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### Monetary Policy, Mortgages and Consumption: Evidence from Italy

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# Monetary Policy, Mortgages and Consumption: Evidence from Italy \*

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## Abstract

Using the Italian Survey of Household Income and Wealth (SHIW), we study whether the drop in interest rates following the Great Recession was associated with an increase in consumption for households with Adjustable Rate Mortgages (ARM) relative to those with Fixed Rate Mortgages (FRM). After the reduction in mortgage payments, consumption of ARM holders increases relative to FRM but the implied marginal propensity to consume (MPC) is not statistically different from zero. We suggest three explanations for the weak consumption response to the income shock. First, cash-on-hand and debt heterogeneity may attenuate the consumption response. Second, borrowers believe that the income shock was transitory, and that interest rates would likely increase in the future, implying a small effect on consumption. Third, the shock is offset partly by a reduction in income from financial assets owned by mortgagors. The findings have implications for the conduct of monetary policy interventions and the credibility of the future path of interest rates, pass-through of monetary policy, and design of the mortgage market.

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# 1 Introduction

The importance of the consumer response to monetary and fiscal policies is attracting renewed attention given the large fiscal stimulus packages and loose monetary policies enacted by governments and central banks on both sides of the Atlantic to counteract the Great Recession. One of the major problems for policymakers is to assess whether these policies are effective in stimulating aggregate demand, of which consumption is the largest component. While several studies analyze how government transfers and tax reforms impact on consumption and output, this paper focuses on the effect of monetary policy on consumption.

There is a large literature analyzing the various channels through which monetary policy has real effects. The traditional *interest rate channel* suggests that an expansionary monetary policy lowers the real rate of interest and the cost of capital, boosting investment, and expenditure on durable consumption and housing. A reduction in interest rates induced by monetary policy also raises asset values which in turn, stimulates consumer spending on nondurable goods and services via a *wealth effect*. There is a further amplification of this mechanism if a monetary policy shock expands the supply of loans by banks, stimulating investment and consumption (Bernanke and Gertler, 1995). According to the *credit channel* hypothesis, small firms benefit more from monetary shocks, because relative to large firms, they are dependent largely on bank loans.<sup>1</sup>

In this paper we focus on a fourth transmission mechanism, that is, the *income effect* arising from an unanticipated change in the mortgage interest rate induced by monetary policy. A reduction in mortgage payments associated with a drop in interest rates operates only for households with Adjustable Rate Mortgages (ARM) but has no effect on households with Fixed Rate Mortgages (FRM) which are tied in to their initial choice. The extra resources obtained by ARM holders may be used to boost consumption expenditure but also may induce some households to deleverage, thereby reducing the household debt burden (Di Maggio *et al.*, 2014; Keys *et al.*, 2014b). This channel is most effective when borrowers perceive that the interest rate change is permanent, calling attention to the credibility of the central bank strategy to maintain low interest rates in

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<sup>1</sup>It is difficult to find empirical evidence to support the credit channel view, because loose monetary policy conditions can increase both the demand for and supply of loans. Jimenez *et al.* (2012) address this crucial identification problem using microeconomic data on Spanish banks and firms. They find that higher interest rates reduce the probability of a loan being granted, and that this effect is stronger for banks with low levels of capital or liquidity, as suggested by the credit channel view.

the future. Furthermore, the same monetary policy shock reduces income from financial assets, counteracting the effect on mortgage payments. Therefore, the monetary shock is not effective if households have invested a large share of their financial wealth in short-term assets. In particular, the consumption response to the monetary policy shock could be similar across the two groups if ARM households invest more heavily in such assets. In this case the gain from lower borrowing rates may be partially or even fully offset by a loss in financial income.

The consumption response depends also on mortgage duration, and expectations about future interest rates. Indeed, in standard intertemporal models, the consumption effect of income shocks depends on households' expectations about the shock itself. If the mortgage has a long residual life and if households believe that the shock is permanent, the change in interest rate affects the present discounted value of all future mortgage payments, with a potentially large impact on consumption. Instead, if the shock is transitory – for instance, because people believe that interest rates will soon revert to a “normal” level, or because mortgages have a relatively short residual life – the consumption effect will be negligible. Therefore, those ARM holders who believe that the reduction in interest rates is permanent, and whose mortgages are of long duration, should respond more to monetary policy. More generally, Auclert (2016) shows that households are not all affected equally by changes in interest rates, and that the composition of households' balance sheets is important to understand how consumption responds to such changes.

To address our research question, we use Italian repeated cross-sectional data for households with mortgages in the post-crisis period, and exploit the exogenous source of variation in mortgage payments induced by monetary policy easing after 2008. Following the collapse of Lehman Brothers in September 2008, within a period of seven months the European Central Bank (ECB) lowered the official interest rate by 325 basis points, from 4.25% to a historic low of 1% (Figure 2). Subsequent years saw further cuts in the official interest rate which brought the minimum bid rate to the current level of 0.05%. As a consequence of the aggressive cuts to the official interest rate, between 2008 and 2010 the 3-month Euribor - the main reference rate for Italian ARM - dropped by 3.8 percentage points.

Our sample focuses on households with mortgages granted before 2008. Households with FRM are the “control” group since their mortgage payments are unaffected by the monetary policy shock. Households with ARM benefit from the interest rate drop, and therefore are the “treat-

ment group”. We apply a difference-in-difference framework to compare consumption for the two groups after the reduction in interest rates.

After the monetary policy shock, annual mortgage payments of borrowers with ARM declined by about 900 euro relative to FRM borrowers. Given an average annual mortgage payment of about 7,000 euros, this is a sizable drop of about 13%. We estimate that, after this shock, consumption of ARM holders increases relative to FRM but the estimated Marginal Propensity to Consume (MPC) is not statistically different from zero. We propose three possible explanations for this result: (i) cash-on-hand and debt heterogeneity may attenuate the consumption response to income shocks; (ii) part of the positive income effect is offset by the reduction in income from financial assets; (iii) between one-third and one half of the sample believes that the monetary shock is transitory, and that interest rates will revert to higher levels in the near future.

The rest of the paper is organized as follows. In Section 2 we review the relevant consumption literature. In Section 3 we describe the impact of the monetary policy shock on mortgage interest rates, and relevant features of the Italian mortgage market. Section 4 presents the data and the empirical strategy. The results and their interpretation are provided in Sections 5 and 6, respectively. Section 7 presents several robustness checks. Section 8 summarizes the results and their implications for monetary policy.

## **2 The consumption effect of income shocks**

Analysis of households’ responses to exogenous changes in future resources have been studied in depth, and have important policy implications for instance, in relation to the consumption impact of tax reforms and fiscal policy shocks. While the literature on the effect of anticipated income shocks on consumption is vast, much less is known about the effect of unanticipated shocks. A major problem in estimating the MPC from a change in households’ resources is to isolate the exogenous shocks to income, and to trace consumption behavior after the shock.

The general reference framework used in the literature is the permanent income hypothesis which suggests that consumption should respond strongly to unanticipated permanent income shocks but not (or very little) to transitory shocks. The literature surveyed in Jappelli and Pistaferri (2010) considers three approaches to testing these theoretical predictions, each of which has

pros and cons. A first approach is to rely on statistical decomposition of income shocks and the covariance restrictions imposed by the theory on the joint behavior of income and consumption, and use long panel data to relate income shocks to consumption changes Blundell *et al.* (2008). Survey questions containing responses to hypothetical income changes represent a second alternative (Jappelli and Pistaferri, 2014). A third method proposed in the literature and the one that is adopted here, identifies episodes when income changes unexpectedly, and in a quasi-experimental setting evaluates how consumption reacts to such changes (Fuchs-Schuendeln and Hassan, 2015).

Most papers that adopt the quasi-experimental approach focus on the shocks induced by stimulus programs, fiscal reforms, or shocks to the incomes of public sector employees. Using the Consumer Expenditure Survey, Johnson *et al.* (2006) estimate that households spent 20% to 40% of the 2001 US income tax rebate during the three-month period of receipt of the rebate. Consistent with liquidity constraints, estimates responses are larger for households with low liquid wealth or low income. Broda and Parker (2008) find that the MPC from the \$100 billion tax rebates issued in the US in 2008 (\$950 per recipient on average) was 18%, and that also in this case, it was larger for low-income, low-wealth households.

Agarwal and Qian (2014) exploits the Singapore government's 2011 announcement of its Growth Dividend Program. The program included a one-time cash payout ranging between \$80 and \$700 per resident; foreigners were excluded from the program. The authors use a panel data set of consumer financial transactions to study how consumers responded to this unanticipated income change, and find an MPC of 0.8 during the ten months following the announcement. They also find a strong announcement effect; consumers increased spending during the two months between the announcement and the actual cash payout (an MPC of about 0.15).

Two recent papers use online financial managers' administrative data on spending and balance sheet data to test whether government employees smoothed their spending during the 2013 U.S. Federal Government shutdown which left them unexpectedly without their regular pay-checks for about two weeks. In particular, Gelman *et al.* (2014) use non-government employees as the control group, and find that the shutdown did not generate a drop in consumption because many individuals rearranged the timing of recurrent expenditures (such as mortgage or credit card payments) to overcome their (temporary) reduced liquidity so as to minimize the effect of the shutdown on their overall consumption. In contrast, Baker and Yannelis (2015), using a different online financial

management dataset, report that consumption appears to respond to the shutdown, which violates the permanent income hypothesis.

In the context of the Italian economy, Neri *et al.* (2015) use the 2014 SHIW to study the consumption effect of a bonus distributed to Italian employees between May and December 2014. About 21% of households reported receiving the bonus, and spending about 50% of it. Households with low liquid wealth or low income reported spending a larger amount of the bonus. Surico and Trezzi (2015) analyze the effects of an increase in Italian property taxes between 2010 and 2012 by comparing the change in expenditure for households affected by the tax increase, to the change in expenditure for non-taxpayers. They find that the proportion of MPC for non-durable goods and services in the property tax is small and not statistically different from zero (around 0.05), while the marginal propensity to spend on durable goods is considerably larger (about 0.43). The spending effect is particularly large for taxes paid on the main dwelling (rather than on other residential properties), for homeowners with mortgage debt, and households with a low liquid wealth-income ratio. Jappelli and Padula (2016), using a difference-in-difference framework, estimate the impact of an unexpected reduction in lifetime resources induced by a reform to the severance pay of Italian public employees. They find that each euro reduction in severance pay reduces the average propensity to consume by 3 cents and increases the wealth-income ratio by 0.32. The response is stronger for younger workers and for households where both spouses are public sector employees.

Other papers focus on the effect of monetary policy on mortgage payments and consumption, and are the closest to our work. Di Maggio *et al.* (2014) focus on U.S. households that purchased homes between 2005 and 2007 using an adjustable rate mortgage (ARM), with an automatic reset of interest rates after five years. The loose monetary policy of the post-recession period, and the implied fall in mortgage rates resulted in an average \$900 monthly drop in mortgage interest payments which represents a substantial income influx for most households. The authors show that after the interest rate reset, the probability of a car purchase increased by 45%, and that on average, 40% of the income increase was used to purchase durable and non-durable goods. Keys *et al.* (2014), using a similar identification strategy, find that a sizable decline in mortgage payments (\$150 per month on average) induces a significant drop in mortgage defaults, and an increase of more than 10% in new financing of automobile purchases. Furthermore, borrowers with lower housing wealth respond more relative to wealthier households, to a mortgage payment reduction.

Cloyne *et al.* (2015) use cohort data for the U.K. and the U.S. and compare the consumption response to an interest rate change in these two countries. The dollar change in mortgage payments is nearly three times larger in the U.K. (which features mostly ARM) than in the US (where FRM dominate), suggesting that monetary policy can have large redistributive effects among households. However, the expenditure difference in the two countries is rather small compared to differences in the magnitudes of the income changes, suggesting that what really matters is not the differential cash-flow effects for the two types of mortgagors, but the general equilibrium effect boosting consumption for the two groups. Indeed, according to Cloyne *et al.* (2015) what really matters is household indebtedness: as in Kaplan and Violante (2014) mortgagors are "wealthy hand-to-mouth" consumers, regardless of whether they hold ARM or FRM mortgages.<sup>2</sup> So other effects of monetary policy, such as the effects on credit and investment, are likely to be the ones most actively at play.

Overall, previous research suggests that the MPC from a transitory income shock tends to be larger than predicted by standard intertemporal models, and that transitory shocks have a lower impact on consumption than do permanent shocks. Responses are often larger for low cash-on-hand households, a finding which generally is interpreted as evidence supporting models with liquidity constraints and precautionary savings. Debt heterogeneity may also play an important role. Indeed, according to Mian *et al.* (2013) the MPC from a negative wealth shock is higher for highly indebted households, who are also more likely to be liquidity constrained. On the other hand in response to a positive income shock, as the one we analyze in this paper, highly indebted households may deleverage rather than consume, leading to a lower MPC.

With respect to the previous literature on monetary policy and consumption, the present paper offers improvements in many dimensions. First, and perhaps most importantly, in Italy borrowers are split equally between ARM and FRM, providing a good basis for quasi-experimental evidence for a single country. Second, rather than administrative data we use a representative sample of borrowers. Third, we use comprehensive consumption data, not just expenditure on cars or selected consumption items. Fourth, we have data also on income, and can measure the impact of the interest rate shock on income from financial assets. Fifth, we have direct measures of expectations

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<sup>2</sup>Kaplan and Violante (2014) define "wealthy hand-to-mouth" consumers as households with substantial amounts of real assets, low liquidity and high MPC. In their model real wealth does not matter much for differences in MPC because households face high transaction costs when they attempt to liquidate real assets, at least in the short run.



about interest rate increases one year ahead which help us to assess whether the monetary shock is perceived as temporary or permanent. Nevertheless, our data have some limitations. The most important one, given the relatively small size of the mortgage market in Italy, is that we use a relatively small sample which for some specifications delivers large standard errors.

### **3 The Italian mortgage market in international perspective**

Before turning to the empirical analysis, it is useful to consider some stylized facts about the size and characteristics of the Italian mortgage market drawing on data from the SHIW. In terms of size, in 2008-2014 the ratio of total household liabilities to disposable income was 28% on average, 70% of which was represented by mortgages. The median loan-to-value (LTV) ratio is 50%, with a median loan duration of 15 years and a median loan amount of 95,000 euro. Thus, compared to other countries at similar levels of economic development, the Italian mortgage market is relatively thin, with median debt-income and LTV ratios substantially below the euro area average (Lea, 2014).

The law and finance literatures emphasize the importance of differences in legal systems and judicial efficiency for the performance of credit markets, suggesting that the cost of enforcing contracts and of disposing of collateral can affect the cost of credit and the market size. The length of housing mortgage foreclosure proceedings is a direct measure of enforcement costs in mortgage markets. Due to the slowness of the judicial process in Italy, debt collection and repossession can be very time-consuming (4 to 6 years) compared to other European countries (1 year), and can induce lenders to limit LTV and debt service-income ratios. Inefficiencies in the mortgage market and enforcement problems have not prevented Italian households from investing heavily in the housing market; the fraction of homeowners has increased dramatically from 46% in 1961 to 70% in 2014. This suggests that in Italy people finance their home purchase with both mortgages and own means but become homeowners much later in life (between 40 and 45) than in countries with more developed mortgage markets which allow people to purchase homes at much younger ages (Chiuri and Jappelli, 2003).

Italy represents a good case to compare the behaviors of ARM vs. FRM mortgage holders. Figure 1 reports the share of ARM in total mortgages for several European countries and the

U.S. There are considerable differences in interest determinations across countries. Badarinza *et al.* (2015a, 2015b) claims that the variation in the share of ARM across countries depends on several factors such as a country's historical inflation volatility, the mortgage market regulatory system, and mortgage funding arrangements. In Spain, the U.K., Portugal, and the Netherlands the market is dominated by variable rate mortgages, often with short-term initial fixed rates Lea (2014). Revisions to the interest rates on these loans are usually simultaneous for all borrowers and are based on changes in the underlying index. At the other extreme, in the U.S., France, and Denmark mortgages are mostly long-term, fixed interest rate loans. Italy represents an intermediate case with a balanced mix of ARM and FRM, indexed to the Euribor, and typically revised every six months. This feature of the Italian mortgage market allows us to conduct a within-country comparison between ARM and FRM holders.

From the point of view of the an individual household, the choice between ARM and FRM should depend on a comparison of the risks and costs associated with these two mortgage types. ARM has short-term variability in required payments, whereas the risk associated to a FRM is related to variability in the real value of the capital good. Koijen *et al.* (2009) argue that in choosing between ARM and FRM homeowners compare estimates of the average ARM rate over the likely duration of the mortgage, with the prevailing FRM rate. For Italy, Paiella and Pozzolo (2007) show that, contrary to the predictions in the theoretical literature, proxies for exposure to other risks, and individual risk aversion are irrelevant for the choice between ARM and FRM, and Foà *et al.* (2015) use data from the Italian Credit Register and the Survey on Loan Interest Rates issued between 2005 and 2008 and show that the choice between ARM and FRM is correlated not only with the relative cost of the two types of mortgages, but also with the characteristics of the banks that originate the mortgage. They conclude that Italian banks can manipulate the choice of their customers and steer their clients into choosing the type of mortgage that the bank favors based on the type of funding on which they rely. Using the same dataset Gambacorta *et al.* (2016) estimate a structural model of distorted advice in the mortgage market and conclude that a large fraction of the population of borrowers lacks the sophistication to take independent decisions about financial instruments.

In short, the choice between ARM and FRM is complex, and the two samples might differ along some dimensions (such as economic resources, demographic variables, credit market char-

acteristics, and preferences). For our identification strategy it is important to control for additional variables, and to focus on households that chose their mortgage type before the unexpected interest rate drop that occurred in 2008.

A related issue is the incentive for borrowers to renegotiate the terms of their mortgage after the interest rate change. In Italy there are three means available to borrowers to modify their mortgage terms: (i) renegotiation with the same bank; (ii) substitution, and (iii) subrogation. Renegotiation requires both parties - mortgagor and the bank - to agree the new contractual conditions (e.g. a different interest rate or duration) and does not entail any additional cost for the borrower. Substitution consists of replacing the existing contract with a new one, and entails all the costs associated with a new mortgage contract. Mortgage substitution is most often used to increase or to reduce the amount of the loan. Finally, subrogation is the transfer of the mortgage to a different bank. Following the “Bersani Reform” which took place in 2007, this type of transfer does not incur any cost for the borrower.

Aggregate financial statistics and microeconomic data indicate that not many borrowers changed the terms of their mortgages. Financial statistics indicate that after the crisis, mortgage renegotiations, substitutions, and subrogations did not exceed 10% of the value of the outstanding mortgages.<sup>3</sup> Microeconomic data on renegotiations, substitutions, and subrogations, available only from the 2014 SHIW, show that on average, in a single year very few borrowers change the terms of their mortgage.<sup>4</sup> Thus, the evidence suggests that few households modify the terms of their mortgage even in periods of substantial drops in interest rates. Bajo and Barbi (2015) analyze the effect of a 2007 reform which made refinancing similar to a cost-free decision for households, on households’ refinancing decisions. They show that although the refinancing gains for fixed rate borrowers amounted to 8% of the principal balance, only 4.2% of borrowers locked in this opportunity following the 2009 drop in interest rates.

This is in line with the evidence for the U.S. (Keys *et al.*, 2014a) and Denmark (Andersen *et al.*, 2015) that many mortgagors do not take advantage of refinancing opportunities, even when there are potential benefits from doing so. Three explanations have been advanced to account for

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<sup>3</sup>For instance, in 2010 substitutions and renegotiations represented 2.8% of the stock of outstanding mortgages, and renegotiation with the same bank represented 2% (Bank of Italy, 2011).

<sup>4</sup>This estimate is based on responses to a question in the 2014 survey that asked: "During the last two years (2013-2014), did your household make any change to the conditions of your mortgage loan?". The fraction of households that replied "yes" was 4.9%, including 4.3% renegotiated and 0.6% subrogated. The fraction that substituted is negligible.

this apparent puzzle. First, from a purely financial point of view, Agarwal *et al.* (2013) develop a formula for the optimal refinancing decision and suggest that refinancing has both costs and benefits. For realistic parameter values, refinancing becomes advantageous if the interest rate differential between the old and the new mortgage exceeds 1% or 2% (depending on the calibration). Campbell and Cocco (2003) argue that borrowing-constrained homeowners base their choice only on a comparison between current ARM and FRM rates.

A second explanation is lack of financial sophistication. Using the American Housing Survey, Campbell (2006) finds that many households do not refinance FRM, particularly poorer and less educated ones, and therefore end up paying higher mortgage rates than the ones prevailing in the market. Badarinza *et al.* (2015a) find evidence that homeowners choosing between an ARM versus a FRM look no further than one year ahead. In a related paper, Johnson *et al.* (2015) study the refinancing opportunities offered by the U.S. Home Affordable Refinance Program and find that over 50% did not refinance, even when the interest rate dropped by 1.8 percentage points, leading to a potential decrease in monthly mortgage payments of \$204 on average. Survey data show that the likely reason for this puzzling finding is borrowers' suspicions about the motives of financial institutions (for many borrowers the offer seemed "too good to be true"). For Italy, Bajo and Barbi (2015) provide comprehensive evidence that investor inattention and lack of financial sophistication play a fundamental role in explaining why households missed out on profitable (to them) refinancing opportunities.

A third explanation is the sluggish adjustment of interest rates on FRM. Figure 3 plots Italian interest rates on new mortgages adjustable within a year, and interest rates on new loans fixed for at least 10 years. While the adjustable interest rate dropped quite significantly between 2008 and 2009, the adjustment to the 10-year fixed interest rate on new operations was more sluggish, providing considerable profit to the banking sector. For example, at the end of 2009 the spread between the cost of a fixed rate mortgage and an adjustable rate mortgage was 2.7 percentage points in Italy, 1 point above the corresponding euro area spread. By comparison, in the U.S., the spread was only 0.7 percentage points. Furthermore, there was a reversal between 2010 and 2012. The bottom line is that in Italy there was little incentive to renegotiate FRMs despite the drop in official interest rates. A complementary explanation for the limited number of renegotiations is that many households lack the financial sophistication required to understand when refinancing is

optimal, and to take the necessary actions.

## 4 Data and empirical strategy

The econometric analysis relies on the SHIW, a large representative survey of the Italian population carried out by the Bank of Italy. The sample structure is consistent with the design of the Labor Force Survey conducted by ISTAT (the Italian National Statistical Institute).<sup>5</sup> Data are collected through personal interviews in the first months of the calendar year, thus flow income and consumption refer to the previous year which in Italy coincides with the calendar year. Questions concerning the whole household are answered by the head of the family or by the person most knowledgeable about the family finances; questions on individual income are answered by each family member. The unit of observation is the family which is defined as including all persons residing in the same dwelling who are related by blood, marriage, or adoption. “Partners or other common-law relationships” are also treated as family. The SHIW contains detailed data on household income, consumption, wealth, and demographic characteristics. Most importantly for this paper, the SHIW provides data on mortgage characteristics: mortgage type (ARM or FRM), mortgage duration, mortgage interest rate, mortgage payment and, since 2008, year when the loan started. The SHIW is a repeated cross-section with a rotating panel component. For our identification strategy, panel data are not required, as explained in detail below. Furthermore, restricting the sample to the panel section of the SHIW would reduce dramatically the sample size (by over 50%). Our baseline regressions use four repeated cross-sections (2008, 2010, 2012 and 2014) and for robustness analysis we also report results using data from the previous four surveys (2000-2006). In 2010 the survey included a special section asking about expectations about interest rates one year ahead which we use to assess whether the income shock is perceived as transitory or permanent.

Table 1 reports sample statistics for ARM and FRM holders in the pooled 2008-2014 sample. In columns 1 and 2 we retain only households with mortgages, and non missing values for mortgage and household characteristics. We also excluded the top and bottom 1% of the con-

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<sup>5</sup>Sampling is carried out in two stages: selecting the municipalities, and selecting the households. Municipalities are categorized into 51 strata, defined by 17 regions and 3 population size classes (over 40,000, 20,000-40,000, less than 20,000). All municipalities that fall into the first group are included; those in the second and third groups are selected randomly with a probability proportional to their population size. In the second stage households are selected randomly from registry office records.

sumption distribution, which resulted in a sample of 2,991 observations with mortgages. Both ARM and FRM mortgagors are aged around 50 years on average, and have household heads who are predominantly male with slightly over 11 years of schooling. ARM holders are wealthier in terms of real and cash-on-hand (defined as financial assets plus current income), have larger loans, and make larger mortgage payments (7,342 euro for ARM holders vs. 6,641 euro for FRM). The mortgage duration for ARM holders is longer (19.5 against 17.2 years) and interest rates are lower (3.9% against 4.8%). Consumption measured as expenditure on non durables is slightly higher for the ARM group (31,200 against 29,300 euro). For comparison, the third column in Table 1 reports the sample statistics for the whole sample (including also households without mortgages). Since mortgage holders tend on average to be younger than the rest of the sample, they are also less likely to be retired, and less likely to have relatively larger families.

The approach implemented in this paper does not require either estimation of the income process or observation of the individual income shocks. Rather, it compares households that are exposed or not to the interest rate shock (or the same households before and after the shock), and assumes that the difference in mortgage payments, consumption, and other variables of interest arises from the shock.

As discussed in Section 3, the sharp decline in interest rates in 2008 represents a positive income shock for ARM households, and has no direct impact on FRM households. To see how the shock affected SHIW respondents, we rely on self-reported mortgage rates.

Figure 4 plots the sample average interest rates for ARM and FRM (left axis) and the three-month Euribor rates (right axis) from 2004 to 2014. The dynamics of the self-reported ARM rate tracks the Euribor rate (the solid line) remarkably well. During the sample period the ARM rate declined by 170 basis points, and the FRM by only 20 points. Figure 5 shows how the interest rate reduction affects the distribution of mortgage payments, plotting the distribution separately for ARM and FRM mortgages before and after the shock. The effect of the monetary shock is evident for ARM households since the distribution of mortgage payments in this group shifts to the left, leaving the distribution of payments for FRM households unaffected. Figure 5 provides strong evidence that the shock has differential effects on household income.

In order to identify the effect of monetary policy on mortgage payments and consumption, we use a difference-in-difference strategy which relies on comparing ARM and FRM holders before

and after the fall in interest rates. In order to take account of changes in the sample composition around the time of the shock, we specify two regression models which allow us to control for household and mortgage characteristics:

$$m_{it} = \beta_{0,t} + \beta_1 ARM_i + \beta_2 ARM_i \cdot POST_t + \beta_3 X_{it} + \epsilon_{it} \quad (1)$$

$$c_{it} = \gamma_{0,t} + \gamma_1 ARM_i + \gamma_2 ARM_i \cdot POST_t + \gamma_3 X_{it} + \eta_{it} \quad (2)$$

where  $m_{it}$  is the household  $i$ 's annual mortgage payments and  $c_{it}$  is annual non-durable consumption,  $\beta_{0t}$  and  $\gamma_{0t}$  are year fixed effects,  $POST_t$  is a dummy that takes the value one after 2008, and  $X_{it}$  are household and mortgage characteristics. Finally,  $ARM_i$  is a dummy that takes the value one if household  $i$  has at least one ARM. This is the relevant variable for our experiment because it implies that the household has experienced a positive income shock.<sup>6</sup> To control for geographic factors that affect both the take-up of ARM and the level and evolution of  $m_{it}$  and  $c_{it}$ , in all specifications we include region and city size indicators. In order to partial out variation driven by mortgage and household characteristics, we control for year of mortgage origination, initial mortgage amount and duration, family size, and characteristics of the household head (gender, age, education, and main employment). The key coefficients of interest are  $\beta_2$  and  $\gamma_2$ . For the mortgage payment regressions, we expect  $\beta_2 < 0$ , i.e. ARM households experience a drop in mortgage payments relative to FRM households, while for the consumption regressions we expect  $\gamma_2 > 0$ , i.e. consumption of ARM households is predicted to increase in relative terms.

The validity of our empirical strategy rests on the assumption that the evolution of the outcome variable for FRM holders provides a valid counterfactual for the evolution of the outcome for ARM holders, in the absence of a fall in interest rates. This assumption requires that the sample of ARM holders does not differ significantly from the sample of FRM holders in terms of unobservable characteristics that would affect outcomes (mortgage payments, consumption, income from financial assets) differently during the period under study. It is particularly important to check whether the dynamics of consumption of the two groups are different before 2008. For this purpose, in

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<sup>6</sup>In practice very few households have more than one mortgage. For instance, in 2008 only 18 out of 736 borrowers have more than one mortgage on the main residence and, of these 18, only 7 have both types of mortgages. Similarly, in 2010 only 9 households out of 695 have different mortgage types on the main residence.

Figure 6 we plot non-durable consumption of the two groups of households from 2000 to 2014. The trends in consumption of the treatment and control groups are similar before the monetary policy shock. Immediately after the shock there is an increase in consumption for ARM households relative to FRM households, but since 2012 the two groups exhibit similar consumption dynamics. Our identification strategy also requires that there are no changes in the composition of the two groups caused by the fall in interest rates. In order to mitigate this concern we estimate equations (1) and (2) also on the subsample of households with mortgages originated before 2008.

Another potential threat to our identification strategy is represented by the possibility that FRM holders renegotiate their mortgage and obtain lower interest rates. If this were true, FRM holders would also receive a positive income shock and would not constitute a valid control group. This threat is easily dismissed: as discussed in Section 4, in Italy long-term rates (and FRM mortgage rates in particular) did not fall significantly until at least 2014, providing quite limited incentives to renegotiate their loans. Indeed, only 4.9% of respondents with a mortgage reported that they made a change to the conditions of the mortgage in 2013-14.

## 5 Empirical results

Table 2 shows the baseline estimates for the effect of the fall in interest rates on annual mortgage payments. Columns (1) and (2) report the coefficients estimated using the full sample, columns (3) and (4) refer to the sub-sample of households with mortgages originated before 2008. In column (5) we add labor income to the list of regressors since demographic variables and occupation are an imperfect proxy for households' resources.<sup>7</sup> All specifications include year fixed effects, region and city size dummies, and mortgage characteristics, with household characteristics included only in columns (2), (4) and (5).

The positive coefficient of the main effect of ARM indicates that annual mortgage payments are on average higher for ARM than for FRM, even if all the controls are included. The negative coefficient of the interaction term ( $\beta_2$ ) shows that after 2008, annual mortgage payments for ARM holders fall relative to FRM holders. The magnitude of the coefficient on the interaction term is sta-

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<sup>7</sup>Since income is measured with an error which is likely to be correlated with consumption and other outcome variables, we do not include income in the baseline specification.



ble across specifications. As expected, the drop in mortgage payments is larger (in absolute value) and more precisely estimated when we restrict the sample to households with mortgages which were taken out before 2008, as shown in columns (3) and (4). The regressions show also that mortgage payments increase with the initial loan amount, and decline with mortgage duration. With the exception of the dummy for marital status, the coefficients of the demographic characteristics are imprecisely estimated.

The inclusion of new mortgagors reduces the difference between ARM and FRM interest rates. The reason is that while FRM interest rates are predetermined for mortgages originated before 2008, new FRM mortgages are offered on the market at lower rates which pulls down the average. The estimates in Table 2 suggest that annual mortgage payments for the treatment group fall by about 900 euros relative to the control group. Given an average annual mortgage payment of about 7,000 euros, this is a sizable drop of about 13%.<sup>8</sup> The coefficient of labor income in column (5) is positive and statistically different from zero, but the estimate of  $\beta_2$  is not affected.

Table 3 reports the estimated coefficients for the impact of the fall in interest rates on non-durable consumption. For mortgage payments, columns (1) and (2) report the coefficients estimated using the full sample, columns (3) and (4) refer to the sub-sample of households with mortgages which were taken out before 2008, and column (5) includes labor income. As in Table 2, all specifications include year fixed effects, region and city size dummies, and mortgage characteristics; household characteristics are included only in columns (2) and (4). The main effect of holding an ARM is positive, suggesting that the treatment group tends to have higher average non-durable consumption. However, the estimates are imprecise and not statistically different from zero. The estimated  $\gamma_2$  is positive but imprecisely estimated. The magnitude of the estimated  $\gamma_2$  together with the estimates of  $\beta_2$  reported in Table 2, implies a set of values for the MPC ( $= \gamma_2/\beta_2$ ) from about 0.4 to 0.8. The other coefficients suggest that consumption is higher for married couples, older households, and larger families, and lower for public employees and the unemployed. As expected, consumption is positively correlated with labor income. At this stage we cannot conclude with confidence that the fall in interest rates has no impact on non-durable consumption for treated households because the estimates are rather imprecise. However, Tables 4 and 5 show

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<sup>8</sup>The size of the income shock induced by the interest rate change is similar to the 2008 tax rebate in the U.S. and the 2014 bonus in Italy.

that redefining the outcome variable, as respectively the logarithm of non-durable consumption, and the consumption-to-income ratio, does not produce qualitatively different results.<sup>9</sup> Taken together, the results in Tables 3, 4 and 5 suggest that the positive income shock caused by the drop in interest rates did not significantly affect the non-durables consumption of treated households. In the descriptive analysis of Section 4 we show that the consumption of ARM households increases between 2008 and 2010 (see Figure 6). To dig deeper into this feature of the data, we also estimate equation (2) restricting the sample to data from 2008 and 2010. The regression shows that the difference is not statistically different from zero at the conventional significance levels. Finally, expanding the sample to include data from 2000 to 2014, we analyze the dynamic propagation of the monetary policy shock. We estimate a version of equation (2) that includes a full set of interactions between ARM and year dummies. Figure 7 reports the point estimates and the 95% confidence intervals for the time-varying coefficients of the ARM dummy. Each coefficient in Figure 7 is normalized relative to 2008, so it can be interpreted as the change in non-durable consumption of ARM households relative to FRM households between year  $t$  and 2008. Although the point estimates after 2008 show an increase in consumption of ARM households relative to FRM households, none of the coefficients is statistically different from zero at the 5% level.

## 6 Discussion and interpretation

The estimates shown in the previous section suggest that ARM mortgagors did receive a positive income shock but on average did not increase their consumption accordingly. This result is consistent with several explanations and in this section we explore three non-competing ones: (1) the distributions of initial debt, cash-on-hand and real assets attenuate the response of consumption to the monetary policy shock; (2) the positive income shock is perceived as temporary; (3) the positive income shock is counterbalanced by a drop in income from financial assets. As far as cash-on-hand heterogeneity, note from Table 1 that FRM households have lower cash-on-hand relative to ARM households. According to models with "wealthy hand-to-mouth" consumers, FRM households should exhibit higher MPC because they have lower liquid resources to buffer income fluctuations.

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<sup>9</sup>We also estimate a model in log-differences restricting the sample to panel households observed in 2008 and 2010, resulting in only 274 observations. The estimated coefficient is 0.04 with t-stat of 1.36.

The effect of debt heterogeneity is ambiguous. According to Mian *et al.* (2013) the MPC from a negative wealth shock is higher for highly indebted households, but in this paper we focus on a positive income shock. Clearly, for given cash-on-hand, highly indebted households may choose to deleverage rather than consume, to reduce the potential consequences of future adverse shocks; in this case one should expect the MPC of ARM households to be lower than the MPC of FRM households.<sup>10</sup> Finally, differences in real wealth should not matter much for MPC heterogeneity because households face higher transaction costs to liquidate real assets, at least in the short run. Since models based on "wealthy hand-to-mouth" a' la Kaplan and Violante (2014) consumers and "debt overhang" hypothesis predict the MPC to depend on the composition of household balance sheets, when estimating the MPC it is very important to control for differences in the initial distribution of cash on hand and leverage.

In Table 6 we expand the baseline specification of Table 3 introducing cash-on-hand and debt quartile dummies. We define cash-on-hand as financial assets plus current disposable income, consistent with models with "wealthy hand-to-mouth" consumers, effectively assuming that the transaction cost of liquidating real assets is very high. As expected, consumption is positively correlated with cash-on-hand and negatively correlated with debt. However, the estimated  $\gamma_2$  is not statistically different from zero and is of similar size as in Table 3. Therefore the data do not support the hypothesis that debt and cash-on-hand heterogeneity drives the low consumption response to the shock.<sup>11</sup>

To address the role of expectations in explaining the low consumption response we rely on a question available in the 2010 edition of the SHIW (but unfortunately not in other years). In that year a sub-sample of the households was asked to assess the likelihood that interest rates would increase in a year's time.<sup>12</sup> Figure 8 plots the histogram of the replies to this question, and shows that there was a low level of confidence that the drop in interest rates would be permanent, and wide

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<sup>10</sup>Mian *et al.* (2013) find that differences in leverage of households can explain the response of consumption to the wealth shocks experienced in the aftermath of the financial crisis. A large increase in debt is not a unique feature of the US economy. Jordà *et al.* (2016), using a long-run dataset covering disaggregated bank credit for 17 advanced economies since 1870, show that the share of mortgages on banks' balance sheets doubled in the course of the 20th century, driven by a sharp rise of mortgage lending to households.

<sup>11</sup>Results are similar including also real assets in the regression. Notice, however, that in our regressions we already control for the value of the house because we condition on the initial value of the mortgage. Defining the dependent variable as the logarithm of non-durable consumption does not affect our main conclusions.

<sup>12</sup>The wording of the question was: "On a scale from 0 to 100, what is the likelihood that in a year's time interest rates will be higher than today?".

heterogeneity among households' expectations. The average subjective probability of an increase in interest rates is 37% but 42% of the households, not included in Figure 8, reported "don't know". This implies that the majority of households was uncertain about whether interest rates would remain at the low levels experienced in 2009, even over a short time horizon. The data show also that expectations about interest rates increases were more prevalent among ARM holders. In fact, a regression of the subjective probability on household characteristics (age, education, family size, marital status, occupation dummies, and a dummy for ARM holders), shows that the probability of an interest rate increase is 8 percentage points higher for ARM holders than for the rest of the sample. Furthermore, more educated households, on average expect higher interest rates (results are not reported here for reasons of space).

A third explanation for the weak consumption effect is that the positive income shock on mortgage payments from interest rate cuts is partially offset by a drop in financial income. In Table 7, using the same specification as in equations (1) and (2), we test whether the fall in interest rates has a differential impact on income from financial assets for ARM households. Financial assets include income from government bonds, CDs, checking and saving accounts, mutual funds, and stocks. Again, these estimates are imprecise, and the coefficient of the interaction between ARM and the post 2008 dummy is not statistically different from zero at conventional statistical levels. However, the sign and the magnitude of the point estimates provide some evidence that ARM holders did suffer a loss of income from financial assets.

To dig deeper into the dynamics of financial income, we estimate the following equation:

$$yf_{it} = \lambda_t + \mu_t ARM_i + \delta X_{it} + \epsilon_{it} \quad (3)$$

where  $yf$  is financial income. The regression includes a full set of year dummies and their interactions with ARM. The estimated  $\mu_t$ , reported in Figure 9, show the impact of the fall in interest rates on  $yf$  relative to 2008. The figure shows that between 2008 and 2010 ARM households experience a marginally significant drop of about 500 euros in income from financial assets relative to FRM households which was only partially reabsorbed in subsequent years.

This differential impact stems from the fact that ARM and FRM households differ in terms of both the level of financial assets, and and portfolio composition. For level, financial assets amount

to 31,000 euro for ARM holders, and to 21,000 euro for FRM holders. Also, the portfolios of FRM households are tilted considerably more towards fixed income assets relative to the portfolios of ARM households. In particular, the share of financial wealth invested in bank deposits, CDs, repurchase agreements, and postal bonds is 58% for FRM households against 42% for ARM households. Both groups invest 6% of their financial wealth in Treasury Bills, either fixed or variable income, but the share of wealth invested in stocks and mutual funds is substantially higher for ARM (39% against 28% for FRM households). Finally, the fraction of financial wealth that represents loans to friends and relatives is 13% for ARM and 8% for FRM. Although in this paper we take the structure of the portfolios of the two groups of households as given, different levels of financial sophistication might explain portfolio differences. In particular, more financially sophisticated households may have a stronger propensity to borrow through ARM, may have higher levels of wealth, and may have a lower fraction of wealth invested in fixed income assets. Figure 8 on interest rates expectations, Table 7 and Figure 9 on financial income, taken together, provide considerable support for our hypothesis that although the drop in interest rates represents a positive income shock for ARM holders, it does not induce a significant increase in household consumption. The reasons are that a large fraction of the sample did not perceive the shock as permanent, and treated households suffered a counterbalancing loss in income from financial assets.

## 7 Robustness checks

The empirical strategy highlighted in Section 4 relies on a time-series break specific to ARM households after 2008. In order to link our estimates more directly to movements in interest rates, as a robustness check we use an alternative identification strategy which exploits time-series variation of the three-month Euribor. The estimated equations are:

$$m_{it} = \theta_{0t} + \theta_1 ARM_i + \theta_2 ARM_i \cdot EURIBOR_t + \theta_3 X_{it} + \epsilon_{it} \quad (4)$$

$$c_{it} = \delta_{0t} + \delta_1 ARM_i + \delta_2 ARM_i \cdot EURIBOR_t + \delta_3 X_{it} + \eta_{it} \quad (5)$$

where  $m_{it}$  is mortgage payments and  $c_{it}$  is non-durable consumption for household  $i$  in year  $t$ ,  $ARM$  is a dummy that equals one if household  $i$  has an adjustable-rate mortgage,  $EURIBOR_t$  is the three-month Euribor measured at annual frequency, and  $X$  is the same set of controls described in the previous sections. This alternative strategy yields similar results: a drop in interest rates reduces mortgage payments but has a small (non-significant) effect on non-durable consumption.

Table 8 reports the estimates from equation (4) for annual mortgage payments. Columns (1) and (2) are estimated over the full sample, columns (3) and (4) show the estimates obtained for the sub-sample of households with mortgages which were granted before 2008, and column (5) adds labor income. A 1 percentage point drop in the three-month Euribor is associated with a decrease in annual mortgage payments of between 181 and 242 euros (depending on the specification). Table 9 displays the results for non-durable consumption: the coefficient of the interaction between the ARM dummy and the three-month Euribor is negative (between -60 and -145 across specifications) but is imprecisely estimated, suggesting that the reduction in mortgage payments is not accompanied by an increase in consumption.

The estimates so far are obtained using our working sample which spans the period 2008-2014, since before 2008 data on the year of mortgage origination are missing. Furthermore, because our precise interest is understanding the extent to which the expansionary monetary policy conducted during the Great Recession passed through to households' consumption via the mortgage channel, we prefer to focus on the sudden and deep drop in interest rates after 2008 rather than on movements in interest rates over time. In order to ensure that the results are not driven by this sample choice, as a robustness check we replicate the specification of equation (4) using the lower quality information available before 2008 but extending the sample to include data from surveys from 2000. The results, reported in Table 10, are quite similar to those obtained using the sample starting in 2008.

As further robustness checks: (i) we replicate the analysis in Section 5 on the sample 2008-2010 and 2008-2012; (ii) we include interaction terms between head of household characteristics and a dummy for post 2008; and (iii) we test for heterogeneity of the treatment effect by interacting the treatment variable with residual mortgage duration. The results are very similar although for reasons of space are not reported here.

## 8 Policy implications

The ECB cut in the MRO rate in 2008 affected households with mortgages differently. While households with ARM effectively saw a substantial decrease in their mortgage payments, households with FRM were not affected directly. The interest rate cut is the basis for our empirical analysis of the effect of a specific channel through which monetary policy may affect household balance sheets and consumption. Using the 2008-2014 Italian SHIW, we show that the drop in interest rates following the Great Recession is associated with a reduction in mortgage payments of about 900 euros (almost 15% of average mortgage payments) for households with ARM. After the shock, consumption of ARM holders increases relative to FRM, but the implied MPC is not statistically different from zero.

We propose three explanations for the weak consumption response to the monetary policy shock. First, the distributions of initial debt, cash-on-hand and real assets attenuate the response of consumption to the monetary policy shock. Second, the shock is offset partly by a reduction in income from financial assets owned by mortgagors. Third, in 2010 more than a third of mortgagors believe that the income shock is transitory, and that interest rate will increase, implying a small effect on consumption. We find supportive evidence for the last two channels, but not for the first one. Overall our study suggests that the consumption response depends on the household's exposure to the shock and expectations about future interest rates. These findings are broadly in line with the consumption literature which suggests that transitory income shocks have a much smaller effect on consumption than permanent shocks, and that "size" also matters since people tend to respond more strongly to large shocks than small shocks. Although our findings do not provide direct evidence on the general equilibrium effects of monetary policy, the small difference in the consumption response of ARM and FRM households is consistent with Cloyne et al. (2015). In particular, we find that cash-flow effects are of relatively minor importance, either because they are not perceived as permanent, or because there is offsetting effect on interest from financial assets. Thus general equilibrium effects from monetary policy are likely to be more important in determining consumption.

The results have several implications for the pass-through of monetary policy through household balance sheets, and the design of mortgage markets.

First, to lower mortgage payments effectively, what matters is the central bank's announced long-run strategy. Consistent with this fact, is that central banks have given increasing importance to forward guidance as a way to affect interest rate expectations. This unconventional monetary policy instrument was introduced in the early 2000s by the Federal Reserve, but was used by the ECB for the first time only in July 2013. Furthermore, until at least summer 2011, the ECB did not convey any expectations that future interest rates would remain low, and raised interest rates in summer 2011 because of the fear of inflation but reverted this policy in subsequent months. The lack of commitment to future low interest rates may have induced many borrowers with ARM to believe that interest payments would increase again in the future.

The second implication is that given the coexistence of assets and liabilities in household portfolios, the net asset position and households' exposure to interest rate risk are crucial to evaluate the effectiveness of monetary policy.

The third important policy implication is that further action is needed to induce borrowers to take advantage of refinancing opportunities. We have shown that even when interest rates drop relatively few households take advantage of this by switching to more favorable loans. In the presence of significant interest rate cuts, and in the absence of significant transaction costs, lack of information and financial sophistication are the main reasons explaining borrowers' inertia. Improving borrowers' awareness of refinancing opportunities - for instance, refinancing an existing FRM loan at a lower interest rate - consolidates interest rate cuts in household balance sheets, increasing the likelihood that interest rate cuts have a positive effect also on consumption expenditure.



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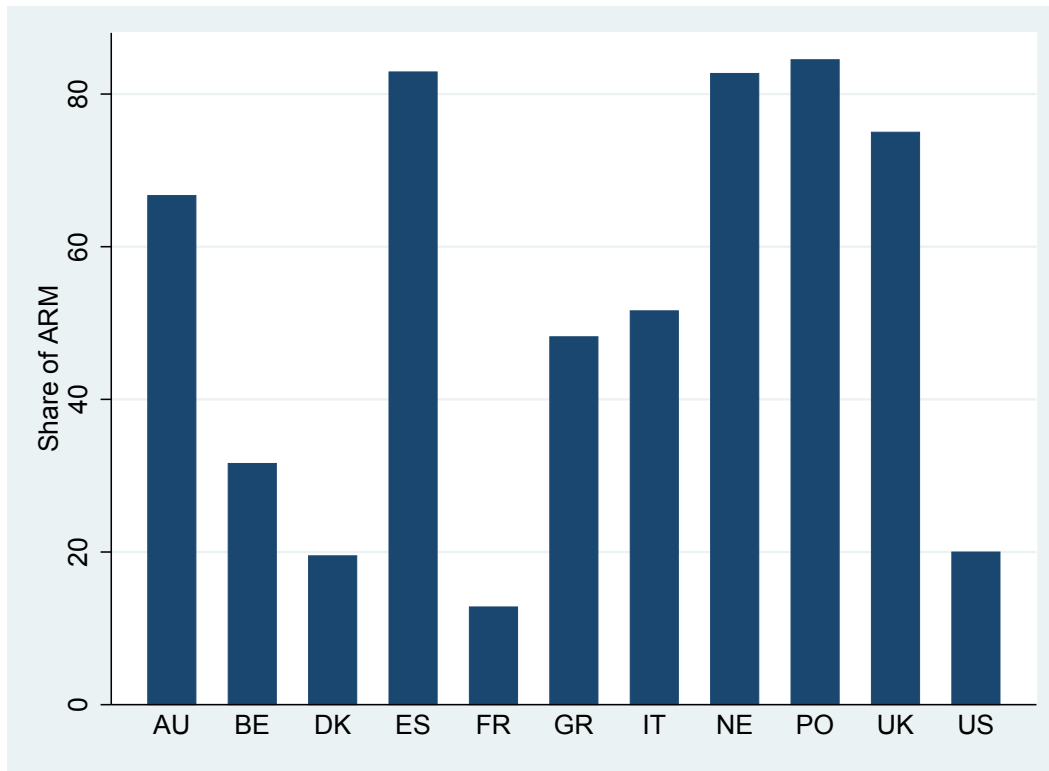
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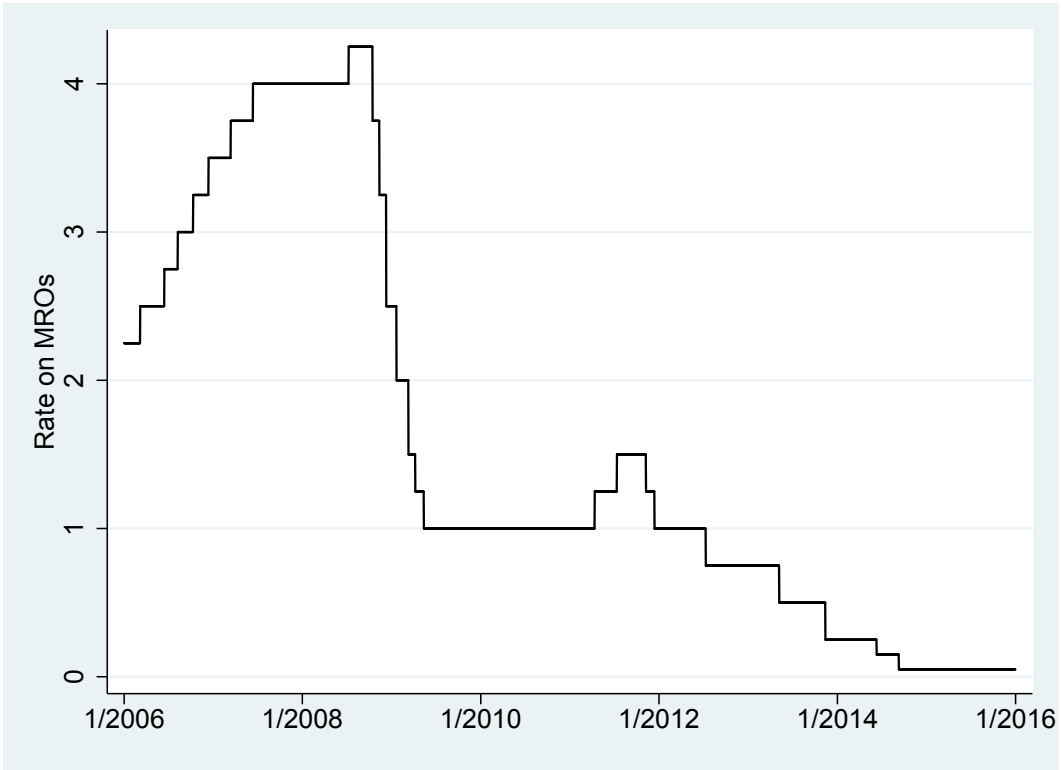
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Figure 1  
Share of ARM: international comparison



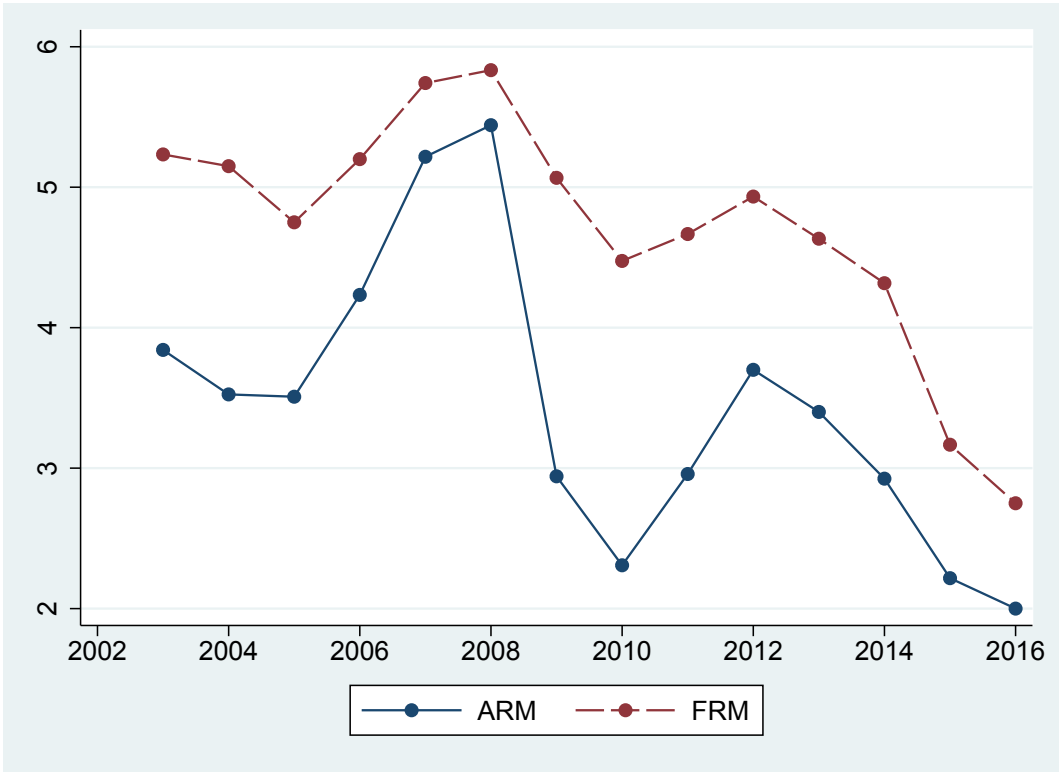
Note. The figure plots the share of adjustable-rate mortgages (ARM) as a fraction of total mortgages. Source: Ehrmann and Ziegelmeyer (2014) and Lea (2014).

Figure 2  
ECB rate on main refinancing operations (MRO)



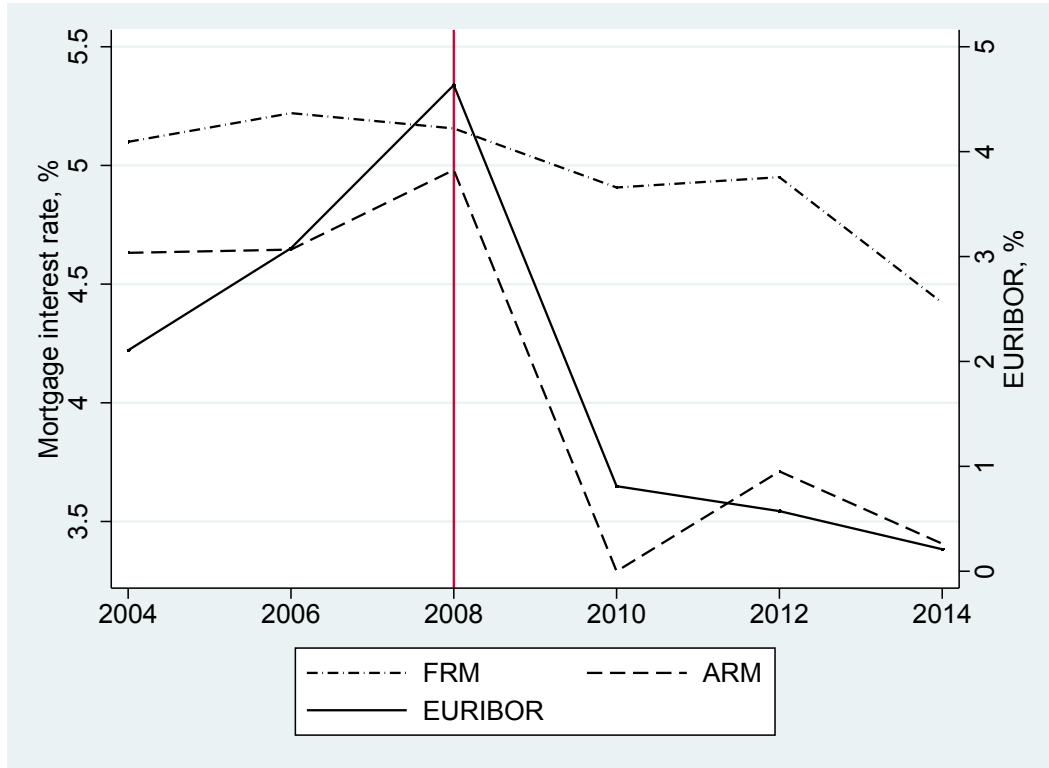
Note. The figure plots the interest rate on main refinancing operations (MRO). Source: European Central Bank.

Figure 3  
Interest rates on new mortgages



Note. The figure plots the interest rates on new mortgage loans. The solid line shows interest rates adjustable within one year, whereas the dashed line shows interest rates fixed for at least 10 years. Source: Bank of Italy (2016).

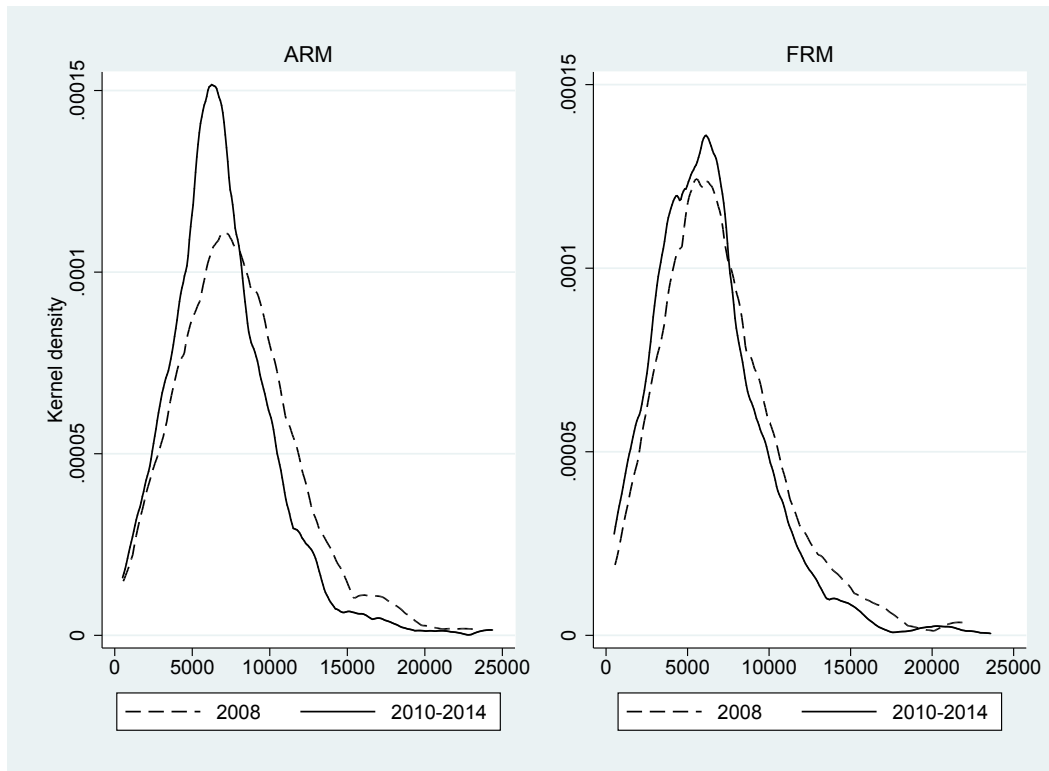
Figure 4  
Mortgage interest rates and Euribor



Note. The figure plots adjustable and fixed mortgage interest rates (left axis) and the 3-months Euribor (right axis). Mortgage interest rates are self-reported in the Survey on Household Income and Wealth (SHIW), whereas the source for the 3-months Euribor is the Statistical Data Warehouse of the European Central Bank.

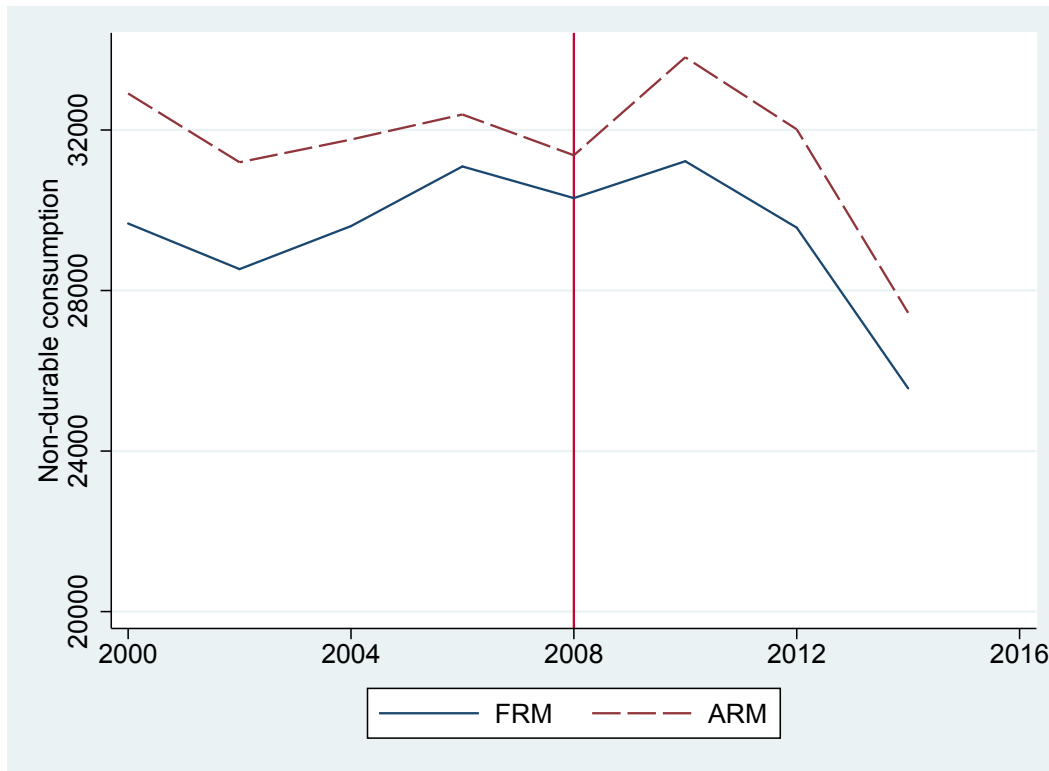


Figure 5  
Density of annual mortgage payments



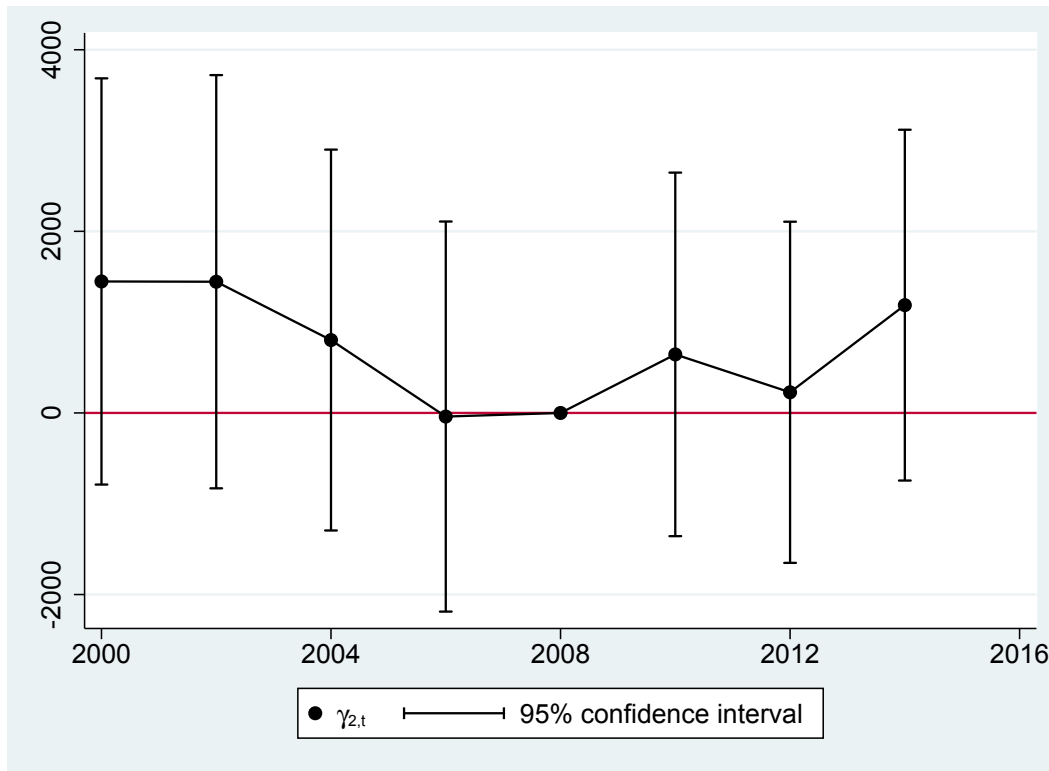
Note. The figure plots the kernel density of annual mortgage payments in 2008 (dashed line) and 2010-2014 (solid line) for adjustable-rate mortgages (ARM, left plot) and fixed-rate mortgages (FRM, right plot). Data are expressed in 2014 euro.

Figure 6  
Evolution of non-durable consumption of ARM and FRM households



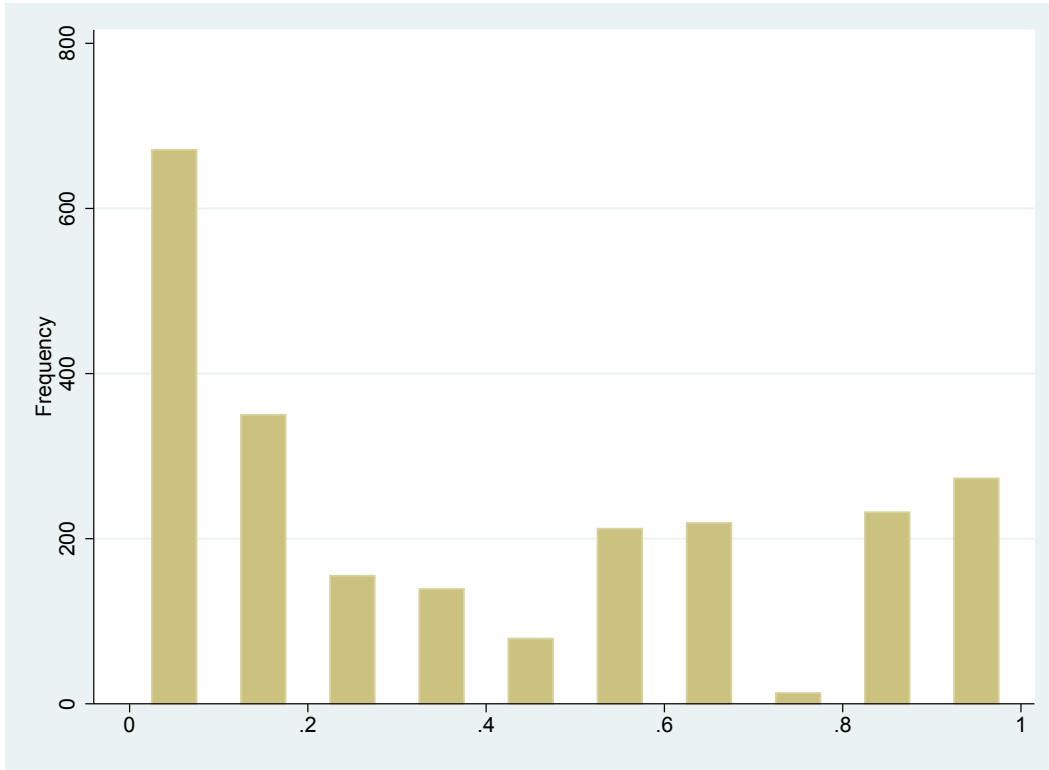
Note. The figure plots average non-durable consumption of households with ARM (dashed line) and households with FRM (solid line). Data are reported in 2014 euro.

Figure 7  
Dynamic response of consumption



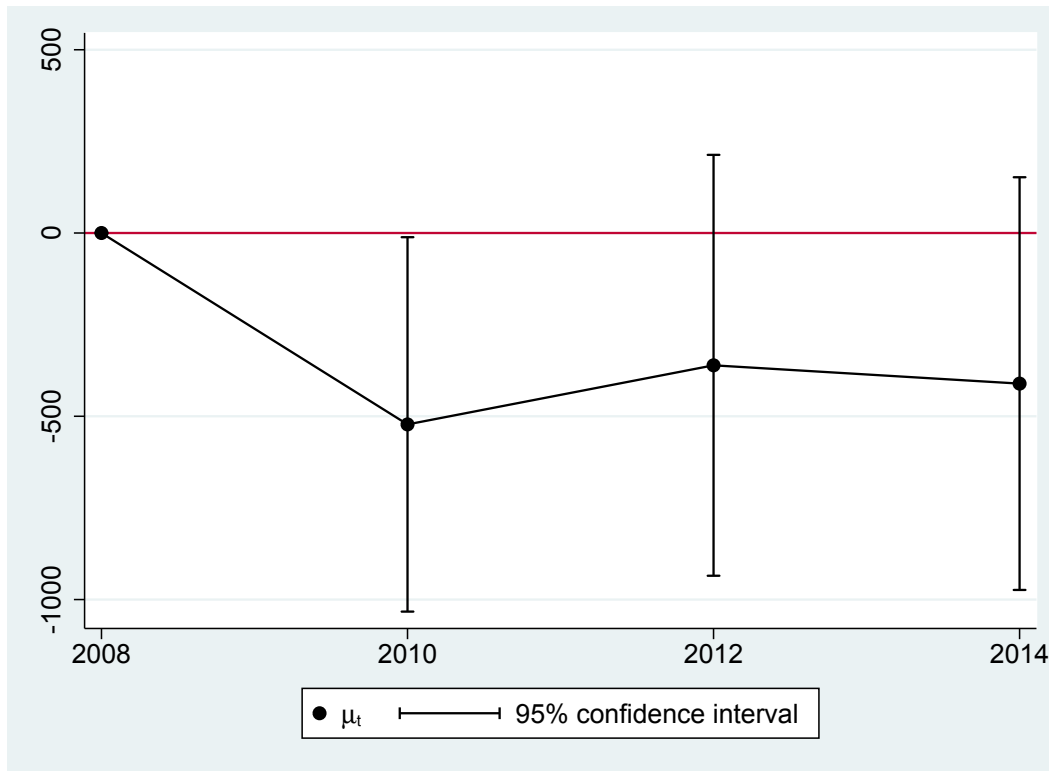
Note. The figure plots the dynamic response of consumption to the monetary policy shock. The  $\gamma_{2,t}$  coefficients and the 95% confidence intervals are estimated from a regression that includes a full set of interaction terms between the ARM dummy and time effects. The 2008 coefficient is normalized to zero. Other coefficients represent the change in non-durable consumption of ARM households relative to FRM households between year  $t$  and 2008.

Figure 8  
Probability that interest rates will increase



Note. The figure plots the histogram of the answers to the question “On a scale from 0 to 100, what is the likelihood that in a year’s time interest rates will be higher than today?”. Source: SHIW 2010.

Figure 9  
Dynamic response of financial income



Note. The figure plots the dynamic response of financial income of households with ARM relative to households with FRM. The  $\mu_t$  coefficients and the 95% confidence intervals are estimated from a regression that includes a full set of interaction terms between the ARM dummy and time effects. The 2008 coefficient is normalized to zero. Other coefficients represent the change in financial income of ARM households relative to FRM households between year  $t$  and 2008.

Table 1  
Summary statistics

	ARM	FRM	All
<i>Balance sheet (a)</i>			
Annual mortgage payments	7,342.24	6,641.47	6,946.87
Non-durable consumption	31,167.61	29,337.13	24,146.65
Consumption-income ratio	69.60	70.53	118.81
Financial income	578.79	364.52	544.35
Labor income	32,236.07	28,757.70	15,727.23
Cash-on-hand	35,360.47	25,032.02	32,637.53
Real wealth	377,624.04	338,254.96	247,345.10
Total debt	85,418.94	66,542.74	9,927.53
<i>Mortgage characteristics (b)</i>			
Mortgage interest rate	3.90	4.83	4.43
Initial loan amount	106,055.36	85,855.94	94,972.45
Mortgage duration	19.49	17.17	18.14
Mortgage origination	2004	2005	2005
<i>Household characteristics (a)</i>			
Male	0.66	0.60	0.56
Married	0.79	0.79	0.61
Age	48.34	49.56	59.21
Years of education	11.81	11.41	9.32
Family size	3.12	3.12	2.45
Public employee	0.20	0.23	0.10
Self-employed	0.17	0.13	0.09
Retired	0.14	0.19	0.46
Unemployed	0.03	0.04	0.04
Observations	1447	1544	32235

Note. Mean of the variables used in the statistical analysis. Column 1 reports the mean of the variables for households with ARM. Column 2 refers to households with FRM. Column 3 uses: (a) households with and without mortgages, and (b) only households with mortgages.

Table 2  
Regression results for annual mortgage payments

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*Post2008	-795.76*** (296.30)	-734.36** (298.96)	-961.19*** (316.64)	-913.52*** (319.30)	-907.50*** (318.62)
ARM	690.39** (278.29)	595.01** (275.27)	770.24*** (288.57)	713.89** (285.52)	704.96** (285.16)
Initial loan amount	0.05*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.04*** (0.00)
Mortgage origination	6.42 (13.29)	8.10 (13.25)	65.43*** (19.17)	67.90*** (19.32)	75.77*** (19.18)
Mortgage duration	-124.04*** (17.81)	-116.55*** (16.64)	-121.49*** (20.51)	-115.32*** (19.01)	-107.05*** (19.74)
Male		205.09 (144.16)		118.22 (164.22)	100.35 (163.50)
Married		-328.83* (194.48)		-362.71 (244.71)	-467.64* (240.45)
Age		8.03 (8.63)		5.59 (10.90)	4.40 (11.06)
Years of education		34.70* (19.83)		33.21 (23.74)	17.18 (23.65)
Family size		84.83 (61.77)		137.65* (71.36)	71.78 (79.52)
Public employee		-71.69 (158.75)		57.71 (177.83)	68.28 (177.09)
Retired		-521.51 (327.33)		-344.47 (380.74)	-150.35 (392.65)
Unemployed		-422.77 (325.32)		-481.53 (383.56)	-437.93 (376.15)

Labor income					0.02**
					(0.01)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Occupation	No	Yes	No	Yes	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is annual mortgage payments, expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.



Table 3  
Regression results for non-durable consumption

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*Post2008	529.22 (921.28)	486.62 (790.05)	324.11 (1014.09)	427.43 (877.53)	504.10 (816.70)
ARM	681.16 (839.65)	476.41 (698.91)	760.96 (872.14)	775.01 (730.34)	661.35 (698.11)
Initial loan amount	0.06*** (0.01)	0.04*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	0.02*** (0.01)
Mortgage origination	-238.32*** (58.52)	-43.22 (49.94)	-447.75*** (79.89)	-272.95*** (67.54)	-172.87*** (64.23)
Mortgage duration	-425.12*** (43.49)	-248.36*** (36.76)	-408.82*** (53.62)	-291.89*** (45.90)	-186.63*** (38.57)
Male		675.94 (503.12)		512.69 (600.19)	285.18 (523.60)
Married		2568.81*** (628.02)		2942.89*** (757.49)	1607.28** (670.54)
Age		301.48*** (30.14)		259.39*** (37.75)	244.24*** (35.14)
Years of education		716.32*** (72.38)		639.40*** (82.21)	435.44*** (75.86)
Family size		2678.75*** (247.12)		2656.21*** (285.50)	1817.73*** (261.94)
Public employee		-1414.63** (666.63)		-640.61 (790.58)	-506.05 (708.43)
Retired		-927.96 (1179.32)		-178.71 (1466.27)	2292.27* (1324.07)
Unemployed		-2413.44** (1185.97)		-2621.57* (1408.23)	-2066.53* (1242.61)

Labor income					0.26***
					(0.02)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Occupation	No	Yes	No	Yes	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is non-durable consumption, expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.

Table 4  
Regression results for log non-durable consumption

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*Post2008	0.01 (0.03)	0.01 (0.02)	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)
ARM	0.02 (0.03)	0.02 (0.02)	0.02 (0.03)	0.03 (0.02)	0.02 (0.02)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Household chars	No	Yes	No	Yes	Yes
Mortgage chars	Yes	Yes	Yes	Yes	Yes
Labor income	No	No	No	No	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is the logarithm of non-durable consumption, expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. The specifications are the same as in Table 3. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.

Table 5  
Regression results for consumption-income ratio

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*Post2008	1.18 (2.09)	0.71 (2.00)	2.89 (2.33)	2.28 (2.18)	2.12 (1.99)
ARM	0.05 (1.93)	0.58 (1.85)	0.03 (2.09)	0.60 (1.97)	0.84 (1.78)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Household chars	No	Yes	No	Yes	Yes
Mortgage chars	Yes	Yes	Yes	Yes	Yes
Labor income	No	No	No	No	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is the consumption-to-income ratio (in percentage), expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. The specifications are the same as in Table 3. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.

Table 6  
Regression results for non-durable consumption including cash-on-hand and debt

	(1)	(2)	(3)
ARM*Post2008	530.67 (833.94)	334.51 (875.15)	420.40 (830.46)
ARM	509.08 (686.80)	761.23 (731.52)	508.40 (689.42)
Male	279.54 (545.60)	519.03 (600.05)	276.85 (545.04)
Married	2266.07*** (674.44)	2969.75*** (754.62)	2290.10*** (670.42)
Age	258.69*** (34.57)	264.88*** (37.85)	264.92*** (34.58)
Years of education	452.71*** (75.60)	638.77*** (81.93)	451.30*** (75.08)
Family size	2733.20*** (259.19)	2599.20*** (285.32)	2673.31*** (257.43)
Public employee	-270.22 (725.92)	-583.89 (793.90)	-217.37 (729.35)
Retired	-1411.17 (1356.94)	-245.27 (1460.28)	-1487.35 (1349.33)
Unemployed	-1319.36 (1294.96)	-2663.03* (1396.99)	-1302.37 (1280.00)
Initial loan amount	0.03*** (0.01)	0.03*** (0.01)	0.02*** (0.01)
Mortgage origination	-205.90*** (62.72)	-372.11*** (80.47)	-310.23*** (75.16)
Mortgage duration	-203.38*** (41.73)	-363.69*** (53.86)	-281.06*** (48.09)
I quartile of cash-on-hand	-10687.01***		-10748.36***

	(696.19)		(696.03)
II quartile of cash-on-hand	-6929.59***		-6955.42***
	(757.38)		(752.15)
III quartile of cash-on-hand	-4303.03***		-4291.73***
	(741.39)		(741.06)
I quartile of debt		-3150.33**	-3262.84***
		(1308.00)	(1256.52)
II quartile of debt		-2030.30*	-2516.35**
		(1082.27)	(1039.54)
III quartile of debt		-1015.86	-969.73
		(861.73)	(810.80)
Year dummies	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes
City size	Yes	Yes	Yes
Occupation	Yes	Yes	Yes
Observations	2148	2148	2148

Note. The dependent variable is non-durable consumption, expressed in 2014 euro. All models are estimated using the sub-sample of households with mortgages originated before 2008 and include time fixed effects, region and city size dummies and mortgage characteristics. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.

Table 7  
Regression results for financial income

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*Post2008	-435.40 (277.86)	-427.15 (272.84)	-293.99 (187.22)	-276.10 (180.01)	-271.29 (176.17)
ARM	493.65* (281.15)	460.11* (271.21)	283.39 (178.87)	259.36 (173.53)	252.22 (169.30)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Household chars	No	Yes	No	Yes	Yes
Mortgage chars	Yes	Yes	Yes	Yes	Yes
Labor income	No	No	No	No	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is financial income, expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. The specifications are the same as in Table 3. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.

Table 8  
Regression results for mortgage payments: alternative specification

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*EURIBOR	194.94*** (71.40)	181.15** (72.05)	241.66*** (77.25)	229.22*** (77.69)	227.16*** (77.53)
ARM	-210.35 (162.01)	-238.28 (160.11)	-334.16* (177.94)	-334.66* (178.82)	-335.64* (177.92)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Household chars	No	Yes	No	Yes	Yes
Mortgage chars	Yes	Yes	Yes	Yes	Yes
Labor income	No	No	No	No	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is annual mortgage payments, expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. The specifications are the same as in Table 3. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.



Table 9  
Regression results for non-durable consumption: alternative specification

	Full Sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM*EURIBOR	-145.11 (222.68)	-133.45 (191.43)	-60.38 (246.79)	-102.13 (214.41)	-128.34 (198.83)
ARM	1305.00** (653.54)	1050.03* (552.12)	1093.42 (776.92)	1255.96* (663.17)	1243.46** (580.27)
Year dummies	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes	Yes
Household chars	No	Yes	No	Yes	Yes
Mortgage chars	Yes	Yes	Yes	Yes	Yes
Labor income	No	No	No	No	Yes
Observations	2991	2991	2148	2148	2148

Note. The dependent variable is non-durable consumption, expressed in 2014 euro. Columns (1) and (2) show the estimates using the full sample. Columns (3), (4) and (5) are estimates using the sub-sample of households with mortgages originated before 2008. All models include time fixed effects, region and city size dummies and mortgage characteristics. Columns (2)-(5) include household characteristics and column (5) includes also labor income. The specifications are the same as in Table 3. Standard errors are reported in parentheses and clustered at the household level. One star indicates significance at 10% level, two stars at 5% and three stars at 1%.

Table 10  
Regression results for mortgage payments and consumption, extended sample

	(1)	(2)
	Mortgage payments	Consumption
ARM*EURIBOR	214.25*** (79.47)	-33.96 (169.88)
ARM	-357.50** (165.69)	804.58 (528.95)
Male	-139.26 (182.82)	207.86 (418.33)
Married	-170.46 (223.49)	2476.09*** (521.78)
Age	6.95 (9.30)	247.30*** (23.13)
Years of education	30.13 (21.65)	813.87*** (60.55)
Family size	110.41* (66.60)	2876.60*** (188.20)
Public employee	13.52 (177.50)	-1449.34*** (507.24)
Retired	-340.67 (349.20)	-820.69 (957.82)
Unemployed	-36.63 (379.68)	-1852.45* (974.01)
Initial loan amount	0.05*** (0.01)	0.04*** (0.01)
Year of home purchase	19.77* (11.01)	-169.44*** (24.10)
Mortgage duration	-148.13*** (20.01)	-198.26*** (29.31)

Year dummies	Yes	Yes
Region dummies	Yes	Yes
Municipality size	Yes	Yes
Observations	5147	5149

Note. The dependent variables are annual mortgage payments (column 1) and non-durable consumption (column 2), both expressed in 2014 euro. Columns (1) and (2) show the estimates using the extended sample of households with mortgages (2000-2014). All models include year fixed effects, region and city size dummies, mortgage and household characteristics. Rather than controlling for the year of mortgage origination (not available before 2008), we control for the year of home purchase. Standard errors are clustered at the household level.