

The supply side of housing finance*

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Abstract

We propose a new, data-based test for the presence of biased financial advice when households choose between Fixed Rate Mortgages (FRM) and Adjustable Rate Mortgages (ARM). If households are wary, the relative cost of FRM and ARM should be a sufficient statistics for a household contract choice: the identity of the bank originating the loan should play no role. If households rely on banks advice to guide their choice, banks may be tempted to bias advice in a direction that is most convenient to them, so that bank-specific characteristics play a role. We test this implication on the sample of 1.6 million mortgages originated in Italy between 2004 and 2010. We find that the choice between ARM and FRM is significantly affected by banks' characteristics, especially over intervals of time during which banks do not adjust the relative price of the two mortgage types. This supports the view that banks are able to affect household mortgage choices not only through a price but also through an advice channel.

JEL Classification: D14, E43, G11, G12, G21

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1 Introduction

The past decade has seen a formidable increased interest in how good are households at making financial decisions, in particular at picking up financial products that best fit their type. When households have limited knowledge of how well a financial product can serve their needs, they have a strong motive to ask for expert's advice, often relying on the supplier of the financial product itself to obtain council.¹ The problem is that advisors may have incentives to distort their recommendations towards products that best serve their needs rather than those of their customers when the latter have a limited ability to detect this conflict of interest. Several papers (see among others, Inderst, 2010; Inderst and Ottaviani, 2010, 2011a, 2011b; Carlin and Manso, 2011; Ottaviani and Squintieri (2006); Kartik, Ottaviani and Squintieri (2007) provide the theoretical underpinnings of how advice affects unsophisticated households financial choices when brokers and/or intermediaries are in conflict of interest and enjoy some informational advantage.

Several attempts have been made to provide evidence of the existence and extent of distorted advice. One approach contrasts the investment performance of individuals who rely on advice with that of those who do not (e.g. Hackethal, Haliassos and Jappelli, 2011). These papers find that advised accounts underperform, in terms of overall return and in terms of Sharpe ratios, non-advised accounts, once advising costs are accounted for – a feature consistent with biased advice. But, because advice is a chosen decision, the result is also consistent with less capable investors choosing to be advised and in spite of this not being able to overcome the deficit in ability or to make a proper use of the advice received. Indeed, some evidence suggests that investors may not follow advice even when it is offered for free and even if it is by construction unbiased (Battacharya et al., 2011). In addition, even though advised investors do worse than non-advised ones, they may still do better than what they would have done choosing on their own. In fact, advice still may help unsophisticated investors avoid common investment mistakes or mitigate behavioral biases (Shapira and Venezia, 2001; Gennaioli, Shleifer and Vishny, 2014). But this benefit is not revealed by comparing investors

¹Hung et al. (2008) report that 73% of US investors rely on professional advice to conduct stock market or mutual fund transactions. About 60% of the investors in the 2007 Unicredit Clients Survey – a Survey on a sample of Italian investors - rely on the help of an advisor or intermediary when making financial decisions and only 12% decide without council.

who rely and not on advice.

A second approach, which in principle deals with this issue, uses randomized field experiments by tracking the recommendations that trained auditors, acting as customers, receive from financial advisors with contrasting or aligned incentives. Mullainathan, Nijöeth, and Schoar (2009) find that existing biases are, if anything, augmented by professional advices, pointing in the direction of potential supplier distortions in households financial decisions. As usual with field experiments, the issue remains of their external validity. Most importantly in this context, the doubt arises of whether in long-term client relationships like those observed in reality, the audited advisors would offer the same (biased) suggestions. Finally, common to both types of studies is the fact that they look at cases where advice is sought by the investors. In practice, advice, especially distorted one, may be offered even when not explicitly solicited by the household: the intermediary or broker may emphasize a particular financial product, or highlight some features while hiding others trying to steer the household choice in a direction favorable to the intermediary. If so, comparing customers who solicit advice and non-advised customers may hide the presence of supply-side distortions or lead to too conservative estimates of their importance.

In this paper we propose a data-based methodology to assess the presence of supplier-induced distortions in household financial choices on mortgages. This market seems particularly interesting because mortgage loans are leading example of transactions where experts on one side of the market may take advantage of consumers' lack of knowledge and experience. For example, Woodward and Hall (2012) study the compensation that borrowers pay to mortgage brokers for assistance from application to closing and find that confused borrowers overpay for brokers' services.

Our approach does not require explicit information on whether a household has asked for or even been given advice unilaterally and can thus detect its effects even when advice is not explicitly observed. We look at the choice between Fixed Rate Mortgages (FRM) and Adjustable Rate Mortgages (ARM) using data on a sample of 1.6 million mortgages originated in Italy from 175 banks over the 7 years- period from 2004 to 2010. Besides information on the terms of the loans and characteristics of the households, the data provides the identity of the bank that has originated the mortgage as well as a rich set of its characteristics.

The idea of the test is simple. Under the assumption that banks have heterogeneous relative advantages in offering the two types of mortgages –

e.g. one bank may have cheaper access to long-term financing than another and thus have a relative advantage offering FRM than ARM – they may have incentives to push household mortgage choice in the direction that is most beneficial to them. If a household is wary, the only thing that should affect its choice is the relative cost of FRMs and ARMs. That is, the relative price of fixed and variable rate mortgages should be a sufficient statistics for mortgage choice. Hence, the identity of the bank or its cost characteristics should play no role once the relative price of the two type of mortgages is controlled for. Differences in banks’ efficiency in supplying FRMs and ARMs, should reveal in the relative price of the two types of mortgages and affect household’s choice only through this channel; otherwise these differences should play no role².

On the other hand, if as in Inderst and Ottaviani (2010, 2011a, 2011b) and Ottaviani and Squintieri (2006) some households are naïve (and, as we will show, banks face some frictions in changing prices), the relative price of the two types of mortgages is no longer a sufficient statistic for mortgage contract choice. If banks exploit the conflict of interest by offering biased advice, the identity of the bank and its characteristics should affect households choice beyond and above any effect bank differences may exert on households decisions via the relative price of ARMs and FRMs. Our strategy is to test the null that household mortgage choice is unaffected by price-relevant bank characteristics once we control for households characteristics and for the relative price of the two type of mortgages faced by the household at time of origination.

We find that the choice between ARM and FRM is strongly affected by the relative price of FRM and ARM as in Kojen, Van Hemert and Van Nieuwerburgh (2009). But we also find that bank characteristics do predict mortgage type choice even when the relative price of FRMs and ARMs faced by the consumer is controlled for. Furthermore, not only time invariant bank characteristics captured by bank fixed effects, but also time varying characteristics that measure changes over time in bank incentives to recommend one type of mortgage versus another, predict households mortgage choice. For example, time variation in the the bank bond spread (the extra cost of issuing fixed rate bonds instead of variable rate bonds), which measures

²The importance of bank-specific fixed effects in a mortgage choice equation may reflect market power or sorting. For this reason our test focuses on time-varying bank characteristics. These should not add information to prices even in cases where fixed effects matter. We discuss this point in detail in later sections.

changes in the bank relative costs of offering the fixed rate mortgages, has a direct effect on household mortgage choice in addition to the effect it has through the relative price of FRM and ARM. This is consistent with the idea that banks with a relative disadvantage at offering FRMs try to twist households decisions towards ARM not only by offering ARMs at a cheaper rate compared to FRMs, but by distorting advice towards ARMs. Economically, the effect of these distortions is relevant. For example, a 1 percentage point increase in the bank bond spread lowers the probability of choosing a fixed rate mortgage by 2.8 percentage points; while sizeable, this effect is one tenth of that of 1 percentage point increase in the relative price of FRMs.

We can rule out that our results reflect uncontrolled households characteristics through sorting of certain type of households into certain type of banks. In fact time-varying bank characteristics have explanatory power when time invariant bank effects which capture sorting are included as controls.

To validate the strength of this interpretation we also exploit two implications of the biased advice models. First, the effects of distorted advice on consumer choice should be stronger among unsophisticated consumers; second, as we show formally, the supplier characteristics should distort choice more if there are frictions in adjusting prices. Consistent with these implications we find that time-varying banks incentives to offer distorted advice have larger effects on the mortgage choice of unsophisticated consumers; additionally, these effects are stronger, particularly among unsophisticated consumers, during intervals of time in which relative prices are not adjusted.

The rest of the paper proceeds as follows. In Section 2 we set up a model in which advice is a (partial) substitute for price setting and show that banks find it optimal to rely also on advice to distort household choice. The model shows that, provided there are at least two supply-side factors that can affect banks mortgage prices, observation of one or more on these factors can be used to detect the presence of unobserved distorted advice. In Section 3 we discuss our empirical strategy and specify the main equation of mortgage choice we will estimate. Section 4 presents the data and Section 5 the estimation results. Section 6 concludes.

2 The Model

In a standard demand framework, prices are a sufficient statistic for the effect of supply factors on consumer choices. Households do not care directly

about the costs or the technology of a firm: they care only to the extent that costs and technology affect prices. Therefore supply variables should not have predictive power on household choices once prices have been controlled for. We use a simple model to show that this property does not hold if the supplier can give biased advice and apply it to the choice between fixed rate and adjustable rate mortgage. If a consumer is unsure about which of several products sold by a firm best fits her needs, the firm can opportunistically bias her choice by giving an advice. If the advice is followed, variables that are correlated with the incentives of the firm predict consumer choices even controlling for prices: two households with similar characteristics facing the same prices may make different choices if they receive different advices. Since *biased* advice is uniquely determined by supplier profitability, supply factors matter for consumer choices over and above prices. We show that this intuitive implication holds in a simple model of a mortgage market where a share of borrowers is unaware of what is the type of mortgage that fits her needs. Our main result is that prices are a sufficient statistic for choices if there is no biased advice; the presence of the latter implies that observable supply factors have an independent role and can thus be used to detect the presence of biased advice. Our model illustrates under which conditions the independent role of supply factors can be interpreted as a test for the presence of (unobserved) biased advice.

2.1 Households

A continuum of households live two periods and needs to finance a house purchase. Households have CARA utility and differ by risk aversion γ . G denotes the distribution of risk aversion across households. Income is constant over time, nominal interest rates follow a random walk and inflation is unpredictable. Under these assumptions (as shown by Kojien et al.), household γ chooses an adjustable rate mortgage (ARM) over a fixed rate mortgage (FRM) if and only if

$$\phi > \frac{\gamma H}{2}(\sigma_\varepsilon^2 - \sigma_\pi^2)$$

where ϕ is the FRM premium, H is the value of the house, σ_ε^2 is the variance of interest rates and σ_π^2 is the variance of inflation. In Annex A we illustrate the full derivation of the decision rule. We normalize $H = 2$ and $\sigma_\varepsilon^2 - \sigma_\pi^2 = 1$ so that the decision rule is

$$\phi > \gamma$$

The normalization does not affect results qualitatively. Under these assumptions, $G(\phi)$ households choose ARMs and $1 - G(\phi)$ choose FRMs.

2.2 Banks

There is a continuum of regions in the economy. In each region, there is one bank. Customers cannot borrow from other regions and the distribution of risk aversion is G in every region. Under these assumptions each bank is a local monopolist³. Banks are characterized by a fixed balance sheet size and fixed liabilities. They can only choose the composition of their assets between long term FRM and ARM. Every bank i is characterized by exposure to N supply factors $(\theta_1, \dots, \theta_N)$. Banks are heterogeneous in their exposure to such factors. Examples of supply factors are the cost of long term finance, the deposit base, access to securitization markets, and everything that affects the relative cost, and incentive, of the bank to sell one of the two mortgage types rather than the other. Typically such factors affect the cost of issuing one type of mortgage over the other because they affect maturity mismatch and interest rate risk. For example, banks with higher access to securitization markets can tolerate more risk, so that they have a comparative advantage in issuing FRMs. A similar reasoning holds for each of our supply factors. The bank has a payoff function⁴ $U(x, \phi, \theta)$ that depends on the share x of short term assets (i.e. adjustable rate mortgages), the FRM premium and supply factors. The bank takes θ as given and chooses x and ϕ .

2.3 No advice

Under the above assumptions and in absence of advice the problem of a bank choosing the fraction x of short term assets and the relative price ϕ can be written as

$$\max_{x, \phi} U(x, \phi, \theta)$$

s.t.

$$x = G(\phi)$$

³Our results hold under more general market structure, as long as banks have some market power. This is because what really matters for us is the ability of the bank to choose both prices and advice, so that the absence of perfect competition is a sufficient condition for our result to hold.

⁴We call it payoff rather than profits because banks choices typically include adjustment for risk.

Since the bank has market power, the objective function can be re-written as

$$v(\phi, \theta) \equiv U(G(\phi), \phi, \theta)$$

so that the optimal FRM premium $\phi(\theta)$ is determined by the FOC:

$$v_\phi(\phi(\theta), \theta) = 0$$

This simply leads us to our first result:

Proposition 1 : In absence of advice, household mortgage choice is independent of bank supply factors conditional on the relative prices of ARM and FRM. In particular, $E(m|\phi) = E(m|\phi, \theta)$ where m denotes mortgage choice.

Prices depend on supply factors, but they do not enter household choice otherwise. Since supply factors are orthogonal to risk aversion, they do not add any further information to household choices compared to the relative price of different mortgages. In a model with no advice, prices summarize all the supply characteristics that matter for mortgage choice. Proofs of this and the following characteristics are in Annex B.

2.4 Advice

We now show the solution when banks can affect consumers choices also through advice. To model advice we assume that a fraction μ of banks' customers are naive. They do not fully understand what their decision rule should be; in our context this can be interpreted as uncertainty on unknown parameters, such as interest rate and inflation volatility. Thus, there is scope for well informed banks to provide counseling.⁵ The rest of the population is sophisticated: they perfectly understand their decision rule. The naive status is independent of risk aversion and is private information, so that the bank cannot distinguish between a naive and a sophisticated borrower. The bank

⁵If households are unaware of what is better for them, advice is valuable. We do not model "good advice". This is not a limit of this model nor of our econometric test because, by definition, good advices should reflect household-specific factors (e.g. their level of financial knowledge or - as in Gennaioli et al , 2014 - on their "anxiety") and as such should not depend on banks characteristics. The advice in our model should be interpreted as that in excess (or in defect) of what would be needed to best fulfill the consumer ignorance. Put this way, all advice in our model is biased advice.

can choose an optimal distortion α in the decision rule. This means that, after biased advice has been given, the household decision rule becomes:

$$\phi - \alpha > \gamma$$

so that a bank distorting toward ARMs will choose $\alpha < 0$, and one distorting toward FRMs will choose $\alpha > 0$. Since sophistication is unobservable, the bank gives the same advice to all the customers. Naive customers just follow the advice. Sophisticated customers ignore the it (they already know what is better for them). Moreover they realize that the bank has tried to deceive them, which costs the bank a reputation loss when advising a wary customer. We call this cost $c(\alpha, \mu, \theta)$. Under these assumptions, the share of customers effectively choosing ARMs is:

$$g(\phi, \mu, \alpha) = \mu G(\phi - \alpha) + (1 - \mu)G(\phi)$$

so that the objective function of the bank becomes:

$$v(\phi, \alpha, \theta, \mu) \equiv U(g(\phi, \mu, \alpha), \phi, \theta) - c(\alpha, \mu, \theta)$$

Under this formulation, banks choices $\alpha(\theta)$ and $\phi(\theta)$ solve the pair of FOCs:

$$v_\alpha(\phi(\theta), \alpha(\theta), \theta, \mu) = 0$$

$$v_\phi(\phi(\theta), \alpha(\theta), \theta, \mu) = 0$$

Here, the N bank specific factors θ affect both the optimal distortion and the mortgage price. Looking at the equations, we can see that in this case θ may have an independent role on mortgage choice even after the price ϕ have been controlled for. This is because choices are affected by an observed variable (prices) and a latent one (advice). Adding θ to a regression of mortgage choice on prices may add information on the unobserved value of α . This result does not always hold: if prices are a sufficient statistic for the effect of θ on α , they would capture everything that the econometrician needs to know about α to predict mortgage choice, so that θ would play no independent role and the existent of distorted but unobserved advice would not be inferred. In particular we can give the following definition:

Definition: The above model satisfies the sufficient statistic property (SSP) if there exists a unidimensional sufficient statistic of the supply factors that fully determines α and ϕ . That is, if there exists a real-valued function $y = f(\theta)$ such that $\phi = h_1(y)$ and $\alpha = h_2(y)$.

If the model satisfies the SSP, knowing prices *and* advice gives the same information as knowing only prices or advice. Therefore θ has no additional predictive power on mortgage choice. The following proposition clarifies conditions under which we can identify the presence of advice.

Proposition 2 : If the model does not satisfy the SSP, household choices depend on the factors θ even after prices are controlled for. In other words, $E(m|\phi, \theta) \neq E(m|\phi)$.

Under SSP, $E(m|\phi) = E(m|y) = E(m|\phi, \theta)$ so that the result in Proposition 2 fails. Notice that if $N = 1$ the SSP is mechanically satisfied with $f(\theta) = \theta$: with only one supply factor, the factor itself is the sufficient statistic. To conclude, advice is a latent choice variable for the bank. For this reason, whenever distortionary advice is unobserved, supply factors generally matter for consumer mortgage type choice even conditioning on prices. If, however, there is a sufficient statistic of supply factors that determines banks price and advice choices, the test fails, as observing prices and advice gives exactly the same information. We presented conditions under which the presence of supply factors is a test for the presence of advice in the context of the mortgage market. Our test is more general than that. In every situation where the bank has some control over prices and can give unobserved biased advice, our test establish the presence of advice, so that the same logic can be applied to any conflict of interest between the bank and the customer, such as portfolio choice, portfolio delegation and other financial choices. Annex C provides an example that illustrates the importance of the SSP for the validity of our test.

2.5 Price rigidity

In the previous section we have shown under which conditions we can infer the existence of biased advice from the relation between lenders supply factors and consumer mortgage type choices, once frictionless mortgage prices are controlled for. We now study the role of price rigidity. The reason to study this twist to the model is that advice is just a soft communication, and thus it is extremely flexible. On the other side, prices are not. This is particularly true in large banks, where changes in pricing policy may entail significant costs of coordination among branches and other sources of menu costs. Hence prices and advice may differ in responsiveness to supply factors. We show that if prices are less flexible than advice, it is possible to infer the

existence of biased advice from the correlation of consumer mortgage choice with banks supply factors even when the sufficient statistics property holds. To see why suppose there is a small menu cost of changing prices. If supply conditions change by little, banks find it optimal not to change prices, so that all movements in θ are reflected in movements in α and supply effects in consumer mortgage reveal biased advice. Moreover, the magnitude of the effect of θ on α may increase: if a bank cannot adjust prices, it is giving up the natural channel to twist demand toward its favorite product. The alternative to twist demand is to propose advice, so that advice is a substitute for pricing activity under price rigidity. To see this, consider the model above and consider the case in which a bank, after a realization of supply factors θ , chooses to leave prices unchanged at ϕ_0 because of a menu cost⁶. The distortion chosen by the bank now satisfies:

$$v_\alpha(\phi_0, \alpha(\theta), \theta, \mu) = 0$$

So that θ has an effect on choices even if the model satisfies the SSP when prices are adjusted: since prices are not moving, all the effect of θ on choices goes through advice. This can be summarized in the following proposition:

Proposition 3 Under price rigidity, $E(m|\phi, \theta) \neq E(m|\phi)$.

Moreover price rigidities may amplify effects of supply factors on mortgage choice, since advice substitutes for pricing in twisting demand. Still, we are not able to establish the result formally. The reason is that the presence of rigidities change the optimal choice of the bank, moving the position of the marginal borrower (the one that is indifferent between ARMs and FRMs) over the support of the distribution of risk aversion. This implies that the marginal effect of supply factors on advice depends on the distribution of risk aversion. To see this, note that the ARM share, in case of rigidities, is:

$$x = G(\phi_0 - \alpha(\theta))$$

so that

$$\frac{\partial x}{\partial \theta_i} = -g(\phi_0 - \alpha(\theta)) \frac{\partial \alpha}{\partial \theta_i}$$

⁶Here rigidity is implicitly modeled as a fixed cost $F > 0$ of changing the relative price. Then inaction is optimal for small movements in θ . Note that the problem of choosing advice remains static conditional on prices.

and the marginal effect depends on the shape of the distribution and the payoff function of the bank. If there is some complementarity between prices and advice for the bank and the distribution of risk aversion does not increase too rapidly in $\alpha - \phi$ the marginal effect is stronger under price rigidity. For example, $v_{\alpha\phi} > 0$ and g uniform are sufficient conditions for this result to be true. Generally, under $v_{\alpha\phi} > 0$, we need fixed costs that are high enough in order to argue that the marginal effect is not stronger under price rigidity: if the effect is not stronger, it means that the distortion under price rigidity is much different from the one under price flexibility. When this is true, the marginal profitability of a change in prices must be higher so that high fixed costs are required for this to happen⁷.

3 Empirical strategy

In the model, we clarify the conditions under which it is possible to test for the presence of biased advice. In particular, we establish that if supply factors affect prices and advice in a sufficiently different way, a regression of household choice on supply factors controlling for prices should find an important role not only for the latter but for the former as well. In this section, we illustrate our empirical strategy to test for the presence of biased advice and discuss assumptions that lead to identification of the effect of advice. Our strategy relies on running the following regression:

$$x_{ibt} = \beta_1\phi_{ibt} + \beta_2z_{ibt} + \beta_3B_{bt} + f_b + f_t + u_{ibt} \quad (1)$$

where x_{ibt} represents the mortgage choice of customer i from bank b at time t and ϕ_{ibt} is the relative price that she faces. z_{ibt} is a set of customer-specific covariates and B_{bt} a set of bank-specific supply factors; f_b, f_t are bank and time fixed effects, and u_{ibt} is an error term. We denote the choice of FRM by $x_{ibt} = 1$ and the choice of ARM by $x_{ibt} = 0$. We include ϕ and z because they are natural determinants of choices, and B to test for advice. The presence

⁷To see this, suppose there is only one supply factor and the optimal solution to the bank problem is linear: $\alpha(\theta) = A_1\theta + A_2\phi$ and $\phi(\theta) = B_1\theta$. Under price flexibility, θ is insignificant and has zero coefficient for mortgage choice once ϕ has been controlled for. Under rigidity, ϕ does not react to θ so that all the variation takes place through α and θ matters for choice. Therefore both the significance and the coefficient of θ onto mortgage choice increase.

of f_b and f_t helps us to identify the importance of advice, as explained below. Our test of advice relies on the economic and statistical importance of coefficients in β_3 : biased advice makes these coefficients significant and their sign consistent with bank's incentives. Specification 1 makes clear that the effect of advice on choices is identified only if household-specific unobserved heterogeneity is uncorrelated with supply factors. First, time-varying factors other than prices affect mortgage choices even in absence of advice. For example, changes in interest rate volatility affect choices and banks balance sheet at the same time. These time-varying factors tend to be aggregate in nature, not bank-specific, so that adding a time effect takes care of them. Another potential problem is sorting: one might argue that more risk averse consumers sort into more solid banks, creating a correlation between choices and supply factors irrespectively of advice if individual risk aversion or the bank solidity are not observed. To control for this, we include bank-specific fixed effects. The idea is that if there is any sorting, this takes place through characteristics of the bank that are stable over time: while it is possible to argue that, for example, larger banks attract more risk averse agents, it is less likely that changes in securitization activity or the share of deposits in total funding from quarter to quarter in a specific bank change the composition of the pool of borrowers over quarters. Therefore the fact that bank characteristics are associated with different pools of borrower is consistent with identification in our model, as long as time-varying bank-specific supply factors do not affect the composition of such pools. The model above has two further implications on the observables. First, the relation between supply factors and choices controlling for prices, should be stronger if there is some price rigidity. Our data exhibit evidence of price adjustment inaction so that we can test for this model implication by estimating

$$x_{ibt} = \beta_1\phi_{ibt} + \beta_2z_{ibt} + \beta_3B_{bt} + \beta_4D_{bt}B_{bt} + f_b + f_t + u_{ibt} \quad (2)$$

obtained adding the term $\beta_4D_{bt}B_{bt}$ to the baseline model, where D_{bt} is a dummy for price inaction in bank b at time t . Based on the model, we expect the effect to be stronger in times of inaction, so that β_4 should be significant and of the same sign as β_3 , therefore reinforcing the effect of bank-specific supply shocks. Finally, the effect should be stronger for less sophisticated customers, as they rely more on advice and should be more so at time of price inaction. To test for this we estimate model (2) separately for the group of sophisticated and unsophisticated borrowers identified using a proxy S_{ibt} for

the financial sophistication of customer i choosing his mortgage from bank b at time t . If the model is correct, we should find β_3 and β_4 to be larger (in absolute value) among unsophisticated borrowers.

4 The data

Our data come from two main administrative sources: the Italian Credit Register (CR) and the Survey on Loan Interest Rates (SLIR). Both datasets are administered by the Bank of Italy. The first collects information on the loan exposures above a certain threshold (75,000 euros) originated by all Italian banks; a subset of 175 banks participate in the SLIR and report also data on the interest rates charged on the loans originated. We have obtained quarterly data on all the mortgages originated between 2004 and 2010 for the 175 banks. The dataset has complete records on around 2 million mortgages recorded in the Credit Register. After excluding mortgages to sole proprietorships, mortgages with a partially adjustable interest rates and mortgages granted on special terms or conditions we remained with 1,662,429 observations on plain vanilla FRMs or ARMs originated by 132 banks that are active in the households mortgage market (see Annex E for more details). The dataset contains detailed information on the type of the loan (*FRM* and *ARM*), the contractual rate and the loan size at origination, as well as a number of characteristics of the borrower. In addition, we have the identifier of each of the banks originating these mortgages and, most importantly, we can merge the mortgage dataset with detailed supervisory data containing information on banks characteristics and their balance sheets. Finally, we complement the mortgage-originator data with information on the structure of the local market where the mortgage originates, the local market power of the bank and the distance between the location of bank headquarters and that of the borrower. In the end, our dataset includes features of the borrower, the lender, the specific terms of the mortgage, as well as information on the local market where the exchange takes place.

4.1 Computing the relative price of FRM

There are two views on what is the appropriate measure of the long term finance premium (LTFP), the relative price of *FRMs* and *ARMs* in household mortgage choice decision. Campbell and Cocco (2003) posit that con-

tract choice of liquidity constrained households is driven by the current difference in funding costs, defined as the spread between *FRM* and *ARM* rates ($r^{FRM} - r^{ARM}$). Using panel data for nine countries, Badarinza et al (2013) support this view and find that the spread between *FRM* and *ARM* rates has a stronger explanatory power for the "ARM share" (*ARMs* issued relative total mortgage issuance) than other measures based on forecasts of *ARM* rates over a longer horizon. They therefore conclude that current cost minimization, rather than longer-term forecasts of *ARM* rates appear to be the primary driver in households' mortgage choice.

Koijen et al (2009) propose an alternative measure of the LTFP. The mortgage's choice is driven by the time-varying *FRM* risk premium, defined as the difference between the fixed term rate and future expected average values of the *ARM* rate ($r^{FRM} - E(r^{ARM})$). Typically, this interest rate differential is positive as borrowers pay an interest premium in order to be shielded from interest rate increases. Because they only have aggregate data, they approximate the *FRM* risk premium with the long term bond risk premium computed by taking the difference between the 10-year bond yield and the one-year expected bond yield, proxying expectations about the latter with a moving average of past yields.

In our analysis we compute both measures at the borrower-bank level. In particular, we calculate: i) $Spread = r_{ibt}^{FRM} - r_{ibt}^{ARM}$; ii) *FRM* risk premium = $r_{ibt}^{FRM} - E(r_{ibt}^{ARM})$ for household i borrowing from bank b at time t .

Since we observe the interest rate on the chosen mortgage at time of origination, we can rely on both time series and individual specific variation in the relative cost of the two types of loans.⁸ Obviously, while we observe the rate on the mortgage actually chosen by individual i and originated by bank b – say a *FRM* (*ARM*), we do not observe the rate that i faced on the alternative type of mortgage at the bank. We overcome this problem by imputing the rate that they would have been charged had they chosen an *ARM* (*FMR*). For this we group customers that chose *FRM* and *ARM* respectively, and then run a sequence of regressions, one for *each* bank, of the rate charged on each type of loan on loan characteristics, borrower characteristics

⁸For instance, the adjustable rate mortgage is given by an individual specific credit spread plus the one-month interbank rate. The first, reflects individual-specific credit-worthiness and differs in the cross section of borrowers that obtain an *ARM* in the same quarter; the second reflects time-varying market conditions and is common to the set of borrowers choosing *ARM* in a given quarter from a certain bank, but potentially can vary across banks.

and a full set of time dummies. We then use the estimated parameters to impute the interest rate to the specific household. We describe the details of this imputations in Annex D. There are three points to notice. First, because we run bank specific regressions any systematic difference across banks in the interest rates charged is reflected in the imputed interest rate. Second, because in each regression we include a full set of time dummies, any effect on interest rates of any time varying bank-specific variable is also reflected in the imputed rate, in particular any variation is its supply factors. Thus, the residual difference between the true rate that the consumer would have faced on the alternative mortgage and the imputed rate reflects only unobserved borrower specific characteristics. This measurement error may create attenuation bias in the estimated effect of the relative price of *FRM* on mortgage choice but is orthogonal to the time varying bank variables that we will use as proxies for incentives to distort advice.

Finally, to compute the *FRM* risk premium ($r^{FRM} - E(r^{ARM})$) we follow Kojien et al (2009) and measure $E(r^{ARM})$ using different lags and leads of the short terms *ARM*. Clearly, the lag zero coincides with the current spread. Figure 1 shows that, as in Kojiean et al (2009), the one year lag measure of the *FRM* risk premium has the highest predictive power on the ARMs share using either aggregate data (the light color bars) or individual data (the darker bars). Hence, we will use this as our reference measure. But notice that the crude correlation of the *ARM* share with the current spread is very close. Figure 2 plots the aggregate *ARM* share (the share of newly originated adjustable rate mortgages over total newly originated mortgages) together with the *FRM* spread and the *FRM* risk premium using one year lag to measure the latter; both correlate positively with the *ARM* share but the *FRM* spread has a somewhat better fit.

Table 1, Panel A reports summary statistics for the actual and imputed rates together with other information on the mortgage contract. The rest of the table reports summary statistics on the borrower (Panel B), the balance sheets of the lenders (Panel C) and on the bank-borrower relationship (Panel D). More information on the data is provided in Annex E.

4.2 Banks supply factors

We use three measures of banks supply factors that should affect the relative cost of supplying *FRM* and *ARM*. The first is the bank bond spread - the premium the bank pays for raising funds issuing fixed-rate bonds vis-à-vis

variable rate bonds. Banks that pay a higher premium face a higher cost of supplying *FRMs* and should therefore distort advice towards *ARMs*. For most banks that originate mortgages in our sample we observe both rates; some small banks are not always active in both markets for fixed and variable rate bonds. For those quarters in which banks were inactive in a specific bond segment (variable or fixed) we have imputed the rate on bonds by using the bank-specific spread (with respect to the market rate) the last time they were active in that segment. As we will see results do not depend on the imputation.

The second measure is a proxy for banks access to securitization. Fuster and Vickery (2012) show that the share of fixed-rate mortgages is positively related to the access to the securitization market. Indeed, by allowing banks to sell some of their assets, securitization increase the bank asset allocation flexibility making long-term investments more palatable. This banks should have a relative advantage in originating *FRM* vs *ARM* and should accordingly, bias advice towards *FRMs* and away from *ARMs*. We proxy access to securitization with a dummy variable equal to 1 if in a given quarter the bank is active in the securitization market.

The third measure is the share of deposits in banks total funding. Because individual depositors face higher switching costs than institutional investors, banks that can count on deposits for their funding, can adjust deposit rates to changing market conditions by less (and more slowly) than banks whose liabilities are mainly composed of variable rate bonds that respond fast and fully to market movements (Berlin and Mester, 1999). Hence, the former are less exposed to market risk and thus better able to stand greater maturity mis-match than the later. Being less subject to interest rate risk, banks with a large deposit share should have a relative advantage in issuing *FRM* vs *ARM* compared to banks with a low deposit share, and thus should bias advice towards *FRMs* and away from *ARMs*.

In sum, when estimating equations 1 and 2 we expect β_3 and β_4 to be both negative if the bank supply factor is the bank fixed bond spread and both positive if it is the securitization activity indicator or the bank deposit ratio.

Table 1, Panel C, shows summary statistics of our supply factors.

4.3 Identifying price inaction

To identify periods of inaction in setting the relative price of *FRMs* and *ARMs* we look at the changes over time of the spread between the two type of mortgages, $r_{bt}^{FRM} - r_{bt}^{ARM}$. This is the price banks control. For each bank, we compute it by taking averages across borrowers of the rates charged on the two types of mortgages originated from the bank in each quarter covered by the sample. The first column of Figure 3 shows the cross-sectional distribution of $\Delta Spread = \Delta(r_{bt}^{FRM} - r_{bt}^{ARM})$ over the whole sample (2004-2010), for the pre-financial crisis quarters (2004-2007) and during the crisis (2008-2010). In all periods the distribution has a spike around zero, consistent with infrequent adjustments of the relative mortgage price.⁹ The distribution tends to be symmetric except during the financial crisis when it shows a fat tail to the right. This is consistent with the fact that after Lehman's default Italian banks faced difficulties in issuing fixed rate bonds causing a higher costs of *FRM* (Levy and Zaghini, 2010). Therefore, part of the adjustment of the spread reflects changes in the slope of the yield curve that modify the relative cost of *FRM*. The second column of Figure 3 shows the distribution of changes in the spread net of the adjustment in the slope of the yield curve ($\Delta(r_{bt}^{FRM} - r_{bt}^{ARM}) - \Delta Slope_t$).¹⁰ Once changes in the slope of the yield curve are filtered out the distribution of the changes in the relative price of *FRM* and *ARM* becomes symmetric around zero. This rules out that most of the changes during the crisis reflect an increase in the cost of fixed-term borrowing common to all banks.

Our main indicator of price inaction for bank b in quarter t , is a dummy equal to 1 if $\Delta(r_{bt}^{FRM} - r_{bt}^{ARM})$ is comprised between $\pm \frac{sd}{3}$, where sd is the spread standard deviation of bank b . For robustness we also compute alternative measures. First, we define inaction using a tighter threshold, namely $\pm \frac{sd}{4}$. Secondly, we have defined inaction if the change of the spread of bank b in a given quarter falls within $\pm \frac{1}{3}$ of the standard deviation of the change in the spread in the pooled data.

⁹Because we are looking at the average spread and the spread has a borrower-specific component, its change may differ slightly from zero even when the bank does not adjust it if there are small changes in the pool of borrowers from one quarter to another. Accordingly, why define inaction as a change in the spread within a small interval around zero.

¹⁰The slope of the yield curve is obtained by taking the difference between the 15-year swap rate and the 1-month interbank rate. We use the 15-year swap rate because the average maturity for a mortgage contract in Italy is 15 years (Casolaro, Gambacorta and Guiso, 2005).

Using our main definition, banks leave the spread unchanged in 41% of the quarters, and inaction occurs more often before the crisis (46% of the cases) than during the crisis (34%, Table 2, Panel A). Figure 4 shows the cross sectional distribution of the number of quarters each bank has remained inactive. The median bank has remained inactive for around 11 quarters with significant heterogeneity across banks.

Substantial price inaction remains even if we use the tighter definition with 32% of quarters of inaction over the whole sample with less frequent adjustments before than during the crisis (Panel B).¹¹

Finally, if instead of the bank specific standard deviation we use the over-all sample standard deviation to define inaction, nothing relevant changes. Using this criteria, Figure 5 shows a scatter plot of the quarterly changes of the spread over the entire sample period and the interval that defines price inaction delimited by the two horizontal lines around zero. In every quarter there is wide heterogeneity in banks' behavior, with adjustments of the spread in both directions.

To illustrate, Figure 6 shows the time pattern of the price adjustment of the two largest and the two smallest banks. It makes clear that: a) price adjustments are generally infrequent and adjustments are more likely to take place the longer the time elapsed since the last adjustment; b) though in some quarters banks adjust simultaneously in response to common shocks, there is a lot of heterogeneity in the timing of adjustment across banks.

Finally, we validate our measure of price inaction with a nonparametric Kaplan and Meier's survival estimator of the probability of keeping the price invariant, shown in Figure 7. For the baseline measure (blue line) it shows that consistent with menu cost models of price adjustment, the probability of keeping the mortgage price unchanged falls as the time since the last adjustment in the spread increases. The probability of inaction after one quarter from the last adjustment is around 34%, drops to 18% after two consecutive quarters and virtually to zero after 5/6 quarters. Result are similar using the definition of inaction based on a tighter threshold (red line).

¹¹Nothing substantial changes if inaction is calculated using changes in the spread net of modifications in the slope of the yield curve (i.e. $\Delta(r_{bt}^{FRM} - r_{bt}^{ARM}) - \Delta Slope_t$). The fraction of inaction episodes is very similar to those in Panel B (35% vs 32%).

4.4 Other controls

In estimating (1) and (2) we control for features of the mortgage (its size and whether is a joint mortgage); individual specific variables (a dummy for Italian nationality of the borrower, its age and gender, and a dummy for cohabitation) which capture part of the heterogeneity in consumer preferences; some additional time-varying bank controls (the leverage ratio, bank size, a merger dummy, a group dummy); characteristics of the local market (lending concentration measured by the market share of the first lending institution in the province, GDP per capita in the province) and a measure of borrower-lender relation (the distance between the borrower and the lender). We also considered a dummy for the "Bersani Law" (n. 40/2007) that abolished early-prepayment fees and a dummy for those banks that joined the "Patti Chiari" (Clear deals) initiative, whose main objective is to simplify bank-borrower relationship. Summary statistics for these variables are reported in Table 1 panel B and D.

5 Results

Before estimating our baseline model (1), in Table 3 we report OLS estimates of various specifications of households mortgage contract choice. Given the importance of interaction effects in our identification strategy and the large number of bank fixed effects here and in the rest of the paper we estimate linear probability models. The left hand side is a dummy variable equal to 1 if the consumer has chosen a *FRM* and zero otherwise. The first column controls only for bank fixed effects. Systematic differences across banks can explain about 9.8% of the variance and jointly bank fixed effects are strongly significant. The second column adds the long-term financial premium measured using the *FRM* risk premium; the latter variable has as expected a negative effect on mortgage choice and is highly significant (p-value 0.000). Interestingly, while the bank fixed effects continue to be statistically significant, when the relative price is added the explanatory power increases considerably: the model can explain about 47.6% of the variance. This is consistent with role that theory assigns to relative prices. Economically, one percentage point increase in the cost of *FRMs*, lowers the probability of choosing this contract by as much as 31 percentage points. The correlation

in column 2 between mortgage choice and the relative price captures both variation over time in the relative cost of *FRMs* that is common to all banks as well as variation over time that is specific to the bank (systematic differences in relative prices across banks are picked up by the bank fixed effects). In column 3 we include a full set of time dummies so that the variation in the relative price of *FRMs* is now only the bank specific one. Notice that since the expectations about future short term rates used to compute the average expected *ARM* rate are common to all individuals, they are absorbed by the time fixed effects so that the variation in the *FRM* risk premium reflects that in the current spread. When we rely only on this source of variation the marginal effect on the relative price is negative and significant and its size somewhat larger (one percentage point increase in the spread lowers the probability of choosing a *FRM* by 35 percentage points). Adding time fixed effects improves also the fit of the model ($R^2=0.59$) suggesting that there are other relevant time varying common variables, besides the *FRM* risk premium that affect mortgage contract choice such as changes in the relative riskiness of the two contracts captured by the time effects. Adding borrower specific controls (Column 4) and then a set of province fixed effects and a measure of local market concentration (column 5) conveys little additional explanatory power and leaves the marginal effect of the relative price unchanged. Columns 6 replicates the estimates in column 2 using the current spread as a measure of the *LTFP*. Results are very similar to those using the *FRM* risk premium though using the latter provides a marginally better fit. Hence, in the rest of the paper we will rely on the *FRM* risk premium as a measure of the *LTFP*.

Overall, this evidence assigns a key role to the relative price as a driver of mortgage contract choice - a point made by Koijen et al (2009). But it shows also some systematic effects on this choice of mortgage originator fixed characteristics. This may be just sorting or reflect a systematic ability of originators to twist consumer choices in a direction favorable to them not via prices but through biased advice. To shed some light on the importance of sorting we retrieve the banks fixed effects from the estimates in Table 3, column 5, whose distribution is shown in Figure 8. The figure suggests some heterogeneity in the pattern of banks specialization with some banks originating mostly *FRMs* and others mostly *ARMs*, though the vast majority tend to originate both. We then compute the means of borrowers observable characteristics for banks that, based on these fixed effects, tend to originate mostly *FRMs*, mostly *ARMs* or those that tend to originate both. Means

are reported for three subperiods. As can be seen from Table 4 there is no difference in any observable neither across the three types of banks nor over time for a given type of banks. While sorting may well occur on unobservables, the fact that borrowers observable characteristics are so similar across banks and over time, makes this possibility somewhat unlikely. Even so, we will always include bank fixed effects and rely only on bank-specific time variation in banks supply factors in our subsequent tests of biased advice.

5.1 Baseline model estimates

Table 5 shows the estimates of our baseline model (1). The first column uses the complete specification of Table 3 (Column 5) but adds to it the fixed rate bank bond spread, the securitization activity dummy and the deposit ratio as measures of time-varying banks supply factors. These variables are not only statistically significant (the fixed rate bank bond spread at the 10% the others with p -values of 0.000 and 0.004, respectively) but their sign is consistent with the nature of the banks incentives that they are supposed to reflect, as discussed in Section 4.2. A high fixed rate bond spread of the bank that originates the loan lowers the chances that the borrower from that bank opts for a fixed rate mortgage while the bank's easiness to securitize loans and its possibility of counting on deposits as a source of funds, increases the borrower's chance of opting for a *FRM*. Because the estimates control for the relative price of *FRM* and *ARM* that the borrower faces at origination, these effects are in addition to any effect that lender supply factors have on the *FRM* spread. Indeed, a regression (unreported) of the *FRM* spread on bank fixed effects, time dummies and our three bank supply factors shows that these variables do affect the *FRM* spread: the fixed rate bank bond spread has a positive effect and the other two variables a negative effect. Taken together this evidence is consistent with the idea than banks respond to changes in their funding conditions by adjusting both prices and distorting advice. The fact that consumers choice is correlated with these bank variables is also consistent with models of naive consumers of the sort studied by Ottaviani and Squintani (2006) and Kartik et al (2007), while it speaks against models of uninformed but smart consumers which predict that on average advice does not distort choice (as in Crawford and Sobel, 1982) . The result of our test suggests that the mortgage market is more likely to be populated by genuinely naive consumers, rather than uninformed consumers that rationally anticipate to receive biased advice from financial intermedi-

aries. Indeed in the latter case, biased information would not be credibly transmitted and advice would not translate into distortions in behavior.

Compared to the response to changes in the relative mortgage price the effect of distorted advice is smaller, as one would expect, but far from being negligible. One hundred basis points increase in the fixed-rate bank bond spread lowers the probability that the borrower opts for a *FRM* through the (biased) advice channel by 2.8 percentage points which is 1/11 times the effect on the decision of an equal size increase in the *LTFP*. If the bank becomes active in the securitization market in a given quarter while it was not in the previous, the probability that the borrowers in that quarter choose a *FRM* increases by 15 percentage points; it increases by a similar amount (13.8 percentage points) if the deposit ratio of that bank increases by one sample standard deviation from one quarter to another.

In column 3 we run the estimates using only the banks for which we actually observe the fixed rate bank bond spread in all relevant quarters, thus avoiding imputations. Though we lose about 400,000 observations results are unchanged. One concern is that the banks supply factors capture non-linear effects of the relative price of *FRMs* versus *ARMs* in the households decision problem. To address it, in column 4 we add to the specification a quadratic and a cubic term in the *LTFP*. Results do not support the concern: though there is some evidence of non-linearity in the effect of *LTFP* on contract choice, the effect of the bank's supply factors is unchanged, statistically and economically. Finally, in the last column we drop the time fixed effects; the effect of the *LTFP* is somewhat smaller in absolute terms and that of the fixed rate banks bond spread somewhat larger in absolute terms because they now capture also unobserved time-varying aggregate components that affect mortgage choice; but the qualitative result is unchanged.

It is worth stressing what is the thought experiment behind our estimates. Take the effect of the fixed rate bank bond spread. Its estimate results from comparing the mortgage contract choice of customers from a given bank in a given quarter that face a given (customer specific) *FRM* spread with the choice made by the customers of the *same* bank in a different quarter that face a possibly different (customer specific) *FRM* spread and noticing that customers that choose the contract in a quarter in which the bank must pay a higher spread for attracting long-term funds tend (once the component of this higher spread that is common to all banks is filtered out) to opt for fixed rate mortgages. When making this comparison, we take into account that the pools of customers in different quarters may have different observable

characteristics and interpret the result of this comparison as evidence that banks distort through advice the mortgage contract choice of their customers in a direction that is favorable to the bank. Thus, when the cost of raising long term financing increases relative to short term financing, the bank tends to recommend *ARMs* so as to reduce exposure to interest rate risk. This interpretation relies on the identifying assumption that the variation in the unobservable characteristics of the pools of borrowers from one quarter to the other is uncorrelated with the quarterly change in the fixed rate bank bond spread. A similar argument applies for the deposit ratio and for the securitization activity. This is a reasonable assumption, if only because it is unlikely that customers observe the balance sheet of the bank originating their mortgage making it hard to believe that those with unobservable personal characteristics that induce a preference for *FRMs* versus *ARMs* sort into banks that in that quarter pay a lower fixed rate bond spread, become active in the securitization market and tend to experience an increase in deposits funding. While unlikely, a skeptical could require further direct evidence to be convinced that the estimates in Table 4 identify biased advice.

5.2 Results with price inaction

The model implications regarding the effects of banks supply factors on households contract choice in periods of price inaction and in period of price changes provide some of this additional evidence. Table 6 shows the estimates of model (2) which adds to the baseline model (1) interaction terms between the three bank supply factors and a dummy equal to 1 if in a given quarter the bank did not change the spread between the two type of mortgages using for this our reference measure. The model predicts a greater reliance on advice - and thus a greater bias on household contract choice in periods of price inaction. The table replicates the estimates of Table 5 but adding the interaction between the price inaction dummy and the fixed-rate bank bond spread and the interaction of the inaction dummy with the securitization dummy and the deposit ratio. In all specifications the interaction with the price inaction dummy has the same sign as the specific supply factor - thus reinforcing its effect - and is statistically significant. The effect is particularly strong for the fixed rate bank bond spread: in quarters in which the bank does not adjust the *FRM* spread, an increase in the cost of raising long-term funds by 100 basis points lowers the probability that a household chooses a *FRM* by about 8 percentage points - against an average effects

over all periods of 2.8 percentage points (using the estimates of column 3, Table 5 and 6). Differences in marginal effects at times of price inaction and on average over all quarter are more contained for the other two factors but: a) they are positive as implied by the biased advice model and b) statistically significant.

Results are confirmed if we use the more stringent definition of price inaction, as shown in panel B, Table 5.

Hence, on this ground too we conclude that the evidence consistently suggests the presence of biased advice when households choose between *FRMs* and *ARMs*.

5.3 Financial sophistication

The model in Section 2 predicts that banks supply factors bias mortgage choice of unsophisticated borrowers more than they bias those of sophisticated ones. To test this implication we run 2 separately in the sample of and unsophisticated consumers proxing sophistication by the size of the loan and distinguishing between clients that have already borrowed from some banks in the past and those ones who apply for a loan for the first time in their life. Wealthier households tend to be more financially sophisticated (Calvet, Campbell and Sodini, 2009) and in turn wealth is positively correlated with the size of the house purchased and thus with that of the loan. Relying on this argument, we look at the group of households that take up loans for the first time in their life and lower in value of 80,000 euros, close to the lower bound for reporting mortgages to the Credit Register. This includes about 2% of the observations in our sample. We then select 2% of the observation from the top tail of the distribution of mortgage size, those taking loans larger than 320,000 euros: this defines the group of sophisticated borrowers. Table 7a shows the estimates on the two samples using the benchmark measure of price inaction. There are two broad features. First, unsophisticated borrowers have stronger negative response to increases in the bank fixed-rate bond spread particularly at times of price inaction. A 100 basis point increase in this spread lowers the chance of choosing a *FRM* by 8.5 percentage points among unsophisticated households and by 3.6 points among the sophisticated ones at times of price inaction and the difference is statistically significant (the test for the difference is shown in the last column). Second, the overall response of mortgage choice to the securitization activity indicator and to the deposit ratio is positive for both groups but larger overall for the un-

sophisticated consumers particularly at times of inaction. For instance, a one standard deviation increase in the deposit ratio increases the chance of opting for a *FRM* rather than a *ARM* by 14.8 percentage points among the unsophisticated and by 10.8 points among the sophisticated in normal times and by 17.2 and 10.8 points during quarters of price inaction. Securitization activity has similar effects, and they too are stronger during price inaction.¹²

Table 7b replicates the estimates using the tighter definition of price inaction; results are very similar to those in panel A.

Overall, we take the results in Table 7 as additional evidence of distorted advice.

6 Conclusion

In this paper we use a novel methodology to detect the presence of (potentially biased) financial advice faced by households when choosing a mortgage.

¹²Though this evidence is consistent with the differential effects of biased advice on wary and naive borrowers predicted by the model, there is a problem with our proxy for sophistication: we may be confounding the effect of sophistication with the pure effect of the size of the loan. From Section 2.1, a larger loan leads to larger portfolio risk, shifting household choices toward *FRMs*. We solve this problem by noting that, in the case of pure size effects, the effect of the loan size on prices and advice should be proportional, while our estimates suggest that in the data it is not. From Section 2, the fraction of households choosing *ARMs* is

$$x = G\left(\frac{\phi + \alpha}{H\sigma^2}\right)$$

where G is the distribution of risk aversion (with density g), ϕ is the *FRM* premium, α is the advice bias, σ^2 is the variance of real interest rates and H is the size of the loan. ϕ and α are choices for the bank so that they depend on supply factors. The effect of a change in the supply factor θ_k is then:

$$\frac{\partial x}{\partial \theta_k} = g\left(\frac{\phi + \alpha}{H\sigma^2}\right) \frac{1}{H\sigma^2} \left[\frac{\partial \phi}{\partial \theta_k} + \frac{\partial \alpha}{\partial \theta_k} \right]$$

If changes in H are pure size effects, distortion and prices are affected proportionally by θ_k . Therefore the change in the regression coefficients of prices ϕ and supply factor θ should be proportional as well. Now suppose that H is related to the fraction of sophisticated borrowers μ . In this case a change in H leads to a change in μ , leading in turn to a change in $\partial\phi/\partial\theta_k$, $\partial\alpha/\partial\theta_k$. In this sense, the fact that size has an effect on choices which is non proportional between ϕ and α signals that the effect takes place through sophistication rather than pure size.

We show that in a simple model of mortgage choice where the mortgage originator can set the price and provide also advice, the relative price of *FRM* and *ARM* is a sufficient statistic for the choice of the mortgage if the originator can costlessly adjust the relative price of the two mortgages. However, if there is a cost of price resetting, the relative price is no longer sufficient to characterize how the supply side of housing finance affects households choice if banks rely also on advice. In this case, banks observable characteristics, correlated with the strength of their incentive to provide distorted advice, directly affect the mortgage type choice and reveal the presence of potentially biased financial advice. We find evidence that is indeed consistent with this prediction and thus with intermediaries distorting advice. Time varying measures of the incentive of the bank to push households to opt for adjustable rate mortgages - such as the its access to long term financing - affect household choice even when controlling for the relative cost of the two type of mortgages charged by the bank at time of origination. Interestingly, as predicted by the model the effect of this distortion is stronger during intervals where banks do not adjust the relative price of the mortgages. In addition, and again consistent with the model predictions, non-price induced supply side effects on borrowers choice are stronger for unsophisticated borrowers who are in principle more responsive to intermediaries advice. Further research is needed to assess the consequences of financial advice on the performance of mortgages and draw conclusions on whether bank advice is beneficial or not to consumers.

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Annex A. Mortgage decision rule

In section 2 we refer to the Kojien rule (Kojien et al., 2009) for mortgage choice. Here we show that such rule governs mortgage choice in our setting. Consider a household with CARA utility and absolute risk aversion γ . Income is y in every period and we abstract from savings behavior. The household needs to finance the purchase of a house worth H with a 100% mortgage. The house is purchased before the first period and sold after the second. Utility from housing is separable from utility from consumption. Under these assumptions, consumption in each period equals income minus interest payment. The household needs to choose between FRM and ARM. Under ARM, she needs to pay the nominal interest rate $r + \pi + \varepsilon$ where r is known, $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ is an unpredictable component, and $\pi \sim N(0, \sigma_\pi^2)$ is inflation. ε and π are uncorrelated. Under FRM, she needs to pay interest $r + \phi$ with $\phi > 0$ known. Under these assumptions, choosing an ARM is

optimal if and only if

$$-\frac{1}{\gamma}E\left(e^{-\gamma(y-(r+\varepsilon)H)}\right) \geq -\frac{1}{\gamma}\left(Ee^{-\gamma(y-(r+\phi-\pi)H)}\right)$$

Using the MGF of the normal distribution the above inequality reduces to

$$\phi > \frac{\gamma H}{2}(\sigma_\varepsilon^2 - \sigma_\pi^2)$$

so that the Kojien rule is optimal in our setting. In the data $\sigma_\varepsilon^2 > \sigma_\pi^2$ and $\phi > 0$, so that the rule correctly predicts a positive fraction of customers choosing both contracts.

Annex B. Proofs

In this section we proof the propositions characterizing the model solution. In what follows we adopt the convention $m = 1$ if the choice is ARM and $m = 0$ if the choice is FRM.

Proposition 1: In absence of advice, household mortgage choice is independent of bank supply factors conditional on the relative prices of ARM and FRM. In particular, $E(m|\phi) = E(m|\phi, \theta)$ where m denotes mortgage choice.

Proof If there is no advice the equilibrium household decision rule as a function of risk aversion and supply factors is:

$$m(\gamma) = \begin{cases} 1 & \text{if } \phi(\theta) > \gamma \\ 0 & \text{if } \phi(\theta) \leq \gamma \end{cases}$$

so that $E(m|\phi) = G(\phi)E(m|\gamma > \phi) + (1 - G(\phi))E(m|\gamma \leq \phi) = G(\phi) = E(m|\phi, \theta)$.

Proposition 2: If the model does not satisfy the SSP, household choices depend on the factors θ even after prices are controlled for. In other words, $E(m|\phi, \theta) \neq E(m|\phi)$.

Proof With advice, the household decision rule becomes:

$$m(\gamma) = \begin{cases} 1 & \text{if } \phi(\theta) - \alpha(\theta) > \gamma \\ 0 & \text{if } \phi(\theta) - \alpha(\theta) \leq \gamma \end{cases}$$

Now $E(m|\phi) = E_\theta \{G(\phi - \alpha(\theta))E(m|\gamma > \phi) + (1 - G(\phi - \alpha(\theta)))E(m|\gamma \leq \phi)\} = E_\theta \{G(\phi - \alpha(\theta))\}$. Using a similar calculation, $E(m|\phi, \theta) = G(\phi - \alpha(\theta))$. If the two coincide, it must be that $\alpha(\theta)$ is deterministic given ϕ , otherwise it is not possible for the expectation of $\alpha(\theta)$ to coincide with each of its realizations. Therefore there must be a deterministic function linking ϕ to α , so that the SSP must be satisfied.

Proposition 3 Under price rigidity, $E(m|\phi, \theta) \neq E(m|\phi)$.

Proof If the SSP does not hold, the result is proved by the last proposition which holds for general degrees of flexibility. Now suppose SSP holds. Under price rigidity, there exists a subset of the supply factor space Θ such that the bank does not adjust the price. Call this subset Θ^I . Now if a bank starts with price ϕ and gets two draws of supply factors $\theta_1, \theta_2 \in \Theta^I$ with $\theta_1 \neq \theta_2$, we must have that $E(m|\phi, \theta_1) = G(\phi - \alpha(\theta_1)) \neq G(\phi - \alpha(\theta_2)) = E(m|\phi, \theta_2)$. Since $E(m|\phi) = E_\theta (E(m|\phi, \theta))$ and the same expectation cannot be with two different realizations, we must have $E(m|\phi) \neq E(m|\phi, \theta)$.

Annex C. An example

The following example produces a closed form solution and illustrates further the conditions under which an observer can infer biased advice from the correlation between consumers mortgage choice and banks supply factors. Assume the following form for the payoff function of the bank:

$$v = \phi + \alpha - \frac{1}{2} \sum_{i=1}^N k_i (\phi - \theta_i)^2 - \frac{\mu}{2} \sum_{i=1}^N q_i (\alpha - \theta_i)^2$$

This formulation captures the idea that the *FRM* premium and the biased advice positively affect profits but they do both carry a cost in terms of maturity risk (captured by the term $\frac{1}{2} \sum_{i=1}^N k_i (\phi - \theta_i)^2$) or reputation loss (the term $\frac{\mu}{2} \sum_{i=1}^N q_i (\alpha - \theta_i)^2$). Such costs are assumed to be quadratic for tractability and are allowed to depend on supply factors in a different way for prices and advice through the sets of coefficients $\{k_i\}, \{q_i\}$. The reputation loss for distorted advice also depends on the proportion of sophisticated

customers. The solution to the bank problem in this case is:

$$\phi(\theta) = \frac{1}{k^s} + \frac{1}{k^s} \sum_{i=1}^N k_i \theta_i$$

$$\alpha(\theta) = \frac{1}{\mu q^s} + \frac{1}{q^s} \sum_{i=1}^N q_i \theta_i$$

where $k^s \equiv \sum_{i=1}^N k_i$ and $q^s \equiv \sum_{i=1}^N q_i$. Here we can see clearly why a regression of mortgage choice on prices gains from adding supply factor θ 's: the reason is that they inform the regression by proxying for advice. Note that this result fails if the two sets of coefficients are linearly related: for example, if $k_i = k$ and $q_i = q$ for all i then $\alpha(\theta)$ is linear in $\phi(\theta)$ so that θ 's have no independent effects on demand: in this case the sample average of the factors is a sufficient statistic for bank choices, and the price control is sufficient to capture it.

Annex D. Interest rate imputation

To impute the rate on the mortgage type that has been disregarded, we divide households in our sample into two groups: those that chose a FRM and those that signed for an ARM. For each bank b we estimate two interest rate models:

$$r_{ibt}^{FRM} = \varpi_1 Z_{ibt} + \chi_1 T_t + u_{ibt} \quad i \in (FRM \text{ group}) \quad (3)$$

$$r_{ibt}^{ARM} = \varpi_2 Z_{ibt} + \chi_2 T_t + u_{ibt} \quad i \in (ARM \text{ group}) \quad (4)$$

where r_{ibt}^{FRM} (r_{ibt}^{ARM}) is the actual rate on the mortgage granted by bank b to individual i who has chosen a FRM (ARM respectively) mortgage at time of origination t ; Z_{ibt} is a vector of mortgage specific characteristic, T_t is a vector of time dummies and u_{ibt} a regression residual.

We then use the estimated coefficients $\widehat{\varpi}_1$, $\widehat{\varpi}_2$, $\widehat{\chi}_1$ and $\widehat{\chi}_2$ to impute the FRM rate for those clients that have chosen an ARM and viceversa

$$\widehat{r}_{ibt}^{FRM} = \widehat{\varpi}_1 Z_{ibt} + \widehat{\chi}_1 T_t \quad i \in (ARM \text{ group}) \quad (5)$$

$$\widehat{r}_{ibt}^{ARM} = \widehat{\omega}_2 Z_{ibt} + \widehat{\chi}_2 T_t \quad i \in (FRM \text{ group}) \quad (6)$$

where \widehat{r}_{ibt}^{FRM} (\widehat{r}_{ibt}^{ARM}) is the imputed rate applied by bank b to client i that has chosen a ARM (FRM) at time of origination t .

Annex E. Technical details on the data

The initial dataset obtained from the Italian Credit Register (CR) and the Survey on Loan Interest Rates (SLIR) included around 2 millions observations from 175 banks. The need to focus on comparable mortgage lead us to exclude: i) mortgage contracts with a length of less than 10 years; ii) contracts in which the interest rate is only partially adjustable; iii) mortgages to sole proprietorships; iv) mortgages granted on special terms or conditions. This reduced the initial sample by 14%. We then controlled for outliers by excluding the two tails of the distribution of mortgage interest rates (1% of the initial database). We also excluded those banks that have a limited participation in the market for mortgages to households (those that reported less than 1,000 observations, 2% of the initial database). The final dataset used for the analysis included 1,662,429 observations and 132 banks.

E.1 Mortgage contract information

The Survey on Loan Interest Rates reports for each mortgage, the date of origination, the amount of money granted (in euros), the type of mortgage (FRM or ARM) and the interest rate on the mortgage at origination. Thus if the mortgage chosen is a *FRM*, the rate reported is the one that fully summarizes the cost of the mortgage. In case of *ARM* the rate reported is the rate at origination and the spread on the market rate – typically the one-month Euribor - to which the mortgage rate is indexed. Summary statistics for mortgage contract information (included fitted values of interest variables reconstructed in Section 4.1) are reported in Panel A of Table 1.

E.2 Borrower variables

We do not observe borrowers preference for risk; to account for risk preference heterogeneity we control for borrower gender and age which have been found to correlate with risk preferences (Guiso and Sodini, 2012 for a review). In extended models of mortgage choice that allow for labor income and liquidity constraints, as in Campbell and Cocco (2003) also other household level variables should matter: a) the variance of the idiosyncratic component of labor income (should make it more likely to choose ARM); b) whether the household is currently liquidity constrained and the probability of moving (low probability of moving should opt for FRM). As it is often the case, administrative records are rich in the data they were meant to collect but often lack information on the unit of observations (in this case the household) that is non-essential for the purpose of the administrative database. As a proxy for these variables we use the nationality of the borrower (the presumption being that Italians are less likely to move), a cohabitation indicator and a set of province dummies for the residence of the borrower. The latter are meant to proxy for differences in background risk and in the degree of local credit market development and thus of the severity of liquidity constraints. Guiso, Pistaferri and Schivardi (2012) show that background risk and local market efficiency differ systematically across Italian provinces. GDP per capita at the regional level proxies for income and wealth effects. Table 1, Panel B shows summary statistics for these variables.

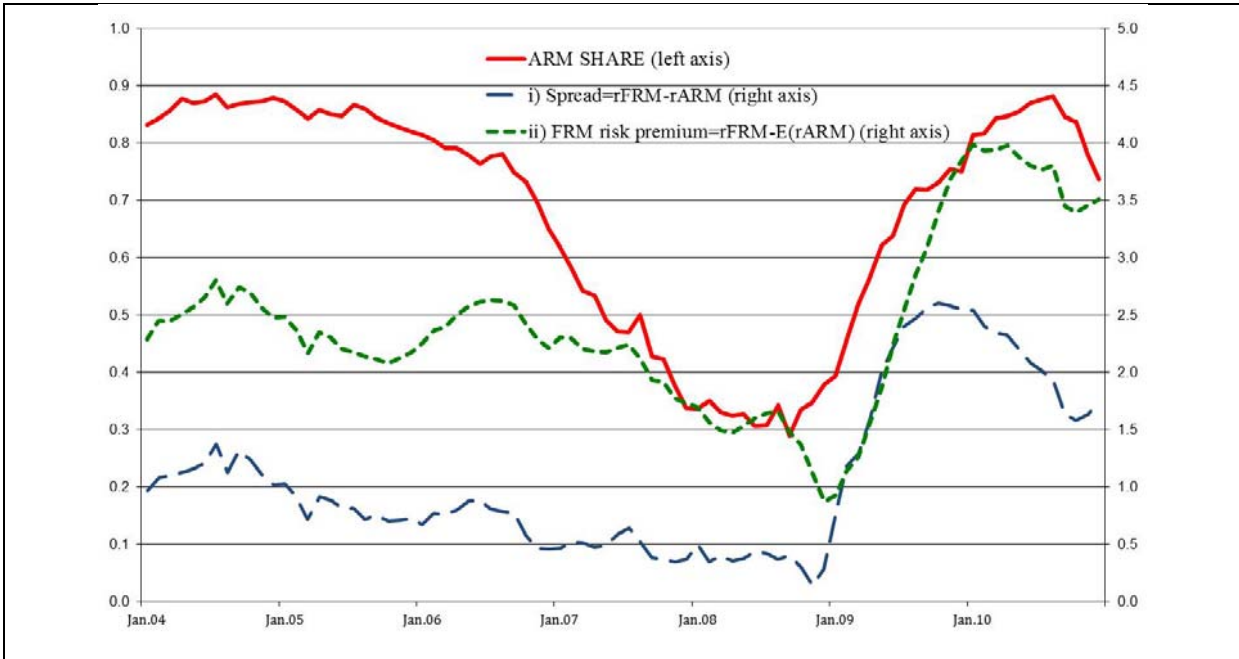
E.3 Lender variables

The Survey on Loan Interest rates and the Credit Register record the identity of the lender and thus we can match the mortgage data with information on the balance sheets of each lender. We include three bank-specific characteristics that influence directly banks' willingness to issue *FRM* vs *ARM* contracts: a) Deposit to total funding ratio; b) Securitization activity dummy (that takes the value of 1 if the bank is active in the securitization market); c) bank bond spread (difference between fixed and variable rate bonds issued by the bank). Other standard indicators are: d) size (log of total assets); e) leverage ratio (TIER1/Total Assets), f) delinquency rate (Bad Loans/Total Loans). We include also some dummies that capture institutional characteristics of the banks (mutual bank, banks that belongs to a group, foreign bank). All bank specific characteristics are summarized in Panel C of Table

1.

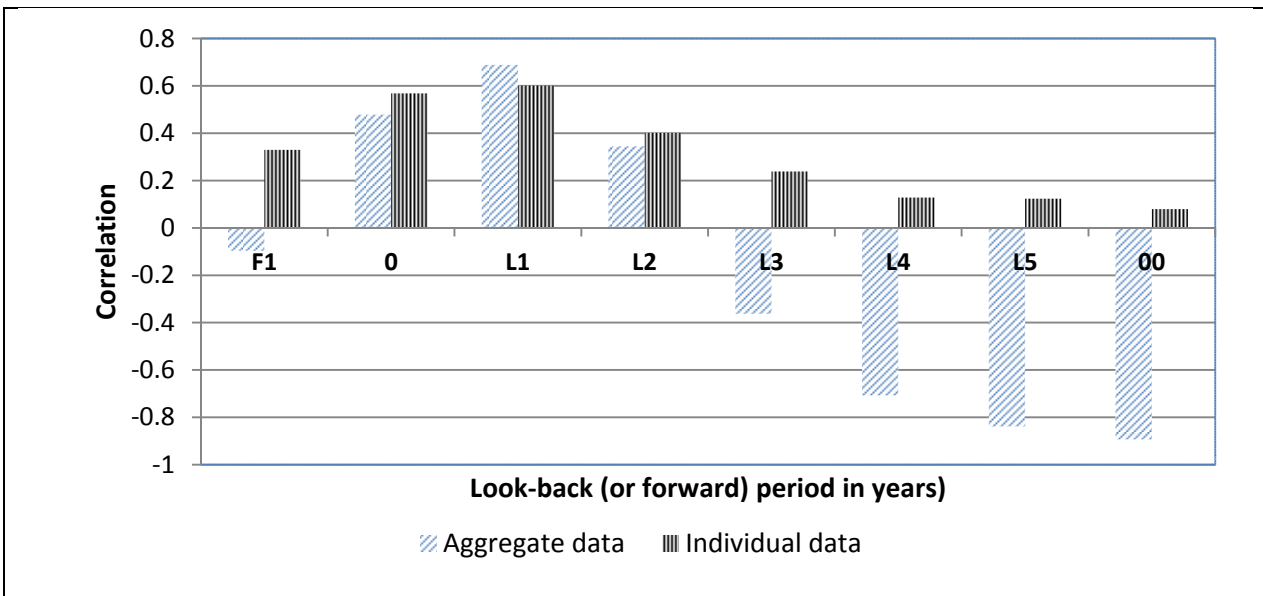
We also include information that qualify the bank-borrower relationship. In particular, we consider two indicators. The first indicator regards "competition". The ability of banks to affect households' choices by setting the relative price of FRM and ARM clearly depends on the competitive pressure they face in the relevant market. We measure competition the market share of the largest 5 banks (used to identify the relevant local market). The second indicator is "informational distance". A greater distance between the bank's headquarter and the household may increase the incentive of the financial intermediary to provide distorted advice. The empirical literature has clearly shown that distance affects the ability of banks to gather soft information, i.e. information that is difficult to codify, which is a crucial aspect of lending relationships (see Berger et al. 2005, Agarwal and Hauswald 2010). We therefore divide banks according to the distance between the lending bank headquarters and households, that we interpret as a form of informational distance. Summary statistics for bank-borrower relationship variables are reported in Panel D of Table 1.

Figure 1. Aggregate share of ARM and alternative “Long term financial premium” measures



Note: The red solid line corresponds to the Adjustable Rate Mortgage (ARM) share in Italy and its values are depicted on the left axis. The blue dashes correspond to the spread between the FRM and the ARM interest rates. The dashed green line displays the FRM risk premium given by the difference between the FRM rate and the one year moving average of the one month interbank rate (a proxy for the expected value of the ARM rate). The time series are monthly from January 2004 to December 2010.

Figure 2. Correlation between the ARM share and alternative measures of the “FRM risk premium”



Note: The figure plots the correlation between alternative measures of the FRM risk premium and the ARM share. The blue histogram is calculated on aggregate data while the black histogram is calculated using data at the bank-client level. The FRM risk premium is given by the difference between the FRM rate and the expected value of the interbank rate. This is calculated in different ways: a forward-looking horizon of 1 year (F1), the actual value (0), a backward-looking horizon of 1, 2, 3, 4, and 5 years (L1 to L5) and an infinite horizon (∞) approximated using the whole sample. The histogram for the actual value 0 indicates the correlation with the Spread measure (in this case $E(i_t^{1M}) = i_t^{1M}$ and FRM risk premium = $r_{ibr}^{FRM} - E(r_{ibr}^{ARM}) = r_{ibr}^{FRM} - r_{ibr}^{ARM} = \text{Spread}$). The results are calculated for the period January 2004 through Dec. 2010.

Figure 3 Distribution of the size of the changes of the spread between FRM and ARM

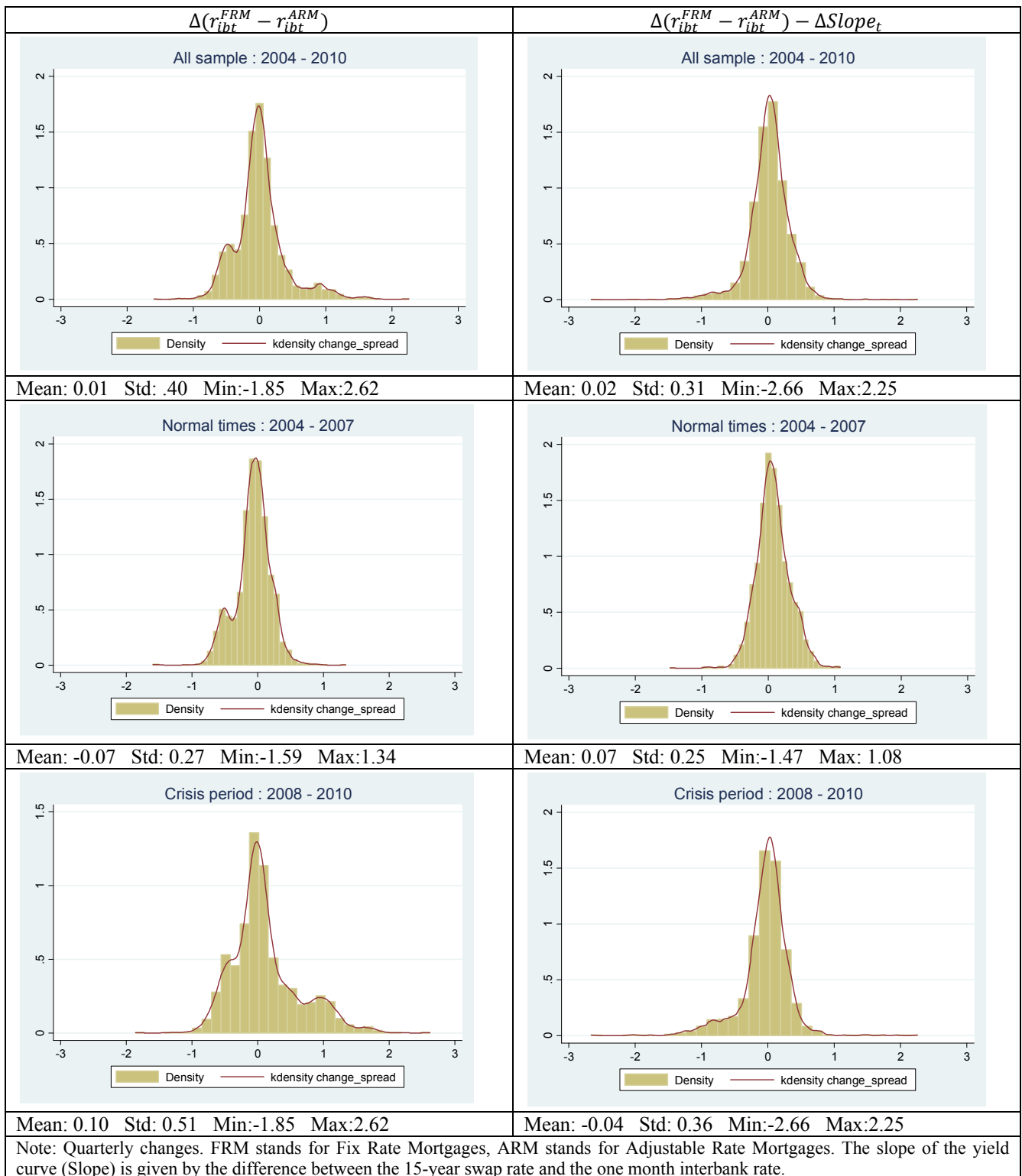


Figure 4 Cross sectional distribution of the numbers of quarters banks remained inactive

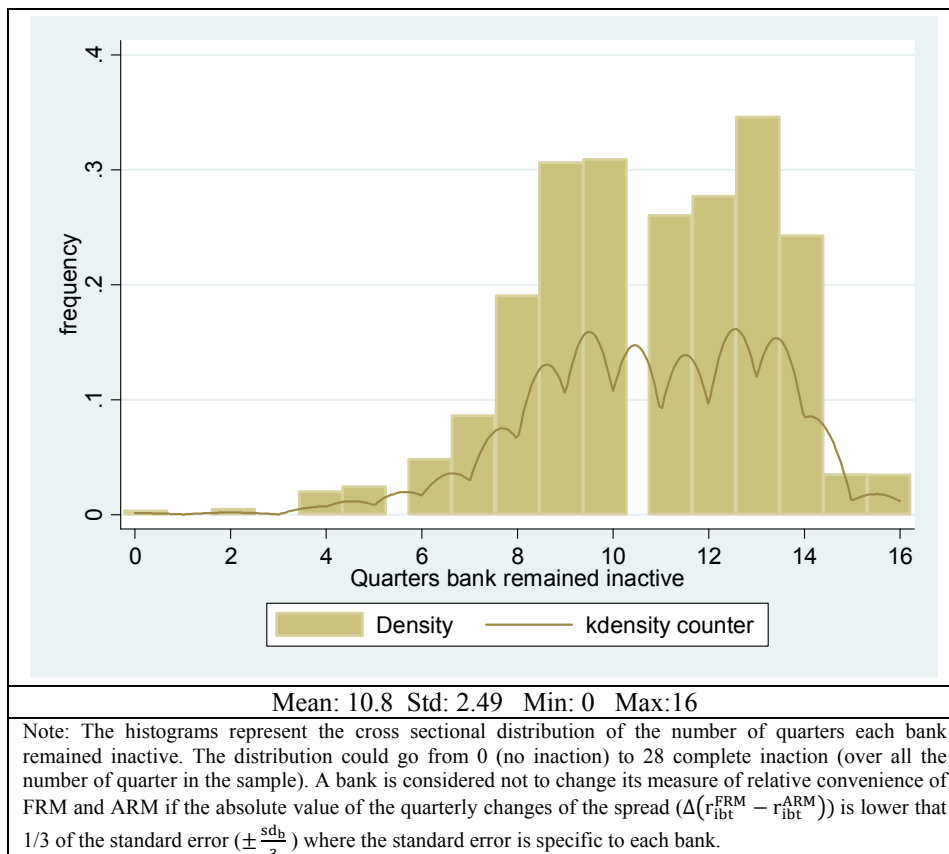


Figure 5 Scatter plot of the quarterly changes of the spread

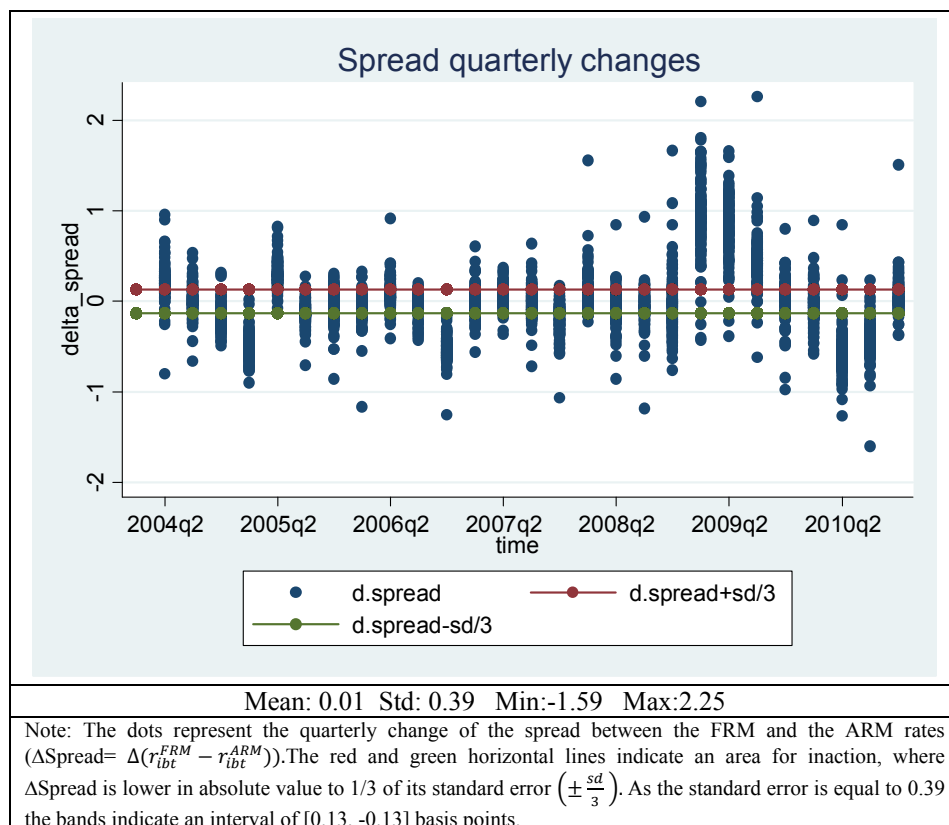
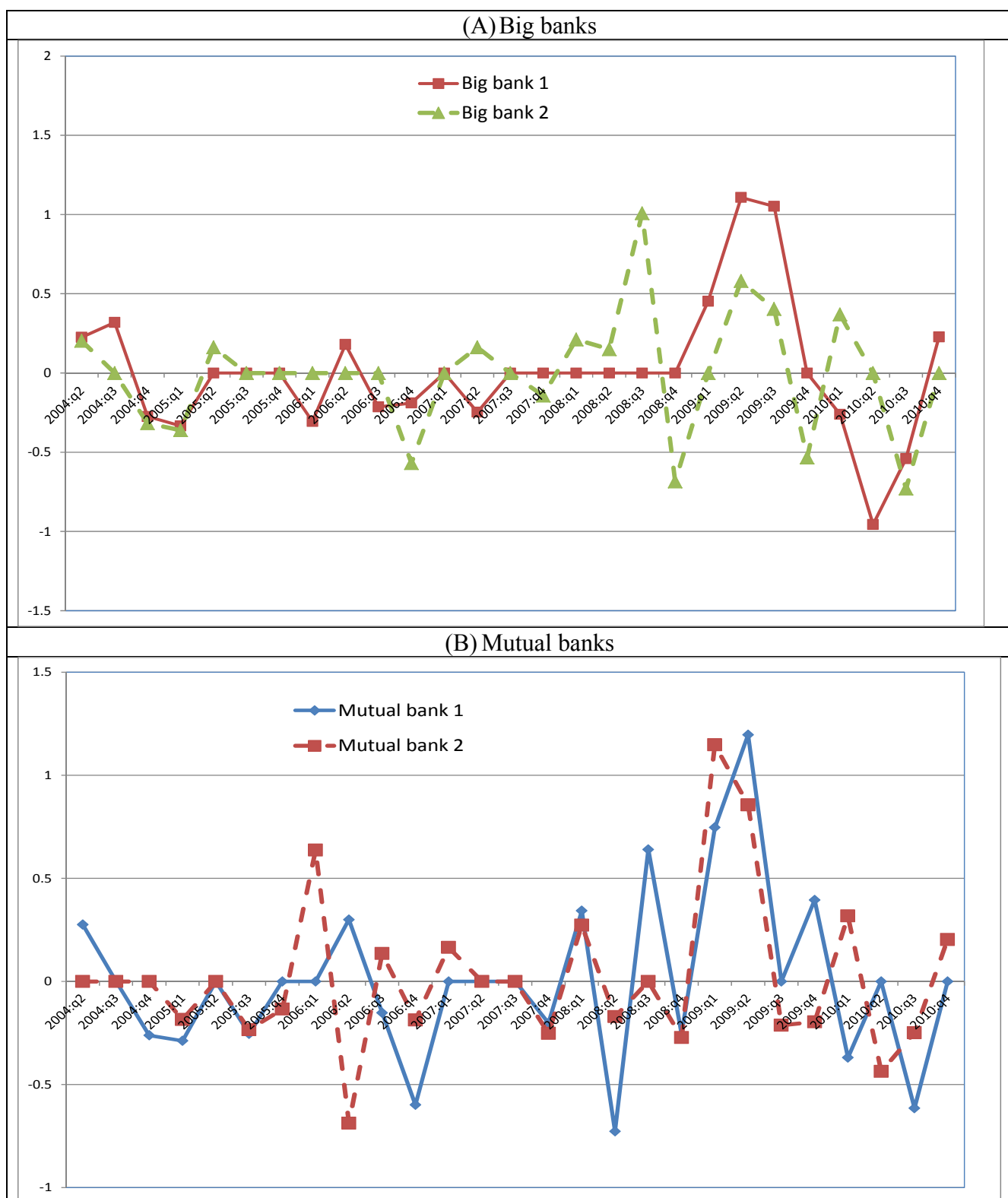


Figure 6 Spread changes for different bank types



Note: Panel A includes two of the biggest banks in the sample. They account for around 20% of the sample. Panel B includes two small mutual banks in the sample. They represent 0.1% of the sample. Each point represents the quarterly change of the spread between the FRM and the ARM rates ($\Delta\text{Spread} = \Delta(r_{ibt}^{FRM} - r_{ibt}^{ARM})$). When ΔSpread is lower in absolute value to 1/3 of its standard error ($\pm \frac{sd_b}{3}$) it is considered as invariant and set to zero. Standard errors are calculated at the bank level.

Figure 7 Probability of inaction: Kaplan and Meier survival estimates

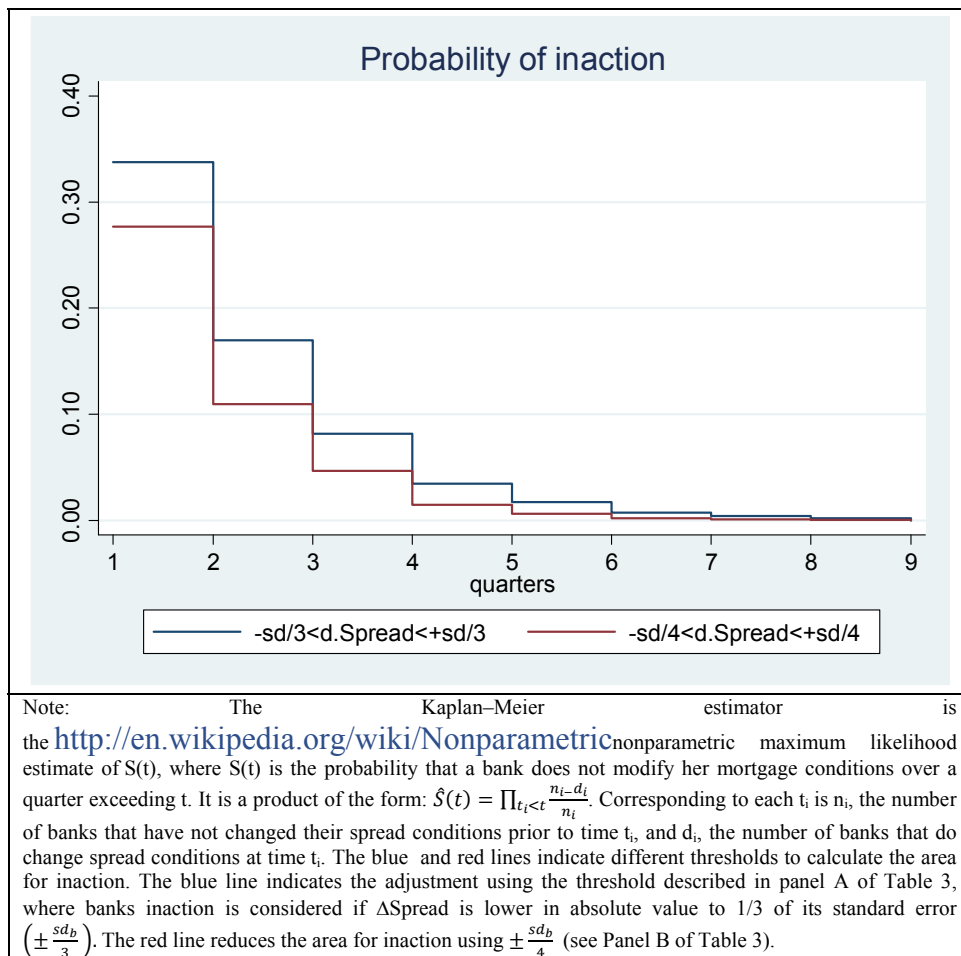


Figure 8. Pattern of bank specialization in the mortgage market

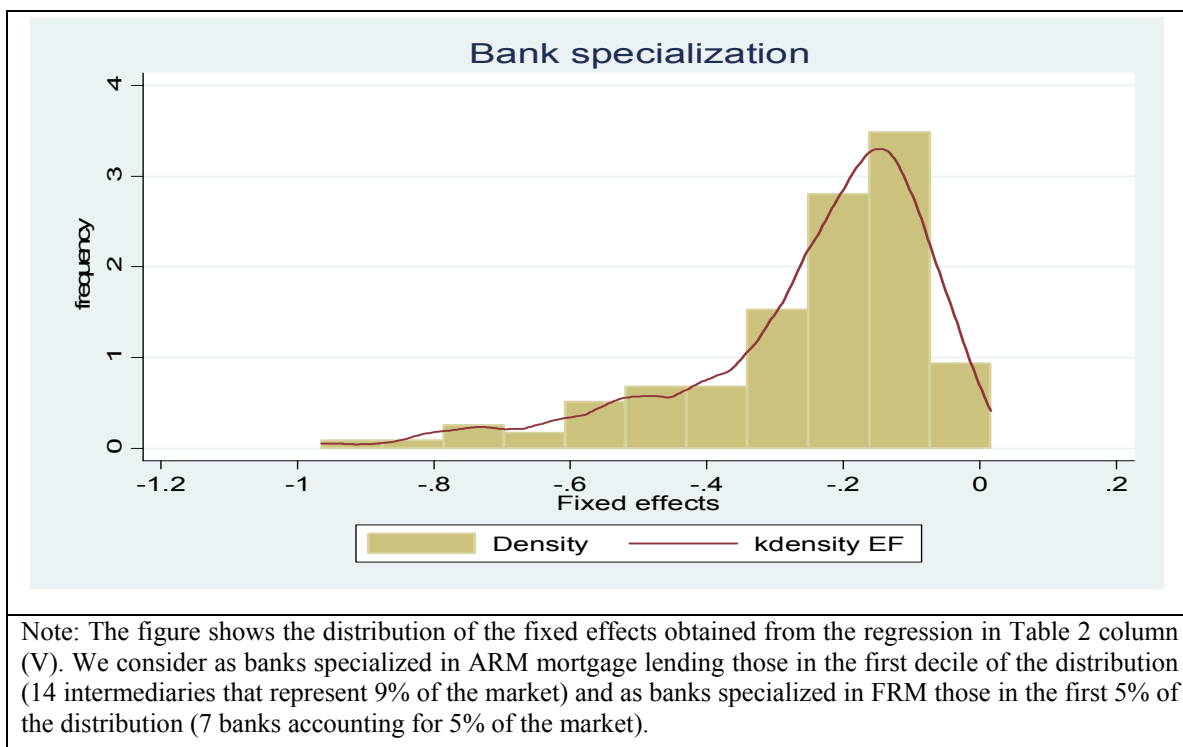


Figure 9 Heterogeneity across time, banks and individuals

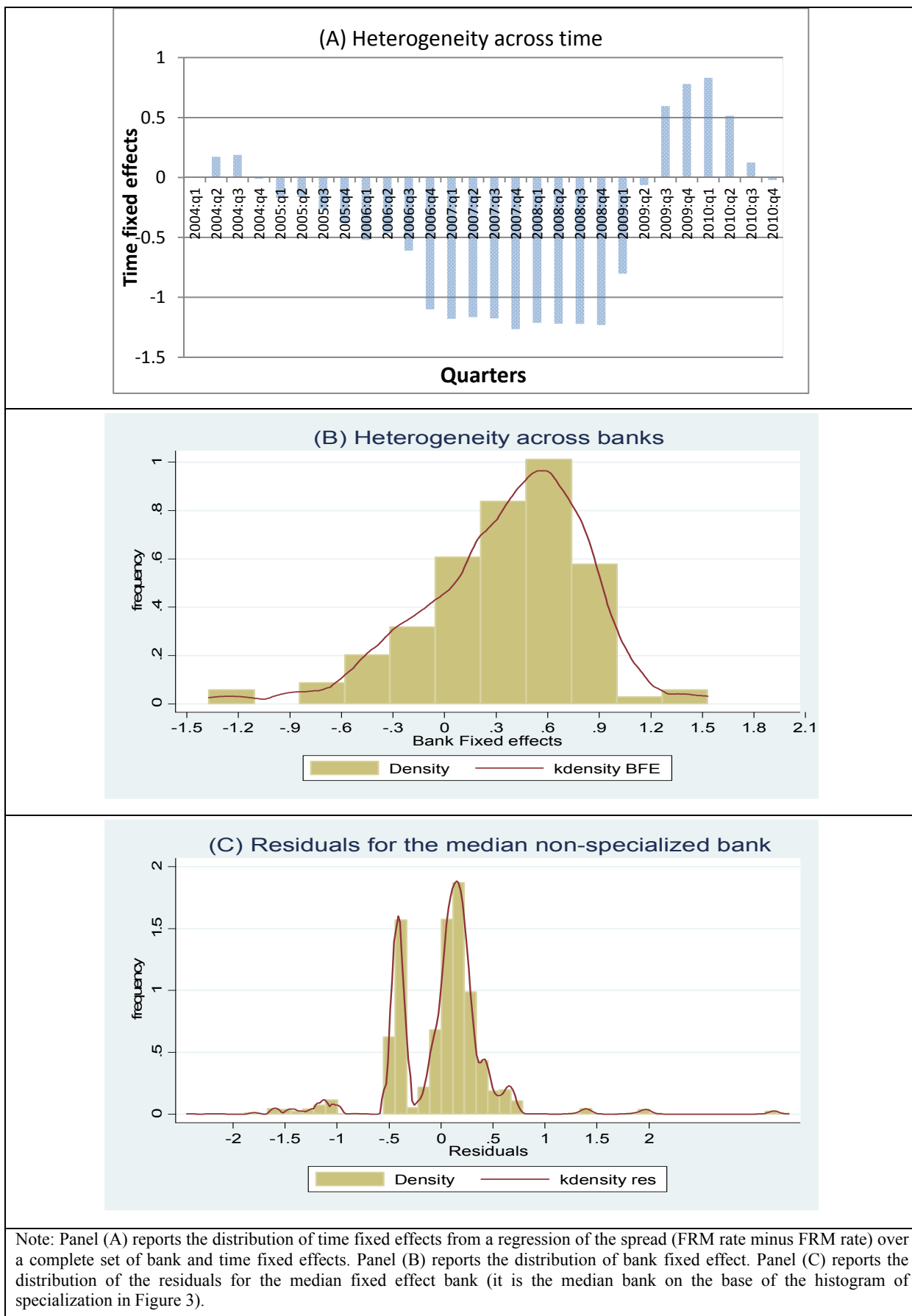


Table 1. Descriptive statistics of the main variables used in the estimation

Variables	Obs.	Mean	Std. Dev.	Min	Max	Median	P10	P90
(A) Contracts' characteristics								
Fixed Rate Mortgage contract	1662429	0.303	0.460	0.000	1.000	0.000	0.000	1.000
Mortgage size (log)	1662429	11.734	0.441	0.693	16.503	11.733	11.280	12.206
Joint Mortgage	1662429	0.509	0.500	0.000	1.000	1.000	0.000	1.000
Interest rate actual:								
- FRM rate	504407	5.545	0.834	1.820	7.068	5.713	4.606	6.376
- ARM rate	1158022	3.829	1.181	1.021	6.940	3.775	2.227	5.530
Interest rate fitted:								
- FRM rate	1158022	5.106	0.482	3.815	6.457	5.133	4.403	5.959
- ARM rate	504407	4.706	1.107	2.114	6.193	5.270	2.670	5.670
Spread (1)	1662429	0.915	1.004	-3.640	4.889	0.725	0.000	2.300
FRM risk premium (2)	1662429	0.897	1.074	-4.714	5.064	0.938	-0.360	2.226
(B) Borrowers' characteristics (3)								
Italian	1662429	0.893	0.294	0.000	1.000	1.000	0.500	1.000
Cohabitation (4)	1662429	0.206	0.405	0.000	1.000	0.000	0.000	1.000
Age (in years)	1662429	38.165	9.302	18.000	90.000	37.000	27.500	51.000
Female	1662429	0.435	0.356	0.000	1.000	0.500	0.000	1.000
(C) Banks' characteristics								
<i>Supply shift factors:</i>								
Deposit funding % (5)	1662429	44.441	20.444	0.003	91.892	46.124	10.494	67.448
Securitization dummy (6)	1662429	0.783	0.321	0.000	1.000	1.000	0.000	1.000
Bank bond spread (7)	1662429	0.283	0.496	-1.120	1.751	0.267	-0.390	0.960
<i>Other characteristics:</i>								
Leverage ratio % (7)	1600446	6.449	2.524	1.425	30.110	6.238	3.582	10.578
Mutual bank dummy	1662429	0.005	0.072	0.000	1.000	0.000	0.000	0.000
Delinquency ratio %(8)	1662410	3.489	2.278	0.018	18.323	3.140	0.957	8.301
Bank size (log)	1662429	10.215	1.436	6.154	12.964	10.144	8.230	12.174
Group dummy	1662429	0.918	0.275	0.000	1.000	1.000	1.000	1.000
Foreign subsidiary dummy	1662429	0.051	0.219	0.000	1.000	0.000	0.000	0.000
Patti Chiari (9)	1662429	0.632	0.482	0.000	1.000	1.000	0.000	1.000
(D) Bank-Borrower relationship (10)								
Distance 1 (province)	1662429	0.152	0.359	0.000	1.000	0.000	0.000	1.000
Distance 2 (region)	1662429	0.264	0.441	0.000	1.000	0.000	0.000	1.000
Distance 3 (same area)	1662429	0.185	0.388	0.000	1.000	0.000	0.000	1.000
Distance 4 (elsewhere)	1662429	0.400	0.490	0.000	1.000	0.000	0.000	1.000
Concentration Index (11)	1662389	60.152	7.386	32.558	99.996	59.294	50.169	68.127
GDP per capita (12)	1662429	10.190	0.236	9.392	10.544	10.273	9.745	10.387

Notes. (1) Difference between the FRM rate and the ARM rate. (2) Difference between the FRM rate and expectation of the ARM rate. The latter is based on the one year moving average of the one month interbank rate. (3) Average across individuals in the case of joint mortgages. (4) In case of joint mortgage. (6) Deposits over total liabilities. (6) Dummy that takes the value of 1 if the bank is active in the securitization market in a given quarter. (7) (5) Tier1 capital over total assets. (8) Bad loans over total loans. (9) Dummy that takes the value of 1 if the bank takes part to the "Patti Chiari" initiative, whose main objective is to simplify bank-borrower relationship. (10) We control for the distance between the lending bank headquarters and household residence by four dummy variables: DIST1 is equal to 1 if borrower k has his residence in the same province where bank j has its headquarters; DIST2 is equal to 1 if: a) DIST1=0 and b) firm k is resident in the same region where bank j has its headquarters; DIST3 is equal to 1 if: a) DIST2=0 and b) borrower k is resident in the same geographical area where bank j has its headquarters; DIST4 is equal to 1 if DIST3=0. (11) Market share of the first 5 banking groups in each province. Not reported Dummy banks, dummy provinces. (12) At the regional level.

Table 2. Distribution of banks' periods of adjustment/not adjustment of the spread

Method to classify adjustment/ not adjustment	Banks' action	2004-2007		2008-2010		All sample	
		Obs.	%	Obs.	%	Obs.	%
A) Inaction if change in spread is in the band $\pm \frac{sd_b}{3}$	Adjust	1,047	54.4	970	65.7	2,017	59.3
	Not Adjust	877	45.6	507	34.3	1,384	40.7
	Total	1,924	100.0	1,477	100.0	3,401	100.0
B) Inaction if change in spread is in the band $\pm \frac{sd_b}{4}$	Adjust	1,224	63.6	1,074	72.71	2,298	67.6
	Not Adjust	700	36.4	403	27.3	1,103	32.4
	Total	1,924	100.0	1,477	100.0	3,401	100.0

Note: The table represents the frequency of adjustment/not adjustment of the spread between the FRM and the ARM rates. A bank is considered not to change its measure of relative convenience of FRM and ARM if the absolute value of the quarterly changes of the spread ($\Delta(r_{ibt}^{FRM} - r_{ibt}^{ARM})$) is lower than a certain threshold. In panel (A) the threshold is given by $\pm \frac{sd_b}{3}$ where the standard error is specific to each bank. In panel (B) the threshold is reduced to $\pm \frac{sd_b}{4}$. In panel (C) the spread is adjusted for changes in the slope of the yield curve ($\Delta(r_{ibt}^{FRM} - r_{ibt}^{ARM}) - Slope$). The slope of the yield curve (Slope) is given by the difference between the 15-year swap rate and the one month interbank rate.

Table 3. Do lender characteristics affect mortgage choice?

Dependent variable is the FRM dummy (Linear probability model to choose an FRM mortgage)	(I) only Bank Fixed Effects (BFE)	(II) BFE and Long Term Financial Premium (LTFP)	(III) BFE+ LTFP + Time Fixed Effects (TFE)	(IV) BFE+TFE+ Borrowers' Characteristics (BC)	(V) Complete model	(VI) BFE and Long Term Financial Premium (LTFP)
		LTFP= FRM risk premium (1)				LTFP= Spread (2)
Long Term Financial Premium (LTFP)		-0.307*** (0.029)	-0.348*** (0.027)	-0.346*** (0.027)	-0.342*** (0.026)	-0.269*** (0.023)
Bank fixed effects (BFE)	yes	yes	yes	Yes	yes	yes
Time fixed effects (TFE)	no	no	yes	Yes	yes	no
Borrowers' Characteristics (BC)	no	no	no	Yes	yes	no
Province fixed effects (PFE) (3)	no	no	no	No	yes	no
Other controls (4)	no	no	no	No	yes	no
Test on BFE joint significance (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Test on TFE joint significance (p-value)	-	-	0.000	0.000	0.000	-
Test on BC joint significance (p-value)	-	-	-	0.000	0.000	-
Test on PFE joint significance (p-value)	-	-	-	-	0.000	-
Observations	1662429	1662429	1662429	1662429	1662429	1662429
Pseudo R-squared	0.0984	0.4760	0.5919	0.5954	0.6000	0.4395
Sample period	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1-2010:Q4

Notes: Parameter estimates are reported with robust standard errors in brackets (cluster at individual bank level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for dummies and fixed effects are not reported. (1) difference between the FRM rate and the expected ARM rate based on borrower's actual ARM rate and one year moving average of the one month interbank rate (2) Difference between the FRM rate and the ARM rate (3) At the regional level (4) GDP per capita at the regional level; Dummy equal to 1 from the second quarter of 2007 onwards, when the "Bersani Law" (n. 40/2007) erased early-prepayment fees, 0 elsewhere.

Table 4. Summary stats of borrowers' characteristics for specialized and non-specialized banks

	Observations	Mortgage size (log)		Joint mortgage (%)		Italian (%)		Cohabitation (%)		Age (in years)		Female (%)	
		Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
<i>All sample</i>													
a) Banks specialized in ARM	150,792	11.744	0.445	0.532	0.499	0.908	0.273	0.220	0.414	37.978	9.189	0.443	0.348
b) Non-specialized banks	1433889	11.734	0.440	0.505	0.500	0.891	0.298	0.203	0.402	38.119	9.282	0.434	0.357
c) Banks specialized in FRM	77,748	11.717	0.458	0.540	0.498	0.915	0.262	0.237	0.425	39.381	9.783	0.445	0.346
Ho: Mean (a) ≠ Mean (c) (p-value)		(0.970)		(0.993)		(0.986)		(0.980)		(0.926)		(0.997)	
<i>2004-2007</i>													
a) Banks specialized in ARM	60,596	11.703	0.450	0.548	0.498	0.889	0.299	0.230	0.421	37.505	9.417	0.440	0.342
b) Non-specialized banks	895,219	11.713	0.438	0.515	0.500	0.875	0.317	0.211	0.408	37.733	9.270	0.430	0.354
c) Banks specialized in FRM	48,074	11.698	0.465	0.542	0.498	0.910	0.271	0.245	0.430	38.940	9.790	0.443	0.345
Ho: Mean (a) = Mean (c) (p-value)		(0.994)		(0.994)		(0.964)		(0.983)		(0.926)		(0.995)	
<i>2008-2010</i>													
a) Banks specialized in ARM	90,196	11.771	0.439	0.522	0.500	0.920	0.253	0.213	0.409	38.295	9.020	0.445	0.352
b) Non-specialized banks	538,670	11.768	0.442	0.489	0.500	0.917	0.261	0.190	0.393	38.761	9.266	0.440	0.362
c) Banks specialized in FRM	29,674	11.749	0.443	0.536	0.499	0.924	0.247	0.223	0.416	40.096	9.730	0.447	0.346
Ho: Mean (a) = Mean (c) (p-value)		(0.975)		(0.985)		(0.992)		(0.988)		(0.904)		(0.997)	

Note: The table reports summary statistics for borrower specific characteristics for three types of banks. a) Banks specialized in ARM; b) non-specialised banks; c) banks specialised in FRM. The three groups of banks have been selected based on the method described in Figure 3. In particular we consider as banks specialized in ARM mortgage lending those in the first decile of the distribution (14 intermediaries that represent 9% of the market) and as banks specialized in FRM those in the first 5% of the distribution (7 banks accounting for 5% of the market). P-values of the test that the mean in group (a) is equal to that in group (c) are reported in parenthesis.

Table 5. Time-varying bank characteristics and mortgage choice

Dependent variable is the linear probability that the borrower chooses a FRM	(I) Baseline model that includes bank supply factors	(II) Restricting the sample to those banks for which we observe the bond spread	(III) Adding non-linear terms for LTP	(IV) Baseline model without time dummies
LTFP (1)	-0.3492*** (0.0238)	-0.3488*** (0.0267)	-0.4735*** (0.0405)	-0.2351*** (0.0150)
LTFP ²			-0.0123 (0.0096)	
LTFP ³			0.0276*** (0.0048)	
Bank bond spread (2)	-0.0271* (0.0154)	-0.0284* (0.0170)	-0.0288* (0.0170)	-0.0350*** (0.0127)
Securitization activity (3)	0.1383*** (0.0275)	0.1505*** (0.0376)	0.1244*** (0.0230)	0.1466*** (0.0356)
Deposit ratio % (4)	0.0059*** (0.0020)	0.0069*** (0.0019)	0.0059*** (0.0022)	0.0038*** (0.0013)
Bank fixed effects (BFE)	yes	yes	yes	Yes
Time fixed effects (TFE)	yes	yes	yes	No
Borrowers' Characteristics (BC)	yes	yes	yes	Yes
Province fixed effects (PFE) and control for bank competition (5)	yes	yes	yes	Yes
Other controls (6)	yes	yes	yes	Yes
Test on BFE joint significance (p-value)	0.000	0.000	0.000	0.000
Test on TFE joint significance (p-value)	0.000	0.000	0.000	n.a.
Test on BC joint significance (p-value)	0.000	0.000	0.000	0.000
Observations	1,662,389	1,261,404	1,662,389	1,662,389
Adjusted R-squared	0.6080	0.6217	0.6283	0.5207
Sample period	2004:Q1-2010:Q4	2004:Q1-2010:Q4	2004:Q1-2010:Q4	2004:Q1-2010:Q4

Notes: Parameter estimates are reported with robust standard errors in brackets (cluster at individual bank level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for borrowers' characteristics and fixed effects are not reported. (1) The Long Term Financial Premium (LTFP) is given by the difference between the FRM rate and the expected ARM rate based on borrowers' actual ARM rate and one year moving average of the one month interbank rate. (2) Difference between the cost of fixed rate bonds and variable rate bonds. (3) Dummy equal to one if the bank is active in the securitization market, 0 elsewhere. (4) Deposits over total liabilities. (5) The bank concentration index is equal to the market share of the first 5 banking groups in each province. (6) The set of controls include: i) GDP per capita at the regional level; ii) Dummy equal to 1 from the second quarter of 2007 onwards, when the "Bersani Law" (n. 40/2007) erased early-prepayment fees, 0 elsewhere. iii) Dummy that takes the value of 1 if the bank takes part to the "Patti Chiari" initiative, whose main objective is to simplify bank-borrower relationship (www.pattichiari.it); iv) A set of dummies to control for the distance between the lending bank headquarters and household residence.

Table 6. The role of price inaction**A. Main definition of price inaction**

	(I) Baseline linear probability model excluding bond spread	(II) Baseline linear probability model	(III) Restricting the sample to those banks for which we observe the bond spread	III) Adding non- linear terms for LTP	(V) Baseline model without time dummies
Dependent variable is the linear probability that the borrower chooses a FRM					
LTFP (1)	-0.3506*** (0.0242)	-0.3499*** (0.0241)	-0.3495*** (0.0269)	-0.4742*** (0.0407)	-0.2400*** (0.0156)
LTFP ²				-0.0122 (0.0096)	
LTFP ³				0.0276*** (0.0048)	
Bank bond spread (2)		-0.0140 (0.0157)	-0.0112 (0.0168)	-0.0023 (0.0183)	-0.0047 (0.0161)
Securitization activity (3)	0.1371*** (0.0270)	0.1370*** (0.0252)	0.1480*** (0.0346)	0.1243*** (0.0217)	0.1485*** (0.0352)
Deposit ratio % (4)	0.0052*** (0.0021)	0.0053*** (0.0021)	0.0062*** (0.0021)	0.0053*** (0.0023)	0.0038*** (0.0015)
D_{ib} (5)	0.0520* (0.0304)	0.0518* (0.0311)	0.0486 (0.0414)	0.0456 (0.0319)	0.1494*** (0.0510)
Bank bond spread * D_{ib}		-0.0621*** (0.0129)	-0.0716*** (0.0132)	-0.0682*** (0.0147)	-0.0860*** (0.0189)
Securitization Activity * D_{ib}	0.0110* (0.0063)	0.0166* (0.0096)	0.0182* (0.0104)	0.0119* (0.0071)	0.0119* (0.0071)
Deposit ratio % * D_{ib}	0.0010** (0.0005)	0.0008* (0.0005)	0.0008* (0.0005)	0.0006* (0.0003)	0.0012* (0.0007)
Bank fixed effects (BFE)	yes	yes	yes	yes	Yes
Time fixed effects (TFE)	yes	yes	yes	yes	No
Borrowers' Characteristics (BC)	yes	yes	yes	Yes	Yes
Province fixed effects (PFE) and control for bank competition (6)	yes	yes	yes	Yes	Yes
Other controls (7)	yes	yes	yes	Yes	Yes
Observations	1,662,389	1,662,389	1,261,404	1,662,389	1,662,389
Adjusted R-squared	0.6081	0.6094	0.6233	0.6298	0.5286
Sample period	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4

Notes: Parameter estimates are reported with robust standard errors in brackets (cluster at individual bank level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for borrowers' characteristics and fixed effects are not reported. (1) The Long Term Financial Premium (LTFP) is given by the difference between the FRM rate and the expected ARM rate based on borrowers' actual ARM rate and one year moving average of the one month interbank rate. (2) Difference between the cost of fixed rate bonds and variable rate bonds. (3) Dummy equal to one if the bank is active in the securitization market, 0 elsewhere. (4) Deposits over total liabilities. (5) The "inaction" dummy D_{ib} takes the value of 1 in those quarters where the bank b left unchanged the relative price measure between FRM and ARM. The threshold to calculate inaction is given by $\pm \frac{std}{3}$ where the standard error is specific to each bank. (6) The bank concentration index is equal to the market share of the first 5 banking groups in each province. (7) The set of controls include: i) GDP per capita at the regional level; ii) Dummy equal to 1 from the second quarter of 2007 onwards, when the "Bersani Law" (n. 40/2007) erased early-prepayment fees, 0 elsewhere. iii) Dummy that takes the value of 1 if the bank takes part to the "Patti Chiari" initiative, whose main objective is to simplify bank-borrower relationship (www.pattichiari.it); iv) A set of dummies to control for the distance between the lending bank headquarters and household residence.

B. Tighter definition of price inaction (threshold $(\pm \frac{sd_b}{4})$)

	(I) Baseline linear probability model	(II) Adding non- linear terms for LTP	(III) Restricting the sample to those banks for which we observe the bond spread	III) Adding non- linear terms for LTP	(V) Baseline model without time dummies
Dependent variable is the linear probability that the borrower chooses a FRM					
LTFP (1)	-0.3500*** (0.0239)	-0.3493*** (0.0238)	-0.3489*** (0.0266)	-0.4741*** (0.0404)	-0.2379*** (0.0150)
LTFP ²				-0.0122 (0.0096)	
LTFP ³				0.0277*** (0.0048)	
Bank bond spread (2)		-0.0195 (0.0146)	-0.0163 (0.0159)	-0.0078 (0.0168)	-0.0177 (0.0136)
Securitization activity (3)	0.1431*** (0.0267)	0.1422*** (0.0253)	0.1546*** (0.0349)	0.1269*** (0.0214)	0.1530*** (0.0340)
Deposit ratio % (4)	0.0059*** (0.0020)	0.0061*** (0.0020)	0.0069*** (0.0019)	0.0060*** (0.0022)	0.0043*** (0.0013)
D_{ib} (5)	0.0370 (0.0255)	0.0369 (0.0242)	0.0290 (0.0309)	0.0319 (0.0280)	0.1333*** (0.0494)
Bank bond spread * D_{ib}		-0.0430** (0.0165)	-0.0504*** (0.0177)	-0.0483*** (0.0182)	-0.0603*** (0.0153)
Securitization Activity * D_{ib}	0.0110* (0.0063)	0.0160* (0.0096)	0.0174* (0.0104)	0.0116* (0.0071)	0.0110 (0.0071)
Deposit ratio % * D_{ib}	0.0007* (0.0004)	0.0007* (0.0004)	0.0007* (0.0004)	0.0007* (0.0004)	0.0008 (0.0009)
Bank fixed effects (BFE)	yes	yes	yes	yes	Yes
Time fixed effects (TFE)	yes	yes	yes	yes	No
Borrowers' Characteristics (BC)	yes	yes	yes	Yes	Yes
Province fixed effects (PFE) and control for bank competition (6)	yes	yes	yes	Yes	Yes
Other controls (7)	yes	yes	yes	Yes	Yes
Observations	1,662,389	1,662,389	1,261,404	1,662,389	1,662,389
Adjusted R-squared	0.6076	0.6085	0.6223	0.6290	0.5254
Sample period	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4	2004:Q1- 2010:Q4

Notes: Parameter estimates are reported with robust standard errors in brackets (cluster at individual bank level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for borrowers' characteristics and fixed effects are not reported. (1) The Long Term Financial Premium (LTFP) is given by the difference between the FRM rate and the expected ARM rate based on borrowers' actual ARM rate and one year moving average of the one month interbank rate. (2) Difference between the cost of fixed rate bonds and variable rate bonds. (3) Dummy equal to one if the bank is active in the securitization market, 0 elsewhere. (4) Deposits over total liabilities. (5) The "inaction" dummy D_{ib} takes the value of 1 in those quarters where the bank b left unchanged the relative price measure between FRM and ARM. The threshold to calculate inaction is given by $\pm \frac{sd_b}{4}$ where the standard error is specific to each bank. (6) The bank concentration index is equal to the market share of the first 5 banking groups in each province. (7) The set of controls include: i) GDP per capita at the regional level; ii) Dummy equal to 1 from the second quarter of 2007 onwards, when the "Bersani Law" (n. 40/2007) erased early-prepayment fees, 0 elsewhere. iii) Dummy that takes the value of 1 if the bank takes part to the "Patti Chiari" initiative, whose main objective is to simplify bank-borrower relationship (www.pattichiari.it); iv) A set of dummies to control for the distance between the lending bank headquarters and household residence.

Table 7. A test based on borrowers' degree of sophistication

A. Main definition of price inaction

	(a) Sophisticated borrowers: old clients with mortgages>320.000 euros	(b) Unsophisticated borrowers: new clients with mortgages<80.000 euros	Difference b-a H0: b-a >0	
Long Term Financial Premium (<i>LTFP</i>) (1)	-0.3148*** (0.0254)	-0.3972*** (0.0291)	0.082 (0.039)	**
Bank bond spread (2)	-0.0131 (0.0187)	0.0074 (0.0236)	0.021 (0.030)	
Securitization activity (3)	0.1085*** (0.0239)	0.1747*** (0.0190)	0.066 (0.031)	**
Deposit ratio % (4)	0.0054*** (0.0010)	0.0074*** (0.0011)	0.002 (0.001)	*
D_{ib} (5)	0.0604 (0.0390)	0.0464 (0.0280)	0.014 (0.048)	
Bank bond spread * D_{ib}	-0.0364** (0.0152)	-0.0847*** (0.0245)	0.048 (0.029)	**
Securitization Activity * D_{ib}	-0.0173 (0.0213)	0.0272* (0.0150)	0.045 (0.026)	**
Deposit ratio % * D_{ib}	-0.0012 (0.0016)	0.0012** (0.0004)	0.003 (0.002)	**
Bank fixed effects (BFE)	yes	yes		
Time fixed effects (TFE)	yes	yes		
Borrowers' Characteristics (BC)	yes	yes		
Province fixed effects (PFE) and control for bank competition (6)	yes	yes		
Other controls (7)	yes	yes		
Bank fixed effects (BFE)	yes	yes		
Observations	29,527	27,158		
Adjusted R-squared	0.4938	0.6677		
Sample period	2004:Q1-2010:Q4	2004:Q1-2010:Q4		

Notes: Parameter estimates are reported with robust standard error in brackets (cluster at individual bank level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for borrowers' characteristics and fixed effects are not reported. (1) The Long Term Financial Premium (*LTFP*) is given by the difference between the FRM rate and the expected ARM rate based on borrowers' actual ARM rate and one year moving average of the one month interbank rate. (2) Difference between the cost of fixed rate bonds and variable rate bonds. (3) Dummy equal to one if the bank is active in the securitization market, 0 elsewhere. (4) Deposits over total liabilities. (5) The "inaction" dummy D_{ib} takes the value of 1 in those quarters where the bank b left unchanged the relative price measure between FRM and ARM. The threshold to calculate inaction is given by $\pm \frac{sd_b}{3}$ where the standard error is specific to each bank. (6) The bank concentration index is equal to the market share of the first 5 banking groups in each province. (7) The set of controls include: i) GDP per capita at the regional level; ii) Dummy equal to 1 from the second quarter of 2007 onwards, when the "Bersani Law" (n. 40/2007) erased early-prepayment fees, 0 elsewhere. iii) Dummy that takes the value of 1 if the bank takes part to the "Patti Chiari" initiative, whose main objective is to simplify bank-borrower relationship(www.pattichiari.it); iv) A set of dummies to control for the distance between the lending bank headquarters and household residence.

B. Tighter definition of price inaction (threshold $(\pm \frac{sd_b}{4})$)

Dependent variable is the probability that the borrower chooses a FRM	(a) Sophisticated borrowers: old clients with mortgages > 320.000 euros	(b) Unsophisticated borrowers: new clients with mortgages < 80.000 euros	Difference b-a H0: b-a > 0	
Long Term Financial Premium (<i>LTFP</i>) (1)	-0.3143*** (0.0251)	-0.3964*** (0.0291)	0.082 (0.038)	**
Bank bond spread (2)	-0.0192 (0.0170)	-0.0026 (0.0228)	0.017 (0.028)	
Securitization activity (3)	0.1063*** (0.0230)	0.1848*** (0.0493)	0.079 (0.054)	*
Deposit ratio % (4)	0.0060*** (0.0010)	0.0079*** (0.0010)	0.002 (0.001)	*
D_{ib} (5)	0.0576 (0.0427)	0.0315 (0.0262)	0.026 (0.050)	
Bank bond spread * D_{ib}	-0.0050 (0.0160)	-0.0592* (0.0338)	0.054 (0.037)	*
Securitization Activity * D_{ib}	-0.0351 (0.0410)	0.0269* (0.0158)	0.062 (0.044)	*
Deposit ratio % * D_{ib}	-0.0010 (0.0012)	0.0007* (0.0004)	0.002 (0.001)	*
Bank fixed effects (BFE)	yes	yes		
Time fixed effects (TFE)	yes	yes		
Borrowers' Characteristics (BC)	yes	yes		
Province fixed effects (PFE) and control for bank competition (6)	yes	yes		
Other controls (7)	yes	yes		
Bank fixed effects (BFE)	yes	yes		
Observations	29,527	27,158		
Adjusted R-squared	0.4930	0.6672		
Sample period	2004:Q1-2010:Q4	2004:Q1-2010:Q4		

Notes: Parameter estimates are reported with robust standard error in brackets (cluster at individual bank level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for borrowers' characteristics and fixed effects are not reported. (1) The Long Term Financial Premium (*LTFP*) is given by the difference between the FRM rate and the expected ARM rate based on borrowers' actual ARM rate and one year moving average of the one month interbank rate. (2) Difference between the cost of fixed rate bonds and variable rate bonds. (3) Dummy equal to one if the bank is active in the securitization market, 0 elsewhere. (4) Deposits over total liabilities. (5) The "inaction" dummy D_{ib} takes the value of 1 in those quarters where the bank b left unchanged the relative price measure between FRM and ARM. The threshold to calculate inaction is given by $\pm \frac{sd_b}{4}$ where the standard error is specific to each bank. (6) The bank concentration index is equal to the market share of the first 5 banking groups in each province. (7) The set of controls include: i) GDP per capita at the regional level; ii) Dummy equal to 1 from the second quarter of 2007 onwards, when the "Bersani Law" (n. 40/2007) erased early-prepayment fees, 0 elsewhere. iii) Dummy that takes the value of 1 if the bank takes part to the "Patti Chiari" initiative, whose main objective is to simplify bank-borrower relationship (www.pattichiari.it); iv) A set of dummies to control for the distance between the lending bank headquarters and household residence.