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EUROSISTEMA

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The series is available online at www.bancaditalia.it.

ISSN 1972-6627 (print)

ISSN 1972-6643 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

FROM FEW TO MANY: PRODUCT DIFFERENTIATION IN THE ITALIAN MORTGAGE MARKET

by Silvia Del Prete*, Cristina Demma♥ and Paola Rossi❖

Abstract

Nowadays Italian borrowers can choose among a variety of mortgage contracts. Using a special Bank of Italy survey on 400 Italian banks over the period 2006-2013, we analyse the supply of ‘non-conventional’ mortgages (loan-to-value ratio greater than 80 per cent, duration longer than 30 years or with a flexible maturity). We build a synthetic indicator measuring the degree of differentiation of mortgages across banks to examine how local market competition and bank-specific characteristics have influenced this process. Our findings – potentially influenced also by customer preferences we cannot control for – suggest that larger, less risky banks and those that have adopted scoring systems are more likely to offer non-conventional mortgages. Moreover, banks operating in more competitive markets and in markets where other banks offer non-conventional loans tend to diversify their supply more. Most of these indications are confirmed by analysing the quantities actually granted. These results suggest that the structure of the local markets does matter and that there could be a non-price competition effect among banks in providing differentiated mortgage contracts.

JEL Classification: G21, G01, D12, D14.

Keywords: Households’ mortgages, financial crisis, bank heterogeneity.

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1. Introduction¹

While Italian households' debt has always been low in international comparisons, in the first decade of this century it grew faster than the average of other European countries (Vacca et al., 2013). This is due to several innovations in the supply of mortgage contracts, such as mortgages with a higher loan-to-value ratio (LTV), with longer maturities or different types of interest rates (Rossi, 2008). Nowadays Italian borrowers can choose from a variety of mortgage contracts to finance the purchase of a house, thus accommodating their personal preferences and enabling banks to escape the 'commodity trap' of a traditionally standardized product. This diversification process began in the first half of the last decade, but it might have been held back in the years following the financial turmoil as a consequence of the riskier profile these contracts present (Gerlach-Kristen and Lyons, 2015) and of tighter credit conditions.

In our paper we examine this differentiation process. In the following sections, we make use of a special survey based on a sample of about 400 Italian banks (representing more than 90 per cent of the Italian mortgage market) over the period 2006-2013. We exploit several features of mortgage loans (e.g. LTV ratio, duration, and other credit standards) across banks in order to build a synthetic indicator at bank level to measure the degree of differentiation in the Italian household mortgage market. Using these characteristics, we are able to go beyond the standard approach on product differentiation followed in the empirical literature, which is mainly based on fixed and variable interest rates applied by banks whereas our approach is to focus on contracts with non-conventional features (henceforth, non-conventional mortgages). In the econometric analysis, we study how local market competition, the adoption of scoring and other bank-specific characteristics correlate with the supply of non-conventional mortgages.

To the best of our knowledge very few papers concentrate on analysing the supply-side of household mortgages, considering local market competition and bank-specific features that may drive banks to diversify mortgages' contractual terms. It is worth noting that our findings should be interpreted with caution, since client preferences we cannot control for could account – at least partially – for the results.

Our estimates suggest that larger and less risky banks are more likely to diversify their offer. The adoption of a scoring system to evaluate client creditworthiness improves the probability that banks will make changes to these contracts. Banks operating in more competitive markets are more likely to diversify their supply of innovative contractual terms. This is also true when the bank operates in markets where other intermediaries already offer non-conventional loans, suggesting a *non-*

¹ We wish to thank Guglielmo Barone, Laura Bartiloro, Raffaello Bronzini, Massimo Gallo, Valentina Michelangeli, Paolo Mistrulli, Steven Ongena, Paolo Sestito, and participants at the workshops held at the Directorate General for Economics, Statistics and Research of the Bank of Italy, in January and September 2015, and in December 2016. The views expressed herein are those of the authors and do not necessarily reflect those of the Bank of Italy.

price competition effect in diversifying household mortgage contracts, even though this latter result could also be influenced by demand preferences. These findings are robust to different model specifications and considering both the mere introduction of a non-conventional mortgage or a synthetic index of differentiation.

Then, we investigate the amount of non-conventional mortgages actually granted to households. Since we analyse an equilibrium point between demand and supply, in this specification demand factors are particularly important. Overall, most of our results are lined up with previous indications. However, we find some differences as far as the use of scoring systems is concerned. Their adoption, *per se*, is not significant, even though banks with longer experience in their use are more likely to grant a higher amount of non-conventional mortgages. Their use only to price non-conventional mortgages increases the amount of these loans, which are usually riskier. On the other hand, the use of credit scores in the monitoring process has a negative impact on the amount granted. This result is consistent with the increasing selective lending policies followed by banks after the international financial crisis.

The rest of the paper is organized as follows. After a brief review of the literature (Section 2), in Section 3 we present the dataset from the Bank of Italy's Regional Bank Lending Survey (RBLS). We focus on the different non-conventional mortgages offered by Italian banks and present some stylized facts, showing some descriptive evidence of the impact of the crisis on the differentiation process. In Section 4 we introduce our econometric set-up and we discuss the main findings in Section 5. Section 6 concludes.

2. Review of the literature

In the literature, little attention was paid to the process of diversifying the contractual terms of mortgages, which was under way prior to the international financial crisis, especially in the US mortgage market, as a means of avoiding the increasing competition.

According to Sa-Aadu and Sirmans (1995) different contractual terms allow borrowers to be better off by selecting the mortgage that fits their preferences in terms of interest rate level and risk exposure. Contract differentiation is then the response to the existence of heterogeneous borrowers.

Rasmussen and Zenios (2007) develop a model for the diversification of homeowners' mortgage loans; they show that, in the Danish market, a portfolio of different contracts may be preferable to satisfy the needs of households. Similarly, Allen, Clark and Houde (2012) consider the Canadian mortgage market between 1999 and 2001 to analyse contract features as well as household and market-level characteristics. They propose and estimate a model where a bank's market power depends upon search frictions and moving customer costs away from their main financial institution.

Bank-specific characteristics play a role in a household's choice, too (Foà, Gambacorta, Guiso and Mistrulli, 2015). These authors study the mortgage contracts on a sample of 1.6 million mortgages, originated in Italy between 2004 and 2010.

According to their results, the choice between adjustable and fixed rates is significantly affected by changes in banks' supply factors, especially in periods during which banks do not change the relative price of the two types of mortgage. This supports the view that banks are able to affect customers' mortgage choices not only by pricing but also through the advice channel.

In Italy, the ability of households to access new debt instruments has increased over time. As documented by Rossi (2008), in the first part of the last decade significant innovations in the Italian household mortgage market were introduced, such as loans with a higher LTV ratio or with a longer maturity. This process was more common in large and medium-sized banks and in those that adopted credit scoring techniques to select their customers early on. However, more recently Felici, Manzoli and Pico (2012) show a decrease in the amount of new mortgages granted in the period 2008-2011. This drop was particularly severe for younger clients, to whom banks frequently grant loans with higher LTV ratios and longer maturities, because of selective lending policies. Younger clients also had greater difficulties in repaying their debt (Bonaccorsi di Patti and Felici, 2008).

Before the global financial crisis, competition in the mortgage market was especially intense from foreign competitors that entered the market in those years (Infante and Rossi, 2013), inducing Italian banks to offer a wider range of mortgage contracts. Monitoring of riskiness became more stringent for these innovative types of mortgages, and it seems that only those banks with an advanced scoring system were able to offer these new contracts.

In this respect, Bofondi and Lotti (2006) specifically studied the adoption of credit scoring by Italian banks and they found that it was initially introduced by large banks with extensive branch networks that could fully exploit scale economies. Nevertheless, more recently Del Prete et al. (2013) suggest that the Great Recession has triggered a convergence process between large and small banks in adopting credit scoring. The crisis also amplified the use of credit scoring, extending it from the loan approval stage to the pricing and monitoring processes. According to Magri and Pico (2010), consistently with a more extensive use of credit scoring techniques, Italian lenders have increasingly priced mortgage interest rates taking credit risk into account.

Given this framework, we concentrate our attention on studying bank characteristics and market competition aspects that could have supported the diversification of the supply of mortgage contracts during the crisis.

3. Data and stylized facts

3.1 The dataset

Our main source of data on mortgage characteristics is the Bank of Italy's special survey, which annually records information on the type of mortgage contracts offered by the banks in the sample, as well as other information on the use of credit

scoring and how the internal lending process is organized. The dataset covers a sample of around 400 Italian banks, representing more than 90 per cent of the Italian mortgage market at the end of 2013.

Among other things, the survey records data at bank-level on mortgages with the following characteristics: *i*) loan-to-value (LTV) ratio above 80 per cent; *ii*) maturity longer than 30 years; *iii*) flexible maturity (with constant reimbursements).

From the different waves of the survey, we are able to build a dataset with yearly information on the characteristics of mortgages to households from 2006 to 2013. Our *differentiation index* of non-conventional mortgage supply, for each bank and year, is equal to:

- 0, if the bank did not supply mortgages with those characteristics;
- 1, if the bank supplied only one of these three kinds of loans;
- 2, if the bank supplied only two of these three kinds of loans;
- 3, if the bank offered all of them.

In the survey, we also have information on the share of new mortgages with those characteristics.

Since 2008, a new survey to the same sample of banks was introduced to record the changes in mortgage demand and lending standards followed by banks at macro-regional level (Regional Bank Lending Survey, RBLS). Surveyed banks were asked to report demand and supply conditions in lending to households. Particularly, they were asked to signal if, compared with the previous six month period, households' demand for mortgages had increased considerably, increased somewhat, was basically unchanged, decreased somewhat or decreased considerably. At the same time banks were asked to signal if their lending criteria were tightened considerably, tightened somewhat, basically unchanged, eased somewhat or eased considerably. For each year from 2008 to 2013 we consider the changes in average credit demand and the average lending supply reported by each bank and we build an indicator, ranging from -1 (considerable reduction in mortgage demand; considerable easing in mortgage supply) to 1 (considerable increase in mortgage demand; considerable tightening in mortgage supply); because of the shorter period of time, we use these variables only in some econometric specifications.

The dataset has been enriched with information at bank-level on balance sheet indicators from the Bank of Italy's Supervisory Reports. We use indicators on profitability, portfolio riskiness, cost-efficiency, and some other bank characteristics such as institutional form and whether the bank belongs to a group, especially one of the top five banking groups.

We also compute some indices measuring the degree of bank competition at territorial level.

Firstly, for each year and every bank in our sample we compute two alternative measures of market concentration in the areas where the bank operates. We consider the Herfindahl concentration index (or alternatively the C3 concentration index, computed on the main 3 banks) for each Italian province where a given bank had

opened branches.² We use the weighted average for each bank in the index, where the weights are the outstanding mortgages of bank i in each province.

Secondly, we propose a *market differentiation index* of the non-conventional mortgages supplied by all the other banks in the markets where each bank operates. More specifically, for every bank i and year t , we compute the provincial values of the previously mentioned *differentiation index* of innovative mortgages considering only the rival banks (e.g. the other banks b , different from bank i , which are active in the same local market), according to the formula:

$$\text{Market Diff}_{i,p,t} = \sum_{b \neq i} \left(\text{Diff_index}_{b,t} \frac{\text{mortgages}_{b,p,t}}{\sum_{b \neq i} \text{mortgages}_{b,p,t}} \right)$$

As before, this index is aggregated at bank-level considering the weighted average per bank of the provincial indicator, where the weights are the outstanding mortgages of bank i in every province.

Finally, to measure the degree of price competition we calculate a *mark-up* indicator: we first compute, for each province, the spread between the local average interest rate charged on household mortgages and the local average interest rate on sight deposits made by households. As before, we aggregate this provincial index at bank-level by weighting the provincial spreads with the share of outstanding mortgages granted by each bank in each province.

3.2 Mortgage and bank characteristics

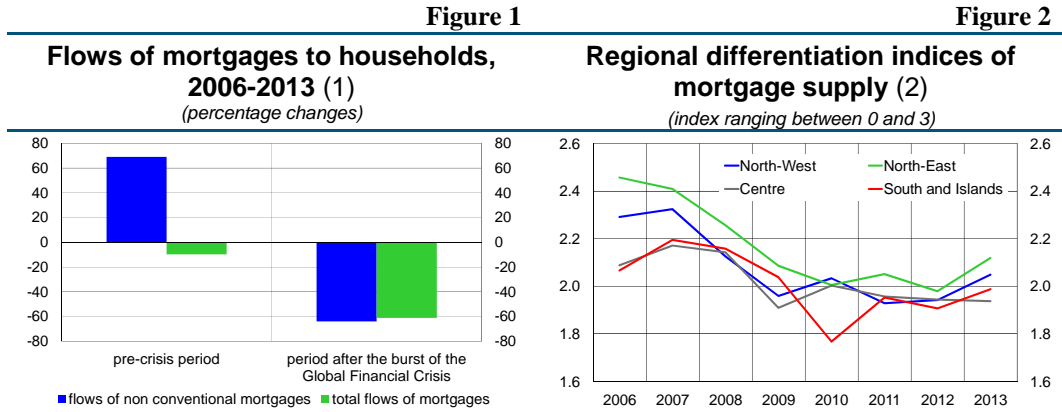
Table 1 shows the main statistics describing the share of non-conventional mortgages. In the whole period, a quarter of the sampled banks did not offer any type of non-conventional mortgage. More in detail, the most common feature of innovative mortgages was a contract with a maturity of more than 30 years, which accounted for around 15 per cent of new mortgages and was by far the most frequent type of mortgage, even considering the median values.

During the pre-crisis period, the behaviour of non-conventional loans was significantly different compared with total mortgages: the surveyed banks reduced the amount of total flows granted to households while considerably increasing the flows of non-conventional mortgages (Figure 1). After the onset of the financial crisis, the flows of new mortgages declined at similar rates for both total mortgages and non-conventional ones: the Great Recession and the Sovereign Debt Crisis adversely affected the mortgage supply, slowing down the innovation process. This is also true considering the different types of non-conventional mortgage separately.

In order to evaluate the geographical differences, we aggregate the bank-level *differentiation index* using weights equal to the new mortgages granted by each bank to households located in each macro-region. Figure 2 shows a cyclical pattern in mortgage contract supply, with a higher level of differentiation before the Global

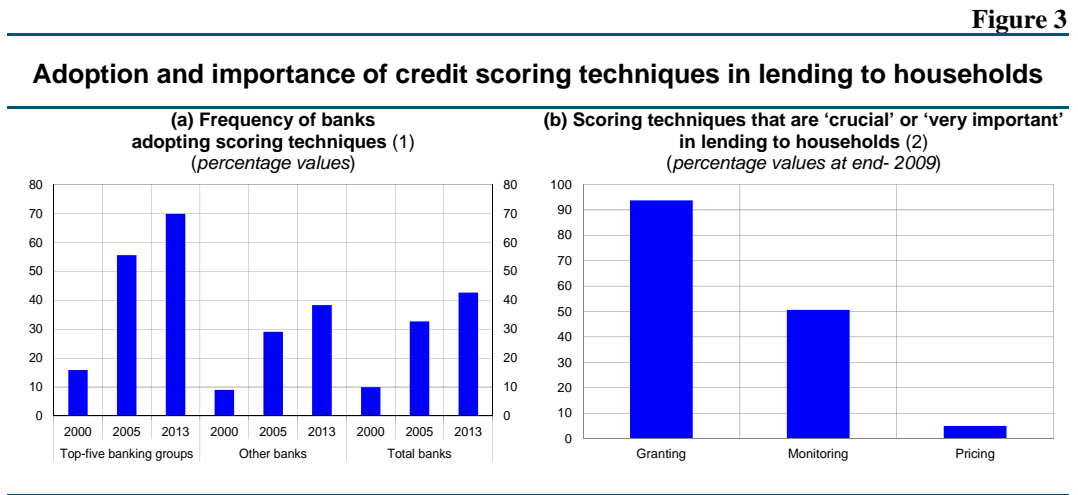
² See Bofondi and Lotti (2006) and Akhavan et al. (2005) for a similar approach.

Financial Crisis, especially in the Northern regions, followed by a sharp reduction during the financial crisis and a recovery in 2013, with the exception of the Centre.



(1) Pre-crisis period: 2006-2008; period after the onset of the Global Financial Crisis: 2008-2013. – (2) For every year the index is a weighted average (weights equal to the flows of mortgages granted by banks to households residing in the macro-area) of bank-level indicators. These are equal to 0 if the bank did not supply one of the non-conventional mortgages (LTV ratio above 80 per cent; maturity greater than 30 years; flexible maturity); 1 if the bank offered only one of these three types of loans; 2 if the bank offered two types of these loans or 3 if the bank offered all three kinds of mortgages.

The surveyed banks were also asked to report on organizational issues, such as the adoption of credit scoring to assess households' creditworthiness. For our purposes, it is important to control for the actual use of these tools, since they were able to improve the differentiation process in mortgage supply by allowing banks to assess and price credit risk more accurately. At the end of 2013, 40 per cent of the banks in the sample, corresponding to 90 per cent of the outstanding mortgages, used scoring techniques; the frequency was more pronounced among the top five banking groups: around 70 per cent of financial intermediaries belonging to these groups had scoring models at the end of 2013 (Figure 3a).



(1) Simple frequencies of the responses. – (2) Frequencies of the responses, weighted by outstanding mortgages in the last year of the banks' participation in the RBLs. Statistics computed on the 2009 RBLs wave; 2006 and 2013 RBLs waves have been considered as checks.

Banks began to use these tools at the end of the 1990s, and their adoption accelerated in the first half of the last decade. The share of banks adopting these

techniques more than tripled between 2000 and 2005 and increased substantially until 2013; this pattern was more noticeable for the top five banking groups. Scoring models were considered crucial or at least very important in 94 per cent of cases (weighted responses) for granting credit (Figure 3b).³ In only half of the cases the banks judged them significant in monitoring the *status* of loans; these techniques were instead rarely employed to price household loans.

Table 2 reports the main descriptive statistics, while Table 3 shows the correlation matrix between the variables.

4. The econometric set-up

In the first step of our econometric set-up we estimate probability models to evaluate the likelihood of supplying non-conventional mortgages, as defined in previous section, in order to assess how bank-level characteristics and market features affected the innovation process. We estimate the following model:

$$\Pr(y_{it} = \text{nonConventional_mortgages_offer}) = f(\alpha, \beta Mkt_{it}, \delta X_{it}, d_t, \varepsilon_{it}) \quad (1)$$

$$\text{with } y_{it} = 1, 0 \quad (1)$$

In equation (1) the dependent variable is a dummy equal to 1 if the bank i at time t ($t = 2006, \dots, 2013$) offered at least one of the following forms of non-conventional mortgages: loans with an LTV ratio greater than 80 per cent, with a maturity longer than 30 years, or with a flexible maturity; it is zero otherwise.

We also estimate equation (1) by using ordered models, where the dependent variable ranges between 0 and 3, and takes into account the increasing number of non-conventional mortgages each bank is offering. The idea is to distinguish banks with a standard offer of household mortgages from banks with a progressively more diversified and innovative range of products. Since our data refer to a panel of banks, as a robustness check of our baseline results we also use a probit estimation with bank random effects. Lastly (not reported), we run a multinomial probability model as a further robustness check.

Among controls, X_{it} is a vector of variables including bank balance sheet indicators (size, riskiness, profitability, equity ratios, liquidity, funding mix) and governance features (banks belonging to one of the top five banking groups).

Particular attention is devoted to the role played by credit scoring techniques in the loan approval process. First, we consider the adoption of credit scoring in the lending process; then, we take into account the experience in their use and their importance in granting, pricing and monitoring mortgages, albeit on a slightly smaller sample (about 370 banks).

³ However, more detailed information on the importance of credit scorings is available only for a smaller sample of about 370 banks.

Finally, the variable Mkt_{it} considers: *i*) the price competition index, measured as the spread between mortgage and deposit rates; *ii*) a concentration index, either Herfindahl or C3 (see Section 3.1 for the definitions); *iii*) the *market differentiation* index (defined in Section 3.1) to account for the pressure from competing banks in offering non-conventional loans. The main idea behind this last measure is that non-price competition from rival banks active in the same local credit markets can affect the set of non-conventional mortgages the bank offers. The value of the *market differentiation* index is lagged one year and is calculated considering only rival banks to each bank i , in order to limit simultaneity issues. We expect that the higher the presence of rival banks with an innovative offer in local mortgage markets, the higher the likelihood for each bank operating in the same market to diversify its offer, even if there could be an indirect effect stemming from client preferences we cannot control for.

In a second econometric exercise, we consider as a dependent variable the amount of these new types of mortgages actually granted to households by each bank, as follows:

$$Share_non\ Conventional\ 3_{it} = \alpha + \beta Mkt_{it} + \varphi X_{it} + v_i + d_t + e_{it} \quad (2)$$

where the dependent variable is the total amount (flows) of the three innovative mortgages already considered (mortgages with an LTV ratio greater than 80 per cent, with a maturity longer than 30 years, or with a flexible maturity), normalized on the new mortgages granted by each bank.⁴ The control variables X_{it} and Mkt_{it} are the same as in model (1), while v_i is the bank idiosyncratic component of the error term, which we estimate both using bank fixed and random effects.⁵

It is important to notice that, both in the probability of diversifying mortgages' contractual terms and in the quantity of non-conventional mortgages actually granted, we do not have a strong *a priori* opinion on the expected sign of the adoption of a scoring system. Since these non-conventional mortgages are riskier than the others, only those scoring characteristics that are able to reduce the ex-ante risk may actually play a role in granting these innovative loans. On the one hand, the scoring can have a positive impact if it reduces customer screening costs, especially if the client's risk can be accurately priced by the same models; on the other hand, it may reduce the supply of these loans, if it is used to identify (and exclude) the riskiest customers, especially in a period of tighter credit standards than in the past.

In both specifications, we introduce year dummies d_t to account for possible cyclical effects, especially the double dip effect of the two financial crises which hit the Italian economy in the period under scrutiny. In some specifications, we also include demand and supply factors derived from the RBLS - albeit for a shorter

⁴ Nearly 10 per cent of the observations displayed a share greater than 100 per cent, since some mortgages can present more than one of the above contractual terms.

⁵ We also run equations (1) and (2) omitting the bank balance sheet indicators that present greater correlation coefficients with other bank balance sheet variables (the ROA and the Dummy top 5; see Table 3). For brevity we did not report these estimates since the results are very similar to those discussed in Section 5.

period due to lack of data before 2008 - to account for the sluggish demand and tight credit standards adopted by banks in that period.

When we concentrate our attention on the quantities actually granted rather than the probability of offering innovative contractual terms, demand factors that we are not able to account for properly could become particularly important in influencing our results. This is especially true for our measure of non-price market competition, which could also be influenced by households' demand preferences.

It is worth noticing also that the impact of scoring techniques could be mixed. We expect that larger and more ICT innovative banks, which adopted credit scoring techniques early on, are more likely to supply non-conventional mortgages. However, these products have – other things being equal – a riskier profile for the bank; therefore scoring systems might reduce the amount actually granted during the crisis period, when lending tightened considerably.

5. Main findings

5.1 *The probability of supplying non-conventional mortgages*

First, we estimate equation (1) using a pooled probit model (Table 4, columns I-III). To control for the stability of the results, in the estimates we follow a stepwise approach (available upon request), by adding new controls to the basic model with only bank balance sheet data and year dummies. Then, since the degree of diversification is increasing with the number of non-conventional mortgages supplied by the bank, we compare these estimates with an ordered probit model (Table 4, columns IV-VI), considering the probability of offering one, two or three types of non-conventional mortgage. For this alternative estimation technique, we follow the same stepwise approach already mentioned.

In the probit model, the evidence suggests that larger and less risky banks, and thus with higher capital adequacy, are more likely to supply non-conventional mortgages to households, with very high impact and significance. The profitability index, the equity ratio, the liquidity assets and the funding mix have negative effects on the likelihood of offering non-conventional mortgages, even if their statistical impact is low or their effects are close to zero (considering marginal effects, not reported). Moreover, banks belonging to the top five banking groups are less likely to diversify their offer. The ordered probit estimates are quite similar to the probability model. Overall, the impact of balance sheets variables on the probability of supplying non-conventional contracts remains substantially unchanged (Table 4, columns IV-VI): large and less risky banks are more prone to offer a higher variety of mortgage contracts. However, the top five dummy loses its significance.

The level of price competition in local markets exerts a significant impact on the probability of supplying non-conventional mortgages: the lower the market spreads on mortgages (higher price competition on the market), the higher the probability to offer new contracts on household loans. Market concentration (Herfindahl) is either

not significant (the result is confirmed even using the C3 index) or its effect is equal to zero.

Our measure of *market differentiation* positively correlates with the probability of offering non-conventional mortgages, both in the simple probit as well as in the ordered probit. This finding suggests a *non-price competition effect* among financial intermediaries operating in the same market: in other words, higher pressure from competitors induces banks to compete on the non-price characteristics of the mortgages as well. However, as already stated, this result could also be influenced by client preferences.

The adoption of a scoring system to evaluate client creditworthiness increases the probability of supplying non-conventional mortgages. According to our evidence, those banks that attach great importance to the score in granting a new mortgage are more likely to supply non-conventional contracts (columns II and V).⁶ However, the importance of scoring in pricing and monitoring mortgages does not significantly influence this probability.

Since our estimates refer to a crisis period, in order to better account for the tightening in lending policy as well as for the sluggish demand for mortgages in that period, we have re-estimated our equation adding two proxies from the RBLS (see Section 3 for more details): *i*) an index for the demand for mortgages, which ranges between 1 (considerable increase in mortgages' demand) and -1 (considerable decrease); *ii*) an index for the stance of the credit policy followed by each bank in granting new mortgages, again ranging between 1 (considerable tightening in mortgage supply) and -1 (considerable easing). The two indexes vary over time and across banks and are able to account for heterogeneity in mortgage demand and lending policies across banks. The RBLS indicators exhibit the expected signs (columns III and VI), but they are never significant; yet our previous findings are robust to the introduction of these new controls.

The dummy variables (not reported in the tables for the sake of simplicity) are negative and statistically significant between 2008 and 2013 with respect to the reference year (2007), indicating that the Great Recession and the Sovereign Debt Crisis did slow down the diversification process in the Italian mortgage market, in line with the descriptive evidence presented in Section 3 (Figures 1 and 2).

As a robustness exercise, since our data refer to a panel of banks, we have checked our results using a probit estimation with bank random effects (see Table 4, columns VII and VIII). Most of our baseline findings are confirmed. Accordingly, larger and less risky banks are more likely to diversify household mortgages, as are those banks operating in more competitive markets in terms of pressure stemming from more innovative rivals. When we consider the panel structure of our data, the variable on the adoption of a scoring model loses its significance, presumably because it presents much lower variance over time.

⁶ This effect is also reinforced over time: those banks which have a longer experience with scoring systems are more likely to provide a higher number of non-conventional loans (not reported).

To further control our results, we have estimated equation (1) by using a multinomial logit model to compare different ways of contract diversification. The results are quite similar to those presented in Table 4 and are not reported for brevity.

Overall, our findings are consistent across different models and point in the same direction both considering the mere introduction of a non-conventional mortgage or a more composite index of differentiation in mortgage supply.

5.2 *The amount of new mortgages granted*

In the second econometric exercise, we estimate the amount of non-conventional contracts actually granted by each bank in each year, normalized by the overall new mortgages granted by the same bank in a given year. We consider a panel of banks in the period 2006-2013 (see equation (2) in Section 4). Our results, controlling for bank random effects, are reported in Table 5. We also introduced bank fixed effects (not reported), which are generally less significant since most of the bank and market characteristics are structural features with a high degree of persistence over time.⁷ Since we can control for many bank-level and market characteristics, we estimate equation (2) with bank random effects using our preferred GLS techniques.

Evidence (column I) suggests that larger, less risky banks and those belonging to the top-five banking groups grant a higher share of non-conventional mortgages. The positive result obtained on our index of the *market differentiation* of mortgages supports the idea that the higher presence of innovative banks in the same local market is once again beneficial to the differentiation process, in terms of the share of innovative loans actually granted; however, as previously pointed out, we cannot properly disentangle whether this effect is due to the structure of the offer or it is influenced by households' demand preferences.

Differently from previous probit models, price competition and the adoption of scoring systems to screen households do not have a significant impact on the amount of these new mortgages granted. However, local market concentration now becomes significant with a negative sign (the same is true considering the C3-index): a higher degree of concentration in the market (and, most likely, lower competition within the market) reduces the share of innovative contracts actually granted to households.

As far as scoring systems are concerned, differently from previous probabilistic models, their adoption is never significant *per se*. As before, credit scoring systems tend to increase the credit granted as experience in their use improves through time (not reported). However, the strict use of scoring in pricing mortgages, which are usually riskier, increases the amount granted, whereas their stringency in the monitoring process has a negative impact, even though these variables are significant at the 10 per cent level (column II). This latter result – as previously suggested – is consistent with the tightening in credit standards during a crisis period (e.g. loans

⁷ Furthermore, we did control for other bank characteristics, such as the area where banks are headquartered and their institutional category (mutual banks or others). For brevity we do not report these results since they are very similar to those discussed in this section.

with less collateral and longer or flexible maturity), when credit quality was deteriorating because of the economic downturn.

One source of concern for the robustness of our results is linked to the lack of controls for the demand for non-conventional mortgages. Therefore, we introduced a demand indicator from the RBSL in the estimates. Finally, in order to better account for the tightening in lending policy during crisis periods, we have added, using the RBSL once again, a proxy of the bank's credit stance for mortgage supply (column III). As before for the probabilistic models, these controls are not statistically significant *per se*, but the relevance of the remaining variables is confirmed.

Finally, in the analysis of the amount of non-conventional mortgages granted to households, we check for the case when the dependent variable is greater than 100 per cent, since there is an overlap for the different types of innovative mortgages granted (e.g. a mortgage which has both an LTV ratio greater than 80 per cent and a maturity longer than 30 years). Therefore, we have re-estimated equation (2) by dropping the cases in which there is an overlap (column IV). Results completely support our previously discussed findings.

6. Concluding remarks

Banks tend to innovate their financial products to reduce the price competition typically associated with the supply of standardized services (the so-called 'commodity trap') and to accommodate the heterogeneity of customers' preferences in accessing the credit market. This process of product diversification began in the domestic market in the first half of the last decade, under the pressure of foreign intermediaries. However, it has been subject to a slowdown in the years following the crisis, most likely because of the riskier profile of these contracts. However, to the best of our knowledge, there are no specific papers focusing on the effects of bank-level and market characteristics that can induce banks to diversify the range of mortgages granted to households, especially during the crisis period.

To fill this gap, we used a special survey on a sample of about 400 Italian banks to analyse the characteristics of non-conventional mortgages over the period 2006-2013. We exploit several features of mortgage loans supplied by the surveyed banks and reported in the survey (e.g. LTV ratio, duration, and other credit standards), in order to build a synthetic indicator to measure the degree of differentiation in the Italian household mortgage market.

We investigated the bank characteristics that are more likely to have an impact on the differentiation process by considering market competition, the adoption of scoring systems and other bank-level features.

Our main findings suggest that larger and less risky banks are more likely to diversify their offer, supplying a larger variety of non-conventional contracts. The adoption of a scoring system to evaluate client creditworthiness increases the probability of offering innovative contractual terms. Banks operating in more competitive markets, or in markets where other banks offer non-conventional loans,

are more likely to diversify their supply of innovative contracts. We also detected a negative impact on the probability of offering non-conventional mortgages as a result of the Great Recession and the Sovereign Debt Crisis, maybe due to the riskier profile of these new contractual terms.

When we investigated the amount of non-conventional mortgages actually granted, most of our results were confirmed, even if we found some differences in the use of scoring systems. Their simple adoption is statistically irrelevant, but the experience gained in their usage and, even more, their strict use in pricing non-conventional mortgages tend to increase the amount of these (usually riskier) loans; on the contrary, their use in the monitoring process has a negative impact on the amount granted, consistently with the increasing selective lending policies followed by banks after the international financial crisis.

Overall, while we are aware that these results should be viewed with some caution since we cannot control properly for demand factors, they confirm that the structure of the local markets does matter and that there could be a non-price competition effect among banks in providing differentiated mortgage contracts.

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Tables

Table 1 - Mortgages with non-conventional features: some stylized facts (1)

Type of mortgages	Mean	p25	p50	p75	Interquartile range	n. obs.	RBSL waves
<i>Panel A: statistics on banks offering innovative mortgages during the period (units and percentages)</i>							
Banks offering at least one innovative contractual terms (LTV ratio>80%, maturity> 30 years, flexible maturity; 0, 1)	0.75	0	1	1	1	2,950	2006-2013
Qualitative indicator (0, 1, 2, 3; supply of none, one, two or three of the three kinds of the previous innovative loans)	1.39	0	1	2	2	2,950	2006-2013
<i>Occurrences (bank-year) = 0</i>	<i>25,2</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>743</i>	<i>2006-2013</i>
<i>Occurrences (bank-year) = 1</i>	<i>27,5</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>810</i>	<i>2006-2013</i>
<i>Occurrences (bank-year) = 2</i>	<i>30,7</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>905</i>	<i>2006-2013</i>
<i>Occurrences (bank-year) = 3</i>	<i>16,7</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>492</i>	<i>2006-2013</i>
<i>Panel B: statistics on the shares of the different kinds of innovative mortgages actually extended during the period (percentages)</i>							
Share of innovative mortgages with LTV ratio>80%, maturity> 30 years, flexible maturity over total new mortgages	30.9	5.7	21.7	41.9	36.2	2,568	2006-2013
<i>LTV ratio>80%</i>	<i>9.5</i>	<i>0.0</i>	<i>3.8</i>	<i>13.2</i>	<i>13.2</i>	<i>2,047</i>	<i>2006-2013</i>
<i>Maturity longer than 30 years</i>	<i>15.2</i>	<i>1.1</i>	<i>11.9</i>	<i>24.5</i>	<i>23.4</i>	<i>2,307</i>	<i>2006-2013</i>
<i>With flexible maturity</i>	<i>12.6</i>	<i>0.0</i>	<i>0.0</i>	<i>10.5</i>	<i>10.5</i>	<i>1,976</i>	<i>2006-2013</i>

(1) Stats in units and percentage values. Values computed as simple statistics (i.e. not-weighted) on the pooled sample on the period 2006-2013.

Table 2 - Banks' balance sheet indicators, territorial concentration, price competition and market diversity: some descriptive statistics – period 2006-2013.

Indicator	Description	Mean	p25	p50	p75	Inter. range	N. obs.
Sizebank	Ln(Total Assets)	20.8	19.9	20.5	21.6	1.8	2,949
ROA (1)	Earnings before taxes/Total Assets	0.5	0.3	0.5	0.9	0.7	2,934
Riskbank (1)	Non-performing loans/Total loans	4.9	2.1	3.7	6.5	4.4	2,935
Equity_ratio (1)	Equity/Total assets	10.5	8.0	10.1	12.4	4.4	2,946
Liquid_ratio (1)	Cash/Total assets	3.6	0.4	0.6	1.4	0.9	2,940
Funding_mix (1)	Funding (deposit and bonds)/Total loans	131.2	108.3	118.5	135.0	26.8	2,949
Market differentiation index (t-1) (2)	Synthetic indicator of the supply of non-conventional mortgages in the markets where the bank operates	2.2	2.0	2.2	2.3	0.3	2,948
Mark up (1)	Average spread between the lending rate charged on mortgages and the interest rate paid on sight deposits where the bank operates (households)	3.6	2.9	3.6	4.2	1.2	2,948
Herfindahl (3)	Average indexes of concentration in the markets where the bank operates	971	850	960	1,087	237	2,948
LendingTightening (4)	Index of supply tightening (2008-2013)	0.10	0.00	0.00	0.25	0.25	2,223
Demand for mortgages (5)	Index of demand for mortgages (2008-2013)	-0.2	-0.5	-0.25	0.0	0.5	2,320
Dummy scoring	The bank has adopted credit scoring to assess households' creditworthiness.	0.5	0.0	1.0	1.0	1.0	2,925
Scoring_grant	Relevance of scores (important or very important) in granting new mortgages	0.4	0.0	0.0	1.0	1.0	2,562
Scoring_price	Relevance of scores (important or very important) in pricing new mortgages	0.1	0.0	0.0	0.0	0.0	2,408
Scoring_monit	Relevance of scores (important or very important) in monitoring extended mortgages	0.3	0.0	0.0	1.0	1.0	2,407

(1) Percentage points. – (2) For more details on this indicator, see Section 3.1 – (3) Average concentration ratio calculated as Herfindahl index considering all banks across all provinces where banks operate, weighted by banks' outstanding mortgages to households in each province. – (4) Positive and negative values indicate respectively a restriction or an improvement of lending conditions to households for house purchases. The range of variation of the index is from -1 to 1. Data are available since 2008. – (5) Positive and negative values indicate respectively an expansion or a reduction in households' demand for mortgages. The range of variation of the index is from -1 to 1. Data are available since 2008.

Table 3 – Correlation matrix

	Size bank	ROA	Risk bank	Equity ratio	Liquid ratio	Funding mix	Dummy top5	Mkt diff.	Mark up	Herfindahl	Lending Tight.	Demand for mortg.	Dummy scoring	Scoring grant	Scoring price	Scoring monet.
Sizebank	1.00															
ROA	-0.11	1.00														
Risk bank	0.04	-0.43	1.00													
Equity_ratio	-0.20	-0.16	0.28	1.00												
Liquid_ratio	-0.08	0.06	0.16	0.13	1.00											
Funding_mix	0.03	0.00	0.02	-0.20	-0.13	1.00										
Dummy top5	0.42	-0.04	0.05	0.05	0.23	0.03	1.00									
Mkt_diff.	0.30	0.04	-0.08	-0.17	0.00	-0.03	0.15	1.00								
Mark up	0.04	0.09	0.10	0.01	0.12	0.07	0.01	0.29	1.00							
Herfindahl	0.14	0.06	0.03	-0.10	0.06	0.08	0.01	0.29	0.09	1.00						
Lending Tightening	0.01	-0.03	-0.01	-0.07	-0.04	0.00	0.01	0.04	0.11	0.06	1.00					
Demand for mortgages	0.00	0.08	-0.08	-0.03	0.00	0.05	-0.05	0.02	-0.08	0.04	-0.29	1.00				
Dummy scoring	0.36	-0.06	0.04	0.06	0.14	0.04	0.32	0.02	0.04	0.13	0.03	0.03	1.00			
Scoring_grant	0.42	-0.08	0.04	0.04	0.14	0.07	0.32	0.11	0.05	0.13	0.04	0.03	0.73	1.00		
Scoring_price	0.03	-0.06	0.11	0.01	0.10	-0.04	0.10	0.01	0.00	-0.01	0.04	-0.07	0.27	0.33	1.00	
Scoring_monit.	0.21	0.03	-0.03	0.06	0.14	-0.07	0.16	0.04	0.04	0.11	0.03	0.00	0.60	0.53	0.17	1.00

Table 4 – Probability of supplying non-conventional mortgages

	Pooled probit estimates (1)			Ordered Probit estimates (2)			Probit with random effects by bank (1), (3)	
	Baseline	Controls on scoring systems	Demand and supply controls	Baseline	Controls on scoring systems	Demand and supply controls	Baseline	Controls on scoring systems
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Size bank	0.281*** (0.0459)	0.259*** (0.0514)	0.350*** (0.0487)	0.200*** (0.033)	0.198*** (0.038)	0.234*** (0.033)	0.393*** (0.0636)	0.394*** (0.0789)
ROA	-0.122** (0.0578)	-0.111 (0.0680)	-0.095 (0.0623)	-0.082** (0.037)	-0.089** (0.045)	-0.063 (0.040)	0.029 (0.0562)	0.077 (0.0699)
Risk bank	-0.064*** (0.0137)	-0.055*** (0.0158)	-0.053*** (0.0134)	-0.047*** (0.012)	-0.047*** (0.014)	-0.035*** (0.011)	-0.044** (0.0185)	-0.036 (0.0220)
Equity_ratio	-0.034** (0.0147)	-0.038** (0.0176)	-0.030* (0.0156)	-0.036*** (0.012)	-0.034** (0.014)	-0.033*** (0.012)	-0.039* (0.0204)	-0.056** (0.0246)
Liquid_ratio	-0.023** (0.0117)	-0.030** (0.0130)	-0.130 (0.1546)	-0.012 (0.009)	-0.018* (0.009)	0.111 (0.135)	-0.027 (0.0187)	-0.030 (0.0222)
Funding_mix	-0.003** (0.0011)	-0.002** (0.0010)	-0.002** (0.0010)	-0.003** (0.001)	-0.003** (0.001)	-0.002** (0.001)	-0.003*** (0.0011)	-0.003** (0.0012)
Dummy top5	-0.379** (0.1755)	-0.516** (0.2107)	-0.213 (0.1897)	0.133 (0.151)	0.120 (0.179)	0.272 (0.166)		
Mark up	-0.408** (0.1910)	-0.601*** (0.2029)	-0.496** (0.2075)	-0.397*** (0.153)	-0.551*** (0.166)	-0.515*** (0.170)	0.159 (0.2521)	-0.084 (0.2891)
Herfindahl	-0.000 (0.0002)	-0.000 (0.0002)	-0.000 (0.0002)	-0.000* (0.000)	-0.000 (0.000)	-0.000** (0.000)	-0.001* (0.0003)	-0.001** (0.0004)
Mkt_differentiation	0.665*** (0.1799)	0.653*** (0.1993)	0.529*** (0.2030)	0.979*** (0.146)	0.958*** (0.164)	0.925*** (0.166)	0.631** (0.2544)	0.671** (0.2981)
Dummy scoring	0.282*** (0.1022)		0.162 (0.1052)	0.178** (0.078)		0.092 (0.081)	0.111 (0.1426)	
Scoring_grant		0.419*** (0.1611)			0.288** (0.114)			0.477* (0.2770)
Scoring_price		-0.245 (0.2523)			-0.006 (0.179)			0.475 (0.4155)
Scoring_monitoring		0.132 (0.1490)			0.018 (0.106)			-0.093 (0.2690)
Lending tightening			-0.092 (0.1833)			-0.117 (0.154)		
Demand for mortgages			0.090 (0.0976)			-0.003 (0.078)		
Constant	-2.961** (1.2813)	-1.511 (1.4457)	-5.129*** (1.1973)				-6.417*** (1.8101)	-5.295** (2.1901)
Cut 1				2.036** (0.988)	1.239 (1.134)	3.068*** (0.913)		
Cut 2				2.930*** (0.988)	2.105* (1.133)	3.993*** (0.914)		
Cut 3				4.046*** (0.992)	3.240*** (1.136)	5.149*** (0.919)		
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,393	1,833	2,070	2,393	1,833	2,070	2,364	1,806
Pseudo_r2	0.163	0.166	0.167					
Clusters	435	372	415	435	372	415	429	366

Notes: (1) The dependent variable is a dummy that equals 1 if a given bank i , at time t , offers at least one of the three kinds of non-conventional mortgages (with an LTV ratio greater than 80 per cent, with a maturity longer than 30 years, or with flexible maturity), and zero otherwise. Robust standard errors in parentheses are clustered at bank-level. (2) The dependent variable is a dummy that equals 1 if a given bank i , at time t , offers one of the three kinds of non-conventional mortgages (with an LTV ratio greater than 80 per cent, with a maturity longer than 30 years, or with flexible maturity), 2 if it offers at least two of them and 3 if it offers all of them; it is zero otherwise. Robust standard errors reported in parentheses are clustered at bank-level. (3) Robust standard errors reported in parentheses. Symbols: *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 5 – Share (percentage) of the total amount (flows) of non-conventional mortgages
(Panel estimations with bank random effects) (1)

	Baseline	Controls on scoring systems	Demand and supply controls	Subsample excluding observations with dependent variable greater than 100%
	(I)	(II)	(III)	(IV)
Size bank	2.890*** (0.8912)	2.897*** (1.0092)	3.013*** (0.9588)	2.639*** (0.6768)
ROA	-1.038 (0.8294)	-0.648 (0.8627)	-0.740 (0.8509)	-1.179 (0.7395)
Risk bank	-0.653** (0.2556)	-0.883*** (0.2579)	-0.602** (0.2585)	-0.100 (0.2087)
Equity_ratio	0.007 (0.2929)	0.265 (0.3519)	-0.151 (0.2927)	0.098 (0.2235)
Liquid_ratio	-0.066 (0.2851)	-0.206 (0.248)	0.922 (3.1020)	-0.132 (0.1921)
Funding_mix	0.019 (0.0318)	0.011 (0.0330)	0.027 (0.0271)	-0.060** (0.0308)
Dummy top5	20.073*** (4.5497)	21.527*** (5.2692)	25.971*** (5.7004)	11.822*** (3.4982)
Mark up	-4.751 (3.9579)	-3.596 (3.2100)	-7.001 (4.3268)	-2.395 (3.0348)
Herfindahl	-0.012** (0.0052)	-0.0070 (0.0050)	-0.007*** (0.0023)	-0.002 (0.0014)
Mkt_differentiation	8.366** (3.3452)	10.507** (3.7846)	6.890* (3.8671)	6.209** (2.4140)
Dummy scoring	0.086 (2.3822)		0.538 (2.7147)	1.384 (1.4898)
Scoring_grant		5.0745 (3.7992)		
Scoring_price		8.572* (5.1593)		
Scoring_monitoring		-6.3288* (3.3000)		
Demand for mortgages			0.114 (1.8225)	
Lending tightening			4.704 (3.5136)	
Constant	-21.146 (26.2354)	-34.817 (25.4565)	7.991 (25.8215)	-15.762 (20.3870)
Year Dummies	YES	YES	YES	YES
Observations	2,160	1,638	1,895	2,020
Clusters	426	356	413	423
R2 (Overall)	0.0976	0.1164	0.1198	0.1055

Notes: Panel estimations, with bank random effects, on the sample of banks in the Bank of Italy's Survey, over the estimation period 2006-2013. Robust standard errors are reported in parentheses. Symbols: *** significant at 1%, ** significant at 5%, * significant at 10%. – (1) The dependent variable is the share (percentage) of the total amount (flows) of the three kinds of innovative mortgages offered by Italian surveyed banks (mortgages with an LTV ratio greater than 80 per cent, with a maturity longer than 30 years, or with flexible maturity), and scaled by the total flows of mortgages recorded by each bank in the Survey. In less than 10 per cent of the observations the share is greater than 100 per cent, because some mortgages can be non-conventional for more than one contractual term.