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Effects of Bank Capital Requirement Tightenings on Inequality

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Effects of Bank Capital Requirement Tightenings on Inequality*

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1 Introduction

There is increasing interest in impleications of central banks' (monetary and financial stability) policies for inequality. Not only is there a growing consensus that changes in inequality may affect central banks' goals and trade-offs (e.g. Cairo and Sim, 2017). Changes in inequality due to central banks' actions also challenge other (redistributive/fiscal) policies. While there is a surge in the literature on the effects of monetary policy on inequality (e.g. Coibion et al., 2017, Furceri et al., 2018), the evidence on the effects of financial stability policy on inequality is still scarce. Frost and van Stralen (2018) and Carpantier et al. (2017) are, to our knowledge, the only recent contributions, but these authors do not focus on bank capital requirements, but on other financial stability instruments.

In this study, we use a narrative index of bank capital requirement tightening events in the US, which we have proposed recently in Eickmeier et al. (2018) and which is exogenous to the financial cycle and to the business cycle. In that paper we have shown that bank capital requirement tightenings permanently and with a delay raise the aggregate bank capital ratio and have sizeable, but temporary effects on loan supply and the real economy. Here we assess effects of the regulatory changes on household income and expenditure inequality. We find that capital requirement tightenings lower inequality. Financial income, which tends to be generated by richer households, declines particularly strongly. Hence, income and expenditures of richer households decline by more than those of poorer households. The monetary policy easing after the regulation is shown to contribute to the decline in inequality at longer horizons, as it cushions the negative effects of the capital requirement tightenings on wages and salaries in the medium run, which represent a considerable share of income of lower- to middle-income households.

In the remainder of the paper we will briefly outline the setup, largely following Eickmeier et al. (2018), to which we refer for details, and the data. We will then present estimates of the reactions of income and expenditures of households in different percentiles of the distribution, of different income categories and a few aggregate variables which help us explain our findings for the percentiles. We will also assess the role of monetary policy in the transmission of capital requirement tightenings to inequality by means of a counterfactual experiment.

2 Methodology and data

We make use of a narrative index of capital requirement tightening events in the US. This index has recently been constructed in Eickmeier et al. (2018), based on detailed readings of legislative documents. We identify six events in response to which a large share of US banks raised their capital ratios simultaneously and significantly: three in the early/mid-1980s, when the US supervisory authorities introduced numerical capital requirements, and three in the early-1990s in relation to the first Basel Accord and a strengthening of regulators' resolution powers.[1] The index is a simple dummy variable with ones in the months of the events and zeros otherwise. We argue and provide ample evidence in our companion paper that the events are exogenous to the state of the financial cycle and the state of the business cycle. Legal procedures and newspaper articles indicate that information on the new regulations are publicly available *before* the regulatory changes become effective. We also exploit that information and allow banks and other agents to adjust six months (which we show to be a reasonable average anticipation horizon) before. We demonstrate that results are robust against plausible changes to the capital requirement index (CRI). See Eickmeier et al. (2018) for details.

We insert the CRI into local projections, as proposed by Jordà (2005), to assess the dynamic responses of selected macroeconomic and financial variables to these capital requirement tightening events, while allowing for anticipation effects.

$$\widetilde{y}_{t+h} = d^h + \delta^h(L)\widetilde{x}_{t-1} + \tau^h(L)CRI_{t+\widetilde{h}} + e_{t+h}, \tag{1}$$

where $\widetilde{y}_{t+h} = y_{t+h} - y_{t-1}$ and $\widetilde{x}^i_t = x^i_t - x^i_{t-1}$ (where x^i_t is an element of x_t) for all non-stationary variables and $\widetilde{y}_{t+h} = y_{t+h}$ and $\widetilde{x}^i_t = x^i_t$ for all stationary variables.

y_{t+h} is the response variable of interest, i.e. percentiles of income, salaries, consumption and expenditures (in real terms), aggregate income components and other variables capturing aggregate household adjustment (real estate bank loans, household net worth, the personal savings rate, and uncertainty).

x_{t-1} is a set of control variables which includes 2 lags of industrial production, of the core PCE deflator and of bank loan volumes; of the Federal Funds rate; of the

[1] The six events are: (i) FDIC, Fed and OCC set numerical guidelines for capital ratios (Dec. 17, 1981), (ii) International Lendings and Supervision Act (ILSA) passed (Nov. 30, 1983), (iii) Common capital ratio guidelines are set by FDCI, Fed, and OCC for all banks (April 18, 1985), (iv) Basel I becomes effective (Dec. 31, 1990), (v) FDIC Improvements Act passed (Dec. 19, 1991), (vi) Prompt Corrective Action becomes effective (Dec. 19, 1982). For details see Section 2 and Appendices A-D of Eickmeier et al. (2018).

BAA spread; and of the left-hand-side variable. The term $\tau^h(L)CRI_{t+\widetilde{h}}$ comprises 2 lags of the CRI, the contemporaneous CRI and leads of the CRI up to $\widetilde{h} = 6$ months, capturing anticipatory effects. We also include deterministic regressors c^h (a constant, a linear trend and a quadratic trend). We rely on monthly data from 1980M1 to 2008M8, where the starting point is given by the availability of the percentile data, and we end before the global financial crisis.

The percentile data are taken from the Consumer and Expenditure Survey (CEX), provided on Lorenz Kueng's website.[2] Consumption includes nondurables, services and durables (e.g. jewellery, furniture), and expenditures comprise - besides consumption - mortgage payments (which contains mortgage interest rate payments and charges), rents, and automobile purchases, among others. Income includes salaries (i.e. labor earnings), financial income, business income, and transfers for each household.[3]

Uncertainty is the macroeconomic uncertainty measure (horizon = 12 months) taken from Jurado et al. (2015). Other data are taken from FRED provided by the Federal Reserve Bank of St. Louis. We note that we already showed the impulse response functions of some of the aggregate series in Eickmeier et al. (2018) (uncertainty and real estate loans), but prefer to provide them here as well in order to make this paper self-contained.

Income, household net worth (defined as financial and non-financial assets minus liabilities) and loans were converted to real by division by the core PCE deflator. All variables enter in logarithms, except for the Federal Funds rate, the BAA spread, the savings rate, and uncertainty. We treat most variables as difference stationary (and include them in differences in the model), except for the Federal Funds rate, the BAA spread, the savings rate, uncertainty and the percentiles, which enter in levels.[4]

The sequence of parameter estimates $\{\tau_1^h\}_{h=1}^H$ yields the impulse response of y_{t+h} to an exogenous tightening in regulatory capital requirements. We provide in the figures below point estimates of variables' reactions (solid lines) to a change of the CRI from 0 (no event) to 1 (a regulatory event) as well as 68% and 90%

[2]See http://lorenzkueng.droppages.com/. See https://www.bls.gov/cex/csxgloss.htm for details on the CEX data.

[3]Results for income after and before taxes are similar, and we only show the former below.

[4]This treatment of the percentile data follows De Giorgi and Gambetti (2017), who focus on consumption data from the CEX, and Coibion et al. (2017), who form distribution measures from the logarithms of the levels of expenditures and income data. As a robustness check we also included the percentiles in differences. Our key results remain unchanged.

confidence intervals based on Newey and West (1987) heteroskedasticity robust standard errors (dark and light shaded areas).

3 Results

3.1 Effects on inequality

We focus here on effects of a typical regulatory event, which raises the aggregate bank capital ratio by 0.3 percentage points after about 2 years after the new regulation becomes effective, as shown in Eickmeier et al. (2018). Industrial production, total bank loans and the Federal Funds rate decline by about 3%, 5% and 2.5 percentage points, respectively. Figure 1 shows point estimates of impulse responses of percentiles 5-95 (in steps of 5) for income, salaries, expenditures and consumption on average up to the first year (6 months before to 1 year after the CRI change) and years 1-2 and 2-3 after the regulation.

Income inequality declines after the CRI increase, as income of households from the higher percentiles declines more strongly than income of households from the lower percentiles.[5] What accounts for these income distribution dynamics? There is no clear change in the distribution of salaries. Consequently, changes in the income distribution will be related to changes in the distribution within or across other income categories. While we have no data available for the distribution within other income categories, we show in Figure 2 impulse responses of aggregate financial income, wages and salaries, transfer income and business income, i.e. the major income categories. Financial income, which is typically generated by income-richer households (Coibion et al., 2017, Owyang and Shell, 2016, Piketty and Saez, 2003, Diaz-Gimenez et al., 1997), is more affected than wages and salaries after the CRI change. Business income (which also tends to be generated by richer households) declines as well, but not significantly, whereas transfer income, which lower-income households tend to receive, rises. Hence, the "income composition channel" seems to be effective and can explain changes in the distribution of income.

Expenditures and consumption broadly follow income dynamics. However, the effects on expenditures and consumption are weaker for all percentiles than those on income. Moreover, the differences between the percentiles are slightly less pro-

[5]The increase in income for the lower percentiles is somewhat implausible, but such reactions in tails are not unusual (see also De Giorgi and Gambetti, 2017).

nounced and probably insignificant up to the first year after the new regulations become effective.

One explanation for the difference between income and expenditure dynamics may be related to some intertemporal optimization motive, which affects households' savings behavior. Figure 3 shows that the personal savings rate declines after some delay after the increase in the CRI. One reason is that uncertainty declines. The decline in bank leverage after regulatory tightenings seems to feed into agents' risk attitudes and expectations. Agents become less worried about risk when bank capital ratios are higher. This leads them to dissave and, *ceteris paribus* increases their expenditures.[6] As savers tend to be the richer households (Dynan et al., 2004, Federal Reserve Board, 2016), expenditures by households in the upper percentiles may be depressed by less after the capital requirement tightenings than expenditures by households in the lower percentiles.[7] [8] Another explanation might be that higher-income households, which also tend to be the more educated, form more accurate expectations about future economic developments, as shown by De Giorgi and Gambetti (2017). By tightening capital requirements regulators intend to enhance financial stability in the long run. This may be expected by higher-income households and reflected in their current expenditures relative to their current incomes.

Other factors seem to be less important. One conjecture might be that poorer households are more likely to become credit constrained after the regulatory tightening.[9] Real estate loans drop strongly and persistently. This would imply a stronger decline of expenditures (which include mortgage payments) than of consumption in the lower percentiles, which is not what we observe. Hence, this factor does not seem to matter much. We further see that household net worth declines. It is, however, unclear what this would imply for inequality. On the one

[6] In Eickmeier et al. (2018) we show that stock market volatility and a measure of precautionary savings decline as well after the regulatory events.

[7] On the other hand the unemployment rate rises after the regulation (not shown). The unemployment rate can also be seen as a measure of income uncertainty (see, for example, Mody et al., 2012) probably affecting lower- or middle-income households. This may also explain why expenditure and consumption profiles in Figure 1 are flatter than the income profile.

[8] That uncertainty seems to be part of the story is consistent with the finding by De Giorgi and Gambetti (2017) that after an (unexpected) increase in (economic policy) uncertainty consumption by households in higher consumption categories declines, whereas consumption in the lower percentiles either does not change or rises. The authors only use consumption data, but not income data from the CEX. In our case, income distribution dynamics seem to dominate uncertainty dynamics as a factor driving households' expenditures. However, uncertainty dynamics may be able to explain why inequality declines by more across incomes than across expenditures.

[9] See Le Blanc et al. (2016) for evidence on the euro area.

hand, the distribution of wealth is highly concentrated in the upper percentiles (see, e.g., Diaz-Gimenez et al., 1997) and, hence, wealth effects could be expected to be larger for those households.[10] On the other hand, evidence suggests that credit-constrained households (which are likely to be those falling in the lower to middle percentiles) might react more strongly to changes in wealth (e.g. Mian and Sufi, 2011, Cooper, 2009).

3.2 Comparison with the literature

How do our results compare to the literature? As noted, we are, to the best of our knowledge, the first looking at effects of capital requirement tightenings on inequality, and can only compare our findings with findings for somewhat similar impulses.

Our results are in line with Mumtaz and Theodoridis (2017) who focus on the effects of adverse financial shocks (captured either by an increase in the excess bond premium (EBP) or in corporate bond spreads or a worsening of financial conditions) from the US on consumption and income inequality in the UK and the note by Owyang and Shell (2016). Both show that financial shocks affect more strongly richer households as those are more exposed to financial markets. We present here evidence that another financial shock (i.e. a capital requirement tightening) leads to the same outcome. We also estimate the effects of a change in the EBP on the percentiles using our local projections approach[11] and confirm Mumtaz and Theodoridis (2017)'s results for the US.

Only Frost and van Stralen (2018) and Carpantier et al. (2017) assess how financial stability policy affects inequality empirically and for advanced economies. They find a positive association between tighter regulation and income or wealth inequality. This is not in line with our findings. They do, however, not consider capital requirement changes, but other measures such as loan-to-value limits (in both cases) and interbank exposure and concentration limits as well as macroprudential reserve requirements (Frost and van Stralen, 2018). Hence, effects may depend on the type of financial stability policy.

Finally, our results are also different from those by Coibion et al. (2017) for a monetary policy shock, i.e. that a monetary tightening increases income and

[10] Dynan (2010) finds that younger (which are also poorer) households do not react to changes in stock market wealth, mainly because their stock holdings are low. However, age is not found to matter for housing wealth effects.

[11] For the setup of the local projections which includes the EBP, see Eickmeier et al. (2018).

expenditure inequality. We insert the monetary policy shock provided by Romer and Romer (2004) (and updated by Coibion et al. (2017)) in our local projections model and were able to replicate their finding. One important difference seems to be the effects on financial income, which we and Coibion et al. (2017) found to rise after the monetary policy tightening shocks, following the increase in the policy interest rate, whereas it declines strongly after the CRI change.

3.3 The role of monetary policy in the transmission of capital requirement tightenings on inequality

The last paragraph suggests that our results may be driven by the monetary policy easing that we find in response to the capital requirement tightening (Eickmeier et al., 2018). We carry out a counterfactual experiment and show how selected variables would have reacted had there been no response of monetary policy to the regulatory event.[12] Figure 4 shows reactions of selected variables (income and expenditure percentiles as well as the 2 largest aggregate income components) from our baseline together with reactions where the Federal Funds rate does not move at any horizon.

Eliminating the monetary policy reaction mainly changes the profiles at longer horizons: Without the monetary policy reaction there would have been no clear change in the income and expenditure distribution between 2 and 3 years after the effective dates. This is because without monetary policy financial income would have declined by less, whereas wages and salaries, and, hence, income generated by lower- and middle-income households, by more than what our baseline revealed. Hence, our results suggest that the monetary policy reaction contributes to the decline in inequality resulting from the capital requirement tightenings at longer horizons, as it cushions the negative effects of the capital requirement tightenings on wages and salaries, which represent a considerable share of income for lower- to middle-income households, at those horizons.

4 Conclusion

In this paper, we use a novel indicator of aggregate regulatory capital requirement tightenings for the US from 1980 to 2008. By means of local projections we inves-

[12] See Eickmeier et al. (2018) for details on the counterfactual experiment and results for other variables.

tigate the effects of regulatory changes on inequality and, hence, fill a gap in the growing literature on the effects of (policy- and non-policy-related) disturbances in financial markets. We find income inequality to decline. Richer households are more exposed to financial markets, and financial income drops relatively strongly after the capital requirement tightening. Expenditure inequality declines as well, but by less than income inequality. Lower uncertainty and more accurate predictions of (positive) future income prospects resulting from higher bank capital ratios may have led richer households to dissave and reduce expenditures by less than poorer households. Finally, we find that the monetary policy reaction contributes to the decline in inequality resulting from the capital requirement tightenings at longer horizons, as it cushions the negative effects of the capital requirement tightenings on wages and salaries, which represent a considerable share of income for lower- to middle-income households, at those horizons.

References

Cairo, Isabel and Jae Sim, "Income Inequality, Financial Crises and Monetary Policy," Technical Report 2017.

Carpantier, Jean-Francois, Javier Olivera, and Philippe Van Kerm, "Macroprudential policy and household wealth inequality," *Journal of International Money and Finance*, 2017.

Coibion, Olivier, Yuriy Gorodnichenko, Lorenz Kueng, and John Silvia, "Innocent Bystanders? Monetary policy and inequality," *Journal of Monetary Economics*, 2017, *88* (C), 70–89.

Cooper, D., "Impending U.S. spending bust? The role of housing wealth as borrowing collateral," *FRB Boston Public Policy Discussion Paper*, 2009, (09-9).

De Giorgi, G. and L. Gambetti, "Business cycle fluctuations and the distribution of consumption," *Review of Economic Dynamics*, 2017, *23*, 19–41.

Diaz-Gimenez, J., V. Quadrini, and J. Rios-Rull, "Dimensions of Inequality: Facts on the U.S. Distributions of Earnings, Income, and Wealth," *Federal Reserve Bank of Minneapolis Quarterly Review*, 1997, *21* (2), 3–21.

Dynan, K., "Wealth effects and the changing economy," *Mimeo, Brookings Institution*, 2010.

Dynan, K.E., J. Skinner, and S.P. Zeldes, "Do the rich save more?," *Journal of Political Economy*, 2004, *112* (2), 397–444.

Eickmeier, S., B. Kolb, and E. Prieto, "The macroeconomic effects of bank capital requirement tightenings: Evidence from a narrative approach," *Bundesbank Discussion Paper*, 2018, (XXX/2018).

Federal Reserve Board, "Report on the Economic Well-Being of U.S. Households in 2015," *https://www.federalreserve.gov/2015-report-economic-well-being-us-households-201605.pdf*, May 2016.

Frost, Jon and Ren van Stralen, "Macroprudential policy and income inequality," *Journal of International Money and Finance*, 2018, *85* (C), 278–290.

Furceri, D., P. Loungani, and A. Zdzienicka, "The effects of monetary policy shocks on inequality," *Journal of International Money and Finance*, 2018, *85*, 168–186.

Jordà, Òscar, "Estimation and Inference of Impulse Responses by Local Projections," *American Economic Review*, 2005, *95* (1), 161–182.

Jurado, Kyle, Sydney C. Ludvigson, and Serena Ng, "Measuring Uncertainty," *American Economic Review*, March 2015, *105* (3), 1177–1216.

Le Blanc, J., A. Porpiglia, F. Teppa, J. Zhua, and M. Ziegelmeyer, "Household Saving Behavior in the Euro Area," *International Journal of Central Banking*, 2016, *12* (2), 15–69.

Mian, A. and A. Sufi, "House prices, home equity-based borrowing, and the US household leverage crisis," *American Economic Review*, 2011, *101* (5), 2132–2156.

Mody, A., F. Ohnsorge, and D. Sandri, "Precautionary savings in the Great Recession," *IMF Economic Review*, 2012, *60* (1), 114–138.

Mumtaz, Haroon and Konstantinos Theodoridis, "US financial shocks and the distribution of income and consumption in the UK," *Cardiff Economics Working Paper*, 2017, (E2017/18).

Newey, Whitney K and Kenneth D West, "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica*, May 1987, *55* (3), 703–708.

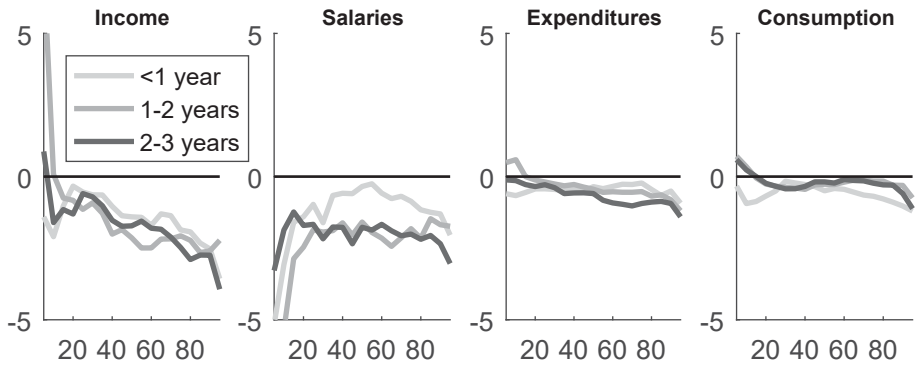
Owyang, Michael and Hannah Shell, "Taking Stock: Income Inequality and the Stock Market," *Economic Synopses*, 2016, *7*, 1–2.

Piketty, T. and E. Saez, "Income Inequality in the United States 1913-1998," *Quarterly Journal of Economics*, 2003, *CXVIII* (1), 1–39.

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

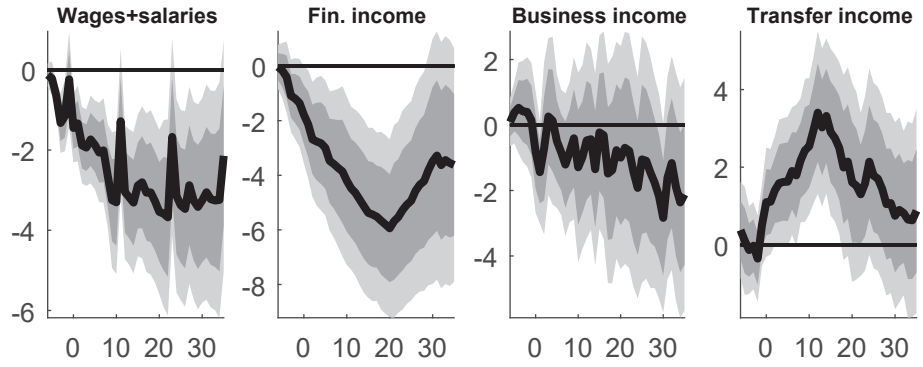
5 Tables and Figures

Figure 1: Transmission to the distribution of income and expenditures



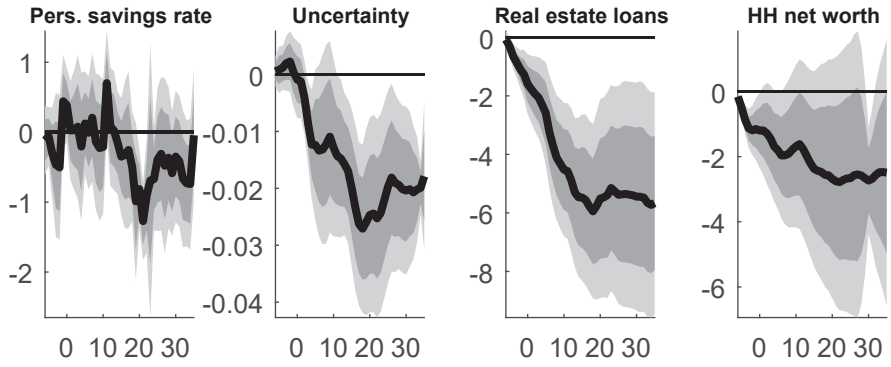
Notes: Point estimates of impulse responses (y-axis) in % for household income and expenditure percentiles 5, 10, ..., 90, 95 (x-axis) on average over horizons -6 months to 1 year, as well as years 1-2 and 2-3.

Figure 2: Transmission of the financial shocks to different income categories



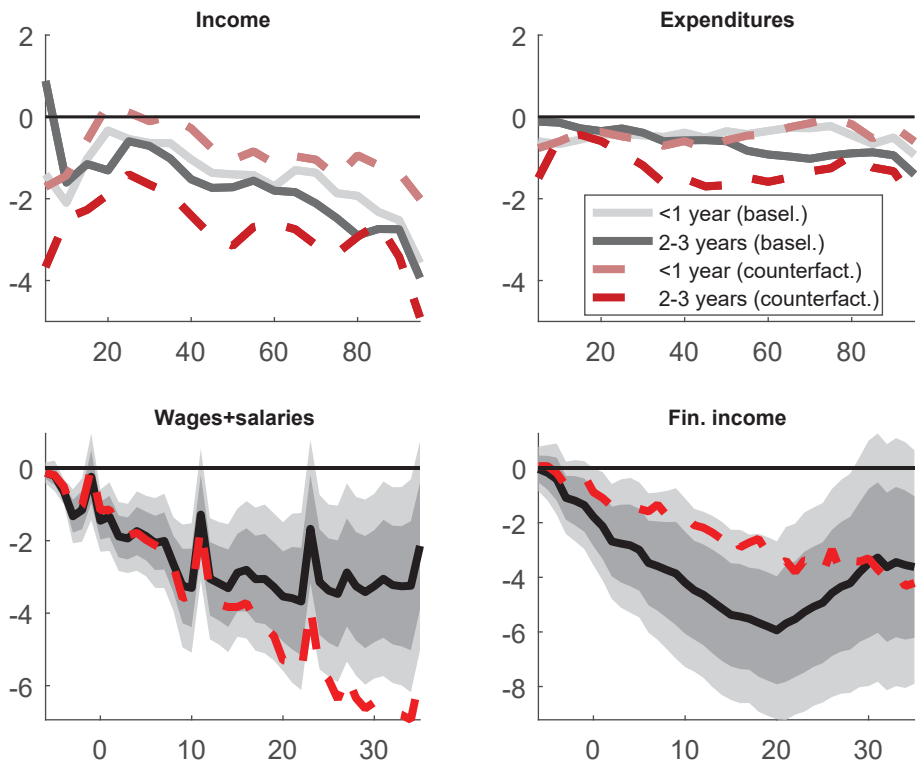
Notes: In %. Point estimates (black solid line), 68% and 90% confidence bands (dark and light shaded areas).

Figure 3: Transmission of a capital requirement tightening to aggregate variables relevant for households



Notes: Personal savings rate in percentage points, other variables in %. Point estimates (black solid line), 68% and 90% confidence bands (dark and light shaded areas).

Figure 4: Transmission of a capital requirement tightening to selected variables in the absence of a monetary policy reaction (counterfactual experiment)



Notes: Point estimates of impulse responses (y-axis) in %. For household income and expenditure we show counterfactuals for point estimates of percentiles 5, 10, ..., 90, 95 (x-axis) on average over horizons -6 months to 1 year, as well as years 2-3. For aggregate income variables we show point estimates from the baseline model (black solid lines), 68% and 90% confidence bands (dark and light shaded areas) together with counterfactual point estimates (red dashed lines). The counterfactual indicates the reaction of variables in the absence of a monetary policy reaction to the capital requirement tightenings. See Eickmeier et al. (2018) for details.