MONETARY POLICY AND INEQUALITY: FINANCIAL CHANNELS

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Abstract

This paper analyses two-way interactions between monetary policy and inequality in selected advanced economies. The analysis focuses on the effects of monetary policy on inequality over the business cycle via its impacts on returns on assets, the cost of debt servicing and asset prices. While monetary policy easing has *a priori* ambiguous effects on income and net wealth inequality, in practice these effects are estimated to be small. A house price increase generally reduces net wealth inequality, while the opposite is true for increases in stock and bond prices. Higher inequality can reduce the effectiveness of monetary policy stimulus in boosting private consumption, but such effects are estimated to be small.

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1. Introduction

The highly accommodative stance of monetary policy in advanced countries over recent years has brought interactions between inequality and monetary policy into the spotlight. In particular, quantitative easing has been perceived to increase inequality given its apparent strong effects on asset prices, and very low interest rates have attracted criticism from savers. This has led central bankers to pay attention to inequality (Coeuré, 2012; Bullard, 2014; Yellen, 2014; Panetta, 2015). Indeed, monetary policy has the potential to affect income and wealth inequality, at least temporarily. At the same time, inequality can influence the effectiveness of monetary policy as less wealthy and lower-income households are less exposed to monetary policy changes.

Against this background, this paper analyses the two-way interactions between inequality and monetary policy in the light of the growing empirical and theoretical literature. Regarding the impact of monetary policy on inequality, the main focus is on financial channels via changes in returns on assets, debt interest payments and asset prices, rather than via its impact on employment and inflation.

The remainder of the paper is organised as follows. Section 2 summarises main drivers of growing inequality and selected papers on the broader effects of monetary policy on inequality. Section 3 discusses theoretical channels how monetary policy affects inequality. It also presents stylised country-specific simulations on how changes in interest rates and asset prices affect income and net wealth inequality. Section 4 investigates the impact of inequality on the effectiveness of monetary policy in boosting household consumption. Finally, Section 5 concludes.

2. Literature review

Rising income and wealth inequality in advanced economies has attracted considerable attention from researchers and policy makers. Since the 1970s, both wealth and income inequality have steadily increased in most OECD countries (OECD, 2015). Initial levels of inequality and the magnitude of their increase

have varied across countries, with generally greater inequality and a larger rise in the United States than in Europe. The financial crisis has exacerbated income and wealth inequality in many advanced economies (Piketty, 2014; OECD, 2015). The secular rise in income inequality is attributable to skill-biased technical change (Acemoglu, 2002), increased global trade (Feenstra and Hanson, 2004), de-unionisation (Card, 2001; Jaumotte and Osorio Buitron, 2015), and population ageing (Heathcote et al., 2010; Karahan and Ozkan, 2013). The increase in post-tax income inequality also reflects the decline in top marginal personal income tax rates. Increasing wealth inequality is mainly explained by strong capital gains (especially for stocks), with a lesser role played by higher income inequality, falling relative ability to save for most households and inheritances (Smith, 2004; Saez and Zucman, 2014).

Although monetary policy is not usually given as a reason for greater inequality, the empirical literature on the topic has been growing in recent years. One consistent finding is that tighter monetary policy tends to increase labour income inequality. For instance, Coibion *et al.* (2012) find that contractionary US monetary policy increases total income inequality and that policy shocks account for a non-trivial share of cyclical fluctuations in inequality in the United States.[2] They also show that contractionary monetary policy raises labour income at top deciles, which may be linked to differences in the substitutability of skilled and unskilled labour with capital. These results are consistent with findings by Carpenter and Rodgers III (2004) which show that interest rate hikes by the Federal Reserve disproportionately increase unemployment rates for minorities and less-skilled workers. Similarly, Heathcote *et al.* (2010) report that in the United States earnings of the lowest-income individuals are most responsive to business cycle fluctuations. Also, Gornemann et al. (2014) demonstrate in a theoretical New-Keynesian sticky-price business cycle model with rich household heterogeneity that contractionary monetary policy leads to higher inequality of earnings, income, wealth and consumption.

2. Coibion *et al.* (2012) estimate how monetary policy shocks, purged of anticipatory effects related to economic conditions, affect changes in Gini coefficients and other inequality measures for total income and labour earnings in the United States between the early 1980s and 2008.

Regarding net wealth inequality, Adam and Tzamourani (2015) demonstrate that increases in asset prices have conflicting impacts on inequality. They find that a 10% increase in the value of housing decreases the euro area Gini coefficient for net wealth by 0.4 Gini point, as housing tends to be held by middle-decile households. In contrast, a 10% rise in stock prices increases the coefficient by 0.3 Gini point, while a change in bond prices has no effect. Bivens (2015) also suggests that asset price increases induced by the large-scale asset purchases by the Federal Reserve likely increased wealth inequality in the case of stocks but reduced it in the case of housing.

Monetary policy can also affect inequality via its impact on inflation. In case of income inequality, theoretical channels and empirical evidence are not clear about the direction of the effects, and they tend to suggest that the effects are negligible for low-inflation countries (Bulíř and Gule, 1995; Parker, 1999; Bulíř, 2001; and Galli and van der Hoeven, 2001). In contrast, unanticipated inflation has the potential to diminish wealth inequality by transferring wealth from lenders to borrowers due to the reduced real value of nominal assets and liabilities. For instance, Doepke and Schneider (2006) show that positive inflation surprises benefit young, middle-class households with fixed-rate mortgage debt, but hurt rich and old households. However, with a fully unanticipated shock, stock holders, who tend to be in the upper net wealth deciles, always gain.

Less empirical research has been done to investigate the role of inequality for the effectiveness of monetary policy. Auclert (2015) proposes a theoretical model which demonstrates that inequality can have aggregate effects when marginal propensity to consume (MPC) covary across households with balance-sheet exposures to aggregate shocks. There also are papers showing that MPC depends on household balance sheets (Mian and Sufi, 2011; Mian *et al*., 2013; and Carroll *et al.*, 2014a, 2014b), implying that inequality may reduce the effectiveness of monetary policy.

3. Effects of monetary policy on inequality

3.1. Challenges with the assessment

Assessing the impact of monetary policy on income and net wealth inequality is conceptually challenging for several reasons. First, while monetary policy affects macroeconomic aggregates, which influence income and net wealth distributions, quantifying its exact and lasting impact on these aggregates is difficult, especially for unconventional measures. This reflects, among other things, challenges with singling out pure monetary policy shocks from reactions of economic variables to other shocks hitting the economy. Even so, the effects of changes in policy interest rates on the real economy and asset prices have been extensively researched. Country-specific estimates vary considerably among studies, implying a high degree of uncertainty. Unconventional monetary policy measures are less researched, and there is less agreement about their effects. For instance, quantitative easing is generally found to have increased prices of government bonds, but the size and duration of these effects are highly uncertain (Martin and Milas, 2012). Moreover, its implications for other asset classes, real GDP growth and inflation are less researched and there is less supportive evidence that quantitative easing affected them. Another source of uncertainty about monetary policy effects stems from the fact that they are likely to vary over time, depending on the phase of a cycle and the functioning of the financial sector and product and labour markets.

Second, the role of monetary policy should be viewed against a counterfactual with no change of the monetary policy stance (Bivens, 2015). In the absence of monetary policy intervention, a larger variation in inequality over the business cycle would be likely.

Third, the direct effects of monetary policy on income and wealth inequality can go in opposite directions over different phases of a business cycle. In a downturn, monetary policy easing is expected to reduce income inequality (i.e. to lessen the downturn-related increase in income inequality). At the same time, the easing is expected to raise asset prices from downturn-induced subdued levels and thus potentially increase net wealth inequality (i.e. limit the downturn-induced reduction in wealth inequality),

if rising asset prices make the distribution of net wealth more unequal. This tends to be the case for stocks and bonds but not for real estate (Section 3.5.3). The opposite effects are expected when monetary policy is tightened in the boom phase.

Fourth, monetary policy could have longer-term effects over several business cycles. This may arise due to asymmetric effects of policy changes over the business cycle. Empirical findings suggest that monetary policy tightening may slow the economy more than an equivalent monetary policy easing strengthens the economy (Morgan, 1993; and Karras, 1996).[3] Such asymmetric monetary policy effects seem to exist not only for real GDP growth but also for nominal variables (Tenreyro and Thwaites, 2013). The asymmetric effectiveness may imply that monetary policy is less effective in reducing income inequality during downturns than it is in increasing income disparities in upturns. Consequently, symmetric monetary policy may contribute to rising income inequality over the entire business cycle. Similarly, longer-term effects may arise when monetary policy stimulus and contraction are asymmetric over the business cycles. For instance, monetary policy tends to react more to declines than to increases in stock prices (Ravn, 2012; 2014). This asymmetry may therefore contribute to a secular rise in wealth inequality, as stock prices are prevented from falling too much in downturns but their increases are not tempered in booms.

Finally, the choice of inequality measure is not straightforward. The most common measure is the Gini coefficient, which takes values between 0 for full equality (all households receive the same income) to 1 for full inequality (one household receives all income). The coefficient reflects mainly developments in the middle of the distribution. Moreover, it is problematic when the analysed distribution includes negative values, which can be the case with net wealth (Chen et al., 1982). Other possible measures include the

3. The limited effectiveness of monetary policy in the downturn can be explained by the fact that prices are less flexible downwards than upwards, and by confidence and credit channels, which are more detrimental to growth in recessions than they are supportive to growth in booms. Empirical evidence indicates that the credit channel (financial accelerator hypothesis) is more relevant in bad times (Gertler and Glichrist, 1994; and Peersman and Smets, 2005).

mean-to-median (M2M) ratio or inter-decile ratios, e.g. the ratio of 10th decile to the 5th decile (D10/D5) and the ratio of 10th decile to the 1st decile (D10/D1). The higher these measures are, the more unequal is the distribution. They are, however, problematic in some cases. The M2M ratio and the D10/D1 ratio reacts strongly to minute changes when the bottom half of the distribution is close to zero. Also, when households in the middle of the distribution are affected differently than households at the bottom of the distribution, then the D10/D1 and D10/D5 measures can move in the opposite direction.

3.2. Monetary policy channels affecting income inequality

Monetary policy-induced fluctuations in business cycles can affect income inequality as income sources vary across the income distribution and these sources react differently to monetary policy changes. Households at the bottom of the distribution tend to depend mainly on social transfers, while households at the top of the distribution depend more on self-employment, capital and property income (O'Farrell et al., 2016). Regarding wages, the lowest-income individuals are most responsive to business cycle fluctuations (Section 2). However, rising income inequality in recessions could be mitigated by larger declines in profits compared with wages. Moreover, households at the bottom of the distribution gain proportionally more from higher social transfers. Indeed, the US experience during the Great Recession suggests that, according to the US Federal Reserve Survey of Consumer Finances, between 2007 and 2010 average wages declined by around 5% in nominal terms, and income from dividends by around twice as much and income from business activities around three times as such, while average transfers increased by 50%.

The focus in this paper is on financial channels as the link between monetary policy and wage income across the income distribution is difficult to establish and the concern of monetary policy effects on inequality arose due to very low interest rates and high asset prices.

3.3. An ambiguous theoretical impact on income inequality via financial channels

Monetary policy effects via returns on assets and debt servicing costs on income inequality are not clear *a priori*. The impact of an interest rate cut on the income distribution depends on the relative size and distributions of assets, liabilities and income as illustrated in Figure 1. The underlying assumption is that all assets pay interest and all liabilities are at variable rates. The size of the effects depends on the magnitude of interest rate changes and the results are approximatively scalable to different interest rate changes.

The upward sloping line in Figure 1 shows where the shares of interest-paying assets minus liabilities (by income group)[4] are equal to that of income shares (by group) and there is no effect on the income distribution. The slope and shape of the line is purely illustrative and it depends on the skewness of income. It is downward-sloping when the skewness of income is high. A change in policy rates has no effect on inequality in two knife-edge scenarios: *i*) where the distributions of assets and liabilities (by income decile) are equal and both the level of assets and liabilities are equal (point X in Figure 1); and *ii*) the level of assets and liabilities differ, but the distribution of assets and liabilities are also equal to that of income (not shown in Figure 1).

In the area above the line, net wealth (referring here to households' interest-paying assets minus liabilities) is more skewed (to high-income groups) than income, so a fall in interest rates reduces inequality. This happens when liabilities are sufficiently large relative to assets, liabilities are less skewed to top earners than income (as indicated on the right-hand vertical axis) and assets are more skewed or only slightly less skewed to top earners than income (as indicated on the left-hand vertical axis). This stems from lower-income households benefiting more from lower debt servicing costs (net of lower returns on assets). Similarly, inequality is reduced when assets are sufficiently large (relative to liabilities) and more

4. Due to the presence of negative values, defining the inequality of the net wealth distribution is problematic. For the purpose of this section, negative net wealth that is skewed toward top (bottom) income groups is considered equivalent to positive net wealth skewed toward bottom (top) income groups.

skewed to top earners than income, and liabilities are less skewed or only slightly more skewed than income.

In the area below the line, net wealth is less skewed than income, so lower interest rates increases inequality. This happens when liabilities are sufficiently large relative to assets, liabilities are more skewed to top earners than income and assets are less skewed or only slightly more skewed than income; or when assets are sufficiently large relative to liabilities and less skewed to top earners than income, and assets are less skewed than income.

[FIGURE 1 HERE]

3.4. An ambiguous theoretical impact on net wealth inequality

The effects of monetary policy-induced asset price changes on net wealth inequality depend in a complex way on the relative distributions of the assets and liabilities, which shape leverage across the net wealth distribution. In particular, the rise in asset prices can either increase or reduce net wealth inequality. These interdependences are illustrated below for the case of an asset price increase. Opposite effects hold true when an asset price declines.

Starting with a simple case where all assets are distributed in the same way and their prices change uniformly, implying that there is effectively only one asset, an asset price rise has no effect on the net wealth distribution if the asset and liabilities are distributed in the same way (Figure 2, Panel A). In this case, leverage does not vary across the distribution. In contrast, a general rise in asset price reduces net wealth inequality, if liabilities are more skewed to the bottom of the net wealth distribution than assets. This stems from high leverage at the bottom of the net wealth distribution. Consequently, asset price appreciation increases net wealth for poor households more than for wealthy households. This effect is stronger the more differentiated are the distributions. The direction of the effect does not depend on the relative size of assets and liabilities. However, the relative size does affect the magnitude of the effect in a possibly non-linear manner, and is largest when assets and liabilities are equal in size.

Inferences about the monetary policy impact on net wealth inequality become more complicated when different asset classes vary in terms of their distribution. Where there are two asset types and no liabilities, increasing the price of the more skewed asset increases inequality (Figure 2, Panel B). This is the opposite effect to Panel A. The direction of the effect does not depend on the relative size of assets but affects its magnitude. The effect is largest when both assets are equal is size and it diminishes when the amount of one asset is very large or very small. In the latter case, we approach in the limit the case where there is only one asset and no liabilities and then an asset price change has no impact on the net wealth distribution.

[FIGURE 2. HERE]

With two assets (A1 and A2) and liabilities present, the distributional effect of an increase in the price of an asset (A1) effectively depends on A1's distribution relative to that of "sub net wealth" calculated as the difference between the other asset (A2) and total liabilities (L) (Figure 2, Panel C). The inferences are analogous to the situation of two asset classes and no liabilities depicted in Panel B. Rising price of A1 has no effect on total net wealth inequality when the skewness of A1 and sub net wealth are the same. This is represented by the dark upward-sloping line. It depicts the various combinations of the skewness of A2 and L that lead to sub net wealth having the same skewness as A1 for a given aggregate size of A2 and L. The latter two determine the slope of the line. The line is flatter (as the dark line in Panel C) when A2 is larger than liabilities, implying that the skewness of sub net wealth is determined predominantly by the skewness of A2. The line is steeper when liabilities are larger (the dashed line). If sub net wealth is more skewed than A1 (the area above the line), then the rising price of A1 reduces inequality, and *vice versa*. The shaded top left area represents where sub net wealth is more skewed than A1 regardless of the relative size of assets and liabilities, with the opposite case in the lower right corner.

Another way to analyse the distributional implications of the price increase of A1 with two assets and liabilities is to view assets in aggregate. In this case, given a different skewness of the two assets, the increase in price of the one asset will result in an uneven appreciation of aggregate assets across the net wealth distribution. The skewness of aggregate asset will depend on the relative size of the two assets and

their relative skewness. In the top left shaded area, asset appreciation is always larger and leverage always higher for poorer households than for wealthy households. Consequently, the increase in the asset price reduces inequality. In the area directly below, given the more unequal distribution of A1 than of A2, the A1 price increase boosts values of aggregate assets more for wealthy households. At the same time, the possible combinations of relative skewness of the two assets and liabilities imply lower aggregate leverage for wealthy households which reduces inequality when asset prices increase. In this case, the relative sizes and skewness of A1, A2 and liabilities determine which of the two effects dominates, implying that inequality may either increase or decline following the increase in the price of A1.

In general, an appreciation of assets that are more equally distributed (such as real estate) benefits households in the middle of the net wealth distribution, reducing inequality (Section 3.5.3). This is in contrast to assets which are highly skewed towards wealthy households (such as bonds and stocks) and whose value gains increase inequality. Consequently, effects of changes in prices of assets with very different distributions can offset each other.

Net wealth distribution effects stemming from policy-induced asset price changes depend also on how prices of particular assets are affected and on the structure of asset portfolios. Monetary policy is likely to affect asset prices differently depending on the asset class. For instance, a 100-basis point fall in policy rates is estimated to boost US and UK house prices temporarily by between 2% and 4% (Aoki *et al.*, 2002, 2004), while the same monetary policy easing increases stock prices by between 4% and 10% (Rigobon and Sack, 2004; and Bernanke and Kuttner, 2005).

3.5. Empirical effects of monetary policy on inequality

The discussion above highlights that it is very difficult to know *a priori* what the impact of monetary policy induced changes in interest rates and asset prices is on the income and net wealth distributions. Thus, the assessment of the impact is ultimately an empirical question. To the extent countries differ with

respect to the composition and distribution of assets and debt, monetary policy may have contrasting effects on inequality.

3.5.1. Methodology and data

The potential impacts of monetary policy on income and net wealth inequality in Europe and North America are measured by changes in the Gini coefficient for the income and net wealth distribution, stemming from a given change in interest rates and asset prices, respectively. These calculations are based on actual income and net wealth distributions measured with the 2012 Canadian Survey of Financial Security, the 2010 ECB Household Finance and Consumption Survey, the 2010-12 UK Wealth and Assets Survey[5] by the Office for National Statistics, and the 2013 US Federal Reserve Survey of Consumer Finances.

Regarding income distribution, only effects via reduced debt servicing costs and returns on financial assets are taken into account, ignoring effects via dividends and rental income but also via employment, prices, GDP growth and exchange rates. It is assumed that interest rates are cut by 1 and 4 percentage points and that there is full and immediate pass-through to interest payments on total outstanding debt and to returns on interest-paying assets in each household income decile. Therefore, estimates serve as an upper bound for the direct impact, when the net effect is positive. The results are symmetric for interest rate increases. For Canada, interest-paying assets include all deposits, bonds and savings accounts. For euro area countries, they include savings accounts (excluding sight accounts), bonds and mutual funds invested mainly in bonds and money markets. For the United Kingdom, they include savings accounts, national savings products, bonds and cash investment savings accounts. For the United States, they include call and savings accounts (excluding checking accounts), bonds and mutual funds invested in bonds.

5. The UK Wealth and Assets Survey differs in that assets in businesses owned by households are not included.

In reality, at any point in time, the impact depends on the speed of the pass-through from policy rates to returns on assets and to the cost of debt. On the asset side, for instance, lower bond yields are passed through to income only when bonds held by households mature and new bonds are purchased. Thus, the speed is determined by the maturity structure of bonds. On the liability side, the prevalence of variable-rate mortgages accelerates the pass-through. However, even with fixed-rate mortgages, when interest rates are cut households can possibly re-mortgage and benefit from lower interest rates, though this may take more time. Re-mortgaging will not take place when interest rates are increased and thus this effect is asymmetric. Variable-rate mortgages predominate in Italy and the Netherlands, while in other countries fixed-rate mortgages dominate (O'Farrell *et al.*, 2016). In the United States, they tend to be pre-payable though, allowing borrowers to take advantage of lower rates by refinancing (Fuster and Vickery, 2014).

The simulations refer to gross income as reported in household surveys, which includes market income, including property income, and transfers but it does not account for taxes and debt servicing costs. The simulations of interest rate cuts also involve marginal changes to debt servicing costs, and in this sense they refer to the disposable income concept.

Regarding effects on the net wealth distribution, it is assumed that households do not alter their asset portfolios in response to asset price changes. Simulations of increases in prices of the three asset categories assume the following definitions of the assets. For Canada, bonds include only directly held bonds; real estate includes main residence and other real estate; and stocks include stocks and all mutual funds. For euro area countries, bonds are considered to include bonds and mutual funds mainly invested in bonds; real-estate includes main residence, other real estate and mutual funds mainly invested in real estate; and stocks include directly held stocks and mutual funds mainly invested in stocks. For the United Kingdom, bonds include bonds and gilts, including fixed-term investment bonds; real estate excludes assets in privately held businesses; and stocks include stocks, insurance products, unit investment trust and Investment Individual Savings Account. For the United States, bonds include directly held bonds and

mutual funds invested in bonds; real estate includes residential and non-residential estates; and stocks include directly held stocks and mutual funds invested in stocks.

3.5.2. Results for income inequality

The results suggest that 1-percentage point lower interest rates reduce income inequality in Canada, the United Kingdom, the United States and around half of the analysed euro area countries, but increase it in remaining euro area countries (Table 1). The direction of changes in the Gini coefficient reflects differences in the distribution of interest-paying assets and total debt across income deciles. In Canada and few euro area countries, the change in the Gini coefficients changes sign when rates are cut by 4 percentage points. With a bigger interest rate cut, income inequality rises as some households with initially very large debt but few assets and low incomes gain massively, shifting them to top deciles and increasing their income compared with lower deciles households. This may reflect the fact that the assumption of a full pass-through of interest rate cuts to marginal changes in servicing costs may not be realistic, as these households may pay very low or no interest rates, for instance due borrowing from relatives. Alternatively, there might be problems with reporting of income and debt.

The changes in income stemming from lower interest rates have a limited net impact on the income distribution. With the 1-percentage point cut in interest rates, Gini coefficients change by at most by 0.15 Gini point in most countries with the exception of Belgium where the coefficient rises by 0.4 Gini point (Table 1). Even if the interest rate declines by 4 percentage points, these changes are only a tiny fraction of changes observed during the Great Recession for all countries with the exception of Austria, Belgium and Germany. Despite much debt being fixed rate, it is assumed that there is full pass-through as there is scope to renegotiate mortgages. Nevertheless, in practice reductions in debt interest payments may be smaller than in the simulations, potentially changing the sign of the net effect in some countries.

The small impact stems from the fact that there is a weak relationship between debt/income ratios and the position in the income distribution implies that those with high debt generally have high income.

Similarly, on the asset side, although high-income households are more likely to hold interest-paying assets, it is the share of interest earnings in income which determines how inequality is affected.

[TABLE 1 HERE]

The effects of monetary policy on the income distribution would be larger if its stabilising effects on employment are accounted for. For instance, a monetary policy-induced lowering of the unemployment rate by 1 percentage point could reduce the Gini coefficient for market income by around 0.4 Gini point (Huber and Stephens, 2014). This could offset the increase in income inequality due to lower interest rates in several euro area countries examined and the United Kingdom, and reduce income inequality in remaining euro area countries, Canada and the United States by substantially more than as a result of changes in net interest income alone. This is consistent with the findings for Italy. Casiraghi *et al.* (2016) show that monetary policy easing in the euro area reduced income inequality for Italian households via its stimulus to economic activity and employment by more than it increased income inequality via interest income and debt servicing costs.

3.5.3. Results for net wealth

Changes in Gini coefficients due to a 10% increase in the price of – separately – real estate, stocks and bonds, and in the price of all of these assets at the same time, are shown in Table 2. In all countries analysed, an increase in house prices reduces inequality but an increase in stock and bond prices increases inequality. In case of real estate, this is due to the fact that this class of assets is more skewed than liabilities but less skewed than the rest of the assets. This implies that all countries are in the top left shaded area in Panel C of Figure 2. In contrast, stocks and bonds are more skewed than liabilities and the rest of the assets, and thus countries fall below the solid line in the bottom left area of Panel C of Figure 2 when their price increases. As the size of other assets (i.e. excluding stocks and bonds) is considerably larger than liabilities the slope of the line is relatively flat, and most of the area in the lower left quarter of Panel C will correspond to an increase in inequality for an increase in asset prices. The outcomes generally hold

true for alternative measures of inequality, including the D10/D5 ratio, whereby the results are qualitatively the same, apart for Austria in the case of house price increases and Slovenia in the case of bond price increases. These results are broadly in line with findings for the euro area countries analysed by Adam and Tzamourani (2015).[6]

Given the dominant share of real estate in total assets in most countries, when prices of the three asset classes simultaneously increase by 10% net wealth inequality declines. It should be, however, noted that in wealth surveys real estate tends to be over-reported and stocks and bonds under-reported compared with households assets in national accounts (O'Farrell et al., 2016). Thus, the overall effect could be smaller. Cross-country differences in the magnitude of the effects reflect differences in the relative size and skewness of assets and liabilities. For example, although real estate forms a larger share of total assets in Luxembourg than in the Netherlands, a real-estate price increase has a smaller effect in Luxembourg as the distribution of housing more closely matches the distribution of net wealth than is the case in the Netherlands.

[TABLE 2 HERE]

4. Net wealth inequality and the effectiveness of monetary policy

Households are an important channel for the transmission of monetary policy, with final household consumption accounting for around two-thirds of GDP in the main advanced economies. Monetary policy easing can induce households to consume more through income, wealth and credit-access effects. High wealth and income inequality could potentially reduce these effects. With higher inequality, monetary policy is directly transmitted mainly through households with large asset holdings and high incomes, and are thus not liquidity constrained, and with a relatively low MPC.

6. The presented simulations are similar to the work of Adam and Tzamourani (2015) but differ in that households with negative net wealth are not excluded, and the effect of asset price increases on pension and insurance funds are not included.

Changes in interest rates have *a priori* ambiguous effects on income (Section 3.3) and thus on consumption. The net consumption effect depends also on the MPC of borrowers and lenders. The relative importance of debt versus interest-paying assets varies greatly from country to country, but on average almost twice as much debt is held as interest-paying assets in advanced economies, even if total household assets exceed on average household debt. Consequently, interest rate cuts are expected to increase overall income and consumption. Borrowers, especially with high debt servicing costs and large loans, usually have a larger MPC than savers.[7] If this is the case, aggregate consumption can increase even if the income loss of lenders is equal or slightly larger than the income gain of borrowers. Empirical evidence suggests both negative (in Japan) and positive consumption effects (in the United Kingdom and the United States) from interest rate decreases (Aron *et al.*, 2012).

The nexus of high inequality of income, debt and assets can, however, reduce the importance of the income effect. As high-income households hold the most debt,[8] the income effect is concentrated among households that have a low MPC (Tables 3). There is evidence which shows higher income groups have a lower MPC. For instance, di Maggio *et al.* (2015) find that low-income US households and those with high loan-to-value ratios are more likely to increase consumption following an interest rate cut rather than pay back debt. Total interest-paying assets are generally more concentrated than debt. The exception is bank deposits, which are a relatively widely held, but most households invest only small amounts in such assets. Consequently, from a purely income effect perspective, with a more equal asset distribution, lower returns on assets would have a stronger negative impact on consumption.

7. Aladangady (2015) finds that, in the United States, those with debt service ratios in the highest quartile (and so likely to be credit constrained) have an MPC of 0.22, compared with a statistically insignificant MPC for those with low debt service ratios. Mian et al. (2013) find that US zip-code areas with a large average loan-to-value (LTV) ratio (90%) also have a MPC three times that of areas with an average LTV ratio of under 30%.

8. There is a direct causal link between income and debt. Banks are hesitant to lend to low income households as they view them as higher-risk customers, partially due to lower collateral. High debt service ratios are an important factor in a household being denied credit (Johnson and Li, 2010). Banks are found to either discriminate using the interest rate they charge or by rationing debt, using a household's position in the income distribution as a signal of creditworthiness (Coibion et al., 2014). Greater income inequality increases the precision of this signal.

Inequality may also weaken the credit and collateral channels. Low-income households may have a lower elasticity of inter-temporal substitution (EIS). They consume proportionately more necessities than luxury goods and they have a higher credit risk, reflecting lower income and higher chances of becoming unemployed, and thus they face more binding credit constraints. A more equal income distribution would likely imply a higher EIS at the bottom of the income distribution and in turn more effective monetary policy. Monetary policy could also ease access to, and reduce the cost of, credit by boosting asset values and thus improving household wealth and collateral (Bernanke and Gertler, 1995). Households with a relative high MPC may be more exposed to the collateral channel. The role of inequality for these effects are not investigated in this paper, reflecting practical difficulties. In particular, it is challenging to disentangle empirically wealth effects, which impact on a household's demand for loans, from the collateral channel, which impacts on banks willingness to supply credit.

[TABLE 3 HERE]

4.1. Methodology and data

The role of inequality is examined by comparing changes in consumption stemming from changes in net wealth due to a general asset price increase under actual and counterfactual net wealth distributions. A more equal, counterfactual wealth distribution assumes that 10% of the actual net wealth of the top decile is redistributed to other deciles: a quarter of the 10% going equally to the bottom 5 deciles, a half to the 6th, 7th and 8th decile, and a quarter to the 9th decile. For the United States, this would imply reversing the increase in net wealth inequality from 1989 to 2013. Net wealth distributions are based on the latest available microdata from household wealth surveys (Section 3.5.1). Prices of stocks, bonds, managed funds, real estate, and – with the exception of the United Kingdom – private businesses are assumed to increase by 10%, with no change in the value of bank deposits, other assets that are unlikely to be affected by monetary policy (such as vehicles) and liabilities.

The impact of the net wealth increase on consumption is calculated using marginal MPC by net wealth deciles estimated by Carroll *et al.* (2014a, 2014b) (Table 3). Although the MPC is likely to vary depending on which asset increases in value,[9] it is assumed that it is the same for all asset types as estimates of the MPC broken down simultaneously by asset class and decile are unavailable. As consumption data are unavailable from the surveys used, percentage increases are calculated by dividing the simulated aggregate consumption increase by aggregate consumption taken from national accounts for the same year as the survey. Net wealth in national accounts is up to 40% higher than from the surveys for the euro area countries but 25% lower for Canada, 20% lower in the United Kingdom and 10% lower for the United States. This suggests that simulated consumption effects may be moderately underestimated for the euro area and overestimated for Canada, the United Kingdom and the United States.

4.2. Results

The wealth distribution has a small impact on how asset price increases are transmitted to consumption (Table 4). Even if the assumed asset price increase boosts consumption by between 2.5% and 7.2% in the baseline, the changes induced by the shift in wealth distribution is marginal. With the more equal counterfactual net wealth distribution, consumption growth rates are the same or at most are higher by 0.2 percentage point than with the actual net wealth distribution. The cross-country differences reflect diversified levels of net wealth in relation to income, MPC and the composition of net wealth. For the euro area countries, these effects seem to be larger than implied by estimates based on aggregate data (Poterba, 2000; and Kerdrain, 2011).

[TABLE 4 HERE]

9. The MPC from financial wealth is generally estimated to be larger than for housing wealth (Poterba, 2000; Gourinchas and Parker, 2002; Aoki et al., 2004; Kerdrain, 2011; and Aron et al., 2012) though Case et al. (2005) find that the opposite for countries other than the United States. There is also disagreement over whether house price increases represent an aggregate wealth effect, or just a redistribution of wealth (Aoki et al., 2004), as they also increase the cost of living for those who do not own housing.

5. Conclusions

The paper demonstrates that monetary policy effects on income and net wealth inequality via financial channels are complex and ambiguous *a priori*, but in practice they tend to be small. Cross-country differences in the size and distribution of income and net wealth components explain contrasting effects for income inequality. A house price increase generally reduces net wealth inequality, while the opposite is true for increases in stock and bond prices. Larger effects on income inequality could be expected when effects via employment are taken into account, but such effects are difficult to incorporate in the analytical framework adopted in this paper. Asymmetric monetary policy over the business cycle may affect inequality over a longer period but this is not investigated. Higher inequality does not seem to significantly affect the effectiveness of monetary policy in boosting private consumption via wealth effects.

Interactions between monetary policy and inequality, even if very small, pose communication challenges. First, public concerns may arise due to the fact that increases in consumption resulting from monetary easing go mainly to the top net wealth deciles (Table 4), though the opposite is likely to be the case when interest rates increase. Second, even if cyclical implications of monetary policy for inequality as measured by the Gini coefficient are small, larger losses or gains for very specific and vocal groups tend to attract media attention. This calls for clear explanations of *pros* and *cons* of various inequality measures and all possible channels affecting the overall net effect. It also needs to be communicated that current effects are likely to be reversed during the monetary policy tightening cycle, and that inequality fluctuations would be much larger without monetary policy intervention.

Because the impact of monetary policy on inequality through the asset and interest rate channels is weak and uncertain, concerns about inequality do not support changes to current monetary policy objectives of price stability and, in some cases, full employment. Fiscal and social policies, including progressive taxation and social welfare and equitable access to education, are better placed to address inequality (OECD, 2015).

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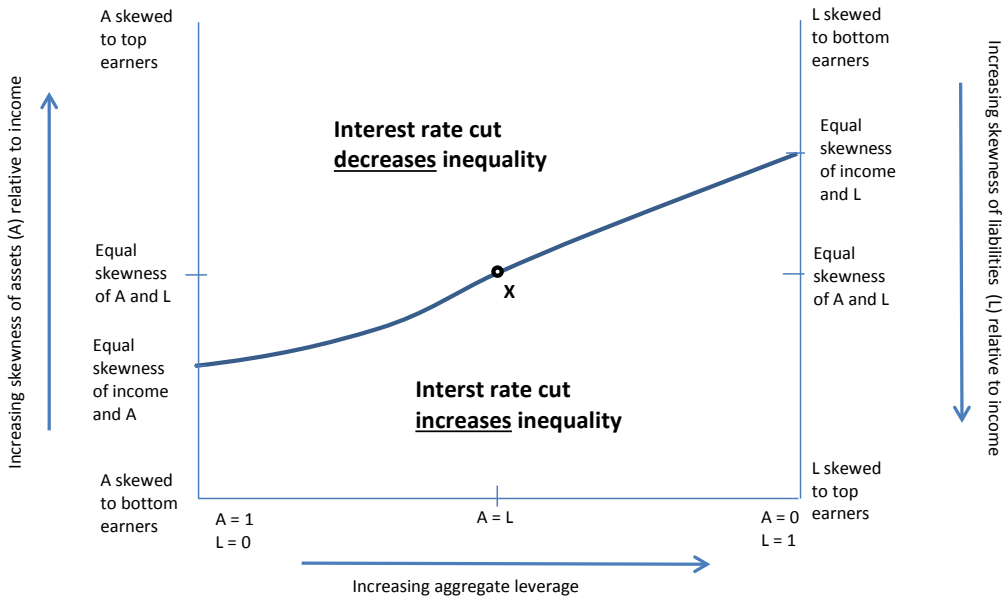
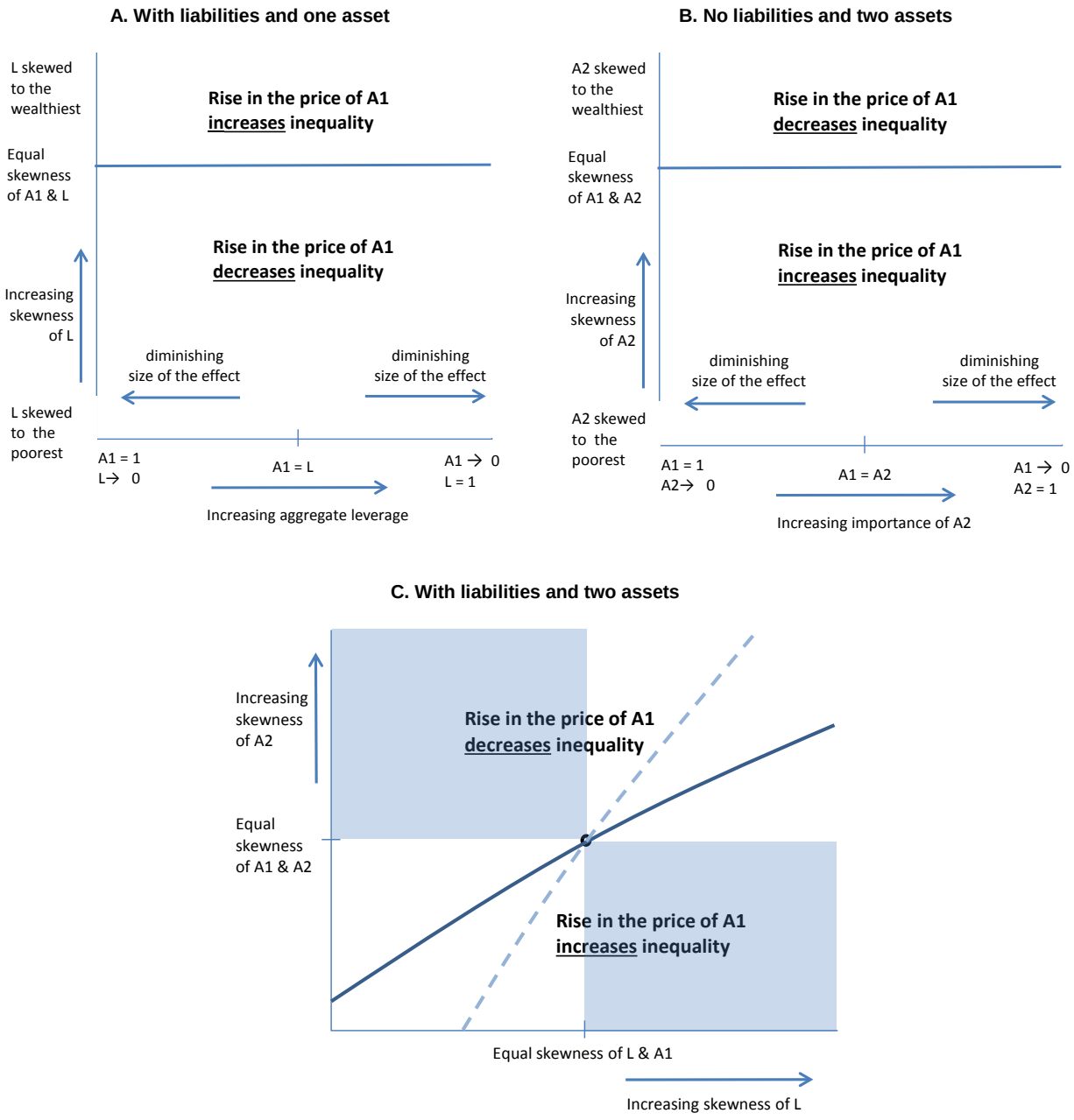
Figures and Tables

Figure 1. Determinants of interest rate cut effects on the income distribution



Note: The upward-sloping line represents where the skewness of income is equal to that of net wealth. The skewness of income is assumed fixed. Point X represents where assets and liabilities are identical in size and distribution. The size of assets and liabilities on the horizontal axis are normalised to 1. The extreme point on the left holds also for any assets greater than zero and no liabilities and the extreme point on the right holds also for any liabilities greater than zero and no assets.

Figure 2. Determinants of changes in net wealth inequality due to an asset price rise



Note: *A1* and *A2* stand for assets, and *L* stands for liabilities. The skewness of liabilities in Panel A, the skewness of A2 in Panel B and the skewness of A1 in Panel C on are assumed constant.

Table 1. Changes in Gini coefficients for the income distribution due to lower interest rates

	Gross income Gini	Changes in Gini with lower interest rates		Changes in market income Gini, 2007-2010
		by 1 p.p.	by 4 p.p.	
Austria	0.408	0.0004	0.0099	0.0100
Belgium	0.487	0.0039	0.0265	0.0090
Canada	0.447	-0.0001	0.0016	0.0110
Finland	0.381	0.0006	0.0030	0.0110
France	0.384	0.0007	0.0040	0.0221
Germany	0.429	0.0009	0.0046	-0.0020
Greece	0.403	-0.0003	-0.0006	0.0270
Italy	0.398	0.0000	0.0007	0.0210
Luxembourg	0.418	-0.0005	0.0004	0.0100
Netherlands	0.313	-0.0009	0.0015	-0.0085
Portugal	0.450	-0.0004	0.0004	0.0060
Slovak Republic	0.358	-0.0003	-0.0006	0.0150
Slovenia	0.475	-0.0001	-0.0002	0.0300
Spain	0.416	-0.0002	0.0015	0.0560
United Kingdom	0.426	0.0010	0.0067	0.0190
United States	0.574	-0.0015	-0.0037	0.0132

Source: Authors' calculations and OECD Income Distribution and Poverty Database.

Table 2. Changes in Gini coefficients for the net wealth distribution due to 10% higher asset prices

	Change in Gini following 10% asset price increase for				Gini for net wealth	*Memorandum* Share of the top decile in total[2]				Share in total assets		
	real estate	stocks	bonds	all[1]		liabilities	real estate	stocks	bonds	real eastate	stocks	bonds
Austria	-0.0051	0.0001	0.0012	-0.0038	0.7600	16	47	77	94	58	2	6
Belgium	-0.0075	0.0014	0.0020	-0.0043	0.6095	9	32	81	82	63	5	7
Canada	-0.0048	0.0009	0.0003	-0.0036	0.6052	16	34	74	61	43	4	1
Finland	-0.0114	0.0009	0.0000	-0.0105	0.6642	13	36	80	78	77	4	0
France	-0.0046	0.0005	0.0001	-0.0041	0.6809	23	41	76	79	67	3	0
Germany	-0.0031	0.0001	0.0001	-0.0029	0.7608	25	53	69	74	62	1	1
Greece	-0.0027	0.0000	0.0001	-0.0026	0.5580	14	36	41	92	84	0	0
Italy	-0.0018	0.0001	0.0002	-0.0015	0.6094	22	41	69	55	77	1	2
Luxembourg	-0.0045	0.0003	0.0002	-0.0041	0.6612	17	47	69	70	82	2	1
Netherlands	-0.0195	0.0002	0.0002	-0.0192	0.6532	13	30	73	64	68	1	1
Portugal	-0.0064	0.0002	0.0001	-0.0062	0.6713	17	43	85	92	71	1	0
Slovak Republic	-0.0031	0.0000	0.0000	-0.0031	0.4467	16	29	84	54	81	0	0
Slovenia	-0.0042	0.0000	0.0000	-0.0042	0.5355	19	29	48	37	80	1	0
Spain	-0.0082	0.0003	0.0000	-0.0079	0.5811	16	35	74	48	78	1	0
United Kingdom	-0.0048	0.0009	0.0003	-0.0036	0.6052	15	33	73	60	43	4	1
United States	-0.0088	0.0009	0.0004	-0.0075	0.8505	26	50	90	96	37	10	3

1. Assumes 10% increase in prices of real estate, stocks and bonds, keeping prices of remaining assets constant.
2. The shares are calculated for the deciles of the net wealth distribution.

Source: Authors' calculations.

Table.3 Marginal propensity to consume by wealth deciles

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Austria	0.25	0.25	0.25	0.25	0.07	0.07	0.06	0.06	0.06	0.06
Belgium	0.14	0.14	0.14	0.14	0.07	0.06	0.06	0.06	0.06	0.06
Euro area	0.17	0.17	0.17	0.17	0.07	0.06	0.06	0.06	0.06	0.06
Finland	0.19	0.19	0.19	0.19	0.07	0.06	0.06	0.06	0.06	0.06
France	0.19	0.19	0.19	0.19	0.07	0.07	0.06	0.06	0.06	0.06
Germany	0.34	0.34	0.34	0.34	0.09	0.08	0.07	0.07	0.06	0.06
Greece	0.13	0.13	0.13	0.13	0.06	0.06	0.06	0.06	0.06	0.06
Italy	0.19	0.19	0.19	0.19	0.07	0.07	0.07	0.07	0.06	0.06
Luxembourg	0.17	0.17	0.17	0.17	0.07	0.06	0.06	0.06	0.06	0.06
Netherlands	0.16	0.16	0.16	0.16	0.07	0.06	0.06	0.06	0.06	0.06
Portugal	0.15	0.15	0.15	0.15	0.07	0.06	0.06	0.06	0.06	0.06
Slovak Republic	0.13	0.13	0.13	0.13	0.07	0.07	0.06	0.06	0.06	0.06
Slovenia	0.13	0.13	0.13	0.13	0.06	0.06	0.06	0.06	0.06	0.06
Spain	0.17	0.17	0.17	0.17	0.07	0.07	0.06	0.06	0.06	0.06
United States	0.32	0.32	0.32	0.32	0.09	0.06	0.06	0.06	0.06	0.06

Note: Euro area averages, as estimated by Carroll *et al.* (2014a), are used for Canadian and UK simulations.

Source: Carroll *et al.* (2014a), "The distribution of wealth and the MPC: Implications of new European data", *ECB Working Paper Series*, No. 1648; and Carroll *et al.* (2014b), "The distribution of wealth and the MPC: Implications of new European data", *ECB Working Paper Series*, No. 1655.

Table 4. Consumption effects of a 10% increase in asset values

	Percentage increase in consumption			*Memorandum*			
				Share of consumption increase going to top 10%		Aggregate MPC	Ratio of net wealth to consumption
	actual	counterfactual	difference	actual	counterfactual		
Austria	3.4	3.5	-0.1	56.6	49.1	0.0635	5.9
Belgium	5.3	5.3	-0.1	37.7	33.6	0.0664	8.6
Canada	5.5	5.6	-0.1	41.0	36.3	0.0649	8.2
Finland	3.2	3.3	0.0	34.9	30.9	0.0693	4.3
France	3.7	3.8	-0.1	46.5	41.0	0.0637	6.0
Germany	3.6	3.8	-0.2	52.5	44.8	0.0676	5.6
Greece	2.5	2.5	0.0	33.8	30.2	0.0655	4.0
Italy	4.4	4.5	-0.1	39.2	34.6	0.0693	6.7
Luxembourg	7.2	7.3	-0.1	43.7	38.7	0.0675	10.6
Netherlands	4.2	4.2	0.0	25.5	22.8	0.0732	4.4
Portugal	3.3	3.4	0.0	46.1	40.9	0.0660	5.2
Slovak Republic	2.6	2.6	0.0	27.1	24.2	0.0718	3.9
Slovenia	3.6	3.6	0.0	32.4	28.9	0.0659	5.7
Spain	6.0	6.1	-0.1	33.7	29.9	0.0727	8.1
Unied Kingdom	6.1	6.2	-0.1	36.7	32.6	0.0671	9.8
United States	4.1	4.3	-0.2	61.8	52.7	0.0674	5.8

Source: Authors' calculations.