

# **Households Rejecting Loan Offers from Banks. If, When, and Why?**

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## **Abstract**

Using the U.S. home mortgage data between 2007 and 2012, this paper looks at applications approved by lender but not accepted by applicant. Evidence shows that less risky applicants with higher income to loan size ratio are more likely to reject loan offers from lenders. Concentrated lenders that focus on one or a few markets and therefore have higher acceptance rate and higher proportion of lending to jumbo mortgages are less likely to be rejected by applicants. This evidence are in line with previous studies showing that concentrated lenders gain information advantage by investing more in private information collection. This paper adds to the literature by showing that information advantage gained by concentrated lenders lowers the probability for them to be denied by applicants. (125 words)

## 1. Introduction

Banking literature usually assumes that it is usually lenders who have the power to reject borrowers and borrowers seldom decline offers from lenders as long as the latter don't change loan terms. But is this truly the case?

This is actually very true in corporate lending, especially for small and medium sized firms who suffered a lot during the crisis period when banks started reducing lending in response to funding shocks. However, the bargaining power of banks is smaller when it comes to private lending, such as home mortgage lending.

One possible reason is that relative to SMEs, households usually have more bargaining power over banks. Another possible reason is that not like SMEs who rely heavily on bank financing, households' financing needs are usually much smaller even when they are interested in buying a house, which give them more options of funding sources. Not only banks, but also non-bank financial institutions, even families and friends, all of them can make a good way of household financing.

On average, about 10% of approved loan applications end up being rejected by applicants in U.S. between 2007 and 2012 (see. Figure 1). This ratio was at around 15% in 2007, kept declining until 5% in 2009, and increased back to about 7% in 2012. Figure 2 shows the general trend of housing price index in U.S. during the same period, which follows the similar pattern as the rejection rate in Figure 1. This is understandable as the change of house price is for sure an important factor that may influence peoples' decision of accepting the mortgage offer. We also find evidence in support of such argument.

Using a rich database of U.S. mortgage market between 2007 and 2012, this paper asks the following three questions: Who are the applicants that are more likely to reject lenders? Particularly, are they risky? Who are the lenders that are less likely to be rejected by applicants? Why is that? What makes lenders less likely to be rejected by applicants?

To the best of our knowledge, this is the first paper that looks at this particular type of loans that are approved by lenders but not accepted by applicants, which is the novelty of our paper. At the same time, we hope this paper will have implications for

financial institutions in a sense that would help them minimize the loss caused by being rejected by applicants. Lastly, we hope our paper will shed lights on studies that try to relate household finance to banking. It is either the current household finance literatures look at banks as a black box, or banking literatures seldom consider the cases when applicants have that power to reject lenders, there is little interaction between household and lenders. This paper also tries to fill this gap in literatures.

Focusing at loans that are approved by lenders only, We claim the following argument as answers to the three questions mentioned above: Less risky applicants with higher income to loan size ratio are more likely to reject lenders. Concentrated lenders that operate in one or a few markets are less likely to be rejected by applicants. Compared to lenders who are more likely to be rejected by applicants, lenders who are less likely to be rejected by applicants usually have higher loan acceptance rate, and lower proportion of non-jumbo mortgages relative to jumbo-mortgages. In lines with previous literatures, lenders who have more incentive to invest in private information collection and therefore have information advantage over other lenders, usually have higher loan acceptance rate and less non-jumbo mortgage lending, which is in support of the argument that concentrated lenders' information advantage over diversified lenders make them less likely to be rejected by applicants.

The paper is organized as follows. Section 2 provides a brief literature review and identification strategy applied in this paper. Section 3 describes the data. In section 4, an empirical model is built and cross-sectional and panel regression analysis of the type of applicants and lenders are conducted, where all the loan, applicant, lender and market characteristics are served as explanatory variables. Section 5 analyzed the regression results and section 6 summarizes and concludes.

## **2. Literature Review**

### **2.1 Shopping around applicants**

We borrow theories from a strand of relevant literature called “Winner’s Curse” which looks at shopping around applicants (Broecker, 1990, and Shaffer, 1998). Their studies identify an adverse selection problem faced by banks and show that risky

applicants shop around until some bank is willing to grant a loan. Their main conclusion is that the average credit worthiness of the pool of applicant is systematically degraded as a function of the number of banks. They claim the main reason is that the proportion of applicants who pass the test of at least one bank increases with the number of banks providing credit.

The most relevant part of their work to this paper is that they show risky applicant will stop shopping around once they receive an offer from a bank, they will accept the offer immediately. The reason for them to do so is very obvious. Risky applicants seldom choose to wait for the next offer. Because they know that they don't have good quality, so if they decline the offer and choose to wait, the next result from lenders is very likely to be rejection and no one knows how long they have to wait for the next loan offers. Based on this analysis, we come up with our first hypothesis:

**Hypothesis 1:** Relative to applicants with lower income to loan size ratio, less risky applicants with higher income to loan size ratio are more likely to reject loan offers from lenders.

## **2.2 Concentrated Lenders with information advantage**

Another strand of relevant literature is from Loutskina and Strahan (2011), in which the authors find that relative to diversified lenders, concentrated lenders that operate in one or a few markets are considered to be informed lenders as they are better able to collect information that is costly to transmit to others and have more incentive to do so. Given that the information advantage owned by concentrated lenders may allow them to know their clients better and therefore price loans more accurately and serve their clients better, we come up with our second hypothesis:

**Hypothesis 2a:** Relative to diversified lenders, concentrated lenders is less likely to be rejected by applicants due to information advantage.

In addition, Loutskina and Strahan (2011) also show that concentrated lenders have higher loan acceptance rate and are more active in jumbo mortgage segment.

It is easy to understand that concentrated lenders have higher loan acceptance rate because in the extreme where information is complete and risks are fully priced, all

applications could be accepted.

Jumbo mortgage is a type of loan that exceeds the loan size limit at around \$ 417,000 set by two GSEs (Government Sponsored Enterprise) Fannie Mae and Freddie Mac. Therefore, jumbo mortgages are more costly to sell, in part because of the absence of GSE subsidies and in part because of their excessively large size. So lenders thus have more incentive to collect private information in the jumbo segment. In line with the argument that concentrated lenders invest more in private information collection, they should be more active in the jumbo segment relative to diversified lenders too.

Hence, in addition to the hypothesis 2a, we add two supplementary hypotheses that are derived from the same theory and in support of hypothesis 2a as following:

**Hypothesis 2b:** Lenders that are more likely to be rejected by applicants are expected to have lower loan acceptance rate than lenders that are less likely to be rejected by applicants.

**Hypothesis 2c:** Lenders that are more likely to be rejected by applicants are expected to be less active in jumbo segment, compared to lenders that are less likely to be rejected by applicants.

### **3. Data**

#### **3.1 HMDA data**

We build our database from a comprehensive sample of mortgage applications and originations collected by the Federal Reserve from 2007 to 2012 under the provisions of the Home Mortgage Disclosure Act (HMDA). Regulators use HMDA data to help identify discriminatory lending. All commercial banks, savings institutions, credit unions and mortgage companies) with more than \$30 million in assets must provide the required information. The HMDA data is a detailed loan application level database containing 14-41 million loans application reported by about 7.5 thousand financial institutions each year, which covers on average over 90% of mortgage dollars issued in the US every year.

[Insert Table 1 here]

Table 1 gives an example of what does the raw HMDA data looks like. To save space,

we only list part of variables. The unit of observation is each loan application, and it has institution ID, property location, loan amount, loan purpose, pre-approval status et al, and applicant characteristics, such annual income, sex, race, ethnicity, and everything about the co-applicant as well. The disadvantage of the data is that applicant ID is not available, so it is very hard to identify how many applications does a specific applicant submits and which lender does he finally select for the sake of advantages of that lender over the other lenders from whom he applied for mortgages. So for now, we mainly focus on identifying a general relationship between lender characteristics and applicants' rejection decision.

An important variable is the action type, which contains the following 8 groups as shown in Table 2. In our sample, only loans of action type 1 which are loans originated, action type 2 which are applications approved but not accepted by applicant and action type 4 which are applications withdrawn by applicants. 84% percent of observations in the final sample are of action type 1 and the rest two types take up 8% respectively.

[Insert Table 2 here]

As mentioned above, counter offer is not a problem in our sample. Here we're particularly interested in loans with action type 1 and 2, which presumably are loans of similar credit quality as they all get approved by lenders. We also add action type 4 which are applications withdrawn by applicants into the sample and use it for robustness tests later on.

In addition to the variables listed above in Table 1, HMDA database also contains a substantial number of loan characteristics such as loan type (insured by Federal Housing Administration or Veterans Administration et al), property type (One to four-family, multi-family or manufactured housing) and owner occupancy (Owner-occupied as a principal dwelling or not). To simplify analysis, we keep only loans that are conventional loans (any loan other than FHA, VA, FSA, or RHS loans), and non-manufacturing housing and owner-occupied as a principal dwelling, which consist about 70% loans from the raw sample. All variables identifying applicant characteristics are included as control in regressions, such as applicant and

co-applicant sex, race, ethnicity, annual income et al. Later on, after adding lender financial information from Call Report, housing price index from FHA, MSA level demographic characteristics from Census Bureau and local banking market characteristics from SOD and HMDA, we drop loans without complete controls mentioned above, which leaves me with our final sample, including about 4,230 financial institutions reporting 9,823,358 loans with properties located in 388 Metropolitan Statistical Areas between 2007 and 2012.

### **3.2 Identification strategy**

One thing needs to be concerned is the counter offer, which happens when lender offers to the applicant to make the loan on different terms or in a different amount from the terms or amount applied for. But this is not a problem in our data as if a lender offers counter offer to applicant, it would be considered as a loan rejection if the applicant turns down the counteroffer or does not respond. If the applicant accepts it, then it will become an originated loan. Put differently, if an applicant decides to reject the offer, what he rejects is the loan with exactly the same terms as he submits his mortgage application. In other words, applicants make the decision to reject the loan approval at their will. This helps me to rule out the concern that applicants are “forced” to reject the loan because lenders make the loan on different terms.

Another problem is endogeneity, which will happen if the applicant rejection rate and characteristics of lenders are not truly correlated with each other, and both of them are actually driven by some other factors, for example, change of house price. To solve this problem, we need to first answer the following question: what could be the reasons for an applicant to reject an offer?

Here we list all possibilities that we can think of as reasons why applicant rejects an offer and we categorized them into the following 4 groups:

*Reason 1:* Change of house price: figure 1 and 2 also find that average applicant rejection rate and house price follow the similar pattern in U.S. between 2007 and 2012. This is very easy to understand because applicants might reject mortgages when house price changes in a way that goes against the value of their mortgages.

results actually also confirm this claim. In order to rule out the influence of house price change and clean our results, we add the yearly change of house price index at MSA level as a control.

*Reason 2:* Unexpected accidents happen to applicants: such as car accident, heart attack, being fired, disasters, or house sellers broke their promise and sell the houses to other people who come late but offer higher bids, et al. Given that the probability of having these accidents varies across people, we cannot fully control it, for now we just add the layoff rate and real GDP growth rate at MSA level to control for the probability for applicant to lose a job. For the rest, we claim that most of the accidents mentioned above are small-probability events, which can be assumed as rarely happen in reality.

*Reason 3:* Applicants apply mortgages from multiple lenders: then they will choose one and reject the others. This is the circumstances that we're particularly interested in. As for the applicants who apply for multiple mortgages, they might choose one and decline the others for the sake of lower interest rates or better service. Then a meaningful question to ask in this case is why can some banks provide lower interest rate than the others? Are they better pricing the mortgage or they are taking extra risk by mistakenly pricing the loan?

*Reason 4:* Applicants get funding from families or friends, or any other funding sources other than financial institutions: for instance, lottery. Again, we cannot control for the probability for the applicant to win a lottery, or get financial support from their families, but we tend to believe that if that is the case, then mortgage would become their second-best choice as family support and lottery require little or no interest rate. So if the applicant submit their application, it's very likely that the applicant has no or limited access to family lending or lottery. Even if they still want to apply for mortgage just as a backup plan, then the interesting question would be which bank do they choose as a backup plan, and in the end of the day, the bank get rejected when the applicant's first-best plan works out.

To sum up, no matter due to what reason applicants decide to reject loan offers from lenders, after controlling for applicant specific characteristics that could influence



applicants' decisions, and trend of house price and economic activity at local level that could drive both lenders' behavior and applicants' decisions, we're trying to show that some of characteristics of lenders can explain the variation among applicants' decision to reject a loan or not.

#### **4. Summary statistics**

Table 3-1, 3-2 and 3-3 presents definitions of all the variables of loan, bank and market characteristics and a brief summary statistic for all of them, which are served as dependent and independent variables in this paper.

[Insert Table 3-1 here]

[Insert Table 3-2 here]

[Insert Table 3-3 here]

In this paper, concentrated lender is defined as lender whose HHI index of lending across MSA exceeds 0.5. In robustness test, we redefine concentrated lenders as those with more than 65% or 75% loans lend to properties located within a MSA. Rejection rate equals to the percentage of loan offers rejected by applicants among all loan offers.

In the final sample, on average, applicant who earns \$ 106,000 every year applies for a mortgage with \$183,000, he gets interest rate at 4%. There are 387 lenders in MSA, among which about 8% are concentrated lenders. House price drops about 6% every year between 2007 and 2012. The lenders' average total asset is \$517,000,000, about 63% of their gross loans are real estate loans, 71% of their asset is deposit, and equity capital takes about 10% in their assets.

#### **5. Empirical model**

##### **5.1 Type of applicants that are more likely to reject lenders**

For the analysis of the type of applicants who tend to reject lenders after loan approval, we report Logit regressions at loan application – year level using the following structure.

***Loan Acceptance<sub>i</sub>***

$$\begin{aligned} &= \alpha + \beta_1 * \text{Income to loan size ratio}_i + \beta * X_i + \gamma_1 \\ &* \text{Concentrated Lender}_{jt} + \gamma * Y_{jt} + \delta_1 * \text{Growth HPI}_{mt} + \delta \\ &* Z_{mt} + \text{Year, MSA FE} + \varepsilon_i \end{aligned} \tag{1a}$$

where *Loan Acceptance<sub>i</sub>* is a dummy which equals to 1 if applications are accepted by applicants after lender's approval, otherwise 0.  $X_i$  are a vector of loan characteristics for each loan  $i$ ,  $Y_j$  is a vector of bank characteristics for each bank  $j$ , and  $Z_m$  is a vector of local market characteristics for each region where the property is located. Standard errors are collected at lender level and year and MSA Fixed effects are added in the regression.

According to hypothesis 1,  $\beta_1$  is expected to negative as risky applicant with lower income to size ratio are more likely to accept offers. Additionally, we should observe positive and significant coefficient  $\gamma_1$  too, because concentrated lenders are less likely to be rejected by applicants if hypothesis 2a is correct.

***Loan Acceptance<sub>i</sub>***

$$\begin{aligned} &= \alpha + \theta * \text{Income to loan size ratio}_i * \text{Conce. Lender}_{jt} \\ &+ \beta_1 * \text{Income to loan size ratio}_i + \gamma_1 * \text{Conc. Lender}_{jt} + \beta \\ &* X_i + \gamma * Y_{jt} + \delta_1 * \text{Growth HPI}_{mt} + \delta * Z_{mt} + \text{Year, MSA FE} \\ &+ \varepsilon_i \end{aligned} \tag{1b}$$

The following step is interacting income to loan size ratio with concentrated lender dummy as shown in equation (1b), which is similar to equation (1a) except for the interaction term. It's unclear what would be the sign for the coefficient of the interested variable  $\theta$  given that there are two opposing effects work at the same time. It is expected to observe a positive  $\theta$  if the positive relationship between applicant acceptance and lender concentration dominates the negative relationship between

applicant acceptance and applicant income to loan size ratio, and vice versa.

## 5.2 Type of lenders that are more likely to be rejected by applicants

The next step is evaluating what type of lenders is more likely to be rejected. This time we choose to run OLS regressions with panel data at lender-year level, as shown in equation (2a) – (2c):

***Applicant rejection rate<sub>jt</sub>***

$$= \alpha + \beta_1 * \text{Conc. Lender}_{j,t} + \gamma * Y_{jt} + \text{Year, Lender FE} + \varepsilon_{jt} \quad (2a)$$

According to hypothesis 2a,  $\beta_1$  is expected to be negative and significant because concentrated lenders are less likely to be rejected by applicants.

***Loan Acceptance rate<sub>jt</sub>***

$$= \alpha + \beta_1 * \text{Denied Lender}_{j,t} + \beta_2 * \text{Conc. Lender}_{j,t} + \gamma * Y_{jt} + \text{Year, Lender FE} + \varepsilon_{jt} \quad (2b)$$

***Non – Jumbo Mortgage Ratio<sub>jt</sub>***

$$= \alpha + \beta_1 * \text{Denied Lender}_{j,t} + \beta_2 * \text{Conc. Lender}_{j,t} + \gamma * Y_{jt} + \text{Year, Lender FE} + \varepsilon_{jt} \quad (2c)$$

Where  $\text{Denied Lender}_{j,t}$  is a dummy which equals to 1 if the average applicant rejection rate of the lender  $j$  in year  $t$  is above median,  $\text{Acceptance rate}_{j,t}$  is the percentage of originated loans among all received loan applications of bank  $j$  in year  $t$ ,  $\text{Non – Jumbo Mortgage Ratio}_{j,t}$  is the percentage of non-jumbo mortgages among all mortgages originated by bank  $j$  in year  $t$ . Standard errors are clustered at lender level. Year and lender fixed effects are added into all regressions.

According to hypothesis 2b and 2c, we are expected to observe positive  $\beta_1$  in equation (2b) and negative  $\beta_1$  in equation (2c).

## **6. Results**

### **6.1 Who are the applicants that are more likely to reject lenders?**

Table 4 reports T-test of loan amount, applicant annual income and income to loan amount ratio across three action types. Result shows that compared to applicants that accept loans, applicants who reject lenders earn similar income but apply for mortgages with significantly smaller amount, and end up have significantly higher income to loan amount ratio than the rest, meaning that those are less risky applicants relative to the other applicants. Applicants who withdraw loans applications (i.e. action type 4) are clearly the riskiest ones as they have the lowest income to loan size ratio.

Table 5-1 presents regression results with logit model as shown in equation (1a) and the results are consistent with results of T-test. Dependent variable is loan acceptance dummy which is 1 if applicant accepts the loan offers from lenders and 0 otherwise. In all 8 columns, the significant and negative coefficient of income to loan size ratio suggests that applicant with high income to loan size ratio are less likely to accept loan. Since credit score of each applicant is not available, we cannot simply conclude that applicants with high income to loan size ratio are necessarily have high credit quality. But at least they are less likely to be risky applicants given that they have higher income to loan size ratio. Therefore, we claim that less risky applicant with higher income to loan size ratio are more likely to reject lenders, and these results are in supportive of our hypothesis 1.

In the last six columns, we add concentrated lender dummy into regressions and find that coefficient of concentrated lender is positive and significant in all four out of six specifications, which means that applicants are more likely to accept loan offers of concentrated lenders. This partly supports hypothesis (2a) that concentrated lenders are less likely to be rejected by applicants, although the reason hasn't been clear yet and still needs to be explored in the next step. Results are robust to year fixed effects and state or MSA fixed effects.

Regression results with interaction term as in equation (1b) are shown in Table 5-2.

Dependent variable is the loan acceptance dummy which is the same as in Table 5-1. In all four specifications, the interaction terms are positive and significant, meaning that applicants who received approvals from concentrated lenders and have higher income to loan size ratio are more likely to accept the approvals. Notice that the economic meaning of the coefficient of interaction term is slightly smaller than that of the coefficient of concentrated lender dummy, which makes sense as it is partially cancelled out by the opposing effect from the negative coefficient of income to loan size ratio. Put differently, the positive relationship between applicant acceptance and lender concentration dominates the negative relationship between applicant acceptance and applicant income to loan size ratio, and this explains why we observe positive and significant coefficient for the interaction term of applicant income to loan size ratio and concentrated lender dummy.

## **6.2 Who are the lenders that are more likely to be denied?**

Table 6-1 reports panel regression results with OLS model as shown in equation (2a). Dependent variable is average applicant rejection rate of the lender. Results show that concentrated lender dummy has negative and significant coefficient in all specifications, meaning that concentrated lenders generally have lower being rejected rate by applicants, which is consistent with results in Table 4 and also supports hypothesis 2a. Then we also run cross-sectional regressions in each year with the same specifications and the results are shown in Table 6-2 and 6-3. In all 12 but 1 columns, concentrated lender dummy have negative coefficient as expected in hypothesis 2a. The coefficient remains significant in 6 out of 12 specifications. This result provides convincing evidence that the relationship between lender concentration and applicant rejection decision is not driven or affected by any general trend in MSA, and is robust across years.

Table 7 reports regression results with OLS model as shown in equation (2b) and (2c). Dependent variables are loan acceptance rate and non-jumbo mortgage ratio of lenders as explained before. The main independent variable is denied lender dummy which equals to 1 if the lender is more likely to be rejected by applicants than at least

50% of the rest lenders. In column 1, the negative and significant coefficient of denied lender suggests that loan acceptance rate of denied lender are lower than their peers, while the positive and significant coefficient of concentrated lenders suggests that they tend to have higher loan acceptance rate due to their information advantage over other diversified lenders. Similarly, we find positive coefficient for denied lender and negative coefficient for concentrated lender in regressions where dependent variable is non-jumbo mortgage ratio, which suggests that lenders that are more likely to be rejected by applicants are likely to more issue non-jumbo mortgages while concentrated lenders tend to issue more jumbo-mortgages. Results with concentrated lenders are consistent with previous studies of Loutskina and Strahan (2011). Suppose concentrated lenders' information advantage story showing that information advantage drives concentrated lenders become less likely to be rejected by applicants holds here, as long as information is the main factor driving the results, then the information disadvantage story should hold for lenders that are more likely to be rejected by applicants too, except that all impact should have opposite sign now. Results in Table 6 perfectly support this hypothesis.

## **7. Robustness Test**

In Table 5, 6 and 7, results are first shown with variables calculated based on loan volume, then they are replaced by variables calculated based on loan number, and results remain the same.

Then we redefine concentrated lender as those have more than 65% or 75% originated mortgages lend to applicants with properties located within one specific MSA, and result doesn't change.

## **8. Conclusion**

This paper looks at detailed loan level data, in particular for the loans offers rejected by applicants. The results show that less risky applicants with higher income to loan size ratio are more likely to reject lenders after their applications get approved. we also find that concentrated lenders are less likely to be rejected by applicants due to

the information advantage they gained by investing more in private information collection. In line with previous studies that shows concentrated lenders also tend to have higher loan acceptance rate and be more active in jumbo segment, this paper finds that those lenders that are more likely to be rejected by applicants have relatively lower acceptance rate and be more active in non-jumbo segment relative to lenders that are less likely to be denied by applicants, and this effect is significant even after controlling for concentrated lender effect.

## References

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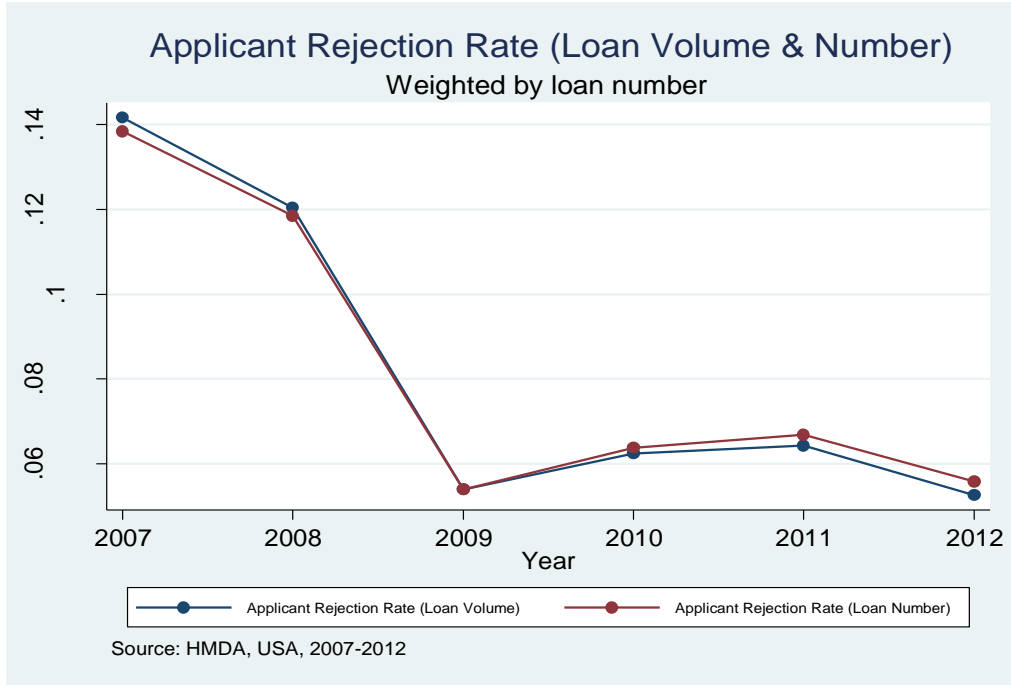
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## Appendix

**Figure 1. Applicant Rejection Rate 2007 - 2012**



**Figure 2. Housing Price Index 2007 - 2012**



**Table 1. HMDA Data Example**

Institution ID	Property MSA	Action Type	Loan Amount (\$000)	Applicant Annual Income (\$000)	Interest Spread	Loan Purpose	Pre-approval	Applicant Ethnicity	Applicant Race	Applicant Sex	Lien Status
10000013044	10180	1	116	41	3.47	1	2	2	5	1	1
10000013044	10180	1	170	82	-	1	1	3	6	3	1
30000016701	10180	1	175	84	-	3	3	2	5	2	1
10000013044	10180	1	39	32	-	3	3	1	5	2	1
30000016701	10180	1	75	24	4.32	3	3	2	5	2	1
10000000008	10180	1	123	83	-	1	3	2	5	1	1
10000000008	10180	2	71	62		1	3	3	6	3	1
10000004166	10180	1	64	64	-	2	3	2	5	1	1
10000004166	10180	1	110	40	-	3	3	2	5	1	1
10000013044	10180	1	102	68	-	1	1	1	5	1	1

**Table 2. HMDA Loan Action Type**

Loan Action Type	Percent in database	Percent in sample
<i>1 -- Loan originated by financial institution</i>	<b>39%</b>	<b>84%</b>
<i>2 -- Application approved but not accepted by applicant</i>	<b>7%</b>	<b>8%</b>
3 -- Application denied by financial institution	22%	
<i>4 -- Application withdrawn by applicant</i>	<b>9%</b>	<b>8%</b>
5 -- File closed for incompleteness	3%	
6 -- Loan purchased by the institution	18%	
7 -- Preapproval request denied by financial institution	0.90%	
8 -- Preapproval request approved but not accepted (optional reporting)	0.80%	

Source: HMDA.

**Table 3. Variable definitions****Table 3-1 Loan Characteristics**

<b>Variable</b>	<b>Labels</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Obs</b>
Loan Volume	Amount of mortgage, in thousand USD	183.02	179.92	9,823,358
Income	Applicant annual income, in thousand USD	106.40	132.08	9,823,358
Income / Loan size	Applicant income / Loan volume	0.95	1.38	9,823,358
Loan Rate Spread	in %, only available for a small part of originated loans	4.07	1.59	428,087
Loan Purpose	1 if Home purchase; 2 if Home improvement; 3 if Refinance	2.44	0.85	9,823,358
Preapproval status	1 if Preapproval was requested, 2 if not, 3 if not applicable.	2.85	0.42	9,823,358
Lien Status	1 if Secured by a first lien, 2 if Secured by a subordinate lien, 3 if Not secured by a lien, 4 if Not applicable (purchased loans)	1.12	0.38	9,823,358
Applicant Ethnicity	1 if Hispanic or Latino, 2 if not, 3 if Information not provided by applicant, 4 if not applicable	2.05	0.38	9,823,358
Applicant Race	1 if American Indian or Alaska Native, 2 if Asian, 3 if Black or African American, 4 if Native Hawaiian or Other Pacific Islander, 5 if White, 6 if Information not provided by applicant, 7 if Not applicable	4.90	0.80	9,823,358
Applicant Sex	1 if Male, 2 if Female, 3 if Information not provided by applicant, 4 if Not applicable.	1.38	0.61	9,823,358
Co-Applicant Ethnicity	1 if Hispanic or Latino, 2 if not, 3 if Information not provided by applicant, 4 if not applicable, 5 if no co-applicant	3.33	1.48	9,823,358
Co-Applicant Race	1 if American Indian or Alaska Native, 2 if Asian, 3 if Black or African American, 4 if Native Hawaiian or Other Pacific Islander, 5 if White, 6 if Information not provided by applicant, 7 if Not applicable, 8 if No co-applicant	6.26	1.62	9,823,358

Co-Applicant Sex	1 if Male, 2 if Female, 3 if Information not provided by applicant, 4 if Not applicable, 5 if No co-applicant.	3.26	1.55	9,823,358
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Source: HMDA.

**Table 3-2 Bank Characteristics**

Variable	Labels	Mean	Std. Dev.	Obs
Total Assets	Total Assets, thousand USD	5.17E+08	6.12E+08	9.82E+06
Liquidity Ratio	(Federal Funds Sold & Resales + Trading Account Assets + Held-to-Maturity Securities + Available-for-Sale Securities + Total Earning Assets) / Average Total Assets	25.8	12.85	9.82E+06
Intangible Assets / Total Assets	Intangible Assets / Total Assets	0.03	0.03	9.82E+06
Total Deposits / Total Assets	Total Deposits / Total Assets	0.71	0.13	9.82E+06
Equity Capital / Total Assets	Equity Capital / Total Assets	0.10	0.03	9.82E+06
Net Income / Total Assets	Net Income / Total Assets	0.01	0.01	9.82E+06
Real Esatate Loans / Gross Loans	Real Esatate Loans / Gross Loans	63.1	15.60	9.82E+06
Financial Institution Loans / Gross Loans	Financial Institution Loans / Gross Loans	1.0	1.87	9.82E+06
Agriculture Loans / Gross Loans	Agriculture Loans / Gross Loans	0.9	2.54	9.82E+06
Commercial & Industry Loans / Gross Loans	Commercial & Industry Loans / Gross Loans	16.7	7.86	9.82E+06
Loan to Individuals / Gross Loans	Loan to Individuals / Gross Loans	10.8	8.34	9.82E+06
Yield on Total Loans and Leases	Yield on Total Loans and Leases	5.8	1.20	9.82E+06
Cost of Total Interest Bearing Deposits	Cost of Total Interest Bearing Deposits	1.7	1.19	9.81E+06
Annual change in TIER 1 Capital	Annual change in TIER 1 Capital	23.8	71.27	9.78E+06

HHI of lending across MSAs	Calculated based on originated loan amount	0.22	0.30	9.82E+06
Concentrated Lender	Dummy:1 if HHI of lending across MSAs is larger than 0.5.	0.18	0.38	9.82E+06
Mortgage acceptance rate	Percentage of originated loans among in all loan applications	0.78	0.12	9.82E+06
Jumbo mortgage ratio	Percentage of jumbo mortgage in all originated loans	0.86	0.11	9.82E+06

Source: Call Report, HMDA.

**Table 3-3 Market Characteristics**

Variable	Labels	Mean	Std. Dev.	Obs
Growth Housing Price Index	Housing Price Index[t]/Housing Price Index[t-1] -1	(0.06)	1.41	9.82E+06
Nr Institutions reporting HMDA in MSA	Nr Institutions reporting HMDA in MSA	387.14	181.90	9.82E+06
Nr Concentrated lenders in MSA	Lender is concentrated if HHI of its geographical diversity of loan distribution exceeds 0.5, based on originated loan amount.	34.81	35.97	9.82E+06
Percent Concentrated lenders in MSA	Percent of concentrated lenders among all lenders in MSA.	0.08	0.06	9.82E+06
HHI of all lenders in MSA	Calculated based on originated loan amount.	0.23	0.19	9.82E+06

Source: HMDA, FHA.

**Table 4. Loan amount, Applicant Income and Income ratio by Action Type**

<b>Action Type</b>	<b>Freq.</b>	<b>Percent</b>	<b>Loan Amount</b>	<b>Applicant Income</b>	<b>Applicant Income / Loan Amount</b>
1 -- Loan originated	8,212,329	83.6	181.94	106.13	0.95
2 -- Application approved but not accepted	745,574	7.59	169.28	104.54	1.21
4 -- Application withdrawn by applicant	865,455	8.81	205.12	110.57	0.76
Total	9,823,358	100	<b>T-test results</b>		
			<b>4 &gt; 1 &gt; 2</b>	<b>4 &gt; 1 &gt;= 2</b>	<b>2 &gt; 1 &gt; 4</b>

Notes: T-test results show significant differences between three action type groups. Detailed table are available upon request.

**Table 5-1. Who are the applicants that reject lenders?**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b><i>Variables of interest</i></b>								
<b>Applicant</b>	<b>-0.060**</b>	<b>-0.060**</b>	<b>-0.060**</b>	<b>-0.060**</b>	<b>-0.059**</b>	<b>-0.060**</b>	<b>-0.059**</b>	<b>-0.059**</b>
<b>Income / Loan</b>								
<b>Amount</b>	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
<b>Concentrated</b>			<b>0.199</b>	<b>0.236*</b>	<b>0.201</b>	<b>0.241*</b>	<b>0.239*</b>	<b>0.275*</b>
<b>Lender</b>			(0.064)	(0.032)	(0.061)	(0.022)	(0.030)	(0.010)
<b><i>Other Market level control</i></b>								
Lag Percent					<b>-0.728*</b>	<b>-4.185***</b>	<b>-0.787*</b>	<b>-4.856***</b>
Conc. Lenders in MSA					(0.021)	(0.001)	(0.017)	(0.000)
Lag Growth	0.031***	0.022**	0.031***	0.031***	0.030***	0.018*	0.030***	0.017*
House Price Index	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.015)	(0.000)	(0.025)
HHI					0.249 (0.788)	0.696 (0.326)	0.190 (0.867)	1.500 (0.159)
<b><i>Other Bank level control (All in Lag)</i></b>								
Log Total Assets	-0.136*** (0.000)	-0.137*** (0.000)	-0.119*** (0.000)	-0.116*** (0.000)	-0.118*** (0.000)	-0.116*** (0.000)	-0.115*** (0.000)	-0.114*** (0.000)
Liquidity Ratio	0.030*** (0.000)	0.031*** (0.000)	0.030*** (0.000)	0.030*** (0.000)	0.030*** (0.000)	0.030*** (0.000)	0.030*** (0.000)	0.030*** (0.000)
Total Deposits / Total Assets	-0.852 (0.062)	-0.862 (0.060)	-0.957* (0.044)	-0.984* (0.040)	-0.964* (0.043)	-1.000* (0.035)	-0.992* (0.039)	-1.031* (0.031)
Real Esatate Loans / Gross Loans	-0.042* (0.020)	-0.042* (0.019)	-0.040* (0.023)	-0.040* (0.023)	-0.041* (0.023)	-0.040* (0.021)	-0.040* (0.023)	-0.040* (0.022)
Commercial & Industry Loans / Gross Loans	-0.046** (0.006)	-0.046** (0.006)	-0.045** (0.007)	-0.044** (0.007)	-0.045** (0.008)	-0.044** (0.007)	-0.044** (0.008)	-0.044** (0.007)
Loan to Individuals / Gross Loans	-0.047** (0.009)	-0.046** (0.010)	-0.046** (0.009)	-0.046** (0.009)	-0.046** (0.009)	-0.046** (0.010)	-0.046** (0.009)	-0.045** (0.010)
<b><i>Other loan level control</i></b>								
Log HMDA Loan Amount	-0.040 (0.133)	-0.041 (0.131)	-0.040 (0.135)	-0.040 (0.136)	-0.040 (0.130)	-0.039 (0.143)	-0.040 (0.131)	-0.039 (0.149)
HMDA Loan Purpose	0.004 (0.879)	0.007 (0.818)	0.004 (0.891)	0.004 (0.891)	0.004 (0.901)	0.007 (0.818)	0.004 (0.902)	0.007 (0.815)
HMDA Preapproval	-0.181** (0.007)	-0.187** (0.004)	-0.182** (0.007)	-0.182** (0.007)	-0.181** (0.007)	-0.189** (0.004)	-0.181** (0.007)	-0.189** (0.004)
HMDA Applicant Ethnicity	-0.063 (0.248)	-0.075 (0.179)	-0.062 (0.258)	-0.061 (0.260)	-0.062 (0.253)	-0.074 (0.184)	-0.061 (0.258)	-0.074 (0.184)

HMDA	-0.103***	-0.105***	-0.102***	-0.102***	-0.102***	-0.104***	-0.101***	-0.103***
Co-Applicant								
Ethnicity	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HMDA Applicant	0.046***	0.050***	0.046***	0.046***	0.046***	0.051***	0.046***	0.051***
Race	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HMDA	0.018*	0.020*	0.018*	0.018*	0.019*	0.020*	0.019*	0.020*
Co-Applicant								
Race	(0.039)	(0.012)	(0.039)	(0.038)	(0.023)	(0.012)	(0.022)	(0.011)
HMDA Applicant	-0.071***	-0.066***	-0.071***	-0.071***	-0.071***	-0.066***	-0.071***	-0.066***
Sex	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HMDA Lien	-0.291***	-0.290***	-0.292***	-0.292***	-0.293***	-0.289***	-0.293***	-0.289***
Status	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	7.952***	30.855***	7.730***	7.665***	6.964***	27.926***	6.911***	26.240***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Observations	7,488,691	7,488,691	7,488,586	7,488,586	7,488,586	7,488,586	7,488,586	7,488,586
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
State FE	yes	no	yes	no	yes	no	yes	no
MSA FE	no	yes	no	yes	no	yes	no	yes

Notes: Robust p value in parentheses (\*\*\*)  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ ). Some independent variables are not shown in the table to save space. Dependent variable is loan acceptance which is 1 if applicant accepts loan after lender approval and 0 if applicant denies the loan. Concentrated lender dummy in column (5) and (6) is defined based mortgage loan volume, while in column (7) and (8), it is defined based on mortgage loan number.



**Table 5-2. Who are the applicants that reject lenders?**

	(1)	(2)	(3)	(4)
	Volume		Number	
<b><u>Variables of interest</u></b>				
<b>Applicant Income / Loan Amount *</b>	<b>0.260***</b>	<b>0.259***</b>	<b>0.300***</b>	<b>0.298***</b>
<b>Conc. Lender</b>	(0.000)	(0.000)	(0.000)	(0.000)
<b>Applicant Income / Loan Amount</b>	<b>-0.099***</b>	<b>-0.099***</b>	<b>-0.105***</b>	<b>-0.105***</b>
	(0.000)	(0.000)	(0.000)	(0.000)
<b>Concentrated Lender</b>	<b>0.284**</b>	<b>0.324***</b>	<b>0.340***</b>	<b>0.376***</b>
	(0.002)	(0.000)	(0.000)	(0.000)
<b><u>Other Market level control</u></b>				
Lag Percent Concentrated Lender in MSA	-0.744*	-3.981***	-0.850*	-4.802***
	(0.017)	(0.001)	(0.012)	(0.000)
Lag Growth Housing Price Index	0.030***	0.019**	0.029***	0.019**
	(0.000)	(0.004)	(0.000)	(0.002)
Lag Growth Real GDP	-0.063	-0.514	-0.058	-0.458
	(0.825)	(0.128)	(0.840)	(0.163)
Lag Log Layoff rate	-0.074	-0.052	-0.074	-0.055
	(0.532)	(0.499)	(0.534)	(0.469)
HHI	0.215	0.804	-0.850*	-4.802***
	(0.814)	(0.517)	(0.012)	(0.000)
<b><u>Other Bank level control (All in Lag)</u></b>				
Log Total Assets	-0.120***	-0.118***	-0.117***	-0.116***
	(0.000)	(0.000)	(0.000)	(0.000)
Liquidity Ratio	0.030***	0.030***	0.030***	0.030***
	(0.000)	(0.000)	(0.000)	(0.000)
Total Deposits / Total Assets	-0.958*	-0.993*	-0.986*	-1.025*
	(0.022)	(0.017)	(0.019)	(0.015)
Equity Capital / Total Assets	-1.179	-1.370	-1.220	-1.418
	(0.653)	(0.599)	(0.642)	(0.586)
Real Estate Loans / Gross Loans	-0.040**	-0.040**	-0.040**	-0.040**
	(0.006)	(0.006)	(0.006)	(0.006)
Commercial & Industry Loans / Gross Loans	-0.045**	-0.044**	-0.044**	-0.044**
	(0.002)	(0.001)	(0.002)	(0.001)
Loan to Individuals / Gross Loans	-0.046**	-0.045**	-0.046**	-0.045**
	(0.004)	(0.004)	(0.004)	(0.004)
Cost of Total Interest Bearing Deposits	0.215	0.220*	0.213	0.218*
	(0.052)	(0.048)	(0.053)	(0.050)
<b><u>Other loan level control</u></b>				
Log HMDA Loan Amount	-0.099***	-0.099***	-0.105***	-0.105***
	(0.000)	(0.000)	(0.000)	(0.000)

HMDA Loan Purpose	-0.000 (0.991)	0.003 (0.918)	-0.001 (0.969)	0.002 (0.939)
HMDA Preapproval	-0.174** (0.006)	-0.183** (0.003)	-0.173** (0.006)	-0.182** (0.003)
HMDA Applicant Ethnicity	-0.061 (0.174)	-0.073 (0.109)	-0.060 (0.179)	-0.073 (0.110)
HMDA Applicant Race	0.047*** (0.000)	0.052*** (0.000)	0.047*** (0.000)	0.052*** (0.000)
HMDA Applicant Sex	-0.070*** (0.000)	-0.064*** (0.000)	-0.070*** (0.000)	-0.064*** (0.000)
HMDA Lien Status	-0.291*** (0.000)	-0.287*** (0.000)	-0.291*** (0.000)	-0.286*** (0.000)
Constant	6.250** (0.007)	28.090*** (0.000)	6.269** (0.006)	26.326*** (0.000)
Observations	7,487,064	7,487,064	7,487,064	7,487,064
Year FE	yes	yes	yes	yes
State FE	yes	no	yes	no
MSA FE	no	yes	no	yes

Notes: Robust p value in parentheses (\*\*\* p<0.001, \*\* p<0.01, \* p<0.05). Some independent variables are not shown in the table to save space. Dependent variable is loan acceptance which is 1 if applicant accepts loan after lender approval and 0 if applicant denies the loan. Concentrated lender dummy in column (1) and (2) is defined based mortgage loan volume, while in column (3) and (4), it is defined based on mortgage loan number.

**Table 6. Which lenders are the more likely to be rejected by applicants?**

**Table 6-1**

	(1)	(2)	(3)	(4)
	Volume		Number	
<b>Concentrated Lender</b>	<b>-0.013**</b> (0.001)	<b>-0.012*</b> (0.016)	<b>-0.019***</b> (0.000)	<b>-0.021***</b> (0.000)
<b>Bank controls</b>	yes	yes	yes	yes
<b>Observations</b>	19,938	19,938	19,938	19,938
<b>R-squared</b>		0.006		0.010
<b>Year FE</b>	yes	yes	yes	yes
<b>HMDA Bank FE</b>	no	yes	no	yes

**Table 6-2**

	(1)	(2)	(3)	(4)	(5)	(6)
	Volume					
	2007	2008	2009	2010	2011	2012
<b>Concentrated Lender</b>	<b>-0.011</b> (0.111)	<b>0.004</b> (0.392)	<b>-0.005</b> (0.452)	<b>-0.020*</b> (0.016)	<b>-0.024**</b> (0.003)	<b>-0.012</b> (0.079)
<b>Bank controls</b>	yes	yes	yes	yes	yes	yes
<b>Observations</b>	3,036	3,234	3,403	3,526	3,400	3,339
<b>R-squared</b>	0.039	0.065	0.032	0.026	0.020	0.014
<b>Year FE</b>	no	no	no	no	no	no
<b>HMDA Bank FE</b>	no	no	no	no	no	no

**Table 6-3**

	(7)	(8)	(9)	(10)	(11)	(12)
	Number					
	2007	2008	2009	2010	2011	2012
<b>Concentrated Lender</b>	<b>-0.018**</b> (0.007)	<b>-0.001</b> (0.753)	<b>-0.007</b> (0.255)	<b>-0.022**</b> (0.005)	<b>-0.028***</b> (0.000)	<b>-0.015*</b> (0.016)
<b>Bank controls</b>	yes	yes	yes	yes	yes	yes
<b>Observations</b>	3,036	3,234	3,403	3,526	3,400	3,339
<b>R-squared</b>	0.059	0.086	0.046	0.036	0.031	0.018
<b>Year FE</b>	no	no	no	no	no	no
<b>HMDA Bank FE</b>	no	no	no	no	no	no

Notes: Robust p value in parentheses (\*\*\*)  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ ). Dependent variable is rejection rate (i.e. percentage of loans rejected by applicants among all approved loans) of the lender. Concentrated lender is a dummy which equals to 1 if its HHI of lending across MSA exceeds 0.5.

**Table 7. Risk taking of lenders that are more likely to be rejected by applicants**

Dep var:	(1)	(2)	(3)	(4)
	Acceptance Rate		Non-jumbo Mortgage Ratio	
	Volumn	Number	Volumn	Number
<b>Denied Lender</b>	<b>-0.080***</b> (0.000)	<b>-0.081***</b> (0.000)	<b>0.015**</b> (0.001)	<b>0.001</b> (0.680)
<b>Concentrated Lender</b>	<b>0.008</b> (0.157)	<b>0.022***</b> (0.000)	<b>-0.031***</b> (0.000)	<b>-0.007</b> (0.086)
<b><i>Other Bank level Controls</i></b>				
Log Total Assets	-0.001 (0.696)	-0.004 (0.057)	-0.030*** (0.000)	-0.009*** (0.000)
Liquidity Ratio	-0.000 (0.965)	-0.000 (0.241)	0.001*** (0.000)	0.000*** (0.000)
Deposits Cost	0.021*** (0.000)	0.022*** (0.000)	-0.021*** (0.000)	-0.009** (0.006)
Loan Yield	-0.017*** (0.000)	-0.018*** (0.000)	0.002 (0.546)	0.004 (0.096)
Net Income / Total Assets	1.141*** (0.000)	1.181*** (0.000)	1.336*** (0.000)	0.884*** (0.000)
Constant	0.838*** (0.000)	0.935*** (0.000)	1.431*** (0.000)	1.010*** (0.000)
Year FE	yes	yes	yes	yes
HMDA Bank FE	no	no	no	no
State FE	no	no	no	no
MSA FE	no	no	no	no
Observations	16,828	16,828	16,799	16,799
R-squared	0.063	0.088	0.081	0.064

Notes: Robust p value in parentheses (\*\*\*)  $p < 0.001$ , (\*\*)  $p < 0.01$ , (\*)  $p < 0.05$ ). Some independent variables are not shown in the table to save space. Dependent variables are loan acceptance rate and non-jumbo mortgage ratio. Loan acceptance rate is the percentage of loan applications accepted by lender among all applications received by the lender. Non-jumbo mortgage ratio is the percentage of non-jumbo mortgages among all mortgages originated by the lender.