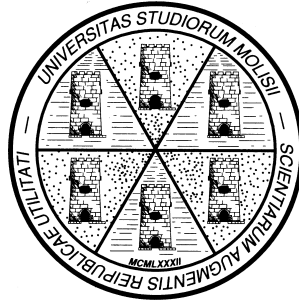


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ECONOMICS & STATISTICS DISCUSSION PAPER
No. 33/07

Choosing Between Fixed and Adjustable Rate Mortgages

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Abstract

This paper estimates the determinants of households' choice between fixed rate (FRM) and adjustable rate mortgage (ARM) contracts, using the Bank of Italy's Survey of Household Income and Wealth. Contrary to the predictions of the theoretical literature, the analysis shows that most household characteristics proxying for exposure to other (non-mortgage-related) risks and for individual risk aversion are irrelevant for the choice. This, in turn, crucially depends on the relative price of the mortgages and on whether the household is liquidity constrained. Liquidity constrained households find ARMs particularly attractive because their initial payments are generally lowest, *ceteris paribus*. This is so despite some evidence that the premium that lenders charge over their cost of funds is substantially higher on ARMs than on FRMs. Taken together, the evidence suggests that ARM holders do not fully take into account the risk of a rise of the reference interest rates. On the other hand, lenders price quite expensively this risk and borrowers end up paying a high price for the benefit of low initial payments.

JEL classification: D10, G1, G21, E4.

Keywords: home purchase finance, adjustable rate mortgages, fixed rate mortgages

1. Introductionⁱ

Housing is the most important asset in the portfolio of most households. It is a relatively illiquid investment, with an uncertain capital value, and it is generally highly leveraged, which makes it a potentially important channel of transmission of monetary policy. Furthermore, houses are both an asset and a consumption good.ⁱⁱ

This paper focuses on housing finance. In recent years, in addition to the traditional fixed and adjustable rate mortgage contracts, borrowers have been given a wide variety of financing methods from which to choose. Examples include pledged savings accounts, interest-only mortgages, graduated and flexible payment mortgages, reverse annuity mortgages, renegotiable rate mortgages and numerous others.ⁱⁱⁱ However, although there is substantial cross-country variation as to which type of mortgage contract is most common, by far the dominant two have been the standard fixed rate and the adjustable rate mortgage. In the United States, for example, most mortgage debt is at rates that are fixed for the entire duration of the contract (although prepayment options are frequent), whereas in the UK there is very little mortgage debt that is fixed for more than a few years. In the rest of Europe, despite increasing financial integration, as Figure 1 shows, housing credit systems have continued to be characterized by different types of contracts, with France and Germany, at one end, where over half of lending is at rates that are fixed for 10 years or longer, and Finland and Portugal, at the other, where basically no loans are granted at rates that are fixed for over five years.

The specific contractual features of housing finance have important implications from a policy perspective, due to the effects that changes in interest rates may have on house price stability and on household behavior and welfare. Although there are several channels through which changes in interest rates can affect the housing market, the household sector

is likely to play a key role in those countries with predominantly adjustable-rate mortgage contracts, since in this case households bear the risk of higher rates directly through their higher mortgage payments and smaller remaining income. Nevertheless, it must be said that, although a nominal fixed-rate mortgage is safe in the sense that its nominal payments are fixed, from the perspective of the borrower it is also risky because its real capital value is highly sensitive to inflation.

The purpose of this paper is to examine the choice between the two dominant types of contract, adjustable-rate (ARMs) and fixed-rate mortgages (FRMs). The borrower's choice between mortgage contracts can be viewed as a problem in household risk management and we are interested in assessing whether households can gauge accurately their circumstances in terms of (non-mortgage related) risk exposure and choose either a fixed-rate mortgage or an adjustable-rate one as appropriate. In this sense, our empirical setup provides a setting to test some of the predictions of Campbell and Cocco (2003), who view the choice of a mortgage contract from a normative perspective and single out the characteristics of a household that should lead it to prefer one form of mortgage over the other. In fact, in principle the relative attractiveness of a specific type of contract should depend on individual circumstances, such as the riskiness of labor income, borrowing constraints, and the probability of moving and pre-paying the loan.

We conduct our empirical analysis using data on Italy, where the market for mortgages is relatively small but has been growing exceptionally fast in the past decade.^{iv} This makes Italy a particularly suitable setting to study housing finance. In fact, there is evidence that housing credit systems are characterized by high degrees of inertia, with the contractual features of new mortgages partly reflecting contracts and conventions established in earlier periods, when inflation, interest rate variability and regulatory practices were very different.

Contractual inertia is less likely to play a relevant role in Italian households' mortgage choice. Furthermore, the dataset that we use is representative of the whole population, whereas most of the existing studies of household mortgage choice use data that have been collected locally, or by some specific lending institution.

We find that, conditional on holding a mortgage, the ARM vs. FRM choice depends only partially on borrower characteristics. Overall, pricing variables seem to play a dominant role and the evidence suggests that in choosing the mortgage type borrowers attach very much weight to the initial level of repayment. Although the initial payments tend to be lower on ARMs, *ceteris paribus*, it seems that the premium that banks charge over their cost of funds is much higher on ARMs than on FRMs.

The rest of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on the choice between fixed and adjustable rate mortgages. Section 3 presents the data that we employ for the estimation. Section 4 discusses the empirical setup and some empirical issues. Section 5 presents the results and section 6 concludes.

2. The ARM vs. FRM choice in the literature

The literature on the choice between fixed and adjustable rate mortgages dates back at least to the first half of the Eighties, but it is still quite scant. Among the first theoretical contributions is that of Baesel and Biger (1980), who have stressed that the optimal choice between ARMs and FRMs depends on the correlation between the rate of inflation and borrowers' labour income. If such a correlation is low, a rise in nominal interest rates is not matched by a wage increase and this augments the burden of the repayment of an ARM, so that FRMs are to be preferred. Statman (1982) adds to this framework, suggesting that when considered as part of the solution to a mean-variance portfolio problem, the optimal choice between adjustable and fixed rate mortgages should also depend on the expected future value

of the house, and therefore on house price inflation. Alm and Follain (1984) extend the analysis and include various types of constraints, such as minimum down-payments, maximum payment-to-income ratios and positive net worth constraints.

More recently, Campbell and Cocco (2003) have studied the optimal choice between adjustable and fixed rate mortgages in a more general framework, allowing for income uncertainty, risk aversion, variability in the end-of-period value of the house, credit constraints and FRM refinancing options. Their seminal contribution stresses that ARMs expose borrowers to income risk, while FRMs expose them to wealth risk. As such, “households with smaller houses relative to income, more stable income, lower risk aversion, more lenient treatment in bankruptcy and higher probability of moving should be the households that find ARMs more attractive”.

The empirical evidence on the determinants of the choice between adjustable and fixed rate mortgages is also limited. Among the most cited results are those of Dhillon et al. (1987), who estimate a standard binary choice model using a sample of about 80 borrowers from the Baton Rouge office of a national US mortgage bank between January 1983 and February 1984. Their results do not match the predictions of the theoretical literature and show instead that borrower characteristics have a very weak effect on the choice between adjustable and fixed rates, while price variables have a sizeable and significant role. Similar evidence is provided by Brueckner and Follain (1988), who follow a two step procedure in that they first estimate the interest rate that each borrower would have obtained had she chosen the alternative type of mortgage and then use the imputed rate as an explanatory variable in the mortgage choice model.^v Their results confirm that the interest rate differential is the major determinant of the choice. Besides this, they find that when market interest rates are higher, borrowers tend to prefer ARMs, *ceteris paribus*, as if they expected

some degree of mean reversion. Consistent with some of the theoretical predictions, they also find that borrowers with higher income and higher savings, and therefore less likely to be credit constrained in the future, have a preference for ARMs. Finally, they show that borrowers with a higher probability of moving (and pre-paying the loan) have a preference for adjustable rate mortgages. Indeed, if the borrower knows that it will move in the near future, thus selling the home and pre-paying the loan, the most appropriate contract would be the one with the lowest current interest rate.

3. The data

We estimate our model using data from the Bank of Italy's Survey of Household Income and Wealth (SHIW) and consider the last five surveys covering the period 1995-2004,^{vi} which contain detailed and homogeneous information on housing finance. The SHIW is a representative sample of the Italian resident population. It has a rotating panel component with fifty percent of households being re-interviewed in the following survey. It provides detailed data on household socio-demographic characteristics, consumption, income and balance sheet items and has plenty of information on housing tenure and finance.^{vii}

After some exclusions,^{viii} we are left with a sample of over 28,000 observations, whose composition is reported in table 1. About 75 percent of households own their home and around 13 percent of homeowners has a mortgage. About half of mortgage holders has a fixed rate loan. For the appraisal of the determinants of the choice between ARMs vs. FRMs, we focus on those mortgage holders who have purchased their home in the two years prior to the interview^{ix} and assume that they have obtained the loan, or re-contracted the terms of an outstanding mortgage, at the time of the purchase. These households represent around 16 percent of the mortgage holders in the sample and exhibit a relatively higher share of adjustable rate mortgage holders. For those mortgage holders who have purchased their

home at earlier dates, there is no sufficient information to obtain reliable measures of their characteristics at the time when they acquired their home, which may have affected their financing choice (for e.g. income and wealth in the years before the interview are not available).

Table 2 reports some summary statistics for the whole sample of households, for that of homeowners, for mortgage holders, and for several sub-samples. For details regarding the exact definition and source of the variables, see the data appendix. Most of the differences in terms of socio-economic characteristics between mortgage holders and the rest of the households in the sample are due to the fact that mortgage holders are relatively younger. So, with respect to the sample average, the head of a household with a mortgage is more likely to be a male, to be married, and is more educated. Mortgage holders' net income is substantially higher and the number of income recipients (not reported in the table) is also higher. In addition, they are more likely to be self-employed, to live in the North of Italy and to have moved from their province of birth. Most of the differences in terms of real asset wealth come from the fact that 25 percent of the sample consist of renters, who tend to be less wealthy than homeowners. In terms of financial wealth, mortgage holders have fewer financial assets and their liabilities are higher. The fourth column of the table reports summary statistics for the sub-sample of "recent" borrowers, i.e. mortgage holders who have purchased their home and obtained a loan in the two years before the interview. This set, which we use for the estimation, is very similar to the sample of all borrowers.

The last two columns of the table distinguish between "recent" borrowers with an FRM and "recent" borrowers with an ARM. The head of a household with an ARM is more likely to be a male, is more educated and is more likely to have moved away from her province of birth. ARM holders are wealthier, but have less financial assets. They are more likely to

invest in risky assets (stocks and corporate bonds), but invest smaller amounts on average. Their liabilities are slightly higher.

Table 3 summarizes some characteristics of the mortgage loans held by the “recent” borrowers. ARM holders borrow larger amounts, but the differences in terms of loan-to-house value are negligible: the loan-to-value ratio is around 44 percent. Mortgage payments on ARMs are larger, but as a share of borrower’s earnings, they turn out to be slightly lower (17.6 vs. 18.8 percent). The average interest rate is comparable. Under the assumption that lenders charge borrowers a rate given by the sum of their cost of funds plus a premium, this implies that the premium on ARMs is higher than that on FRMs. In fact, over the sample period considered, short-term rates – the benchmark for ARMs – have been lower than long-term rates – the benchmark for FRMs. Based on this, we have computed the premium charged to mortgage holders as the difference between the mortgage rate paid by the household in the year of interview and the interest rate of one-year government bonds – if it is an ARM – or the interest rate of government bonds with a maturity as close as possible as that of the mortgage – if it is a FRM. The premium charged to ARM holders amounts to 125 basis points on average, over 100 points higher than the average premium of FRM holders.

4. The empirical framework

We consider an environment where at each date households choose whether to buy a house and ask for a loan to finance the purchase. When demanding a loan for home purchase financing, households can choose between two types of contracts, adjustable rate mortgages and fixed rate mortgages. Conditional on buying and borrowing, we assume that the choice between mortgage contracts is a function of household characteristics and of the relative cost of the loans and estimate the following probit regression:

$$Pr(Y_{ijt} = k) = f(X_{it}, Z_{jt}), \quad k = 0, 1; \quad (1)$$

where: $Y_{ijt} = 1$ if the mortgage that household i has taken at time t in the housing and credit market j is an ARM and $Y_{ijt} = 0$ if it is an FRM; X_{it} denotes the socio-demographic characteristics of the household i at time t (e.g., size, income, wealth), and Z_{jt} includes the characteristics of the mortgage products available, which may vary across credit markets j and over time (e. g., the interest rates).

In practice, we estimate equation (1) on the sample of “recent” borrowers. We therefore exclude all those households whose mortgage demand at time t is non-positive, which comprise renters, those who have purchased their home without needing financing, those who have inherited or just haven’t paid for it and all those who are not moving and purchasing a home at t . We must therefore allow for the possibility that our sample is “selected”, so that the mortgage type choice is not independent from the decision to buy a new house and borrow. We address this issue by estimating the model in steps as follows. First, we estimate a probit for the probability of purchasing one’s home with a mortgage, and compute the Heckman correction term for the censoring of the loan demand. Then, we estimate equation (1), the probit for choosing an ARM over an FRM, augmented by the

Heckman correction term. As it is discussed below, identification is achieved by exclusion restrictions.

We conclude the analysis by estimating a propensity score matching model to appraise the differences between ARMs and FRMs. A direct comparison is not feasible because we are unable to observe the characteristics of the FRM contract offered to someone who has then chosen an ARM and viceversa. The differences in the terms and features of the contracts can be expected to be the most crucial determinant of the choice. Including these differences as regressors in equation (1) is however problematic, because some of the characteristics of the mortgage granted to household i may be endogenous to its choice.

The estimation of a propensity score matching model amounts to comparing mortgages granted to households that are similar in *all* respects, except for their choice between adjustable versus fixed rates loans.^x In practice, we split our sample between ARMs ('treated' observations) and FRMs ('untreated' or 'control' observations), match each 'treated' observation with a set of 'untreated' observations (chosen so as to be as similar as possible to the 'untreated' ones), and then compare the characteristics of the loans issued to the two groups. More formally, defining as Z_A a generic attribute of an ARM, as Z_F the same attribute for an FRM and as X a set of household, credit and housing market characteristics, this procedure amounts to estimating:

$$\alpha \equiv E [(Z_A) - (Z_F) | X], \quad (2)$$

where α is the relevant variable for the appraisal of the mortgage type choice.

5. Estimation results

5.1. *Choosing whether to buy and take out a mortgage or not: an affordability problem*

As previously discussed, before estimating equation (1), we need to evaluate a binary choice model for the probability that a household has purchased its home in the two years prior the interview and has taken out a mortgage, i.e. that it has purchased a home, asked for a loan to finance it and obtained it. In this instance, the control group is the entire population in the sample, as it is appropriate in relation to the type of sample selection bias that potentially affects the estimation of the model for mortgage choice.

The probability of purchasing a new home depends on a set of observable and unobservable household preference parameters and on a set of “affordability” constraints. The latter consist in a wealth constraint, which determines one’s ability to afford the outright purchase of one’s home or the required down-payment, and in an income constraint, which determines one’s ability to meet any scheduled mortgage payments. The wealth and income constraints depend in turn on household’s net wealth and income, on the terms of the mortgage contract, and on the desired level of housing – hence, on the household socio-economic status and demographic characteristics – and of non-housing consumption. These affordability constraints can result in liquidity constraints that would prevent moving or outright home ownership.

To estimate the model we need to find at least one variable that affects the decision to purchase one’s home and ask for a mortgage, but not that regarding the type of loan. We chose the share of households renting their home and a polynomial in the average annual per-square meter rent, which varies per province and year of interview. These variables capture the development of the rental market, which matters for household’s mobility and is particularly relevant for the choice to own one’s home, as opposed to rent it. We also use the

number of banks where the household holds a bank account, which can be expected to be positively related to the individual's information on financial instruments. The coefficients of these variables turn out to be statistically significant in the decision to ask for a loan, but not in that regarding the choice of the type of mortgage.

Table 4 reports the results of the estimation of the selection equation, where the dependent variable is a dummy that takes on value 1 if the household has purchased its home and financed the purchase with a mortgage in the two years before the interview. We include year dummies because households from different surveys are pooled together and dummies for the province of residence to control for heterogeneity. Interpreting the regressor coefficients is not straightforward, as most variables affect both the demand and the supply of credit and the signs of the two effects might be different, possibly cancelling each other out.

The variables that we use for identification are all strongly significant. The coefficient on the share of households renting their home is negative, which is consistent with the hypotheses that the fraction of renters proxies for the efficiency of the rental market and that the more efficient the rental market the lower the likelihood to buy and borrow. Furthermore, the probability that a household has purchased its home and obtained a mortgage is concave in the rental prices and peaks past the median: the higher the rents, the more attractive the home purchase; however, if rental prices are very high, it becomes difficult for households to accumulate enough savings to afford the down-payment required for a home purchase. Finally, the coefficient on the number of banks where household members have accounts is positive, which is consistent with the hypothesis that this variable captures financial “education” and the overall familiarity with the financial instruments that are available to households.

Loan price considerations do seem to matter, as the probability of buying and financing the purchase with a mortgage is significantly decreasing in interest rates. Also the term spread of 10-year government bonds over 1-year bills as a ratio of income is significant, which captures household's ability to endure future rate changes: the higher the term spread relative to income the lower the likelihood of borrowing. Furthermore, the higher the per-square meter price, the more likely that the buyer will need some finance.

The evidence regarding the other variables included in the regression is consistent with theoretical predictions and with the results of other studies on credit market participation (see, among others, Magri 2002 and Fabbri and Padula 2004). In equilibrium, mortgage market participation turns out to be decreasing in the household head's age, which is consistent with the presumption that the young make up for a large share of home buyers and with the life-cycle hypothesis that the demand for credit is relatively higher for young consumers, whose earnings profiles are upward sloping. This effect seems to prevail over the supply side adverse selection considerations suggesting that debts ceilings may be lower for young consumers than for the rest of the population. The probability of home purchasing with a mortgage is higher for married couples, to whom banks are relatively more inclined to lend, especially when first-time buyers. It is lower among those living in small municipalities, possibly as a result of wider intra-household informal credit in small towns. The joint significance of the provincial dummies cannot be rejected. Furthermore, the coefficients of these dummies (not shown) reveal a pattern: those households living in the central and southern provinces are less likely to finance the home purchase with a mortgage, even allowing for the positive coefficients on the area dummies (Living in the Center and Living in the South). This is indeed consistent with both lower supply, due for example to

greater aggregate risk or contract enforcement problems, but also with lower demand, due for example to wider intra-household informal credit.

The probability of having purchased a home and taken out a mortgage is concave in income. It is convex in (beginning of period) net wealth, although the minimum is achieved at the 99th percentile of the distribution. All this is consistent with the view that, given the collateral, banks' willingness to lend depends on income, which proxies for the ability to pay regularly the installments on the mortgage: the lower the income, the lower the likelihood of being granted large amounts of credit, no matter how large one's wealth is (an income-wealth interaction term would not affect the result). On the other hand, the higher one's wealth and income, the greater the ability of paying off the house at the time of purchase, and therefore the lower the demand for credit. *Ceteris paribus*, the probability of having purchased a home and taken a mortgage is increasing in the cost of housing relative to that of non-durable consumption (measured by the ratio of rent – actual or imputed – to expenditure on non-durable goods).

Finally, the probability of asking and obtaining a mortgage is not significantly affected by the number of bank branches in the local credit market, nor by the efficiency of the legal enforcement as captured by the length of civil trials in the judicial district where the household lives.

5.2. Choosing between FRMs and ARMs: a risk-management problem

Next, we estimate a binary choice model for the probability of choosing a specific mortgage type. This choice amounts essentially to one between different types of risk. A nominal FRM is a risky contract because its capital value is highly sensitive to inflation. On the other hand, the risk of an ARM comes from the short-term variability in the real payments that are required in each period. This variability matters especially if the borrower faces binding

liquidity constraints. In fact, constraints bind in states of the world with low income and low house prices; in these instances, buffer-stock savings are low and home-equity falls below the minimum required to obtain a second loan. The risk of an ARM is that it will require higher interest payments in this situation causing a cut in consumption. As Campbell and Cocco (2003) point out, homeowners with expensive houses relative to their income, volatile labor income or high risk aversion are particularly adversely affected by this type of risk.

Table 5 reports the results of the estimation of the probit for the probability that borrowers choose an ARM. As mentioned earlier, the model is estimated on the sample of households who have purchased their home in the two years prior the interview and have asked and obtained a loan to finance their purchase. As a measure of the goodness of fit, we consider the model's ability to classify borrowers. Using a 50 percent cutoff point to optimally classify borrowers with a high propensity to take out an ARM, the model is able to predict correctly the behaviour of around 80 percent of them.^{xi}

In the regression we control for the rate on ARMs and for the spread between fixed and adjustable rates. Since we do not observe the rates that mortgage holders would have been charged if they had chosen the alternative type of mortgage, we have predicted them by regressing the relevant mortgage rate on household and market specific characteristics, such as age, education, occupation, short-term and long-term (province-level) interest rates on bank loans.^{xii} FRMs are less likely when the variable interest rates are lower and when the fixed-adjustable interest rate spread is higher. The coefficient on the interest rate on ARMs is positive and significantly different from zero at the 10 percent level, suggesting that, for a given spread, an increase in short-term rates reduces the likelihood of taking on a fixed rate mortgage. This is consistent with the hypothesis that borrowers expect some mean reversions in market interest rates. Instead, a one percentage point increase in the imputed spread

between fixed and adjustable rates raises the probability of taking out an ARM by 10 percentage points.

Average house prices have a positive statistically significant coefficient. This is consistent with the view that households choose the lowest interest rate, which is typically that on ARMs, if they are facing a relatively large expense and are therefore more likely to be closer to being liquidity constrained (this variable could however capture some time-varying province specific factor, correlated with house prices, which we do not control for). Relative to household income, house prices have a negative effect on the probability of choosing an ARM. This suggests that households are aware that when prices are high relative to income the variability of ARM payments may pose greater risks.

Overall, individual borrower characteristics have little influence on the mortgage choice decision, which is in line with the evidence of Dhillon et al. (1987) for the United States. Notable exceptions are the household head's age and the dummy for having children, whose signs are negative. The fact that older borrowers are less likely to demand ARMs could be rationalized on the ground of lesser liquidity constraints. Households with children could be less likely to demand ARMs, because people with children tend to behave in a more risk averse way.

Quite surprisingly, compared with the stark theoretical predictions of Campbell and Cocco (2003), the choice is also unrelated to the type of employment and to income and wealth. Holding everything else constant, the results indicate a positive relationship between the probability of taking out an ARM and the ratio of non-durable consumption-to-income, but only among those for whom such ratio is very high and for whom the benefits of low initial payments can be particularly large.

Stronger competition in the credit market, measured by the number of bank branches per thousand of inhabitants, is associated with a higher propensity to take on ARMs. Finally, the coefficients on unreported time dummies become significantly different from zero and positive starting from the year 2000, after Italy joined the European Monetary Union, consistent with the hypothesis that, expecting a more stable monetary environment, borrowers have moved further towards ARMs.

The third column of the table reports the result of a probit estimate where we control for sample selection, in order to verify whether the sub-sample of “recent” borrowers, that we use for the estimation, is “selected”. Our analysis of the mortgage type decision appears to be robust to the inclusion of a Heckman correction term based on the probit of Table 4. In fact, the additional regressor is not significant, nor it affects the coefficients of the other variables in any noteworthy way. A likelihood ratio test of independent equations does not reject the null at the 59 percent level. Hence, we can safely consider the mortgage type choice independent from that of having purchased a home with a mortgage.

Finally, the last column presents the result of a specification where a dummy for the “main bank” of the household is introduced. This should permit a better control for supply conditions, if there is a common component for all clients of the same bank. Indeed, the coefficients of the dummy variables for the major eighteen banks considered are jointly significantly different from zero, although very few of them are so when considered individually. Most interesting, the coefficients of the other variables included in the regression are virtually unchanged, confirming the overall robustness of the original specification.

5.3. Characteristics of ARMs and FRMs

As a final exercise, we have checked whether ARMs and FRMs show significant differences with respect to their most important characteristics: size, interest rate, value of the house that is bought, loan-to-house value ratio, average value of the installments, maturity and the premium charged by banks over their cost of funds. This has been done using the propensity score matching technique described in section 3, which amounts to comparing the average value of the feature under scrutiny across mortgages with the most similar characteristics, except for having an adjustable or a fixed interest rate.

Quite surprisingly, the results reported in table Table 6 show that, after controlling for borrowers' individual characteristics, the only significant difference between ARM and FRM contracts is the premium that banks charge over their cost of funds. In fact, although adjustable rate mortgages are slightly larger, have slightly higher interest rates, are used to finance the purchase of more expensive houses, have a slightly longer maturity, and have the same loan-to-value ratio, none of these differences is statistically different from zero. The only significant difference is in the interest rate premium, that is much higher for ARMs than for FRMs. Such premium reflects borrower's riskiness and any markup that a lender enjoying some form of market power can charge. Taken together, this evidence suggests that lenders are pricing quite expensively the higher interest rate risk that ARMs pose on borrowers and borrowers are paying a high price for the benefit of low initial payments.

6. Concluding remarks and policy implications

The stock of mortgages for home purchases in Italy and in most developed countries has risen substantially over the past decade. Understanding the functioning of this market is of increasing importance, because of the potential effects that changes in house prices, inflation

and interest rates – in particular interest rate rises from the actual historically low levels – can have on the investment and consumption choices of the growing number of indebted households. The evidence presented in this paper, although preliminary, has provided a basis to answer some questions that are still open.

A first issue is that of the determinants of the rapid surge in house related lending in the past decade. Based on the results of the empirical analysis, in Italy, both demand and supply factors seem to have mattered. Among the demand factors, the reduction in the interest rates seems indeed to have favoured an increase of the number of households holding a mortgage – although the size of this effect is not as significant as one might have been expected. Among the supply factors, the positive correlation between the number of bank branches in a province and the probability that its inhabitants hold a mortgage points to the increase in bank diffusion and competition as one of the possible explanations for the increase in house financing.

A second important question that the results of the empirical analysis help answering is what are the characteristics of households holding ARMs – facing a higher risk of suffering a cut in consumption in case of an increase in interest rates –, and of those taking on FRMs – facing a higher capital value risk. Contrary to the indications of the theoretical literature, household characteristics proxying for risk aversion and exposure to other non-mortgage-related risks seem to have very low explanatory power on the choice between ARMs and FRMs. Indeed, the only significant characteristics in the equation explaining households' mortgage choices are the age of the head and whether there are children in the house: both reduce the probability of taking on an ARM. Moreover, borrowers with very high expenditures on non-durable goods, that are more likely to be currently liquidity constrained, are also more likely to choose an ARM.

What seems to matter the most in the choice are the price variables. FRMs are less likely when the fixed-adjustable rate spread is high and when, for a given spread, the adjustable rate is high, consistent with the hypothesis that borrowers expect interest rates to be partly mean-reverting. Households buying houses in expensive areas are more attracted by ARMs, possibly because they are cheaper in the short-run. However, the higher the per-square meter price relative to their income, the less likely borrowers are to take on an ARM, possibly because they fear to be unable to repay the loan if interest rates rise. On the supply side, stronger bank competition seems to favour ARMs, as shown by the positive coefficient of the number of branches per inhabitants.

Overall, these results provide some evidence consistent with the hypothesis that ARMs are a significantly more attractive form of mortgage for those households that currently face some type of liquidity constraint. These households attribute a particularly high value to the level of the initial payment, which is generally lower than that on FRMs, tend to overlook the overall cost of the mortgage, and do not fully take into account the risk of a rise of the reference interest rates. On the other hand, lenders price quite expensively this risk and borrowers end up paying a high price for the benefit of low initial payments. In fact, after controlling for borrowers characteristics, the only significant difference between ARMs and FRMs is in the premium that lenders charge over their cost of funds. Hence, overall, some attention should be paid to the negative effects that an increase in interest rates might have on ARM holders. On the contrary, on the side of banks, there seems to be no evidence of excessive risk taking.

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Data appendix

Definition and source of the variables used in the estimation.

Table 4:

Age, *education*, *marital status*, *occupation (public employee, self-employed, unemployed)* refer to the head of the household. *High education* is a dummy that takes on value 1 if the household head has a high school diploma or a university degree. Source: Bank of Italy Survey of Household Income and Wealth (SHIW).

Household size refers to the number of individuals in the household. Source: SHIW.

Household income is the sum of all incomes of all household members. Source: SHIW.

Lagged household net wealth has been computed by subtracting household savings from end-of-period household net wealth. Source: SHIW.

Small town is a dummy that takes on value 1 if the household lives in a town with less than 40,000 inhabitants. Source: SHIW.

Moved from province of birth is a dummy that takes on value 1 if the household head lives in province which is different from that where she was born. Source: SHIW.

Cost of housing/non-durable expenditure is the ratio of rent for renters or imputed rent for owners to non-durable expenditure. Source: SHIW.

Share of renters is the ratio of the number of households living in a province that report to rent their home in the year of interview to the number of households living in that province in that year. Source: SHIW.

Rent $\times m^2$ is the average of per- m^2 actual rent for renters and per- m^2 imputed rent for owners living in the same province for each year of interview. Per- m^2 actual rent and per- m^2

imputed rent have been computed by dividing actual rent and imputed rent by the size of the house, which is reported in m^2 . Source: SHIW.

House prices $\times m^2$ is the average per- m^2 price of residential dwellings located in the province where the household lives, in the survey year. Source: Il Consulente Immobiliare (Il Sole24Ore).

Lagged mortgage rate refers to the rate that banks charge household on long-term loans. It is computed as average over the loans granted to households living in the same province. To those who borrow in the two years before that of interview we attach the average rate charged the year before that of borrowing. To those who do not borrow we attach the average rate charged the year before that of the survey. Source: Central Credit Registry.

Term spread to income is the ratio of the difference between the returns of ten and one year government bonds to nominal household income. Source: Ministry of Economy and Finance and SHIW.

Branches per 1,000 inhabitants refers to the number of bank branches in the province where the household lives, in the survey year. Source: Bank Supervisory Reports.

Number of banks is the number of different banks where any household member has a checking or saving account. Source: SHIW.

Per capita GDP refers to the value added of the province where the household lives in the year of interview, with the exception of 2004. For 2004 the data are not yet available and we use GDP for 2003. Source: Conti Economici Territoriali, National Institute of Statistics (ISTAT).

Length of civil trials is the average number of days for a civil trial (first and second degree of judgement). The average is computed by judicial district and per year. Source: Annuario delle Statistiche Giudiziarie Civili, National Institute of Statistics (ISTAT).

Provincial dummies and *dummies for Center* and *South* refer to the location where the household lives in the year of interview. Source: SHIW.

Table 5 (variables non included in table 4, only):

Interest rate on ARMs is the rate on ARMs estimated in a first stage regression of interest rates on borrowers' and credit market characteristics. Source: estimate based on SHIW data.

FRM – ARM spread is the difference between the rate on ARMs and that on FRMs estimated in a first stage regression of interest rates on borrowers' and credit market characteristics. Source: estimate based on SHIW data.

Children is a dummy that takes on value 1 if any member of the household is less than 18 years old. Source: SHIW.

No. of income recipients refers to the number of individuals who receive an income. Source: SHIW.

Non-durable expenditure/income is the ratio of household non-durable expenditure to household income. Source: SHIW.

Probability of moving is the probability that a household moves from its province of birth estimated with a probit regression on borrowers and geographical characteristics. Source: SHIW.

(Non-durable expenditure/income)>0.9 is a dummy that takes on value 1 if the ratio of household non-durable expenditure to household income is greater than 0.9. Source: SHIW.

Maturity ratio is computed as ratio of the average maturity on ARMs over the average maturity of FRMs. Average maturity is by area (North, Center, South) and year. Source: SHIW.

Table 6 (variables non included in table 4 and 5, only):

Mortgage size is the value of the loan. Source: SHIW.

Interest rate is the actual value of the interest rate on the mortgage. Source: SHIW.

Average value of instalment is the average mortgage repayment over the year. Source: SHIW.

Maturity is the maturity of the mortgage loan, in years. Source: SHIW.

Loan-to-value ratio is the ratio of *mortgage size* and the value of the house. Source: SHIW.

Risk premium is the difference between the mortgage rate paid by the household in the year of interview and the interest rate of one-year government bonds – if it is an ARM – or the interest rate of government bonds with a maturity as close as possible as that of the mortgage – if it is a FRM. Source: Ministry of Economy and Finance and SHIW.

ⁱ We thank for their comments and suggestions participants at the XIV International “Tor Vergata” Conference on Banking and Finance (Rome, December 2005), at the Finance and Consumption Workshop on Consumption and Credit in Countries with Developing Credit Markets (Fiesole, June 2006), at the 62nd Congress of the International Institute of Public Finance (Paphos, August 2006) and at the XLVI Annual Conference of the Società Italiana degli Economisti (Verona, October 2006). The views expressed are those of the authors and do not necessarily reflect those of the Bank of Italy. Address for correspondence: Monica Paiella, Bank of Italy, Research Department, Via Nazionale 91, Roma 00184, Italy, tel. +39.06.4792.2595, fax. +39.06.4792.3723. E-mail addresses: monica.paiella@bancaditalia.it; pozzolo@unimol.it.

ⁱⁱ The unusual features of housing wealth and its importance to households have raised a host of questions including the effects of illiquid risky housing on savings and portfolio choice (see, for example, Flavin and Yamashita 2002; Cocco 2001; and Paiella 2001), the effects of housing wealth on consumption (see, for example, Guiso et al. 2006; Pellizzon and Weber 2003, Skinner 1996; and Engelhardt 1996), the effects of taxation and mortgage laws on tenure and housing financing choices (see, for example, Jappelli and Pistaferri 2004; Poterba 2001; and Maki 2001).

ⁱⁱⁱ The pledged saving account mortgage is a type of mortgage in which the borrower’s payments are supplemented by payments from a saving account pledged as additional collateral for the loan. The saving account is established with the downpayment. An interest-only mortgage can be paid back through many various forms of savings or investment plans that build independently over the term to equal the amount of the original mortgage debt. In the graduated and flexible payment mortgages, the payment starts low and rises over time. A reverse annuity mortgage works much like traditional mortgages, only in reverse: a homeowner borrows against the equity in her home and receives regular payments from the lender. Renegotiable rate mortgages consist of automatically renewable mortgages of three to five years which are secured by a long-term mortgage for up to 30 years. At the end of each short-term period, interest rates are adjusted based on a national average mortgage rate index.

^{iv} In the last decade the ratio of Italy residential debt to GDP rose from slightly more than 6 percent to almost 15 percent of GDP. In 2004 it was about a third of the EU15 average and less than a fifth of the ratio for the US. From a supply side perspective, loans to households accounted for over 15 percent of bank total loans versus an EU average of about 30 percent.

^v In practice, they estimate a mortgage supply equation and use it to calculate the interest rate on an FRM that would have been charged to an ARM holder had he made the alternative choice, and vice-versa.

^{vi} The Survey is biannual with the exception of the 1998 wave, which was run three years after the previous one. For a description and assessment of the survey, see Brandolini and Cannari (1994). The overall quality of the data has also been analyzed more recently by Battistin et al. (2003).

^{vii} The SHIW has been widely used in studies of saving behavior by Italian households. See, for example, the essays in the volume edited by Ando et al. (1994). The Survey's wealth and income data have also been used by Guiso et al. (1996) and its consumption information by Miniaci and Weber (1999) and by Jappelli and Pistaferri (2000), among others.

^{viii} From the original sample, we exclude those households whose head is less than 20 or more than 70 years old (19 percent of the sample), those who do not own, nor pay cash rent for their home (7 percent of the sample) and those with non-positive income (0.4 percent of the sample). Furthermore, we exclude about 7 percent of mortgage holders whose mortgage information are completely inconsistent. For another 4 percent of mortgage holders with incomplete information we are able to recover payments or loan data using other information, such as those coming from other interviews (for the households in the panel). After dropping all those mortgage holders with incomplete or inconsistent mortgage information, we are left with a sample where the share of mortgage holders and homeowners is somewhat lower than in the population.

^{ix} The interviews are run in the spring of the year following that covered by the survey.

^x See Rubin (1979). For a recent survey, see Blundell and Costa Dias (2002).

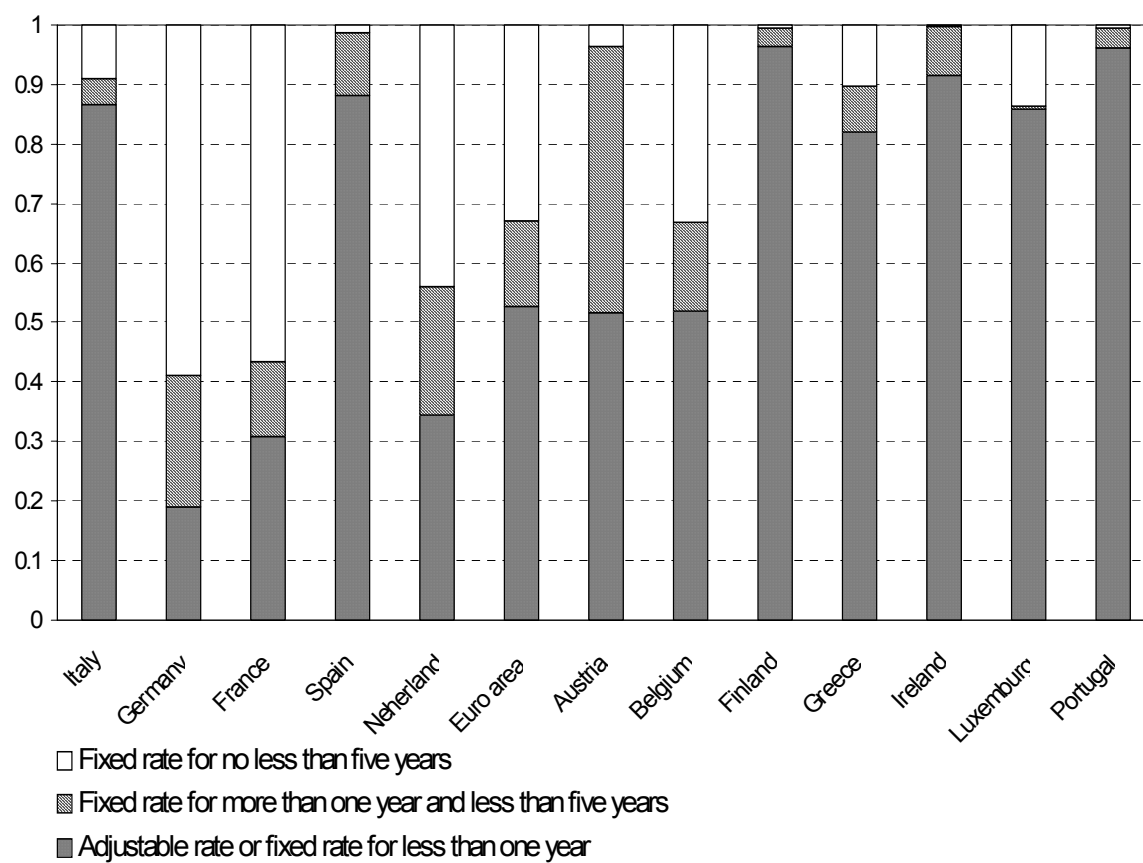
^{xi} The pseudo R^2 reported in the table is quite low. However, its appraisal is somewhat problematic since for the case of a dichotomous dependent variable the upper limit for R^2 is likely to be substantially less than 1 (see Morrison 1972).

^{xii} The results are available from the authors upon request.

Figure 1

New residential mortgages in the Euro area by type of interest rate

(percentage values)



Source: Banca d'Italia and ECB. Data refer to new residential mortgages granted between January 1 and October 31, 2004.

Table 1

Sample Composition

Share of:	1995	1998	2000	2002	2004
Homeowners	0.718	0.751	0.762	0.767	0.753
Homeowners with home-mortgage	0.173	0.120	0.118	0.117	0.143
Mortgage holders with ARM	0.462	0.547	0.533	0.512	0.538
Mortgage holders who have purchased their home in the 2 years before that of interview	0.114	0.189	0.175	0.119	0.153
<i>of which: with ARM</i>	<i>0.593</i>	<i>0.505</i>	<i>0.532</i>	<i>0.533</i>	<i>0.641</i>
Number of observations	6,078	5,346	5,844	5,606	5,579

Table 2

Summary statistics: Household characteristics

All refers to the entire sample. The other columns refer to homeowners, homeowners with a mortgage, households who have purchased their home and obtained a mortgage in the two years previous that of interview (“recent” borrowers), “recent” borrowers with a fixed rate mortgage (FRM) and “recent” borrowers with an adjustable rate mortgage (ARM) holders, respectively. * denotes a share of households. ^(a) indicates that the mean is based on positive observations only. Mean values, unless specified otherwise. All monetary variables are evaluated at euros of year 2000.

	All	Home-owners	With mortgage	“Recent” borrowers		
				All	FRM	ARM
Home owners*	0.750	1	1		1	1
Mortgage holders*	-	0.134	1		1	1
ARM holders*	-	-	0.515	0.459	0	1
Age	51	52	45	41	41	40
Male head*	0.722	0.737	0.770	0.760	0.750	0.768
Married*	0.751	0.781	0.864	0.850	0.880	0.827
Household size	3.026	3.065	3.295	3.116	3.223	3.034
Less than high school*	0.592	0.565	0.404	0.394	0.462	0.342
High school diploma*	0.314	0.331	0.459	0.456	0.429	0.477
University degree*	0.094	0.104	0.137	0.150	0.109	0.181
Movers from province of birth*	0.264	0.234	0.345	0.335	0.310	0.354
Living in the North*	0.455	0.448	0.570	0.618	0.495	0.713
Living in the Center*	0.205	0.217	0.207	0.169	0.201	0.143
Living in the South and Islands*	0.341	0.335	0.223	0.214	0.304	0.143
Self-employed*	0.152	0.163	0.179	0.183	0.179	0.186
Unemployed*	0.034	0.029	0.016	0.014	0.033	0.000
Total net income	32,100	35,700	38,600	33,600	30,900	35,800
Net wealth	213,000	272,000	230,900	179,000	163,000	191,000
Home value	-	167,000	178,000	172,000	160,000	182,000
Real assets other than home	67,100	81,500	64,600	48,100	38,200	55,900
Deposits and gov. bonds	17,200	19,500	13,600	10,800	11,200	10,500
Other financial assets*	0.206	0.240	0.262	0.228	0.179	0.266
Other financial assets	9,200	11,100	9,100	9,400	11,900	7,400

Continues Table 2

Home-related debt*	0.142	0.180	1	1	1	1
Home-related debt	4,600	5,900	34,000	60,500	56,600	63,500
Other debt*	0.133	0.120	0.193	0.190	0.174	0.203
Other debt	832	796	1,295	1,200	1,200	1,200
No. of observations	28,449	21,333	2,866	421	184	237

Table 3

Summary statistics: Mortgage loan characteristics

Mean values with standard errors in parentheses.

	All	FRM	ARM
Initial loan	64,800 (38,500)	59,700 (37,500)	68,800 (38,900)
Loan to value	0.441 (0.238)	0.438 (0.247)	0.443 (0.231)
Mortgage duration	14.0 (4.9)	13.2 (5.1)	14.6 (4.7)
Interest rate	6.6% (3.3%)	6.6% (3.1%)	6.5% (3.4%)
Real interest rate	3.6% (2.8%)	3.6% (2.7%)	3.5% (2.8%)
Annual mortgage payments	5,900 (3,300)	5,600 (3,500)	6,400 (4,900)
Mortgage payments to earnings	0.180 (0.121)	0.188 (0.133)	0.175 (0.112)
Default risk premium		0.196 (2.840)	1.250 (2.699)
Share of subsidized loans	57.9%	62.3%	54.4%
No. of observations	421	184	237

Table 4

Probability of holding a mortgage

The dependent variable takes on the value of one if the household has purchased its home and has been granted a mortgage in the two years prior that of interview, zero otherwise. Standard errors in parentheses. The estimates have been corrected for cluster for provincial effects. * significant at 10 per cent level; ** significant at 5 per cent level; *** significant at 1 per cent level.

	Coefficient (standard error)	Marginal effect (standard error)
Share of renters (per province)	-1.41*** (0.47)	-0.01*** (0.00)
Rent x m ² (per province)	0.04*** (0.02)	2.0e-04*** (1.0e-04)
(Rent x m ²) ²	0.00*** (0.00)	-1.9e-06*** (5.4e-07)
Number of banks	0.15*** (0.04)	8.0e-04*** (2.0e-04)
Lagged mortgage rate (per province)	-0.38*** (0.02)	-2e-03*** (2e-04)
Term spread to income	-0.01*** (0.00)	-7.5e-05*** (1.9e-05)
House price x m ² (per province)	0.20* (0.12)	1.0e-03* (6.0e-04)
Age/100	-1.86 (1.98)	0.01 (0.01)
(Age/100) ²	-1.36 (2.11)	-0.01 (0.01)
High education	0.12 (0.11)	6.0e-04 (6.0e-04)
High ed. X household income/100,000	-0.41 (0.27)	-2.0e-03 (1.3e-03)
Married	0.30*** (0.09)	1.2e-03*** (3.0e-04)
Household size/10	-0.40 (0.27)	-2.0e-03 (1.4e-03)

Continues Table 4

Small town (<40,000 inhabitants)	-0.14*	-7.0e-04*
	(0.08)	(4.0e-04)
Moved from province of birth	0.10	5.0e-04
	(0.07)	(4.0e-04)
Public employee	0.10*	6.0e-04*
	(0.06)	(4.0e-04)
Self-employed	0.02	1.0e-04
	(0.07)	(4.0e-04)
Unemployed	-0.03	-1.0e-04
	(0.20)	(9.0e-04)
Household income/100,000	1.15**	0.01**
	(0.46)	(2.0e-03)
Households income/100,000) ²	-0.30	-1.5e-03
	(0.21)	(1.0e-03)
Lagged household net wealth/100,000	-0.06**	-3.0e-04**
	(0.02)	(1.0e-04)
Lagged household net wealth/100,000) ²	3.0e-04***	1.5e-06***
	(1.0e-04)	(4.9e-07)
Cost of housing/non-durable expenditure	1.18***	0.01***
	(0.24)	(1.1e-03)
Bank branches per 1,000 inhab (per province)	0.55	2.8e-03
	(0.72)	(3.6e-03)
Per-capita GDP/1,000 (per province)	0.02	1.0e-04
	(0.01)	(1.0e-04)
Length of civil trials days/100)	-0.03	-2.0e-04
	(0.03)	(1.0e-04)
Living in the Center	4.83***	0.81***
	(0.62)	(0.13)
Living in the South	2.27***	0.07
	(0.67)	(0.06)
Constant	-0.73	
	(1.20)	
No of observations	28,462	28,462
Pseudo R2	0.53	
P-value test for dummies for province = 0	0.00	
P-value test for dummies for year = 0	0.00	

Table 5

Probability of choosing an ARM

The dependent variable takes on the value of one (zero) if the household, which has purchased its home and has been granted a mortgage in the two years prior that of interview, has chosen an ARM (FRM). The second column reports the marginal effects of the probit in the first column. The probit in the last column allows for sample self-selection. The estimates have been corrected for cluster for provincial effects. * significant at 10 per cent level; ** significant at 5 per cent level; *** significant at 1 per cent level.

	Basic specification		Heckman correction	Bank controls
	Coefficient (stand. error)	Marginal effect (st. err.)	Marginal effect (st. err.)	Marginal effect (st. err.)
Interest rate on ARMs	0.16** (0.07)	0.07*** (0.03)	0.08*** (0.03)	0.08*** (0.03)
FRM-ARM spread	0.24*** (0.07)	0.08*** (0.03)	0.09*** (0.03)	0.08*** (0.03)
Long term yield	0.12 (0.08)	0.04 (0.03)	0.03 (0.03)	0.03 (0.03)
House price x m2/(Income/100,000)	-0.10*** (0.03)	-0.04*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)
House price x m2 (per province)	0.40*** (0.12)	0.16*** (0.05)	0.15*** (0.05)	0.15*** (0.05)
Age	-1.67** (0.76)	-0.63** (0.3)	-0.72** (0.31)	-0.54* (0.31)
Gender	0.14 (0.16)	0.06 (0.06)	0.06 (0.06)	0.02 (0.06)
High education	0.08 (0.15)	0.04 (0.06)	0.04 (0.06)	0.03 (0.06)
Married	-0.24 (0.20)	-0.09 (0.08)	-0.08 (0.08)	-0.09 (0.08)
Children (dummy)	-0.15** (0.07)	-0.06** (0.03)	-0.06** (0.03)	-0.05* (0.03)
No. of income recipients	-0.08 (0.11)	-0.04 (0.04)	-0.03 (0.04)	-0.02 (0.04)

Continues Table 5

Probability of moving	1.66 (1.72)	0.68 (0.68)	0.74 (0.67)	0.90 (0.75)
Moved from province of birth	0.06 (0.13)	0.02 (0.05)	0.02 (0.05)	0.02 (0.05)
Public employee	0.05 (0.14)	0.02 (0.06)	0.02 (0.06)	0.02 (0.06)
Self-employed	0.11 (0.21)	0.04 (0.08)	0.04 (0.08)	0.06 (0.07)
Non-durable expenditure/Income	0.47 (0.48)	0.18 (0.19)	0.20 (0.19)	0.13 (0.20)
High non-durable expenditure	0.62** (0.27)	0.23*** (0.09)	0.22*** (0.09)	0.25*** (0.09)
Household income/100,000	0.43 (0.67)	0.17 (0.26)	0.18 (0.27)	0.28 (0.28)
Lagged household wealth/100,000	-0.01 (0.04)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Bank branches per 1,000 inhabitants	1.10** (0.54)	0.42** (0.21)	0.45** (0.22)	0.47* (0.25)
Mills ratio			0.02 (0.02)	
Constant	-3.62*** (1.4)			
No. of observations	420	420	420	420
Pseudo R ²	0.13	0.13	0.13	0.16
P-value test year dummies = 0	0.00	0.00	0.00	0.00
P-value test main bank dummies = 0				0.02

Table 6

Characteristics of ARMs and FRMs – Matching Model

The table presents the results of a matching logit regressions of the characteristics of ARMs and FRMs. The mean of each variable is calculated for samples of comparable adjustable and fixed rate mortgages, where the matching is done using a propensity score function with the kernel option, controlling for characteristics of the household (age, gender, education and occupation of the head, marital status and number of income recipients) and of the credit market (number of bank branches and household main bank dummies), and including geographical and time dummies. P-values for the test of significance of differences of means are reported in parenthesis (significance is computed by using the bias-corrected confidence interval).

Variables	ARMs	FRMs	Difference (<i>p-value</i>)
Mortgage size	67,634	66,368	4,056 (0.91)
Interest rate	6.73	6.58	0.15 (0.57)
House value	181,513	169,601	11,912 (0.89)
Average value of installment	6,063	5,639	424 (0.48)
Maturity	14.34	13.82	0.52 (0.89)
Loan to value ratio	0.44	0.44	0.00 (1.00)
Risk premium	1.25	-0.11	1.37 (0.00)
No. of observations (common support)	222	181	
No. of observations	237	184	