Mortgages and consumption

SUMMARY

Using the Italian Survey of Household Income and Wealth, 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 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 short-lasting, 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.

JEL codes: E2, E4

—*Tullio Jappelli and Annalisa Scognamiglio*

Interest rate changes, mortgages, and consumption: evidence from Italy

Tullio Jappelli and Annalisa Scognamiglio

Università di Napoli Federico II, CSEF, and CEPR; Università di Napoli Federico II and CSEF

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 analyse 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 analysing 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 stimulate 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.[1]

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 associated with 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 and 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 long-lasting, calling attention to the credibility of the central bank strategy to maintain low interest rates in the future. Furthermore, the same interest rate change reduces income from financial assets, counteracting the effect on mortgage payments. Therefore, the interest rate 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 interest rate change 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 effect of positive interest income shocks can be dampened also by precautionary motives. This effect is particularly likely to occur after a recession during which households have exhausted their precautionary balances and choose to go back to their preferred target wealth–income ratio, rather than increase consumption.

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 persistent, the change in interest rate affects the present discounted value of all future

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[1] 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.

mortgage payments, with a potentially large impact on consumption. Instead, if people believe that the shock is short-term – for instance, because borrowers think that interest rates will soon revert to a 'normal' level, or because mortgages have a relatively short residual life – the consumption effect will be small or negligible, unless households are liquidity constrained. Therefore, those ARM holders who believe that the reduction in interest rates is persistent, and whose mortgages are of long duration, should respond more to interest income changes. More generally, Auclert (2017) 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 7 months the European Central Bank (ECB) lowered the official interest rate by 325 basis points, from 4.25% to a historic low of 1%. 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. We carefully check whether the change in the Euribor was unanticipated. The first piece of evidence is based on macroeconomic projections produced each quarter by ECB staff and the second is based on a series of interest rate shocks estimated by a standard three-variable VAR.

Our sample is drawn from the Survey of Household Income and Wealth (SHIW) and focuses on households with mortgages granted before 2008. Households with FRM are the 'control' group since their mortgage payments are unaffected by the interest rate change. Households with ARM benefit from the interest rate drop, and therefore are the 'treatment group'. We apply a difference-in-difference framework to compare consumption for the two groups after the reduction in interest rates. In this respect, our paper is the first empirical study that exploits microdata with information on both ARM and FRM households to identify the effect of interest rate changes on consumption.

Between 2008 and 2010, 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. A similar experiment with expenditure on vehicles also suggests no response to the shock. 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; and (iii) between one-third and one-half of the sample believes 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 interest rate shock on mortgage interest payments, and in Section 4, we report relevant features of the Italian mortgage market. Section 5 presents the data and the empirical strategy. The results and their interpretation are provided in Sections 6 and 7, respectively. Section 8 presents several robustness checks. Section 9 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 behaviour 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 (2017) 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 behaviour 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, 2016).

Most papers that adopt the quasi-experimental approach focus on the shocks induced by stimulus programmes, fiscal reforms, or shocks to the incomes of public sector employees. Using the Consumer Expenditure Survey, Johnson *et al.* (2006) estimate that households spent 20–40% of the 2001 US income tax rebate during the 3-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 (2014) 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) exploit the Singapore government's 2011 announcement of its Growth Dividend Programme. The programme included a one-time cash payout ranging between $80 and $700 per resident; foreigners were excluded from the programme. 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 10 months following the announcement. They also find a strong announcement effect; consumers increased spending during the 2 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 US Federal Government shut down which left them unexpectedly without their regular pay-checks for about 2 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 (2017), 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 (2016) analyse 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 US households that purchased homes between 2005 and 2007 using an ARM, with an automatic reset of interest rates after 5 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.* (2014b), 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 >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.* (2016) use cohort data for the United Kingdom and the United States 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 United Kingdom (which features mostly ARM) than in the United States (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 with 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.* (2016) 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.[2] So, the effects of monetary policy on credit and investment are likely to be the ones most actively at play in the comparison of the effectiveness of monetary policy between the United Kingdom and the United States. It is important to stress that Cloyne *et al.* (2016) identify the channels through which monetary policy affects consumption by cross-country comparison, while we identify these effects by using microdata on ARM and FRM households in the same country.

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 that 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 analyse 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

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2 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.
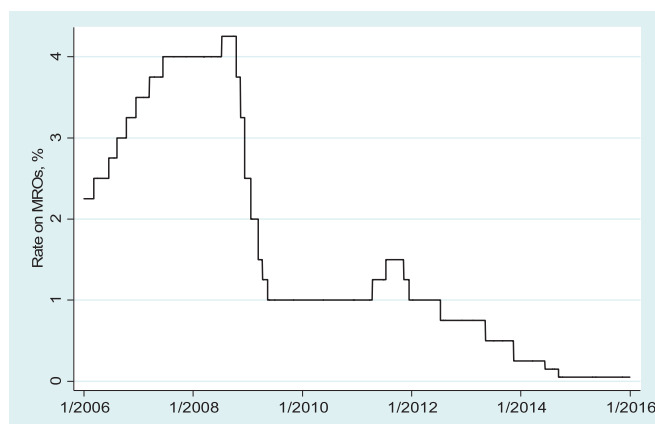
Figure 1. ECB rate on main refinancing operations (MRO)

Notes: The figure plots the interest rate on main refinancing operations (MRO).

Source: Statistical Data Warehouse, European Central Bank.

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 about interest rate increases 1 year ahead which help us to assess whether the interest rate 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. Measurement error in non-durable consumption may also be associated with the precision of our estimates.

3. THE INTEREST RATE SHOCK

Following the collapse of Lehman Brothers in September 2008, within a period of 7 months the ECB lowered the official interest rate by 325 basis points, from 4.25% to a historic low of 1%, as shown in Figure 1. 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. 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 households with mortgages, we rely on self-reported mortgage rates available in the Italian SHIW. Figure 2 plots the sample average interest rates for ARM and FRM (left axis) and the 3-month Euribor (right axis) from 2004 to 2014. The dynamics of the self-reported ARM rate tracks the Euribor (the solid line) remarkably well. During the sample period the ARM rate declined by 170 basis points, and the FRM by only 20 points.
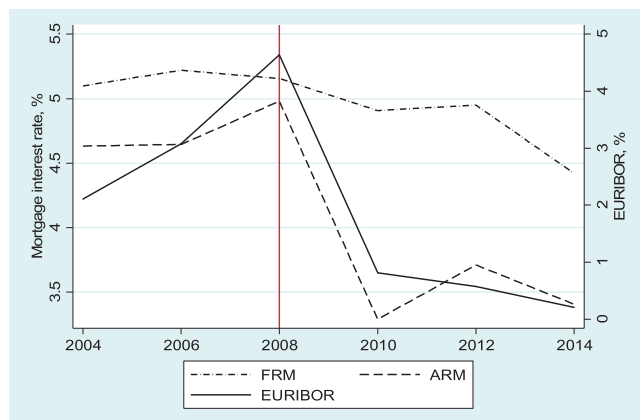
Figure 2. Euribor and mortgage interest rates in Italy

Notes: The figure plots adjustable and fixed mortgage interest rates (left axis) and the 3-months Euribor (right axis). Mortgage interest rates are drawn from the SHIW.

Source: Statistical Data Warehouse, European Central Bank.

An interest rate drop impacts consumption if the drop is unexpected; that is, if before 2008 households could not foresee the crisis coming and therefore could not predict interest rates to fall dramatically.

To establish whether the drop in interest rates was indeed unanticipated, we construct a series of interest rate shocks estimated by a standard three-variable VAR. The VAR includes the unemployment rate, the 3-month Euribor and the inflation rate and two lags of each variable. It is estimated for the euro area using monthly data from April 1998 to April 2016 drawn from the Statistical Data Warehouse. We compute 1 year ahead, rolling windows forecasts, of the Euribor and plot the difference between the actual and forecasted Euribor in the upper panel of Figure 3. The VAR identifies a sizable unexpected drop in the Euribor between 2008 and 2010.

We draw a second piece of evidence from ECB staff macroeconomic projections for the euro area.[3] These projections are produced each quarter by ECB staff and are an input to the Governing Council's assessment of economic developments and the risks to price stability. For the 3-month Euribor, the report assumes that short-term interest rates evolve in line with the prevailing market expectations, derived from futures rates. We report in the lower panel of Figure 3 the difference between the actual and projected Euribor 1 year ahead from 2005 to 2015. The difference is about zero in 2008 (the actual Euribor was 4.3%, against the projected 4.6%), while in 2009 the actual Euribor dropped to 1.2%, while the projected value was still 3.5%. Thus, the interest rate shock of 2008–10 was not predicted even by the ECB staff 1 year ahead.

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3   Details of the projections are described in https://www.ecb.europa.eu/pub/projections/html/index.en.html.
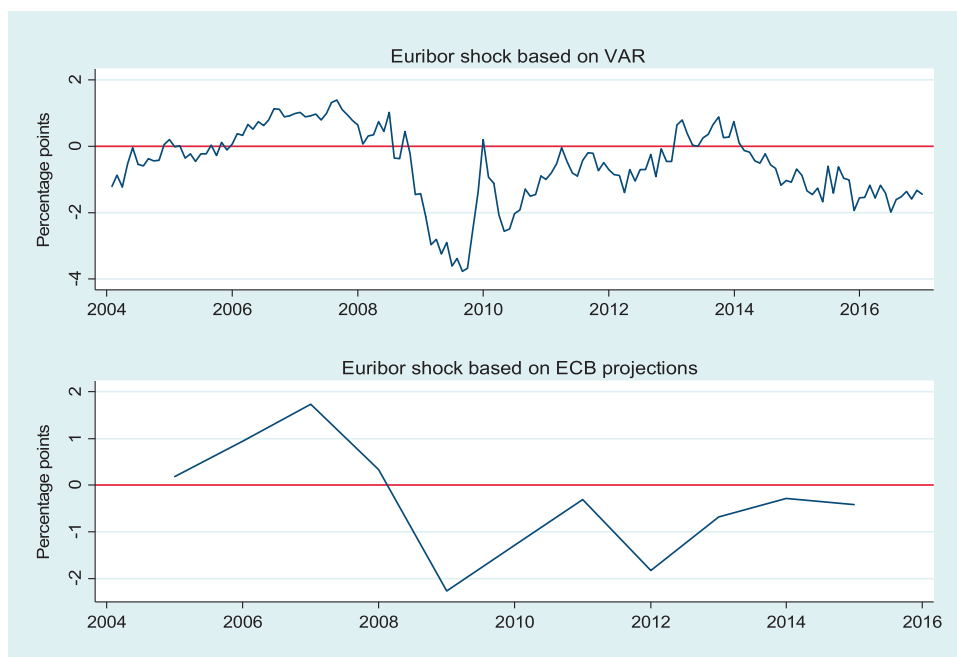
Figure 3. Interest rate shocks in the euro area

Notes: The upper panel plots the difference between the actual and one year ahead rolling forecasts of the Euribor. The forecast is obtained by estimating a VAR with the unemployment rate, the three-month Euribor and the inflation rate and two lags of each variable. The VAR uses monthly data for the euro area from April 1998 to April 2016.

Source: Statistical Data Warehouse of the European Central Bank. The lower panel plots the difference between the actual and projected Euribor by ECB staff one year ahead from 2005 to 2015 and ECB staff macroeconomic projections for the euro area (https://www.ecb.europa.eu/pub/projections/html/index.en.html).

The two sets of forecasts reported in Figure 3 show that the interest rate drop was unexpected both according to standard econometric methods as well as estimates based on futures and used by the ECB for policy analysis. Notice that there is a downward trend in interest rates over the sample period. However, the interest rate drop is unexpected even considering this trend. Indeed, ECB staff is well aware of the time-series properties of interest rates, but still over-predicted substantially the Euribor between 2008 and 2010. The VAR even filtering out a linear (or quadratic) trend still delivers the same evidence of a sizable and unexpected drop in interest rates.

4. THE ITALIAN MORTGAGE MARKET IN INTERNATIONAL PERSPECTIVE

Before turning to the empirical analysis, it is useful to consider some institutional features about the size and characteristics of the Italian mortgage market drawing on data from the SHIW. In terms of size, in 2008–14 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 with other countries at similar
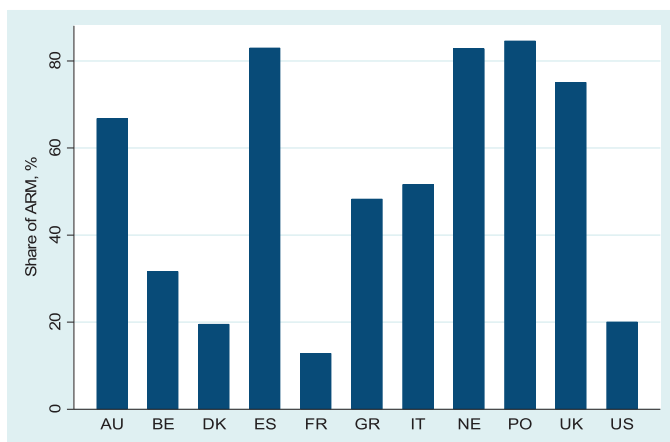
Figure 4. Share of ARM: international comparison

Notes: The figure plots the share of adjustable-rate mortgages in total mortgages (ARM).

Source: Ehrmann and Ziegelmeyer (2014) for the euro area and Lea (2010) for the US.

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, 2010).

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 (4–6 years) compared with 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. Indeed, 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 behaviours of ARM vs. FRM mortgage holders. Figure 4 reports the share of ARM in total mortgages for several European countries and the United States. There are considerable differences in interest determinations across countries. Badarinza *et al.* (2016, 2017) claim 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 United Kingdom, 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 United States, 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 6 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 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 favours based on the type of funding on which they rely. Using the same dataset Gambacorta *et al.* (2017) 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 several dimensions (such as economic resources, demographic variables, credit market characteristics, 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.

The evidence suggests that not many borrowers changed the terms of their mortgages. Financial statistics indicate that in 2010 substitutions and renegotiations

represented 2.8% of the stock of outstanding mortgages, and renegotiation with the same bank represented only 2% (Bank of Italy, 2011). Microeconomic data on renegotiations, substitutions, and subrogations show that on average, in a single year very few borrowers change the terms of their mortgage. Our 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. Thus, few households modify the terms of their mortgage even in periods of substantial drops in interest rates.

Bajo and Barbi (2015) analyse 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 United States (Keys *et al.*, 2014a) and Denmark (Andersen *et al.*, 2017) 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 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.* (2017) find evidence that homeowners choosing between an ARM versus a FRM look no further than 1 year ahead. In a related paper, Johnson *et al.* (2015) study the refinancing opportunities offered by the US 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 5 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.
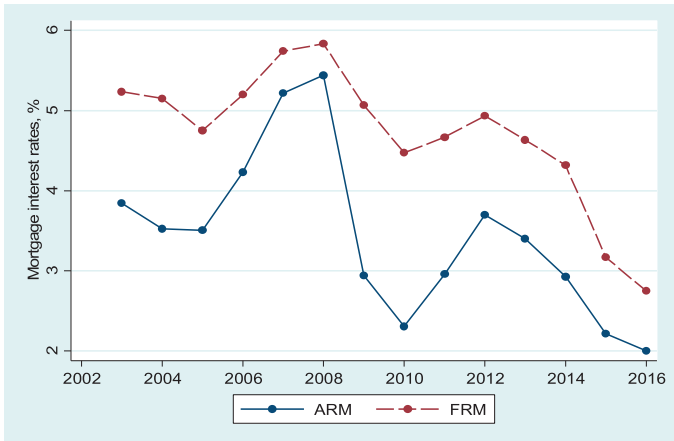
Figure 5. Mortgage interest rates on new loans in Italy

Notes: The figure plots the interest rates on new mortgage loans in Italy. The solid line refers to interest rates that are adjustable within one year. The dashed line refers to interest rates fixed for at least 10 years.

Source: Bank of Italy (2016).

For example, at the end of 2009 the spread between the cost of a FRM and an ARM was 2.7 percentage points in Italy, 1 point above the corresponding euro area spread. By comparison, in the United States, 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.

5. 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 Labour Force Survey conducted by ISTAT (the Italian National Statistical Institute).[4]

Data are collected through personal interviews between March and June, and flow income and consumption refer to the previous calendar year which in Italy coincides with the fiscal 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

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4　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, and <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.

Table 1. Summary statistics

	ARM	FRM	All
Balance sheet			
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
Labour 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
Observations	1,447	1,544	32,235
Household characteristics			
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	1,447	1,544	32,235
Mortgage characteristics			
Annual mortgage payments	7,342.24	6,641.47	6,980.49
Mortgage interest rate	3.90	4.83	4.38
Initial loan amount	106,055.36	85,855.94	95,628.11
Mortgage duration	19.49	17.17	18.29
Mortgage origination	2,004	2,005	2,004
Observations	1,447	1,544	2,991

Notes: Sample means of the variables used in the empirical analysis. Column 1 reports statistics for households with ARM. Column 2 refers to households with FRM. Column 3 refers to all households, except for mortgage characteristics, where means are computed using only the sample of mortgagors.

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), duration, interest rate, 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 with expectations about interest rates 1 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 2008–14 sample. In Columns 1 and 2, we retain only households with mortgages, and non-missing
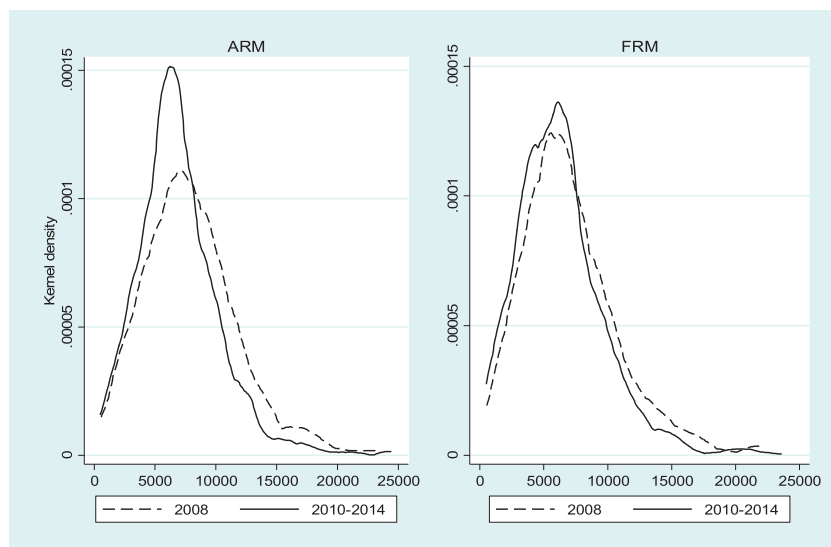
Figure 6. The distribution of mortgage payments

Notes: 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 and drawn from the SHIW.

values for mortgage and household characteristics. We also exclude the top and bottom 1% of the consumption distribution, which results in a sample of 2,991 observations with mortgages. Both ARM and FRM mortgagors are aged 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 estate 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 report in Figure 6 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

interest rate 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 6 provides strong evidence that the shock has differential effects on household income.

In order to identify the effect of interest rate changes on mortgage payments and consumption, we use a difference-in-differences 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:

$$m_{it} = \beta_{ot} + \beta_1 \text{ARM}_i + \beta_2 \text{ARM}_i \times \text{POST}_t + \beta_3 X_{it} + \epsilon_{it}, \tag{1}$$

$$c_{it} = \gamma_{ot} + \gamma_1 \text{ARM}_i + \gamma_2 \text{ARM}_i \times \text{POST}_t + \gamma_3 X_{it} + \epsilon_{it}, \tag{2}$$

where m_{it} is the household i's annual mortgage payments and c_{it} is the annual non-durable consumption, β_{0t} and γ_{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 1 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.[5]

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 β_2 and γ_2. For the mortgage payment regressions, we expect $\beta_2 < 0$, that is, ARM households experience a drop in mortgage payments relative to FRM households, while for the consumption regressions we expect $\gamma_2 > 0$, that is, 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 mortgage payments and consumption 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 Figure 7 we plot non-durable consumption of the two groups of households from 2000 to 2014. The trends in consumption of the treatment

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5 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.
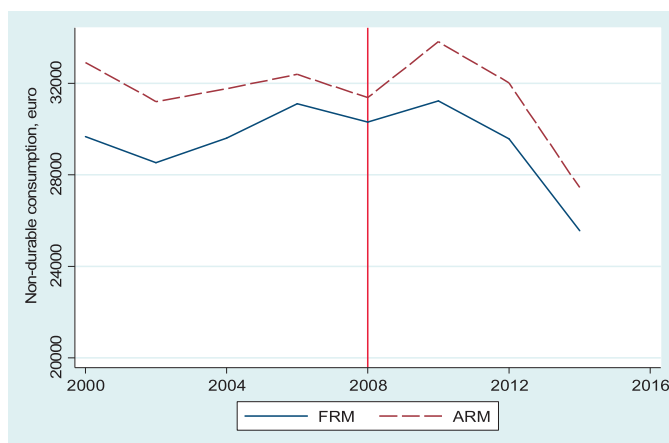
Figure 7. Non-durable consumption of ARM and FRM households

Notes: The figure plots average non-durable consumption of households with ARM (dashed line) and FRM (solid line). Data are reported in 2014 euro and drawn from the SHIW.

and control groups are similar before the interest rate 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 5, 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.

6. 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 and Columns (3) and (4) refer to the sub-sample of households with mortgages originated before 2008. In Column (5), we add labour income to the list of regressors since demographic variables and occupation are an imperfect proxy for households' resources.[6]

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6 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.

Table 2. Regression results for annual mortgage payments

	Full sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM×Post-2008	−795.76***	−734.36**	−961.19***	−913.52***	−907.50***
	(296.30)	(298.96)	(316.64)	(319.30)	(318.62)
ARM	690.39**	595.01**	770.24***	713.89**	704.96**
	(278.29)	(275.27)	(288.57)	(285.52)	(285.16)
Initial loan amount	0.05***	0.04***	0.04***	0.04***	0.04***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mortgage origination	6.42	8.10	65.43***	67.90***	75.77***
	(13.29)	(13.25)	(19.17)	(19.32)	(19.18)
Mortgage duration	−124.04***	−116.55***	−121.49***	−115.32***	−107.05***
	(17.81)	(16.64)	(20.51)	(19.01)	(19.74)
Male		205.09		118.22	100.35
		(144.16)		(164.22)	(163.50)
Married		−328.83*		−362.71	−467.64*
		(194.48)		(244.71)	(240.45)
Age		8.03		5.59	4.40
		(8.63)		(10.90)	(11.06)
Years of education		34.70*		33.21	17.18
		(19.83)		(23.74)	(23.65)
Family size		84.83		137.65*	71.78
		(61.77)		(71.36)	(79.52)
Public employee		−71.69		57.71	68.28
		(158.75)		(177.83)	(177.09)
Retired		−521.51		−344.47	−150.35
		(327.33)		(380.74)	(392.65)
Unemployed		−422.77		−481.53	−437.93
		(325.32)		(383.56)	(376.15)
Labour 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	2,991	2,991	2,148	2,148	2,148

Notes: The dependent variable is annual mortgage payments, expressed in 2014 euro. Columns (1) and (2) report full-sample estimates. Columns (3)–(5) report estimates using the sub-sample of households with mortgages originated before 2008. 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%.

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 (β_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 stable 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%.[7] The coefficient of labour income in Column (5) is positive and statistically different from zero, but the estimate of β_2 is not affected.

Table 3 reports the estimated coefficients for the impact of the fall in interest rates on non-durable consumption. 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 labour 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 γ_2 is positive but imprecisely estimated. The magnitude of the estimated γ_2 together with the estimates of β_2 reported in Table 2 implies a set of values for the MPC ($=\gamma_2/\gamma_2$) 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 labour 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, Table 4 shows that redefining the outcome variable, as the logarithm of non-durable consumption or the consumption-to-income ratio, does not produce qualitatively different results.[8]

Our findings suggest that there is no systematic relation between the income shock and consumption. One concern is that the MPC is imprecisely estimated because of measurement error in reported non-durable consumption. To gauge the potential impact of measurement error, we repeat our analysis focusing on vehicles where measurement error should be less of a concern. We choose to focus on vehicles rather than on

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7 The size of the income shock induced by the interest rate change is similar to the 2008 tax rebate in the United States and the 2014 bonus in Italy.

8 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.

Table 3. Regression results for non-durable consumption

	Full sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM×Post-2008	529.22	486.62	324.11	427.43	504.10
	(921.28)	(790.05)	(1,014.09)	(877.53)	(816.70)
ARM	681.16	476.41	760.96	775.01	661.35
	(839.65)	(698.91)	(872.14)	(730.34)	(698.11)
Initial loan amount	0.06***	0.04***	0.05***	0.04***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Mortgage origination	−238.32***	−43.22	−447.75***	−272.95***	−172.87***
	(58.52)	(49.94)	(79.89)	(67.54)	(64.23)
Mortgage duration	−425.12***	−248.36***	−408.82***	−291.89***	−186.63***
	(43.49)	(36.76)	(53.62)	(45.90)	(38.57)
Male		675.94		512.69	285.18
		(503.12)		(600.19)	(523.60)
Married		2,568.81***		2,942.89***	1,607.28**
		(628.02)		(757.49)	(670.54)
Age		301.48***		259.39***	244.24***
		(30.14)		(37.75)	(35.14)
Years of education		716.32***		639.40***	435.44***
		(72.38)		(82.21)	(75.86)
Family size		2,678.75***		2,656.21***	1,817.73***
		(247.12)		(285.50)	(261.94)
Public employee		−1,414.63**		−640.61	−506.05
		(666.63)		(790.58)	(708.43)
Retired		−927.96		−178.71	2,292.27*
		(1,179.32)		(1,466.27)	(1,324.07)
Unemployed		−2413.44**		−2621.57*	−2066.53*
		(1,185.97)		(1,408.23)	(1,242.61)
Labour 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	2,991	2,991	2,148	2,148	2,148

Notes: The dependent variable is non-durable consumption, expressed in 2014 euro. Columns (1) and (2) report full-sample estimates. Columns (3)–(5) report estimates using the sub-sample of households with mortgages originated before 2008. 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%.

durables all together because vehicles are 'big ticket items' and because estimates for vehicles can be compared with previous literature in a more direct way. Indeed, Di Maggio *et al.* (2016) analysis of the impact of US interest rate changes on ARM households focuses only on vehicles.

In Table 5, we report probit estimates for the probability of purchasing a vehicle and Tobit estimates for the amount spent on vehicles. The specification is identical to the baseline regression for non-durable consumption. The focus is once again the interaction term between the post-2008 period and the ARM dummy. Results indicate that the interest rate drop did not boost the demand for vehicles. These estimates are qualitatively

Table 4. Regression results for log consumption and consumption-to-income ratio

	Full sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
Panel A: log non-durable consumption					
ARM×Post-2008	0.01	0.01	0.01	0.01	0.01
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
ARM	0.02	0.02	0.02	0.03	0.02
	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)
Panel B: consumption-to-income ratio					
ARM×Post-2008	1.18	0.71	2.89	2.28	2.12
	(2.09)	(2.00)	(2.33)	(2.18)	(1.99)
ARM	0.05	0.58	0.03	0.60	0.84
	(1.93)	(1.85)	(2.09)	(1.97)	(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
Labour income	No	No	No	No	Yes
Observations	2,991	2,991	2,148	2,148	2,148

Notes: In Panel A, the dependent variable is the logarithm of non-durable consumption. In Panel B, the dependent variable is the consumption-to-income ratio (in percentage). All variables are expressed in 2014 euro. Columns (1) and (2) report full-sample estimates. Columns (3)–(5) report estimates using the sub-sample of households with mortgages originated before 2008. 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%.

consistent with Berger and Vavra (2015), who find that durable expenditures respond more sluggishly to economic shocks during recessions. They compute the impulse response of durables with respect to three policy shocks: a permanent decline in the interest rate, a permanent decline in the payroll tax, and a subsidy to durable adjustment. In each case, the response during the Great Recession is weaker than in periods of booms. In particular, they estimate that the response of durable spending to an income shock in 1999 is almost twice as large as if it occurred in 2009. To explain their results, they point out that during recessions microeconomic frictions lead to declines in the frequency of households' durable adjustment. In Section 8, we provide further evidence on the potential asymmetric response of consumption to interest rate changes during expansions and recessions.

Taken together, the results in Tables 3–5 suggest that the positive income shock caused by the drop in interest rates did not significantly affect the consumption of ARM households. In the descriptive analysis of Section 5, we show that the consumption of ARM households increases between 2008 and 2010 (Figure 7). 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

Table 5. Regression results for vehicles

	Tobit		Probit	
	(1)	(2)	(3)	(4)
ARM×Post2008	-269.59	-297.90	-0.03	-0.03
	(419.13)	(416.30)	(0.03)	(0.03)
ARM	443.28	442.94	0.04*	0.04*
	(359.96)	(357.50)	(0.02)	(0.02)
Male	225.81	221.73	0.01	0.01
	(229.79)	(227.57)	(0.01)	(0.01)
Married	406.35	224.49	0.02	0.01
	(297.67)	(295.13)	(0.02)	(0.02)
Age	-10.36	-15.53	-0.00	-0.00
	(12.54)	(12.53)	(0.00)	(0.00)
Years of education	34.60	14.26	0.00	0.00
	(29.64)	(29.62)	(0.00)	(0.00)
Family size	301.10***	225.41**	0.02***	0.01**
	(95.60)	(95.54)	(0.01)	(0.01)
Public employee	88.59	125.25	0.01	0.01
	(261.56)	(259.52)	(0.02)	(0.02)
Retired	-127.33	267.59	-0.01	0.01
	(559.08)	(562.24)	(0.04)	(0.04)
Unemployed	-351.17	-283.80	-0.02	-0.01
	(700.70)	(698.51)	(0.04)	(0.04)
Initial loan amount	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Mortgage origination	-14.21	-6.67	-0.00	-0.00
	(22.00)	(21.82)	(0.00)	(0.00)
Mortgage duration	-21.70	-9.95	-0.00	-0.00
	(16.12)	(16.05)	(0.00)	(0.00)
Labor income		0.03***		0.00***
		(0.01)		(0.00)
Year dummies	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes
City size	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes
Observations	2991	2991	2955	2955

Notes: The table reports Tobit (Columns 1 and 2) and Probit (Columns 3 and 4) estimated marginal effects for the demand for vehicles. All variables are expressed in 2014 euro. 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%.

include data from 2000 to 2014, we analyse the dynamic propagation of the shock. We estimate a version of Equation (2) that includes a full set of interactions between ARM and year dummies. Figure 8 reports the point estimates and the 95% confidence intervals for the time-varying coefficients of the ARM dummy. Each coefficient in Figure 8 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.
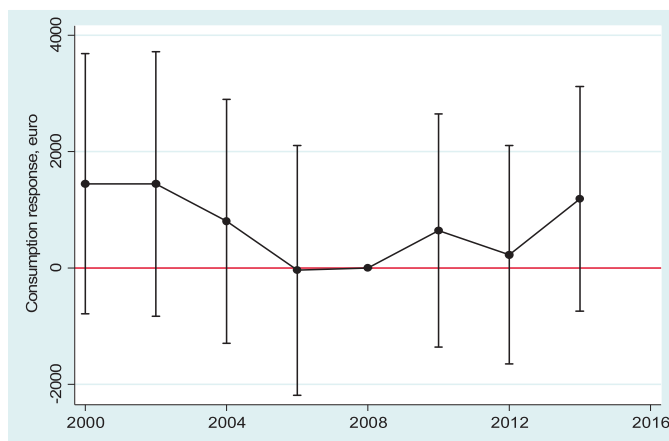
Figure 8. The response of consumption to the monetary policy shock

Notes: The figure plots the coefficients and the 95% confidence intervals estimated from a regression that includes a full set of interaction terms between ARM and year dummies. 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.

7. 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 shock; (2) the positive income shock is perceived as temporary; and (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. 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 here 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, we expect the MPC of ARM households to be lower than the MPC of FRM households.[9]

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9 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.

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 the '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 correlates positively with cash-on-hand and negatively with debt. However, the estimated γ_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 drive the low consumption response to the shock.[10]

A second explanation for the weak consumption effect is the role of expectations. According to standard intertemporal models, the size of the MPC depends, among other things, on the persistence of the income shock and the presence of liquidity constraints. The MPC is large when the income shock is persistent or when households have exhausted their cash-on-hand and face a liquidity constraint. Notice however that our sample includes borrowers who own a house worth on average about 300,000 euro and also have relatively high cash-on-hand (i.e., a mean of 30,000 euro and a median of 11,000). Therefore, we rule out that our sample contains a significant fraction of liquidity constrained households.

To assess the role of expectations, 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.[11] Figure 9 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 long-lasting and wide 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 9, report '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

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10 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.

11 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?'.

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

	Originated before 2008		
	(1)	(2)	(3)
ARM×Post-2008	530.67	334.51	420.40
	(833.94)	(875.15)	(830.46)
ARM	509.08	761.23	508.40
	(686.80)	(731.52)	(689.42)
Male	279.54	519.03	276.85
	(545.60)	(600.05)	(545.04)
Married	2,266.07***	2,969.75***	2,290.10***
	(674.44)	(754.62)	(670.42)
Age	258.69***	264.88***	264.92***
	(34.57)	(37.85)	(34.58)
Years of education	452.71***	638.77***	451.30***
	(75.60)	(81.93)	(75.08)
Family size	2,733.20***	2,599.20***	2,673.31***
	(259.19)	(285.32)	(257.43)
Public employee	−270.22	−583.89	−217.37
	(725.92)	(793.90)	(729.35)
Retired	−1,411.17	−245.27	−1,487.35
	(1,356.94)	(1,460.28)	(1,349.33)
Unemployed	−1,319.36	−2,663.03*	−1,302.37
	(1,294.96)	(1,396.99)	(1,280.00)
Initial loan amount	0.03***	0.03***	0.02***
	(0.01)	(0.01)	(0.01)
Mortgage origination	−205.90***	−372.11***	−310.23***
	(62.72)	(80.47)	(75.16)
Mortgage duration	−203.38***	−363.69***	−281.06***
	(41.73)	(53.86)	(48.09)
I quartile of cash-on-hand	−10,687.01***		−10,748.36***
	(696.19)		(696.03)
II quartile of cash-on-hand	−6,929.59***		−6,955.42***
	(757.38)		(752.15)
III quartile of cash-on-hand	−4,303.03***		−4,291.73***
	(741.39)		(741.06)
I quartile of debt		−3,150.33**	−3,262.84***
		(1,308.00)	(1,256.52)
II quartile of debt		−2,030.30*	−2,516.35**
		(1,082.27)	(1,039.54)
III quartile of debt		−1,015.86	−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	2,148	2,148	2,148

Notes: The dependent variable is non-durable consumption, expressed in 2014 euro. All regressions are estimated using the sub-sample of households with mortgages originated before 2008. 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%.
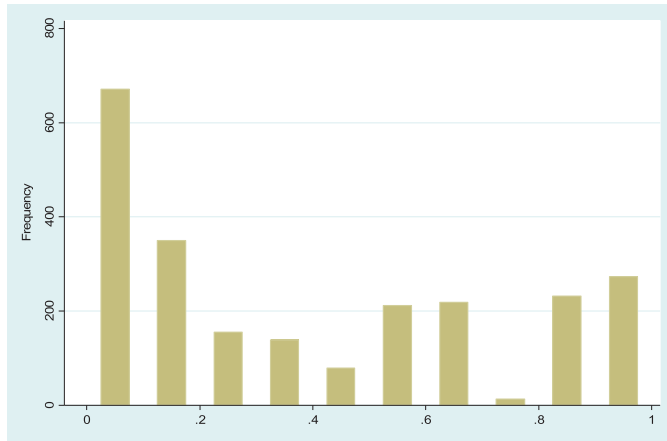
Figure 9. Interest rate expectations

Notes: The histogram is based on 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?". Data are drawn from the 2010 SHIW.

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).[12]

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:

$$yf_{it} = \lambda_{0t} + \mu_t \text{ARM}_i + \delta X_{it} + \epsilon_{it}, \tag{3}$$

where yf is the financial income. The regression includes a full set of year dummies and their interactions with ARM. The estimated μ_t, reported in Figure 10, show the impact of the fall in interest rates on y relative to 2008. The figure shows that between 2008

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12   Our evidence on interest rate expectations is partly speculative because it relies on subjective expectations about interest rates 1-year ahead, but we have no data for 2 (and more) years ahead.

Table 7. Regression results for financial income

	Full sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM×Post-2008	−435.40	−427.15	−293.99	−276.10	−271.29
	(277.86)	(272.84)	(187.22)	(180.01)	(176.17)
ARM	493.65*	460.11*	283.39	259.36	252.22
	(281.15)	(271.21)	(178.87)	(173.53)	(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
Labour income	No	No	No	No	Yes
Observations	2,991	2,991	2,148	2,148	2,148

Notes: The dependent variable is financial income, expressed in 2014 euro. Columns (1) and (2) report the estimates using the full sample. Columns (3)–(5) report estimates using the sub-sample of households with mortgages originated before 2008. 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%.
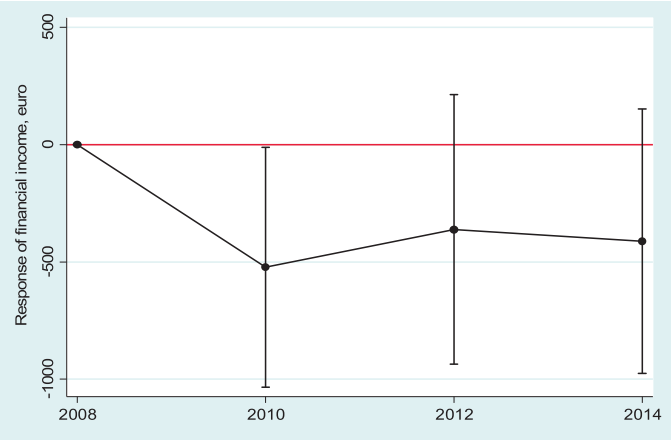

Figure 10. The response of financial income to the monetary policy shock

Notes: The figure plots the response of financial income of households with ARM relative to households with FRM. The coefficients and the 95% confidence intervals are estimated from a regression that includes a full set of interaction terms between ARM and year dummies (see equation 3). The 2008 coefficient is normalized to zero. Data are drawn from the SHIW.

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 re-absorbed 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 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, higher levels of wealth, and a lower fraction of wealth invested in fixed income assets.

Figure 9 on interest rates expectations, Table 7 and Figure 10 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 long-lasting, and ARM households suffered a counterbalancing loss in income from financial assets.

8. ROBUSTNESS CHECKS

The empirical strategy highlighted in Section 5 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 3-month Euribor. The estimated equations are:

$$m_{it} = \theta_{ot} + \theta_1 ARM_i + \theta_2 ARM_i \times EURIBOR_t + \theta_3 X_{it} + \epsilon_{it}, \quad (4)$$
$$c_{it} = \delta_{ot} + \delta_1 ARM_i + \delta_2 ARM_i \times EURIBOR_t + \delta_3 X_{it} + \epsilon_{it}, \quad (5)$$

where m_{it} is the mortgage payments and c_{it} is the non-durable consumption for household i in year t, ARM is a dummy that equals 1 if household i has an adjustable-rate mortgage, EURIBOR is the 3-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 labour income. A 1 percentage point drop in the 3-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 of estimating Equation (5) for non-durable consumption: the coefficient of the interaction between the ARM dummy and the 3-month Euribor is

Table 8. Regression results for mortgage payments: alternative specification

	Full sample		Originated before 2008		
	(1)	(2)	(3)	(4)	(5)
ARM×EURIBOR	194.94***	181.15**	241.66***	229.22***	227.16***
	(71.40)	(72.05)	(77.25)	(77.69)	(77.53)
ARM	−210.35	−238.28	−334.16*	−334.66*	−335.64*
	(162.01)	(160.11)	(177.94)	(178.82)	(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
Labour income	No	No	No	No	Yes
Observations	2,991	2,991	2,148	2,148	2,148

Notes: The dependent variable is annual mortgage payments, expressed in 2014 euro. Columns (1) and (2) report regressions using the full sample. Columns (3)–(5) report estimates using the sub-sample of households with mortgages originated before 2008. 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	−133.45	−60.38	−102.13	−128.34
	(222.68)	(191.43)	(246.79)	(214.41)	(198.83)
ARM	1,305.00**	1,050.03*	1,093.42	1,255.96*	1,243.46**
	(653.54)	(552.12)	(776.92)	(663.17)	(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
Labour income	No	No	No	No	Yes
Observations	2,991	2,991	2,148	2,148	2,148

Notes: The dependent variable is non-durable consumption, expressed in 2014 euro. Columns (1) and (2) report regressions using the full sample. Columns (3)–(5) report estimates using the sub-sample of households with mortgages originated before 2008. 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%.

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 2008–14, 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

Table 10. Regression results for mortgage payments and consumption, 2000–14 sample

	Mortgage payments (1)	Consumption (2)
ARM×EURIBOR	211.97***	−30.94
	(79.82)	(170.66)
ARM	−355.83**	816.82
	(165.91)	(530.03)
Male	−149.79	170.94
	(183.07)	(418.41)
Married	−177.18	2,535.75***
	(224.24)	(522.95)
Age	7.32	251.69***
	(9.34)	(23.24)
Years of education	31.01	813.26***
	(21.69)	(61.08)
Family size	110.30*	2,862.02***
	(66.78)	(188.75)
Public employee	26.39	−1,468.03***
	(177.00)	(509.12)
Retired	−347.38	−883.00
	(352.49)	(967.35)
Unemployed	−29.41	−1,965.60**
	(383.70)	(977.83)
Initial loan amount	0.05***	0.04***
	(0.01)	(0.01)
Year of home purchase	19.71*	−167.26***
	(11.03)	(24.20)
Mortgage duration	−147.35***	−197.12***
	(20.09)	(29.43)
Year dummies	Yes	Yes
Region dummies	Yes	Yes
Municipality size	Yes	Yes
Observations	5,117	5,119

Notes: The dependent variables are annual mortgage payments (Column 1) and non-durable consumption (Column 2), both expressed in 2014 euro. The table reports estimates using the sample of households with mortgages in 2000–14. Standard errors are clustered at the household level. One star indicates significance at 10% level, two stars at 5%, and three stars at 1%.

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.

A weak consumption response of ARM households may depend also on a precautionary savings effect, that is, households respond to the positive income shock by deleveraging rather than increasing consumption. This effect is particularly likely to occur after a recession during which households have exhausted their precautionary balances and

need to go back to their preferred target wealth/income ratio. A similar mechanism is also present in Guerrieri and Lorenzoni (2011), who show that after an unexpected permanent tightening in consumers' borrowing capacity, constrained consumers repay part of their debt while unconstrained consumers increase their precautionary savings. The interesting implication of this mechanism is that the effect of monetary policy can be state-dependent and, during crises, can be dwarfed by precautionary savings motives.

To dig deeper into this mechanism, we estimate the consumption effect of the interest rate shock that occurred between 1998 and 2001, that is, around the time of the introduction of the Euro. The period witnessed a substantial fall in nominal interest rates that, as in the 2008–10 episode, affected the ARM households relative to FRM households. We apply the same methodology used in our analysis for the post-2008 shock, and find no consumption effect on ARM households. This finding suggests that the consumption response of ARM households to interest rate changes is weak also in periods in which GDP is growing around its trend, and therefore our evidence does not support the hypothesis that a reduction in mortgage payments is effective in expansions but not in recessions. Although we do not have the data for this expansionary period we speculate that the interest rate insensitivity of consumption might be associated to the same mechanisms described in Section 7.

Our analysis does not consider the potential effect of house prices changes on the MPC, and their interactions with the income shock.[13] We thus introduce the market value of real assets in the estimation. Since results are very similar to those presented in Section 7, house price changes do not affect our estimates and their interpretation. As further robustness checks: (i) we replicate the analysis in Section 6 on the sample 2008–10 and 2008–12; (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 ARM × Post-2008 with residual mortgage duration.

9. 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 2008–14 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

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13 Eurostat Statistics report that between 2008 and 2010 Italian house prices have been flat, and that between 2010 and 2012 there was a decline of about 10%.

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 interest rate drop that occurred between 2008 and 2010. First, the distributions of initial debt, cash-on-hand, and real assets attenuate the response of consumption to the 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 soon, 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.

More broadly, 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 qualitatively consistent with Cloyne *et al.* (2016). 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.

The results have several implications for the transmission 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. In fact, it 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 favourable 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.

Discussion

Elena Carletti

Bocconi University

The literature has put forth four main channels of monetary policy transmission: (i) *interest rate channel*, according to which expansionary monetary policy lowers real interest rates and cost of capital, thus boosting investment and consumption; (ii) *wealth effect*, through which lower interest rates raise asset values, thus stimulation investment and consumption; (iii) *credit channel*, through which expansionary monetary policy increases supply of loans by banks, stimulating investment and consumption; and (iv) *income effect*, through which a reduction of interest rates reduces payments on ARMs, thus boosting households' consumption. This latter effect is most effective if the monetary policy shock is unanticipated and permanent. Furthermore, it may interact with the wealth effect through changes in financial income.

This paper investigates whether the income effect is at play in Italy during the period 2008–14 using survey household data. In particular, it asks the following question: Did the drop in interest rates between 2008 and 2014 increase consumption of households with ARMs relative to those with FRMs? The analysis shows that households with ARMs pay approximately 900€ less annually on their mortgages, corresponding to 13% of the total annual payment. Despite this significant drop in mortgages payments, the response on consumption is weak. Households with ARMs increase their consumption relative to households with FRM, but not significantly.

The finding of a weak consumption response contrasts with other papers analysing the income effect of expansionary monetary policy in the United States in the same period. For example, Di Maggio *et al.* (2014) find that also in the United States lower interest rates reduced households' payments on ARMs by approximately 900€ annually. However, differently from the case of Italy, such a reduction translated into an increase in the probability of a car purchase and into greater consumption of durable and non-durable goods.

The authors investigate three explanations for the weak consumption response: (a) cash-on-hand and debt heterogeneity; (b) expectations of transitory versus permanent shock; and (c) only the last two seem to play a role in the analysis. In particular, by exploiting one question in the 2010 survey, the authors show that households probably saw the drop in interest rates to be transitory rather than permanent. Moreover, they

find that the positive shock on ARM payments was partly offset by a negative financial income effect. Specifically, ARM households saw their financial income reduced by approximately 500€ relative to FRM households. This curbed the positive shock on mortgages payments, thus leaving ARM households with little overall advantage.

The paper contributes to the growing literature on the ineffectiveness of monetary policy, at times, and it confirms the asymmetric effects in terms of transmission of monetary policy between positive and negative shocks. Although the analysis is nicely done, some more discussion of the 'no significance finding' may be helpful to exclude that this is not due to measurement problems or to missing factors. In line with this, the discussion will centre on four issues. The first two concern the nature of the decrease of interest rates, while the other two will touch upon the wealth effect of monetary policy and the general economic uncertainty characterizing the years in which the analysis is conducted. Let me explain each of these issues in turn below.

The decline in interest rates takes place over a long period of time. As Figure 2 in the paper also shows, the ECB rate on MROs declines from above 4% to 1% between 2008 and 2010, to then slightly more than 0% in early 2014 after a temporary increase in early 2012. This shows that the most substantial decline occurs at the outset of the global financial crisis, when central banks started to lose their monetary policy and inject massive amounts of liquidity in the system. The further decline in later years responds to the Euro area sovereign crisis and the related lack of economic recovery in the peripheral countries. This figures raises the question whether the shock, that is, the decline of interest rates, can be treated as 'unanticipated'. One possibility to dig a bit deeper into this issue is to split the analysis in different periods, and in particular, to see whether households react more in terms of consumption in the early years of the period when rates decline so substantially. Surprisingly, the authors still find a non-significant result in terms of households' consumption propensity when they restrict the analysis to the period 2008–10.

The second issue concerns whether households see the shock as being transitory or permanent. The idea here is that households should respond less in the former case than in the second. To analyse this issue, the authors exploit one question contained in the survey in 2010. The question asks households whether they expect interest rates to increase in the following year. Among the respondents, 37% declare yes, while 42% are uncertain. Interestingly, households with ARMs expect rates to increase more than households with FRMs. The authors conclude that households tend to consider the shock to be transitory. I find this conclusion a bit too tentative for two reasons. First, the survey question concerns only the possibility that interest rates increase in the following year. Thus, it has a short-term horizon rather than a long period, which is usually considered to be more appropriate in consumption theory. Second, a large proportion of respondents is undecided (and taken out of the analysis), which reduces the significance of the question responses. Given this and the importance of understanding households' expectations on the shock length, I wonder whether there can be other ways to capture such expectations (and their potential adjustment over time) such as unconventional

monetary policy instruments (e.g., LTRO or OMT or announcement on the use of QE) be used to measure households' expectations? Could one plausibly assume that the more such tools are used the more households expect interest rates to remain low given that these tools are more likely to be used when rates are around the zero lower bound to foster the effectiveness of monetary policy?

The third comment concerns the wealth effect and households' choice between ARM and FRM. Normally, expansionary monetary policy induces a positive wealth effect, in that lower interest rates boost asset prices and thus perceived wealth. Here, however, the focus is on financial income, mostly in the form of interest rate income, which reduces when interest rates decline. The focus on financial income raises several questions. The first is what happens to the 'normal' wealth effect channel, that is to asset prices and related households' investments. Do ARM households have some financial investments such as shares or bonds? Does their price increase and if so, what can be the perceived wealth increase from such investments? The second question is why ARM households are so much more exposed to interest rate risk, given they tend to be more sophisticated than FRM households and already exposed to this risk through their mortgage. Related to this, how do households choose the type of mortgage to initiate? Is this a 'pure' choice for them or do banks influence such a choice? Foà *et al.* (2015) show that bank characteristics matter for the type of mortgage households initiate, thus suggesting an influence from the supply side. This result seems particularly relevant. Could the authors exploit it by using bank characteristics as an instrument in their analysis?

The final comment refers to the drivers of the decline of interest rates. As discussed in the literature, interest rates started reducing both in nominal and real terms already in the mid-80s and their decline accelerated in the aftermath of the global financial crisis and the European sovereign debt crisis. What explains such a long-term decline? According to the *financial cycles view* (Borio, 2012; Lo and Rogoff, 2015), economic agents accumulated excessive debt in the period before the crisis based on optimistic expectations. When the crisis burst, agents started deleveraging massively, thus inducing a dampening of investment and real interest rate. As a consequence, nominal interest rates decline due to recession and accompanying monetary policy response. By contrast, according to the *secular stagnation view* (Summers, 2014), the decline of interest rates has been driven by structural reasons, namely adverse demographic developments and lower total factor productivity from the supply side, and increased preference for safe assets. This led to excess saving over investment and lower real interest rates, thus inducing downwards pressure on nominal rates. The two views have different implications for the duration of low interest rates: According to the former, interest rates will increase again when cyclical factors vanish away; while according to the latter interest rates have declined permanently so that their level will remain low even when cyclical factors vanish.

This discussion has clear implications for the analysis in the paper. As the authors argue, the positive shock of lower ARM payments should have a stronger effect on consumption when the decline in interest rates is permanent. However, if such a decline is

due to structural factors as argued by the secular stagnation view and it is accompanied by a period of low growth, then the effect on consumption may be limited. In line with this, as the decline of low interest rates in the period 2008–12 occurred in the midst of an economic and financial crisis, especially in Italy where the financial crisis was followed by a sovereign crisis, households may have just been induced to save for precautionary reasons. Although this is not at the centre of the analysis in the paper, it is important to discuss more the macroeconomic situation in Italy during the sample period and its potential effect on households' behaviour.

In sum, the paper represents an interesting and important contribution to the literature on the ineffectiveness of monetary policy and the asymmetric effects between positive and negative monetary policy shocks. Three main suggestions are provided for the lack of results. The analysis is very careful and arguments convincing. The findings have implications for the conduct of monetary policy interventions and the credibility of the future paths of interest rates.

João Cocco

London Business School

The Great Recession is considered by many to be the worst economic crisis since the Great Depression of the 1930s. During the early 2000s US house prices and household mortgage debt increased at an unprecedented pace. When the crisis began, in the face of house price and income drops, highly indebted households were forced to cut-back on consumption, which contributed to further declines in economic activity. Those unable (or unwilling) to meet their required mortgage payments defaulted, leading to an increase in foreclosures, and further falls in house prices. Financial institutions suffered losses in their portfolio of loans, constraining their ability to extend credit.

Monetary authorities recognized these risks early on, and reduced short-term interest rates so as to stimulate economic activity. However, the structure of the US mortgage market may have prevented the monetary policy transmission mechanism from operating effectively. The predominant form of mortgage contract is the long-term nominal FRM. For mortgage borrowers to be able to benefit from the reduction in interest rates, they need to refinance their loans. Furthermore, it has to be the case that the reduction in short-term rates leads to a reduction in mortgage rates. In other words, long-term rates need to drop and credit spreads cannot increase and offset the impact of the reduction in interest rates. It soon became apparent that many households with low or negative home equity were indeed constrained in the ability refinance their mortgages, motivating the introduction of the Home Affordable Refinance Program aimed at facilitating such refinancing activity.

These events highlighted the links between monetary policy, mortgage markets and household consumption, and the importance of their study. Most of the existing evidence is, however, US-based. Tullio Jappelli and Annalisa Scognamiglio provide

evidence using Italian data, the Survey of Household Income and Wealth. Their study makes a particularly important contribution since the structure of the Italian mortgage market is such that it allows them to compare ARM and FRM borrowers. The former benefit immediately from any reduction in interest rates, that is, they do not need to refinance their loans. The quasi-experimental setting is the large drop in interest rates following the collapse of Lehman Brothers in September 2008 (of 325 basis points in the space of 7 months). They estimate the effects of the interest rate drop on the mortgage payments and consumption of ARM holders (treatment group) and FRM holders (control group) using a difference-in-differences methodology.

Before discussing their results let me briefly point out some of the key identifying assumptions behind the analysis. They are that the sample of ARM holders does not differ significantly from the sample of FRM holders in unobservable characteristics and that there are no changes in the composition of the two groups caused by the fall in interest rates. The authors present compelling evidence in support of these assumptions and to mitigate concerns that there may be, they estimate the equations on the subsample of mortgage holders with loans originated before 2008.

The results from their analysis are both interesting and provocative. The authors find that there is a large decline in the annual mortgage payments of ARM holders compared with FRM holders, of around 900 euros, or 13% of the average annual mortgage payment of around 7,000 euros. This is a large decline, and what one would expect given the large decrease in interest rates, from which ARM borrowers immediately benefit. The estimated increase in non-durable consumption of ARM borrowers is higher than that of FRM borrowers, as one would expect, but the implied MPC is not statistically different from zero. This is a puzzling result: ARM borrowers see a substantial fall in the value of their mortgage payments, but they do not significantly increase consumption.

One possible explanation is that the estimated MPC is not statistically significant because of measurement error in non-durable consumption. To address this possibility the authors repeat their analysis using car purchases, which are less likely to suffer from measurement error. Again they find that the purchase of cars of ARM borrowers (compared with FRM borrowers) was not stimulated by the reduction in interest rates.

The authors propose several different explanations for the consumption response and find supporting evidence for two of them, namely that: (i) the drop in interest rates (the income effect) is perceived by borrowers as being temporary, they are not liquidity constrained, so that their consumption does not respond to the associated drop in mortgage payments and (ii) the drop in interest rates led to a decline in the income that borrowers receive from their financial assets, offsetting the positive income shock on mortgage payments.

An alternative explanation for which the authors do not find supporting evidence concerns the role of economic uncertainty. If ARM borrowers were more exposed to the economic uncertainty that was a characteristic of this period and in particular uncertainty about future interest rate movements, they might have had stronger precautionary

savings motives and incentives to deleverage. This might have offset the effects of the interest rate reduction.

These results have important lessons. One should not assume that a reduction in interest rates and in the mortgage payments will automatically stimulate consumption. It depends on the expectations of borrowers regarding future interest rate movements and on their financial position. Furthermore, one should not assume that ARMs will always be more effective than FRMs as vehicles of monetary policy transmission. In the case of Italy there was no differential consumption response. The results also raise the question of why Italian households hold simultaneously mortgage debt and substantial financial assets. It would be interesting to evaluate the costs of this behaviour.

PANEL DISCUSSION

In their comments, Andreas Madestam suggested that there may be heterogeneous effects according to household wealth since poor households will hold less financial assets, while Ian Cassar highlighted that there might also be heterogeneity between house prices between two different types of mortgages. Richard Portes wondered if individuals may be modifying their behaviour because of the so-called secular stagnation. He also stated that the authors should carefully check the work of Cloyne *et al.* (2017) showing that following a temporary cut in interest rates, households with mortgage debt increase their spending significantly, homeowners without debt do not adjust expenditure at all, and renters increase spending but by less than mortgagors. According to their findings, however, income rises considerably for all types of households.

Eliana Viviano highlighted potential measurement error issues and suggested looking at other outcome variables such as labour supply. Moritz Schularick questioned whether the findings are indeed the result of monetary policy or, instead, driven simply by the global financial crisis. He also said that according to previous literature but unlike in Italy as per what the authors suggest, households with ARM tend to be a specific group of individuals.

Nicola Fuchs-Schündeln argued that the authors are controlling for cash-on-hand but should instead be splitting the sample into households that were likely to be constrained versus unconstrained. The sample could also be divided into households that expect interest rates to increase versus those expecting interest rates to remain low. Salvador Barrios asked if there is information on the year the mortgage was taken since ARMs are a more recent phenomenon. Finally, Tommaso Monacelli wondered why some agents might at some point become interest rate insensitive and stated he was not convinced with the interpretation of the permanent versus transitory monetary policy shock.

Replying to comments and questions, A.S. first clarified that they do sample splits based on cash-on-hands but there is no significant difference. She also argued that

because of the small sample size, breaking the sample can be problematic. A.S. then highlighted that house prices only started to decrease in Italy in 2012. She also mentioned that they can check if there were any effects on labour supply and, regarding the comment raised by Richard Portes, clarified that Cloyne *et al.* (2017) is mentioned in the paper and that their conclusions are in line with what they find.

REFERENCES

Agarwal, S., J. C. Driscoll and D. I. Laibson (2013). 'Optimal mortgage refinancing: a closed form solution', *Journal of Money, Credit and Banking*, 45, 591–622.

Agarwal, S. and W. Qian (2014). 'Consumption and debt response to unanticipated income shocks: evidence from a natural experiment in Singapore', *American Economic Review*, 104, 4205–30.

Andersen, S., J.Y. Campbell, K.M. Nielsen and T. Ramadorai (2017). 'Inattention and inertia in household finance: evidence from the Danish mortgage market', CEPR Discussion Paper No. 10683.

Auclert, A. (2017). 'Monetary policy and the redistribution channel', Stanford University, Mimeo.

Badarinza, C., J.Y. Campbell and T. Ramadorai (2016). 'International comparative household finance', *Annual Review of Economics*, 8, 111–44.

——. (2017). 'What calls to ARMs? International evidence on interest rates and the choice of adjustable-rate mortgages', *Management Science*, published online in advance, doi 10.1287/mnsc.2016.2629.

Bajo, E. and M. Barbi (2015). 'Out of sight, out of mind: financial illiteracy, inattention, and sluggish mortgage refinancing', University of Bologna, Mimeo.

Baker, S. and C. Yannelis (2017). 'Income changes and consumption: evidence from the 2013 Federal Government shutdown', *Review of Economic Dynamics*, 23, 99–124.

Bank of Italy (2011). *Annual Report*, Bank of Italy, Rome.

——. (2016). *Financial Stability Report*, Bank of Italy, Rome.

Berger, D. and J. Vavra (2015). 'Consumption dynamics during recessions', *Econometrica*, 83, 101–54.

Bernanke, B. S. and M. Gertler (1995). 'Inside the black box: the credit channel of monetary policy transmission', *Journal of Economic Perspectives*, 9, 27–48.

Blundell, R., L. Pistaferri and I. Preston (2008). 'Consumption inequality and partial insurance', *American Economic Review*, 98, 1887–921.

Broda, C. and J. Parker (2014). 'The economic stimulus payments of 2008 and the aggregate demand for consumption', *Journal of Monetary Economics*, 68, S20–36.

Campbell, J.Y. (2006). 'Household finance', *The Journal of Finance*, 61, 1553–604.

Campbell, J.Y. and J. Cocco (2003). 'Household risk management and optimal mortgage choice', *The Quarterly Journal of Economics*, 118, 1449–94.

Chiuri, M.C. and T. Jappelli (2003). 'Financial market imperfections and home ownership: a comparative study', *European Economic Review*, 47, 857–75.

Cloyne, J., C. Ferreira and P. Surico (2016). 'Monetary policy when households have debt: new evidence on the transmission mechanism', Bank of England Working Papers 589.

Di Maggio, M., A. Kermani and R. Ramcharan (2014). 'Monetary policy pass-through: household consumption and voluntary deleveraging', Mimeo.

Ehrmann, M. and M. Ziegelmeyer (2014). 'Household risk management and actual mortgage choice in the euro area', ECB Working Paper No. 1631.

Foà, G. G. Gambacorta, L. Guiso and P.E. Mistrulli (2015). 'The supply side of housing finance', EIEF Working Paper 07/15.

Fuchs-Schuendeln, N. and T.A. Hassan (2016). 'Natural experiments in macroeconomics', *Handbook of Macroeconomics*, 2, 923–1012.

Gambacorta, L., L. Guiso, P.E. Mistrulli, A. Pozzi and A. Tsoy (2017). 'Distorted advice in the mortgage market: theory and structural estimation', CEPR Discussion paper 12115.

Gelman, M., K. Shachar, M.D. Shapiro, D. Silverman and S. Tadelis (2014). 'Harnessing naturally occurring data to measure the response of spending to income', *Science*, 345, 212–5.

Guerrieri, V. and G. Lorenzoni (2011). 'Credit crises, precautionary savings, and the liquidity trap', NBER Working Papers 17583.

Jappelli, T. and M. Padula (2016). 'The consumption and wealth effects on an unanticipated change in lifetime resources', *Management Science*, 62, 1458–71.

Jappelli, T. and L. Pistaferri (2014). 'Fiscal policy and MPC heterogeneity', *American Economic Journal: Macroeconomics*, 6, 107–36.

——. (2017). *The Economics of Consumption*, Oxford University Press, Oxford.

Jimenez, G., S. Ongena, J.L. Peydro and J. Saurina (2012). 'Credit supply and monetary policy: identifying the bank balance-sheet channel with loan applications', *American Economic Review*, 102, 2301–26.

Johnson, D., N. Souleles and J. Parker (2006). 'Household expenditure and the income tax rebates of 2001', *American Economic Review*, 96, 1589–610.

Johnson, E., S. Meier and O. Toubia (2015). 'Money left on the kitchen table: exploring sluggish mortgage refinancing using administrative data, surveys, and field experiments', Mimeo.

Jordà, O., M. Schularick and A.M. Taylor (2016). 'The great mortgaging: housing finance, crises and business cycles', *Economic Policy*, 31, 107–52.

Kaplan, G. and G.L. Violante (2014). 'A model of the consumption response to fiscal stymulus payments', *Econometrica*, 82, 1199–239.

Keys, B.J., D.G. Pope and J.C. Pope (2014a). 'Failure to refinance', NBER Working Paper No. 20401.

Keys, B.J., J. Benjamin, A. Seru and V. Yao (2014b). 'Mortgage rates, household balance sheets, and the real economy', NBER Working Paper No. 20561.

Koijen, R.S.J., O.V. Hemert and S.V. Nieuwerburgh (2009). 'Mortgage timing', *Journal of Financial Economics*, 93, 292–324.

Lea, M. (2010). 'International comparison of mortgage product offerings', Research Institute for Housing America.

Mian, A., K. Rao and A. Sufi (2013). 'Household balance sheets, consumption, and the economic slump', *Quarterly Journal of Economics*, 128, 1687–726.

Neri, A., C. Rondinelli and F. Scoccianti (2015). 'The marginal propensity to consume out of a tax rebate: the case of Italy', Mimeo.

Paiella, M. and A.F. Pozzolo (2007). 'Choosing between fixed and adjustable rate mortgages'. SSRN: http://ssrn.com/abstract=976346.

Surico, P. and R. Trezzi (2016). 'Consumer spending and fiscal consolidation: evidence from a housing tax experiment', CEPR Discussion Paper No. 11735.