinguishing changes in access to finance related to real shocks versus those due to monetary shocks. Kashyap, Lamont and Stein (1994) find that available liquidity of firms was especially important for firms without bond rating during the 1982-83 recession which they argue was mainly caused by a monetary tightening. Gertler and Gilchrist (1994) find that investment in inventories is sensitive to liquidity during low growth periods. Such evidence, based on business cycle shocks, can at best offer partial evidence on the possible impact of monetary policy on different types of firms.

 A rather limited number of papers in the literature finds support for heterogeneous firm behaviour *directly* related to monetary policy (and even fewer related to monetary policy shocks). Monetary tightening in principle should reduce the collateral value firms can pledge to external borrowers through its impact on asset prices. Using data for firms in the U.S., Oliner and Rudebusch (1994) show that after monetary tightenings (which they define as quarters with increases in the term spread of at least 65 basis points) small firms react more to their own cash flow, but they find no increased sensitivity for large firms. There is also evidence for some euro area countries. Rondi, Sack, Schiantarelli and Sembenelli (1998) use balance sheet data of private Italian firms over the period 1968 to 1991 to illustrate that, after a monetary tightening, small firms reduce short term debt. In addition, both inventory and fixed investment becomes more sensitive to internal liquidity in periods of policy rate hikes. These papers focus only on the broader credit channel transmission of monetary policy but ignore the traditional interest rate channel. Chatelain, Generale, Hernando, von Kalckreuth and Vermeulen (2003) summarize a set of results on the effect that monetary policy has through both the traditional interest rate channel and the broad credit channel in the four largest euro area countries (Germany, France, Italy and Spain). They find that most of the effect of monetary policy is transmitted through the traditional interest rate channel (through user cost changes) as well as through cash flow of firms. This latter finding points to the importance of indirect aggregate demand effects also for firms.

---

[17] For evidence on the effect of bank tightening during the financial crisis, see Buca and Vermeulen (2017).

A more recent literature has looked into collateral value changes for small firms and their role for investment (again collateral value changes can and do occur also independently of monetary policy). The self-employed often use their own house as collateral to get a loan for their business. This observation opens the way for a residential collateral channel by which movements in the value of housing collateral (caused by real or monetary shocks) can change borrowing capacity of small firms. In a recent paper, Bahaj, Foulis and Pinter (2017) using UK data estimate that a 1 pound increase in the value of residential real estate of firms directors raises the firms' investment and wage bill by 0.03 pounds. In another recent paper Ottonello and Winberry (2017) show that firms with low leverage or high credit ratings are the most responsive with their investment to monetary policy shocks. This study uses identified monetary policy shocks and interacts them with the leverage of firms in a regression to explain investment. In their sample of U.S. firms they find that the 50% least-leveraged firms account for nearly all of the total response to monetary policy. They argue that this is caused by default risk. Higher leveraged firm have higher default risk and firms with higher default risk react less to monetary policy shocks because their marginal cost of borrowing increases steeply in additional leverage.

6. Concluding remarks

In this paper we argued that all monetary policy decisions tend to have re-distributional consequences. Expansionary monetary policy, both standard and non-standard, tends to reduce income and wealth inequality.

We also demonstrated that an indirect effect, related to the general equilibrium impact of monetary policy on households' income through an expansion in aggregate demand, is likely to be the most important determinant of the distributional consequences of standard monetary policy. The channels of transmission are less well understood for unconventional tools of monetary policy such as quantitative easing. It is however reasonable to believe that indirect effects may be even stronger than for standard policy, because direct effects are linked to changes in short-term rates that are normally absent for quantitative easing.

Our results also suggest that a few, hand-to-mouth households with low liquidity account for the lion share of the consumption response to monetary policy shocks. Monitoring the composition of household balance sheets and the heterogeneous impact of monetary policy on households is therefore important to gain a better understanding of the monetary policy transmission mechanism.

References

Adam K. and P. Tzamourani (2016), Distributional consequences of asset price inflation in the euro area, *European Economic Review*, Vol (89), 172-192.

Adam, Klaus and Zhu, Junyi (2016). "Price level changes and the redistribution of nominal wealth across the euro area", *Journal of the European Economic Association*, Volume 14, Issue 4, August 2016, pp 871-906.

Agarwal, Sumit, Liu, Chunlin, and Souleles, Nicholas S. (2007). "The Reaction of Consumer Spending and Debt to Tax Rebates—Evidence from Consumer Credit Data", *Journal of Political Economy* 115, no. 6 (2007): 986-1019. doi:10.1086/528721.

Auclert, Adrien (2017). "Monetary Policy and the Redistribution Channel", *Working Paper*, No 23451, NBER.

Bahaj, Saleem, Foulis, Angus and Pinter, Gabor (2017). "Home Values and Firm Behaviour", *Working Paper*, No 679, Bank of England, October.

Baumeister, Christiane and Benati, Luca (2010). "Unconventional Monetary Policy and the Great Recession - Estimating the Impact of a Compression in the Yield Spread at the Zero Lower Bound", *Working Paper*, No 1258, ECB, Frankfurt am Main, October.

Bernanke, Ben S., Gertler, Mark and Gilchrist, Simon (1999). "The Financial Accelerator in a Quantitative Business Cycle Framework", *Handbook of Macroeconomics*, Elsevier, Vol. 1(C), pp. 1341-1393.

Bernanke, Ben S. and Kuttner, Kenneth N. (2005). "What explains the stock market's reaction to federal reserve policy?", *Journal of Finance*, Vol. 60, pp. 1221-1257.

Blundell, Richard, Pistaferri, Luigi, and Preston, Ian (2008). "Consumption Inequality and Partial Insurance", *American Economic Review*, Vol. 98(5), pp. 1887-1921.

Blundell, Richard, Pistaferri, Luigi and Saporta-Eksten, Itay (2016). "Consumption Inequality and Family Labor Supply", *American Economic Review*, Vol. 106(2), pp. 387-435.

Bracha, Anat and Cooper, Daniel (2014). "Asymmetric Responses to Income Changes: The Payroll Tax Increase versus Tax Refund in 2013", *Economics Letters*, Vol. 124(3), pp. 534-538.

Browning, Martin and Crossley, Thomas F. (2001). "The Life-Cycle Model of Consumption and Saving", *Journal of Economic Perspectives*, Vol. 15(3), pp. 3-22.

Brunnermeier, Markus K. and Sannikov, Yuliy. "The I Theory of Money", mimeo.

Bucă, Andra and Vermeulen, Philip (2017). "Corporate investment and bank-dependent borrowers during the recent financial crisis", *Journal of Banking & Finance*, Elsevier, Vol. 78(C), pp. 164-180.

Bunn, Philip, Le Roux, Jeanne, Reinold, Kate and Surico, Paolo (2017). "The Consumption Response to Positive and Negative Income Changes", *Working Paper*, No 645, Bank of England, February.

Casiraghi, Marco, Eugenio Gaiotti, Lisa Rodano, and Alessandro Secchi (2018). "A 'Reverse Robin Hood'? The Distributional Implications of Non-Standard Monetary Policy for Italian Households", *Journal of International Money and Finance,* forthcoming.

Chatelain, J-B, Generala, A., Hernando, I., von Kalckreuth, U. and Vermeulen, P. (2003). "New findings on firm investment and monetary transmission in the euro area", *Oxford Review of Economic Policy*, Vol. 19, No 1.

Christelis, Dimitris, Georgarakos, Dimitris, Jappelli, Tullio, Pistaferri, Luigi and Van Rooij, Maarten (2018). "Asymmetric Consumption Effects of Transitory Income Shocks", *Economic Journal*, forthcoming.

Cloyne, James, Ferreira, Clodomiro and Surico, Paolo (2016). "Monetary Policy When Households Have Debt: New Evidence on the Transmission Mechanism". *Working Paper*, No 589, Bank of England, August.

Coibion, Olivier, Gorodnichenko, Yuriy, Kueng, Lorenz and Silvia, John (2017). "Innocent Bystanders? Monetary Policy and Inequality", *Journal of Monetary Economics*, Vol. 88(C), pp. 70-89.

Doepke, Matthias and Schneider, Martin (2006). "Inflation and the Redistribution of Nominal Wealth", *Journal of Political Economy*, Vol. 114(6), pp. 1069-1097.

Domanski, Dietrich, Scatigna, Michela and Zabai, Anna (2016). "Wealth inequality and monetary policy", *BIS Quarterly Review*, March.

European Central Bank (2009). "Housing Finance in the Euro Area", occasional paper 101, European Central Bank.

Fagereng, Andreas, Holm, Martin B. and Natvik, Gisle J. (2016). "MPC Heterogeneity and Household Balance Sheets", *Discussion Paper*, No 852, Statistics Norway.

Fuster, Andreas, Greg Kaplan, and Basit Zafar (2018). "What Would You Do With $500? Spending Responses to Gains, Losses, News and Loans", NBER Working Paper No. 24386.

Georgarakos, Dimitris and Tatsiramos, Konstantinos (2018). "Monetary policy transmission to consumer sentiment and durable consumption", mimeo.

Gertler, Mark and Gilchrist, Simon (1994). "Monetary Policy, Business Cycles, and the Behaviour of Small Manufacturing Firms", *Quarterly Journal of Economics*, Vol. 109(2), pp. 309-340.

Gomez, Matthieu, Landier, Augustin, Sraer, David A. and Thesmar, David (2016). "Banks' Exposure to Interest Rate Risk and the Transmission of Monetary Policy", *Working Paper Series*, No 13, ESRB, June.

Gornemann, Nils, Kuester, Keith and Nakajima, Makoto (2016). "Doves for the Rich, Hawks for the Poor? Distributional Consequences of Monetary Policy", *International Finance Discussion Papers*, No 1167, Board of Governors of the Federal Reserve System (U.S.A).

Havránek, Tomáš (2015). "Measuring Intertemporal Substitution: The Importance of Method Choices and Selective Reporting", *Journal of the European Economic Association*, Vol. 13, pp. 1180-1204.

Household Finance and Consumption Network (2016). "The Household Finance and Consumption Survey: results from the second wave", *Statistics Paper Series*, No 18, ECB, Frankfurt am Main, December.

Jappelli, Tullio and Pistaferri, Luigi (2010). "The consumption response to income changes", Annual Review of Economics, 479-506.

Jappelli, Tullio and Pistaferri, Luigi (2014). "Fiscal Policy and MPC Heterogeneity", *American Economic Journal: Macroeconomics*, Vol. 6(4), pp. 107-36.

Kaplan, Greg and Violante, Giovanni L (2018). "Microeconomic Heterogeneity and Macroeconomic Shocks", *Journal of Economic Perspectives*, in preparation.

Kaplan, Greg, Moll, Benjamin, and Violante, Giovanni L. (2018). "Monetary Policy According to HANK", *American Economic Review*, Vol. 108(3), pp. 697-743.

Kaplan, Greg, Violante, Giovanni L., and Weidner, Justin (2014). The Wealthy Hand-to-Mouth. *Brookings Papers on Economic Activity*, Vol. 48 (Spring) 77-153.

Kashyap, A., Lamont, O. and Stein, J. (1994). "Credit Conditions and the Cyclical Behaviour of Inventories", *Quarterly Journal of Economics*, Vol. 109(3), pp. 565-592.

Lenza, Michele and Slacalek, Jiri (2018). "How does monetary policy affect income and wealth inequality? Evidence from the euro area", European Central Bank, mimeo.

Luetticke, Ralph (2017). "Transmission of Monetary Policy with Heterogeneity in Household Portfolios", mimeo.

Misra, Kanishka, and Surico, Paolo (2014). "Consumption, Income Changes, and Heterogeneity: Evidence from Two Fiscal Stimulus Programs", *American Economic Journal: Macroeconomics*, Vol. 6(4), pp. 84-106.

Mumtaz, Haroon and Theophilopoulou, Angeliki (2017). "The impact of monetary policy on inequality in the UK – An empirical analysis", *European Economic Review*, Vol. 98, pp. 410-423.

Oliner, Stephen D. and Rudebusch, Glenn (1996). "Is there a broad credit channel for monetary policy?", FRBSF Economic Review.

Ottonello, Pablo and Winberry, Thomas (2017). "Financial heterogeneity and the investment channel of monetary policy", *Meeting Papers*, No 598, Society for Economic Dynamics.

Petev, Ivaylo, Pistaferri, Luigi, and Saporta-Eksten, Itay (2011). "Consumption and the Great Recession: An Analysis of Trends, Perceptions, and Distributional Effects", *The Great Recession*, Russell Sage Foundation, pp. 161-195.

Romer, Christina D. and Romer, David H. (2004). "A New Measure of Monetary Shocks: Derivation and Implications", *American Economic Review*, Vol. 94(4), pp. 1055-1084.

Rondi Laura, Sack, Brian, Schiantarelli, Fabio and Sembenelli, Alessandro (1998). "Firms' Financial and Real Responses to Monetary Tightening: Evidence for Large and Small Italian Companies", *Giornale degli Economisti*, Bocconi University, Vol. 57(1), pp. 35-64, April.

Sahm, Claudia R., Shapiro, Matthew D. and Slemrod, Joel (2010). "Household Response to the 2008 Tax Rebate: Survey Evidence and Aggregate Implications", *Tax Policy and the Economy*, Vol. 24, pp. 69-110.

Shapiro, Matthew D. and Slemrod, Joel (1995). "Consumer Response to the Timing of Income: Evidence from a Change in Tax Withholding", *American Economic Review*, Vol. 85(1), pp. 274-283.

Shapiro, Matthew D. and Slemrod, Joel (2003). "Did the 2001 Tax Rebate Stimulate Spending? Evidence from Taxpayer Surveys", *Tax Policy and the Economy*, Vol. 17, pp. 83-109.

Souleles, Nicholas S. (1999). "The Response of Household Consumption to Income Tax Refunds", *American Economic Review*, Vol. 89(4), pp. 947-958.

Souleles, Nicholas S. (2002). "Consumer Response to the Reagan Tax Cuts", *Journal of Public Economics*, Vol. 85(1), pp. 99-120.

Stephens, Melvin (2001). "The Long-Run Consumption Effects of Earnings Shocks", *Review of Economics and Statistics*, Vol. 83(1), pp. 28-36.

Tzamourani, Panagiota (2018). "The Interest Rate Exposure of Euro Area Households", Deutsche Bundesbank, mimeo.

Miguel Ampudia
European Central Bank, Frankfurt am Main, Germany; email: miguel.ampudia@ecb.europa.eu

Dimitris Georgarakos
European Central Bank, Frankfurt am Main, Germany; email: dimitris.georgarakos@ecb.europa.eu

Jiri Slacalek
European Central Bank, Frankfurt am Main, Germany; email: jiri.slacalek@ecb.europa.eu

Oreste Tristani
European Central Bank, Frankfurt am Main, Germany; email: oreste.tristani@ecb.europa.eu

Philip Vermeulen
European Central Bank, Frankfurt am Main, Germany; email: philip.vermeulen@ecb.europa.eu

Giovanni L. Violante
Princeton University, New Jersey, United States; email: violante@princeton.edu