Monetary Policy Betas: Evidence from Italy

Valerio Pieroni*

UAB and Barcelona School of Economics

November, 2022

Preliminary and Incomplete: Comments are Welcome.

Abstract

This paper provides new empirical evidence on the heterogeneous effects of monetary policy. Using a series of identified monetary policy shocks and the Italian Survey on Household Income and Wealth (SHIW), I estimate the responses of households' consumption and income to monetary policy by net worth. I find that high-wealth and low-wealth households show large consumption responses. I show that interest rate cuts increase employment opportunities for low-wealth households. At the same time, expansionary monetary policy shocks lead to capital gains at the top of the distribution.

Keywords: Income, Consumption, Wealth, Monetary Policy, Inequality.

JEL Classification: E21, E40, E52.

*I would like to thank Raul Santaeulalia-Llopis for his guidance and support. I thank all the participants at Macro Club of Universitat Autonoma de Barcelona for helpful feedback and comments. All errors are my own.

1 Introduction

In recent years, researchers have documented important macroeconomic implications of household heterogeneity using micro evidence and structural Heterogeneous Agents New Keynesian (HANK) models (Kaplan, Moll, and Violante (2018), Lee (2021)). This work emphasizes several transmission channels of monetary policy to household consumption operating through financial income, business profits, and labor market effects. As a result empirical research on the distributional outcomes of monetary policy has become an important issue in monetary economics (Amberg, Jansson, Klein, and Rogantini Picco (2022), Holm, Paul, and Tischbirek (2021)). The aim of this project is to provide new evidence on the cross-sectional effects of monetary policy.

In this paper I construct a time series of monetary policy shocks for the European Central Bank, and using the Survey of Household Income and Wealth (SHIW) from the Bank of Italy I investigate income and consumption responses to monetary policy across the wealth distribution. The microdata is particularly useful as it measures the joint distribution of consumption, income, and wealth over an extended period of time and has a large panel component. These information, not always available for many advanced economies, allow me to document the effects of monetary policy by households' net worth. This paper presents two main findings. First, I document U-shaped consumption responses across the wealth distribution. Households at the bottom 20% and at the top 20% show the largest consumption adjustments. These responses are almost two times the response of the wealth group that contains the median household. Second, I connect these consumption dynamics to changes in the unemploymnet rate for low-wealth households and to capital gains due to changes in stock prices for households at the top of the wealth distribution. These results are important because they provide new evidence on the transmission mechanisms of monetary.

The key advantage of the SHIW is that it provides comprehensive information on household consumption, income, and wealth. The limitation is that the microdata is a biannual survey and therefore has a low frequency. As a consequence, in this paper I try to exploit mostly the cross-sectional dimension rather than the time dimension. I begin with a descriptive analysis of the main variables in the SHIW. In particular, I focus on nondurable consumption, household earnings from wages and self-employment income, and net worth. Therefore, my analysis includes both liquid and illiquid assets such as housing and private business ownership. Moreover, the microdata allows me to compute asset holdings across broad asset classes and study households' portfolio composition by net worth. I document a substantial heterogeneity in asset holdings. In summary, households at the bottom 50% of the wealth distribution tilt their portfolios toward liquid assets such as bank deposits and government bonds. Housing is the asset of the middle-class, from the 50th to the 90th wealth percentile. Wealthy households at the top 10% of the distribution invest their savings in stocks and equities. This evidence is consistent with the findings of the most recent literature (Fagereng, Holm, Moll, and Natvik (2021)). Since the literature has extensively studied the role of home equity, mortgages, and business profits for

the transmission of monetary policy is important to include these elements in my analysis and study households' responses by net worth.

To study the effects of conventional monetary policies I first need exogenous variations in the main policy rate. I identify monetary policy shocks with the high-frequency approach (Jarocinski and Karadi (2020)), using financial data from the Euro Area Monetary Policy Event Study Database (Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019)). I employ the SVAR with external instruments (SVAR-IV) framework (Stock and Watson (2012), Mertens and Ravn (2013)) to estimate the aggregate effects of interest rate changes and validate the construction of the monetary policy shock series. Then, I study the cross-sectional impulse response functions to monetary policy estimated using a set of local projections with instrumental variables (LP-IV) (Jordà (2005), Stock and Watson (2018), Jordà, Schularick, and Taylor (2020)). This is the main econometric framework that I use for my analysis of the heterogeneous effects of monetary policy.

My main finding is that consumption of households at the bottom and at the top of the wealth distribution increases substantially relative to other wealth groups. These effects tend to be present after two years from an expansionary monetary policy shock, when the effect of monetary policy on aggregate variables reaches its peak. To better understand these effects I also study the response of household disposable income. I find a hump shaped response across the wealth distribution. Together with the U-shaped consumption response this implies that households tend to save most of these income gains. Then, I also decompose the response of income between nonfinancial income sources and financial income sources excluding capital gains that are not reported in the SHIW. I find that labor earnings drive most of the total income effects. Mortgages and house prices can be important to account for the response of middle-class households, but the large consumption changes at the tails of the distribution require to also investigate alternative transmission channels. Thus, since household labor earnings cannot explain the consumption effects of monetary policy at the tails of the wealth distribution I consider different channels.

The first channel works through changes in the unemployment gap between low-wealth households and the other wealth groups. In particular, I define an household as unemployed if the household head, namely the major income earner of the family, is unemployed. First, I document a large unemployment gap between households at the bottom 20% of the wealth distribution and households in the middle-class. The share of unemployed households at the bottom 20% is more than twice the fraction of unemployed households in the middle-class. A linear probability model shows that households at the bottom 20% of the distribution are more likely to find an occupation after expansionary monetary policy shocks. While this effect is somewhat weak the unemployment response of the other wealth groups is almost null. Therefore, this evidence suggest that accomodative monetary policies do have positive effects on the unemployment gap increasing the employment opportunities for low-income workers at the bottom of the wealth distribution seeking for an occupation. These effects are consistent with the findings of the literature studying the effects of monetary policy in the context of heterogeneous

agents models with labor market frictions (Gornemann, Kuester, and Nakajima (2021)).

The second channel is given by the effect of monetary policy on households' wealth through changes in stock prices. In advanced economies wealth tend to be highly concentrated at the top of the distribution in the form of equity holdings (Hubmer, Krusell, and Smith (2021)). Since wealthy households hold most of the publicly traded equity, changes in stock prices can have a substantial effect on households' wealth. These effects can stimulate consumption directly through a standard wealth effect or increase the income of prospective sellers as emphasized in Fagereng, Gomez, et al. (2022). I try to quantify these effects using the response of stock prices to monetary policy shocks and the SHIW data on households' portfolios. First, I estimate a set of local projections with a monthly time series for stock prices and monetary policy shocks. I find that on average after two years from an interest rate cut of 25 basis points stock prices rise by 1.1%. Then, I leverage the portfolio shares from the SHIW mcirodata to estimate the total capital gains in each year following the expansionary monetary policy shock. I find that in the second year the average capital gain for households at the bottom 20% of the wealth distribution is well below 100 euro, and households in the middle-class gain around 400 euro. On the other hand, wealthy households around the 80th wealth percentile gain more than 1,500 euro. These effects can be as large as 10,000 euro at the top 5%. Di Maggio, Kermani, and Majlesi (2020) also provide an empirical analysis on the wealth effects out of stocks and find small Marginal Propensities to Consume (MPCs) out of unrealized capital gains for Sweden. However, even if one use 3% as a benchmark consumption response out of capital gains, wealth effects can account for part of the consumption responses because the total capital gains can be very large. Moreover, some of these capital gains can generate income for those households that sell their stocks and the MPC out of this income gains can be even higher. Therefore, these estimates suggest that wealth effects can account for a significant fraction of the consumption responses at the top 20% of the wealth distribution.

At the current stage there are several limitations in my analysis that are important to highlight. First, measurament errors can be contributing to the sample variability of the estimates. However, note that in this application the measurament errors do not generate an attenuation bias on the estimates given the way in which monetary policy shocks are identified. For the same reason it is unlikely that measurament errors on the outcome variables are correlated with monetary policy shocks and therefore they do not induce a correlation between residuals and monetary policy innovations. Second, since the public microdata contains jackknife weights only for a limited sample period the estimated standard errors do not take properly into account the survey design of the SHIW.

In this paper I explore empirically the relationship between monetary policy and wealth inequality. I provide new empirical evidence on the effects of monetary policy at the tails of the wealth distribution and supporting evidence for transmission mechanisms of monetary policy that can account for at least part of these effects. This evidence is useful to guide the development of quantitative models with heterogeneous agents. Additionally, the findings in this paper complement the existing evidence and extend its validity across countries. Overall, by con-

tributing to the empirical investigation of the transmission mechanisms of monetary policy this paper seeks to provide an improved understanding of how monetary policy shapes the economy.

Literature. This paper is related to a recent and growing literature on the distributional consequences of monetary policy. The existing literature focuses mostly on income and consumption inequality and the evidence is quite mixed. Coibion, Gorodnichenko, Kueng, and Silvia (2017) find that in the United States an expansionary monetary policy shock decreases income and consumption inequality. Instead Chang and Schorfheide (2022) find that expansionary monetary policy shocks reduce earnings inequality, but widen consumption inequality. Moreover, studies based on administrative microdata respectively from Denmark and Sweden find that a more accomodative monetary policy increases income inequality (Andersen, Johannesen, Jorgensen, and Peydró (2021), Amberg, Jansson, Klein, and Rogantini Picco (2022)). Recent papers have examined the effect of monetary policy on consumption and wealth. Bartscher, Kuhn, Schularick, and Wachtel (2021) document that in the United States expansionary monetary policy shocks lift black households out of unemployment, but also generate large capital gains for white households. Cloyne, Ferreira, and Surico (2020) find that the consumption response to monetary policy of households with a mortgage is larger than the response of outright home owners and renters. The reason is that mortgagors tend to have low liquid asset holdings and therefore high MPCs. Almgren, Gallegos, Kramer, and Lima (2022), Slacaleky, Tristani, and Violante (2020) also investigate the effects of monetary policy in the Euro Area with a focus on the role of liquid wealth. Holm, Paul, and Tischbirek (2021) using administrative data from Norway find that the response of household expenditure is U-shaped across the distribution of liquid assets. So far the literature has focused on liquidity positions. In this paper I complement this work by studying the consumption responses throughout the wealth distribution including illiquid assets and household debt. These responses are informative about the transmission mechanisms of monetary policy given the systematic portfolio differences across wealth groups. The idea is that large consumption responses from middle-class households suggest an important role of house prices and mortgages for the transmission of monetary policy, while strong responses at the top indicate a critical role of the stock market. I document large consumption responses at the tails of the wealth distribution and provide evidence on the transmission mechanisms of monetary policy that can explain these consumption responses.

Outline. The paper is organized as follows. In Section 2 I present a descriptive analysis of household consumption, income, and wealth in the SHIW including household portfolio composition across broad asset classes. I also discuss the identification of monetary policy shocks. Section 3 presents the econometric framework. Section 4 contains the main results of the paper. Section 5 concludes.

2 Data

In this paper I estimate cross-sectional impulse response functions (IRFs) for consumption and income across the wealth distribution using Italy's Survey of Household Income and Wealth (SHIW) from the Bank of Italy, and a series of monetary policy innovations of the European Central Bank.

2.1 Household micro data

The Survey on Household Income and Wealth (SHIW) from Bank of Italy is the Italian component of the Household Finance and Consumption Survey (HFCS) from the European Central Bank (ECB). The SHIW is a biannual survey. The main advantage of the SHIW is that it provides comprehensive information on household income, consumption, and wealth. The analysis in this paper includes all waves from 2000 to 2016.

The interviews are collected in the first months of the calendar year. Income and consumption flows refer to the previous year, assets and liabilities are end-of-year values. Consumption is defined as household expenditure on nondurable goods. Disposable income is the sum of net earnings (labor income and self-employed income net of taxes), business profits and dividends, interest income net of interest expenses. Following the literature on heterogeneous agents models I focus on liquid wealth and net worth. Liquid wealth is given by liquid assets (bank deposits, government and corporate bonds, stocks and other financial assets). Total wealth or net worth is given by assets (real estates, private businesses, valuables, and liquid wealth) minus liabilities (mortgages, consumer debt).

The SHIW is a representative sample of the Italina resident population. The sample is drawn in two stages, at municipality and household level, with a stratification of municipalities by region and demographic size. Cross-sectional sampling weights are provided to obtain point estimates.[1] Cross-sectional Jackknife replication weights are provided to compute standard errors. Over the years the sample size reached 8,000 households and 20,000 individuals. The average participation rate across waves is around 50 percent for the whole sample and 80 percent for panel households. Since 1998 almost all the interviews are computer based. The average duration of an interview is 50 minutes. Questions concerning the whole household are addressed to the person most knowledgeable about the family finances. Jappelli and Pistaferri (2010), provide a comparison between national accounts and SHIW aggregates for consumption and income variables and find a close match.

I restrict the sample to households with more than one observation during the period 2000-2016, and with positive income and consumption. I also restrict the sample to families in which the household head, defined as the major income earner, is between 25 and 65 years old. The result is a pooled cross-section with 27,076 observations, that span from a minimum of 1,927 households in 2016 to a maximum of 3,614 households in 2012. The average number of house-

[1] The design variables in the public datasets are not provided to protect confidentiality.

holds per year over the sample period is 3,087. Demographic characteristics are defined relative to the household head. All monetary variables are adjusted for inflation with 2010 as a base year. Table 1 reports descriptive statistics. These are global statistics for the whole sample, that is they are constructed using family-year cells.

Table 1: Summary statistics.

	Mean	Std. Deviation	10th P.	Median	90th P.
Consumption	24,410	12,892	12,147	21,738	39,526
Disposable income	24,635	21,782	4,189	20,398	45,869
Earnings	23,982	21,223	1,865	20,098	44,939
Profits and dividends	586	5,926	0	0	0
Interest income	67	2,738	-1,286	55	1,136
Liquid assets	26,470	90,045	0	7,459	58,609
Illiquid assets	222,614	408,801	0	147,591	479,535
Total debt	14,692	62,880	0	0	42,625
Wealth	239,423	438,626	2,141	151,375	516,975
Age	46.5	10.4	32	47	61
Education	3.5	0.8	3	3	5

Note: Summary statistics (weighted) for the overall sample in euro, 2010 prices. Data source: SHIW 2000-2016. See main text for variable definitions. Education can be equal to 1 (no education), 2 (elementary school), 3 (middle school), 4 (high-school), 5 (college), 6 (master or PhD).

In this paper I focus on the effects of monetary policy on different wealth groups. The remainder of the section illustrates characteristics of the income and asset composition of households along the wealth distribution.

Figure 1 shows the income and asset composition across wealth groups. Wealth groups are defined using the quantiles of the cross-sectional distribution of wealth. Namely, for each survey year t, I assign household i to a wealth group g if its wealth in t is between the $(g-1)$-th and g-th ventile of the wealth distribution. Income sources are given as a percentage of disposable income and portfolio shares as a percentage of total assets. The figure shows group means averaged across years.

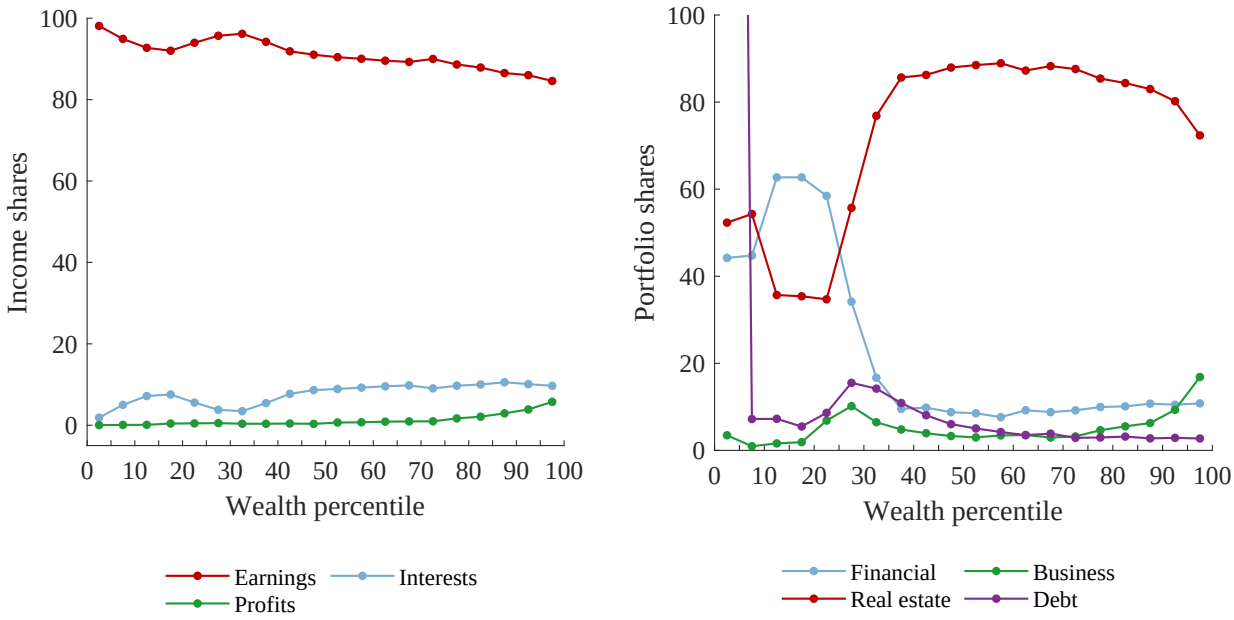

Figure 1: Income and assets by wealth.

Note: The left panel shows income sources as a share of disposable income. The right panel shows asset holdings as a share of total assets. Group averages shown.

Households rely almost entirely on labor earnings, either as workers or self-employed, throughout the wealth distribution. Capital income provides a substantial contribution to household incomes only at the top 10%. Among these households the income share of interests and dividends is around 15%. Households at the bottom 5% have negative wealth as the value of debt exceeds that of total assets. Overall, at the bottom of the distribution households wealth is held in the form of bank deposits. The increase in home equity and debt between the 20th and 40th percentiles, suggests that households in this wealth group take mortgages to become homeowners. Housing is the most important asset for the middle class, between the 50th and the 90th percentiles. At the top 10% there is a substantial increase in the share of private equity confirming the important role of entrepreneurs for top wealth groups.

2.2 Monetary policy shocks

Most of the variation of policy rates is due to the systematic response of policy to economic conditions. Then, to estimate causal effects of the policy on economic activity we need to isolate interest rate changes that are exogenous to economic conditions. I rely on the Euro Area Monetary Policy Event Study Database constructed in Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019). The idea of this approach is to use high-frequency financial markets data around policy announcements to extract exogenous changes in the policy interest rate. The identifying assumptions are that in the narrow time window that goes from the ECB press release to the press conference changes in asset prices are not systematically affected by other

news, and that monetary policy does not respond to asset price changes in this time window. I use changes in the 1-month Overnight Index Swap (OIS) rate to measure financial market surprises to monetary policy and the ECB interest rate on the Main Refinancing Operations (MRO) as the main policy rate.

I further clean monetary policy surprises from additional information released in the time window between the ECB press release and press conference by means of the sign restriction in Jarocinski and Karadi (2020). The idea is to consider only meetings in which stock prices move in the opposite direction of interest rate surprises. The reason is that in the conventional monetary transmission mechanism of theoretical models stock prices increase in response to lower interest rates. A positive comovement suggests that the interest rate response to the announcement could be due to other news about the economy. To measure stock prices I employ the Eurozone stock index Stoxx50. Then, I regress changes in the ECB main policy rate decided in each meeting on the monetary policy surprise in that meeting

$$\Delta i_m = \alpha + \beta \Delta s_m + u_m.$$

The OIS rate time series contains information on both conventional and unconventional policy measures. To isolate the effects of the former type of measures I focus on the years from 2000 to 2014, before the ECB quantitative easing. The details of the estimation results are reported in the Appendix A.1. The monetary policy shocks are given by the fitted values $\epsilon_m := \Delta\hat{i}_m$ from this regression. I convert the frequency of monetary policy innovations observed at each ECB meeting into an annual time series summing up all the shocks within each year $\epsilon_t = \sum_{m \in t} \Delta\hat{i}_m$. Figure 2 shows the resulting time series of monetary policy innovations.

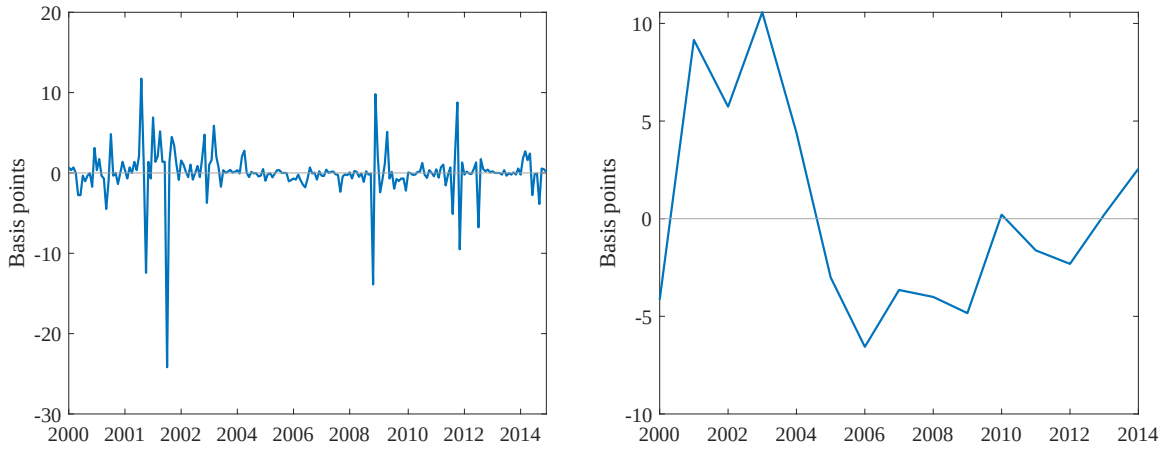

Figure 2: Monetary policy shock series.

Note: The left panel shows the time series of monetary policy innovations at daily frequency. The right panel shows the same time series at annual frequency.

2.3 Aggregate effects of monetary policy

I analyze the aggregate effects of monetary policy using a proxy SVAR with policy surprises as an external instrument (proxy). I use monthly time series for the period 2000M1-2016M12 from the ECB and Eurostat. The monetary policy surprise series is given by OIS rate changes. The VAR includes the following variables: the MRO rate, the log of industrial production, the unemployment rate, and inflation.[2] The VAR includes 12 lags and a constant. I estimate the model by ordinary least squares (OLS). I use a wild bootstrap to compute confidence bands from 1,000 bootstrap repetitions. The first-stage F-statistics is 16.6, so weak instrument problems are unlikely to be a major concern. The model delivers impulse responses that are broadly in line with the standard monetary policy transmission mechanism. Figure 3 shows that an exogenous 25 basis points interest rate cut increase economic activity and inflation.

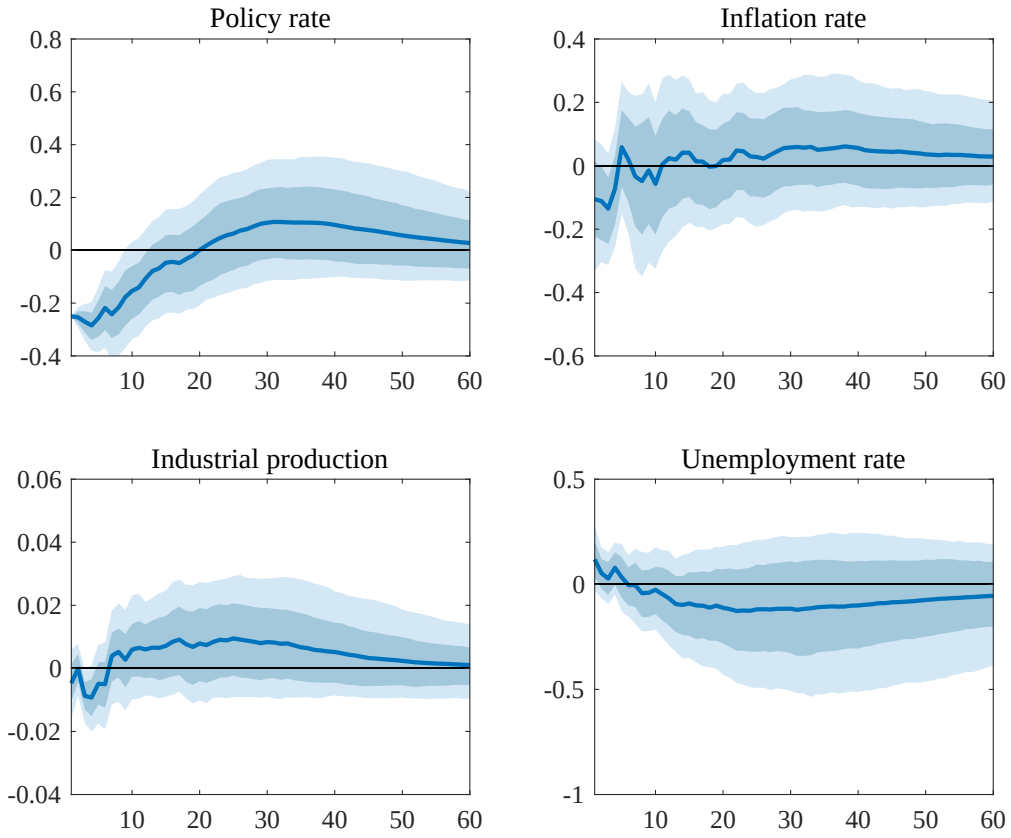

Figure 3: Aggregate responses to monetary policy.

Note: Solid lines show the estimates of the response to an exogenous reduction in the MRO rate by 25 basis points on impact. Shaded areas indicate 68% and 90% bootstrapped confidence intervals.

[2]To obtain the monthly time series of policy surprises, I aggregate daily OIS rate changes in each month. Similarly, I aggregate MRO rate changes in each month to construct a monthly time series for the level of the ECB policy rate. As a robusteness check I also consider the sample period 2000M1-2014M12, and find that the results do not substantially change.

This evidence is reassuring regarding the construction of the monetary policy shock series. Moreover, the estimated responses display a peak after around two years from the monetary policy shock. Therefore, I focus on the cross-sectional effects of monetary policy shocks at a two-year horizon. Finally, there are some caveats that is important to highlight. First, the confidence intervals of almost all the responses include the zero. This is a common finding the literature (Amberg, Jansson, Klein, and Rogantini Picco (2022)). Second, moving block bootstrap provides more accurate estimates than the wild bootstrap. Third, despite the fact that the cumulative response of inflation is positive there is a price puzzle on impact as inflation seems to decrease in the initial periods. There are several solutions to this problem such as include the more volatile components of inflation, i.e. energy and food prices, in the VAR. However, despite these limitations the main objective of this estimation exercise is to broadly charcterize the macroeconomic effects of the monetary policy surprises used to identify monetary policy innovations rather than providing a precise quantification of the effects of monetary policy.

3 Econometric model

In this section I present the econometric framework that I employ in the main empirical analysis. I begin by dividing households into wealth groups and then I estimate the impulse responses for each group $g = 1, 2, ..., G$. Specifically, I set $G = 5$ so that household i is allocated to group g in year t according to the quintiles of the wealth distribution in the previous years. In particular, I use average wealth in $t-2$ and $t-4$, and when a complete wealth history is not available I simply use wealth in $t-2$. This definition has two advantages. First, the recent literature on heterogeneous-agent models makes predictions on the cross-sectional effects of monetary policy based on the stationary or "long-run" wealth distribution. Second, ordering household according to lagged wealth guarantees that the group allocation is not influenced by shocks occurring in period t. Having defined wealth groups, I estimate the following set of local projections

$$\frac{y_{it+h} - y_{it-2}}{y_{it-2}} = \alpha_g + \beta_g \epsilon_t + \sum_{k=1}^{L} \delta_{g,k} \epsilon_{t-k} + \gamma_g x_{it-2} + u_{it} \quad \forall t, \forall i \in g. \tag{1}$$

The dependent variables is the percent change in income or consumption between years $t+h$ and $t-2$. The estimation horizon is $h = 0, 2, 4$. I set $L = 2$ to control for the lagged monetary policy shocks $\epsilon_{t-1}, \epsilon_{t-2}$. The control x_{it-2} is the lagged percent change in the outcome between years $t-2$ and $t-4$. The coefficient of interest β_g captures the average percentage change in income or consumption of household in group g due to a one percentage point increase in the policy rate.[3] Therefore, these coefficients deliver the impulse response functions of consumption and income to monetary policy innovations. I estimate the model by pooled OLS. The standard errors are clustered at the household and year levels. Respectively to account for serial correlation in

[3]From Equation (1) we have $\beta_g = \text{E}[100(\Delta y_{it+h}/y_{it-2})|\epsilon_t = 1\%] - \text{E}[100(\Delta y_{it+h}/y_{it-2})|\epsilon_t = 0\%], \forall i \in g$.

the dependent variable for each household and correlation in the monetary policy shock across households in each year. To avoid any outlier to drive the results the dependent variables and the control x are winsorized at the 1% and 99% cutoffs in each year. I also drop observations for which income growth exceeds 500 percent.

4 Results

This section presents the main results of the empirical analysis. First, I study the cross-sectional responses of consumption and disposable income to expansionary monetary policy shocks at a two-year horizon. Then, I provide supportive evidence from the response of unemployment and households' wealth to monetary policy. This additional results allow to better understand the transmission channels of monetary policy.

4.1 Consumption responses to monetary policy

The impulse response functions of consumption and income to a 25 basis point expansionary monetary policy shock are given by $-0.25\beta_g$. Figure 4 reports these responses. The left panel shows that monetary policy shocks have large and statistically significant effects on consumption at the tais of the wealth distribution, while the responses around the median are small. Consumption of the poorest households rise by 0.41 percent, household close to the median increase their consumption by 0.21 percent, and wealthy households increase their expenditure by 0.36 percent. These effects lead to a U-shaped cross-sectional pattern in the consumption responses with the largest adjustments at the top and at the bottom of the wealth distribution.

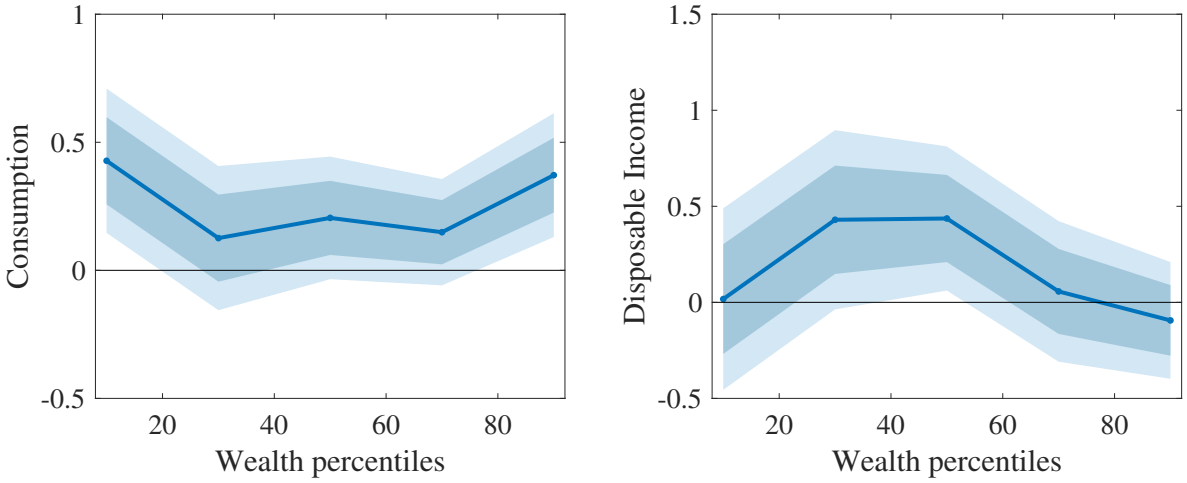

Figure 4: Consumption and income responses to monetary policy.

Note: Solid lines show the estimates of the response to an exogenous reduction in the MRO rate by 25 basis points on impact. Shaded areas indicate 68% and 90% confidence intervals.

The differential consumption responses between the top and bottom groups and the middle-class are broadly consistent with previous findings of the recent empirical literature on the heterogeneous effects of monetary policy. However, existing studies mostly focus on the income dimension or can only report imputed consumption from income and wealth data. Instead, in this paper I document the effects of monetary policy on a direct measure of nondurable consumption across the distribution of household net worth. This provides novel evidence that can be useful to test the predictions of a large class of quantitative HANK models, including models with liquid and illiquid assets.

Since wealth is weakly but positively correlated with consumption. These responses also suggest that the effect of monetary policy on consumption inequality is on average small since it increases consumption of households at the bottom and at the top almost by the same amount. This could also be the result of the fact that monetary policy increases consumption inequality in some periods but reduces it in other periods. So far, the empirical literature presents mixed results on the effects of monetary policy on consumption inequality. For example, Coibion, Gorodnichenko, Kueng, and Silvia (2017) find that interest rate cuts decreases consumption inequality, while Chang and Schorfheide (2022) suggest that inequality increases.

On the income side the results are less clear and this is likely due to limitations in the income measure. The responses are hump-shaped but with large confidence intervals. In particular, income in the second and third quintiles increases by almost 0.4%. As a result the estimates are only weakly significant even in the middle section of the wealth distribution. This substantially limit the interpretation of the income responses. This problem could be related to measurament errors on income growth. More importantly the definition of income excludes capital gains that are an important income source for households at the top of the distribution. This can explain the missing income response at the top of the distribution. I decompose the income response in Figure 4 by income sources and as expected I find that the response of disposable income is essentially driven by household earnings from wages and self-employment income while financial income shows little variation with monetary policy. The reason is that while interest rate cuts increase profits and dividends they reduce net interest income throughout the wealth distribution. As a result the two effects offset each other and financial income show little variation. Since the SHIW data allows to further disentangle interest expenses from interest revenues this is an important dimension to further explore to better understand the income responses. However, given the relative size of labor earnings and financial income from interest payments, it is unlikely that income effects from the latter can explain the size of the consumption movements at the tails. Finally, at the current stage there are also some other limitations to highlight. First, the standard errors do not properly take into account the survey design since the jaccknife weights for the estimation of the standard errors are only available until 2008, leaving uncovered a substantial part of the sample. A first step would be to compare the estimates before 2008 and then use clusters across years, regions, and municipalities for the remaining sample periods. Second, some households leave the sample well before the final sample period and others only enter in later sample periods.

4.2 Unemployment gap and monetary policy

In this section I investigate the effects of monetary policy on unemployment by household net worth. Since the consumption response of low-wealth households cannot be explained by the effects of monetary policy on the intensive income margin, I explore whether it reflects an adjustment on the extensive margin that draws low-income workers in the labor market. In the SHIW unemployment is concentrated at the bottom of the wealth distribution. Specifically, unemployed households at the bottom 20% of the wealth distribution are 34% of the total number of unemployed households in the economy. This number is 13% in the wealth group that contains the median household and only 7% at the top 20%. Since there is a significant unemployment gap between wealth groups, unemployment can be an important channel through which an accomodative monetary policy stimulates consumption of low-wealth households.

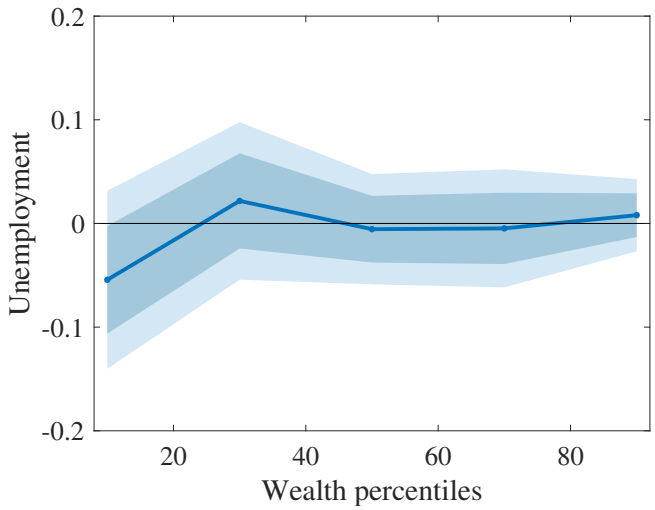

Figure 5: Unemployment responses to monetary policy.

Note: Solid lines show the estimates of the response to an exogenous reduction in the MRO rate by 25 basis points on impact. Shaded areas indicate 68% and 90% confidence intervals.

I estimate a version of model (1) with unemployment as the outcome variable. Figure 5 shows the effects of an interest rate cut of 25 basis point on the probability of unemployment across the wealth distribution. Households at the bottom 20% of the wealth distribution are less likely to be unemployed with an expansionary monetary policy. On the other hand, the effect for households in other wealth groups is clearly zero. Note that the 90% confidence interval contains the zero throughout the wealth distribution. The aim of this exercise is to document a potential mechanism driving the consumption responses of low-wealth households, I leave a more precise quantification of the unemployment channel and its effects on households' income for future research. Overall, I find evidence in the microdata that an accomodative monetary policy shrinks the unemployment gap between wealth groups.

4.3 Wealth effects of monetary policy

Households at the top of the wealth distribution show a large and significant consumption response to monetary policy, unfortunately the income measure from the microdata does not include capital gains, which are an important income source for households at the top of the distribution. To overcome this drawback I try to indirectly quantify the capital gains from publicly traded equity across the wealth distribution. To this end, I first estimate the effect of monetary policy innovations on stock prices. Then, I combine these estimates with the portfolio data from the SHIW to determine the households' capital gains from equity holdings.

As a first step I need to estimate the effects of monetary policy on stock prices. Since the monetary policy shocks are common in the Euro Area and households tend to hold diversified portfolios of stocks I use the Italian stock index FTSE MIB to measure stock prices. The outcome variable y_t is given by stock price changes, and the covariate of interest ϵ_t is the time series of monetary policy innovations from Section 2.2. I aggregate these data at the month level over nine years from 2006 to 2014 and estimate the following set of local projections

$$y_{t+h} = \alpha_h + \beta_h \epsilon_t + \sum_{k=1}^{L_1} \delta_{h,k} \epsilon_{t-k} + \sum_{k=1}^{L_2} \gamma_{h,k} y_{t-k} + u_t.$$

Then, from the response of stock prices to monetary policy shocks I compute the capital gains at the household level using the equity holdings from the SHIW. In particular, the measure of real financial wealth that I use contains stocks and a set of private bonds. This add some noise in the estimation, however the main objective of this section is to measure possible wealth effects at the top of the distribution and wealthy households tend to tilt their portfolios toward stocks increasing the accuracy of the estimates.

Figure 6 shows the results of these computations. The left panel plots the response of stock prices to monetary policy, in the right panel I leverage the portfolio data from the SHIW to compute the implied changes in households' wealth across the distribution. According to these estimates after one year from a 25 basis points reduction in the ECB policy rate stock prices increase by 1.1%. This implies a total capital gain of more than 2000 euro for households in the top 5% of the wealth distribution over the first year from the shock. The capital gains for the bottom half of the distribution are well below 100 euro. The capital gains for households at the top 20% are around 500 euro and about one-fourth as much for the median household. Therefore, the wealth effects of monetary policy appear to be concentrated at the top 20% of the distribution exactly where we observe the largest consumption response. From the left panel of Figure 6 we clearly observe that stock prices rise over the three years. Table 2 reports the total capital gains across different wealth groups in each year. The effects at the bottom are quantitatively small and overestimated as these households are more likely to have more bonds than stocks in their portfolios. The gap between the top and other wealth groups is much larger. The wealth effect at the 90th percentile is more than 10 times the wealth gain of the median households. The wealth gap is even larger with respect to the top 5% where the capital gains

are more than 20 times the effects at the median. These results suggest that portfolio effects and capital gains from equity holdings can explain at least part of the consumption responses that I document in Section 4.1. According to the consumption estimates the average response at the 90th percentiles could be around 1,400 euro. Therefore, even if households consume a small fraction of these capital gains this could explain a significant part of the increase in consumption at the top of the distribution. More broadly, the findings in this section show that wealth concentration determines large differences in households' exposure to monetary policy shocks.

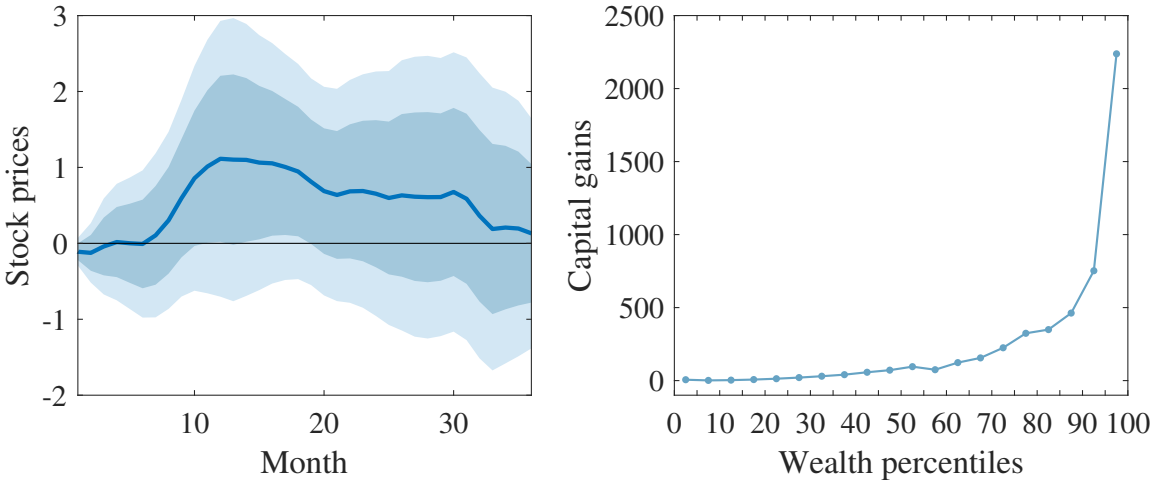

Figure 6: Stock prices and portfolio effects of monetary policy.

Note: On the left panel the solid lines show the estimates of the response to an exogenous reduction in the MRO rate by 25 basis points on impact. Shaded areas indicate 68% and 90% confidence intervals. The right panel plots the implied capital gains computed from SHIW equity holdings.

Table 2: Portfolio effects over time.

Total capital gain	20-25	50-55	80-85	90-95	95-100
1 year	12	95	349	752	2,237
2 years	57	422	1,544	5,497	9,898
3 years	27	201	738	1,591	4,734

Note: The table shows the average wealth effects due to a reduction in the MRO rate by 25 basis points in each year after the shock.

5 Conclusion

This paper aims to provide novel evidence on the heterogeneous effects of monetary policy across different wealth groups using consumption and wealth measures from the SHIW and monetary policy shocks identified from monetary policy surprises with the high-frequency approach. I find U-shaped consumption responses by household net worth. This evidence can be useful to test the predictions of quantitative HANK models. However, the underlying transmission mechanisms are critical to guide the development of these models. For this reason, I explore two transmission channels that can explain the large consumption responses at the tails of the distribution. First, accomodative monetary policy by stimulating the economic activity can draw marginal workers in the labor market. Second, expansionary monetary policies rise stock prices. Since household systematically differ in equity holdings across different wealth groups, rising equity prices have different effects on households' wealth and mostly benefit wealthy households at the top of the distribution. I find supportive evidence for these channels of monetary policy transmission.

The SHIW can be useful to investigate the importance of heterogeneoity in other dimensions for the consumption effects of monetary policy, for example by liquid wealth, age, and education. These estimates are particularly useful as they can provide further direct evidence regarding the transmission mechanisms through which monetary policy causes the consumption movements across wealth groups documented in this paper.

References

Almgren, Mattias, José-Elías Gallegos, John Kramer, and Ricardo Lima (2022). "Monetary Policy and Liquidity Constraints: Evidence from the Euro Area". In: *American Economic Journal: Macroeconomics* 14 (4), pp. 309–40.

Altavilla, Carlo, Luca Brugnolini, Refet Gürkaynak, Roberto Motto, and Giuseppe Ragusa (2019). "Measuring euro area monetary policy". In: *Journal of Monetary Economics* 108, pp. 162–179.

Amberg, Niklas, Thomas Jansson, Mathias Klein, and Anna Rogantini Picco (2022). "Five Facts about the Distributional Income Effects of Monetary Policy". In: *American Economic Review: Insights* 4, pp. 289–304.

Andersen, Asger Lau, Niels Johannesen, Mia Jorgensen, and José-Luis Peydró (2021). "Monetary Policy and Inequality". Working Paper.

Bartscher, Alina, Moritz Kuhn, Moritz Schularick, and Paul Wachtel (2021). "Monetary policy and racial inequality". Working paper.

Chang, Minsu and Frank Schorfheide (2022). "On the effects of monetary policy shocks on earnings and consumption heterogeneity". CEPR Discussion Paper No. DP17049.

Cloyne, James, Clodomiro Ferreira, and Paolo Surico (2020). "Monetary Policy when Households have Debt: New Evidence on the Transmission Mechanism". In: *The Review of Economic Studies* 87 (1), pp. 102–129.

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

Di Maggio, Marco, Amir Kermani, and Kaveh Majlesi (2020). "Stock Market Returns and Consumption". In: *The Journal of Finance* 75 (6), pp. 3175–3219.

Fagereng, Andreas, Matthieu Gomez, Emilien Gouin-Bonenfant, Martin Holm, Ben Moll, and Gisle Natvik (2022). "Asset-Price Redistribution". Working paper.

Fagereng, Andreas, Martin Holm, Ben Moll, and Gisle Natvik (2021). "Saving Behavior across the Wealth Distribution: The Importance of Capital Gains". Working paper.

Gornemann, Nils, Keith Kuester, and Makoto Nakajima (2021). "Doves for the Rich, Hawks for the Poor? Distributional Consequences of Systematic Monetary Policy". Working paper.

Holm, Martin, Pascal Paul, and Andreas Tischbirek (2021). "The Transmission of Monetary Policy under the Microscope". In: *Journal of Political Economy* 129 (10).

Hubmer, Joachim, Per Krusell, and Anthony Smith (2021). "Sources of U.S.Wealth Inequality: Past, Present, and Future". In: *NBER Macroeconomics Annual* 35, pp. 391–455.

Jappelli, Tullio and Luigi Pistaferri (2010). "Does consumption inequality track income inequality in Italy?" In: *Review of Economic Dynamics* 13 (1), pp. 133–153.

Jarocinski, Marek and Peter Karadi (2020). "Deconstructing Monetary Policy Surprises—The Role of Information Shocks". In: *American Economic Journal: Macroeconomics* 12 (2), pp. 1–43.

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

Jordà, Oscar, Moritz Schularick, and Alan Taylor (2020). "The Effects of Quasi-Random Monetary Experiments". In: *Journal of Monetary Economics* 112, pp. 22–40.

Kaplan, Greg, Ben Moll, and Gianluca Violante (2018). "Monetary Policy According to HANK". In: *American Economic Review* 108 (5), pp. 697–743.

Lee, Donggyu (2021). "The Effects of Monetary Policy on Consumption and Inequality". Working paper.

Mertens, Karel and Morten Ravn (2013). "The dynamic effects of personal and corporate income tax changes in the United States". In: *American Economic Review* 103 (4), pp. 1212–47.

Slacaleky, Jiri, Oreste Tristani, and Gianluca Violante (2020). "Household Balance Sheet Channels of Monetary Policy: A Back of the Envelope Calculation for the Euro Area". In: *Journal of Economic Dynamics and Control* 115.

Stock, James and Mark Watson (2012). "Disentangling the channels of the 2007-2009 recession". In: *Brookings Papers on Economic Activity*.

— (2018). "Identification and Estimation of Dynamic Causal Effects in Macroeconomics Using External Instruments". In: *The Economic Journal* 128, pp. 917–948.

Appendix

A Further details on the data

A.1 First stage regression

This section illustrates the estimation of the first stage regression of monetary policy surprises Δs_m on the ECB policy rate Δi_m . Figure 2 shows the estimation results. The sample size is given by 98 observations. I restrict the model to have a zero constant term α. Unrestricted estimates confirm that the constant term is not statistically significant. The first two columns of Table 3 show the effects of further cleaning the monetary policy surprises with sign restrictions.

Table 3: First stage regression.

Δi_m	(1)	(2)	(3)
Δs_m	0.78	0.68	0.69
	(0.001)	(0.02)	(0.02)
Constant	-1.45	-2.2	-
	(0.14)	(0.19)	-
Sample size	205	98	98

Note: (1), no sign restriction, (1) sign restriction, (3) sign restriction and $\alpha = 0$. p-values in parentheses.

A.2 Aggregate variables

Figure 7 shows the macroeconomic variables used in the VAR estimation. The industrial production index is seasonally and calendar adjusted, the unemployment rate is seasonally adjusted.

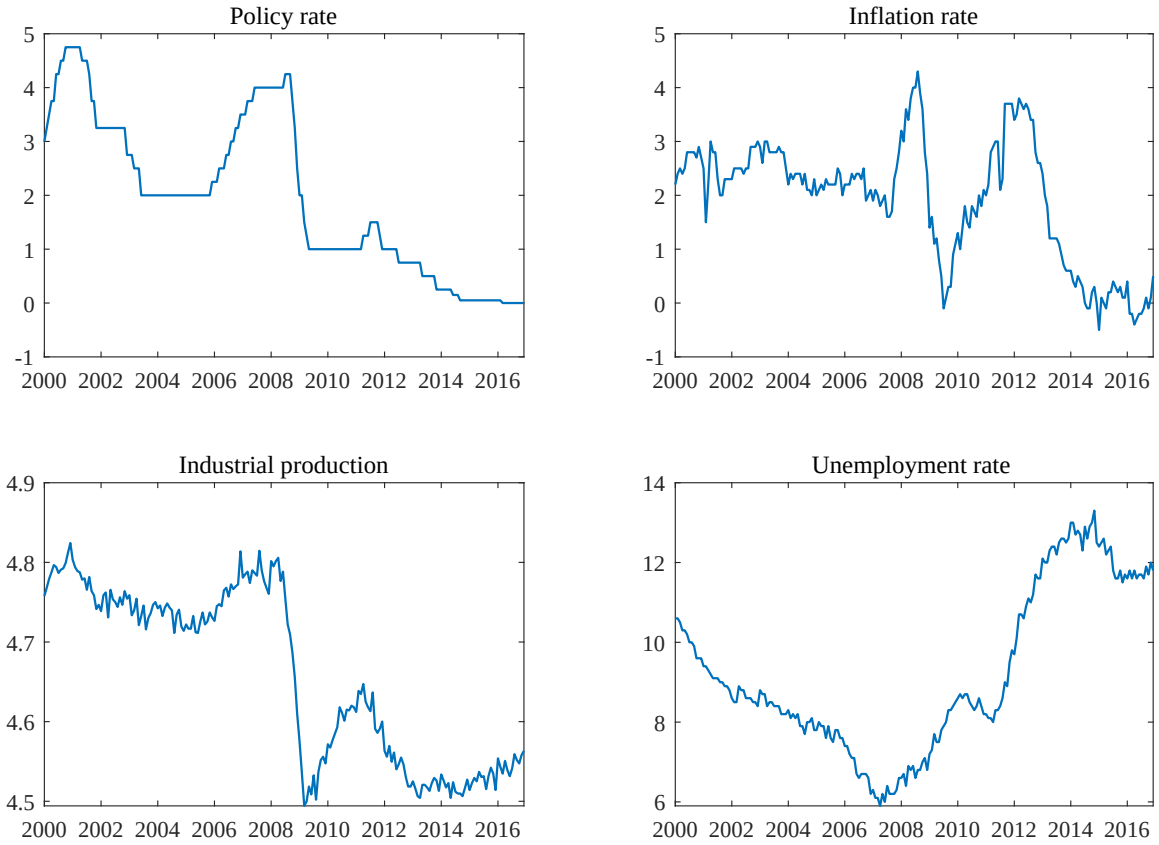

Figure 7: Aggregate time series

Note: Industrial production (first bottom panel) shown with log-scale, the other variables are percentages. Data source ECB, Eurostat.