

Mortgage Brokers and the Effectiveness of Regulatory Oversight

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Abstract

This paper studies the responses among different types of mortgage brokers to occupational licensing regulations. By explicitly accounting for heterogeneities between sole and corporate brokers, we find evidence that sole brokers respond to financial regulatory oversight by applying a more stringent screening process in conducting brokerage activities, hence achieving better loan performances. Specifically, loans originated through sole brokers exhibit higher quality on an array of credit-relevant characteristics, including those reported and unreported to future investors. By contrast, we find no such regulatory effect on corporate brokers who tend to rely more on reported characteristics that are critical to the subsequent loan securitization at the expense of unreported information despite the latter indicating potential risks. Hence, the agency problem among sole brokers can be mitigated by the consolidated financial requirement for occupational licensing. However, such provision is ineffective in governing corporate brokers. Additionally, welfare gains associated with the occupational licensing regulation are achieved at the expense of prospective borrowers paying a higher loan price and having reduced credit access. Stricter licensing regulations may induce welfare loss related to credit rationing as reasonable loan applications are not funded, including those with potentially lower default risk.

Keywords: mortgage brokers, occupational licensing regulations, reported and unreported information, loan performance.

JEL Classification: G21, G24, J44

1. Introduction

The securitization boom in the United States subprime mortgage market during the mid-2000s was accompanied by steady prosperity in the mortgage broker business. Approximately 60% of residential mortgages were originated through mortgage brokers during 2004-2006 (Kleiner and Todd 2009, LaCour-Little 2009, Ambrose and Conklin 2014).⁵ With the subsequent collapse of the real estate market bubble together with the following recession, attention especially criticisms was directed towards the role of mortgage brokers in precipitating the financial crisis. Mortgage brokers are typically blamed for being loosely and inconsistently regulated (LaCour-Little 2009). Calls have been made advocating for consolidated regulations in the mortgage broker market (Barr 2007, Brooks and Simon 2007). In this paper, we explicitly investigate the heterogeneities among different types of brokers in their responses to consolidated occupational licensing regulations.

Similar to the economics of real estate agents, mortgage brokers facilitate loan origination by reducing search time and financial costs to both lenders and borrowers (Yang and Yavas 1995, Elder et al. 2000). By consulting a mortgage broker, a prospective borrower can obtain more information on prices and detailed contractual terms, and has more choices provided by multiple lenders than he otherwise might have on his own. Lenders also benefit from lower financial and labor costs through economies of scale and specialization than when the loans were originated through retail channels.

Despite fulfilling this important facilitating role, mortgage brokers are prone to trading off the potential benefits of choosing the most suitable loan product for the borrower against originating a loan product that generates the highest upfront profits (Berndt et al. 2010). Both public press (Barr 2007, Brooks and Simon

⁵ Kleiner and Todd (2009) document that mortgage broker firms are involved in loan origination of as many as 68% of all mortgages in 2004. This figure declined to 58% by 2006. LaCour-Little (2009) documents that mortgage brokers produced around 65% of the residential loans in the United States in 2004, with the percentage increasing in 2005 and 2006 before dropping to 57% in 2007. Based on statistics released from Federal Reserve Bulletin, he estimates broker revenue to be nearly \$29 billion in 2006. Ambrose and Conklin (2014) note that mortgage brokers, accounting for around 50% of residential mortgage originations, generate residential mortgage with estimated revenue of \$20 billion in 2006 alone.

2007, Gramlich 2007) and academic research (LaCour-Little and Chun 1999, Keys et al. 2009, LaCour-Little 2009, Berndt et al. 2010, Jiang et al. 2014a) have criticized mortgage brokers for their self-centered misbehavior of encouraging excessively expensive and risky loans to maximize their own profit. While lenders can indirectly affect broker behavior through say, their funding decision, a more direct and effective way to oversee market discipline and govern brokers is by enhancing the occupational licensing standards for mortgage brokers.

Among the series of licensing regulations, there is one that requires brokers to maintain a certain amount of net worth to demonstrate their ability to fulfill their financial obligations, or obtain surety bonds to show their financial credibility and willingness to perform as set forth in the bond. This financial requirement raises the stake of wrongdoing in that the money deposited as a bond will be forfeited to compensate claimants when there is broker misbehavior (Pahl 2007).

This financial requirement potentially has differential impacts given that there are two types of mortgage brokers in the United States – sole proprietorships (hereinafter referred to as “sole brokers”) and entities such as partnerships, corporations, or limited liability corporations (hereinafter referred to as “corporate brokers”).⁶ Although a candidate seeking for a license as a sole broker or a corporate broker is subject to the same dollar amount of bond and net worth requirements, the one seeking to be a sole broker will have to bear this financial requirement on his own since he will be the only owner of the broker business. A corporate broker, on the other hand, generally has multiple owners to jointly share this financial burden and runs on a relatively larger scale. Hence, the impact of a regulatory financial requirement may differ between these two types of brokers.

In this paper, we develop a novel identification strategy that accounts for heterogeneities between sole and corporate brokers, and explicitly investigate their respective responses to licensing regulations. We argue

⁶ Section 3.2 provides details of the classification of sole and corporate brokers.

that a sole broker, compared to a corporate broker with multiple owners and a relatively larger operating scale, is more likely to be impeded by this financial entry barrier and hence, is more sensitive to changes in this financial provision. Specifically, the enhanced financial requirement will be more effective in screening candidates seeking sole broker licensing and improve the quality of brokerage service as reflected in a more stringent screening process in loan origination.

We use a loan-level dataset provided by national mortgage lender, New Century Financial Corporation (NCFC).⁷ In supporting our hypothesis, the empirical evidence demonstrates that sole brokers react to the elevated financial requirement by applying more stringent screening standards in conducting loan origination activities, resulting in higher loan prices, tightened credit supply, and reduced default and prepayment risks. Corporate brokers, on the other hand, do not appear to respond to the financial provision to the same degree. Additionally, by exploring the underlying mechanisms under which brokers adjust their screening criteria, we find that sole brokers improve loan quality by assessing borrower creditworthiness on an array of characteristics, including those reported and unreported to investors. By contrast, corporate brokers simply refer to FICO score, CLTV (Combined loan-to-value) ratio, borrower characteristics that are reported to investors, even when the unreported but credit-relevant information indicates higher potential risks.

To the best of our knowledge, this is the first study exploring the heterogeneous responses to the reinforced licensing impediments among different types of mortgage brokers. In doing so, it extends the literature in assessing the effectiveness of occupational regulations in supervising mortgage broker behavior by demonstrating that the financial requirement is more effective for sole but not corporate brokers. Moreover, it sheds light on recent discussion concerning deteriorated underwriting standards by lenders induced by securitization expansion (Keys et al. 2010, Keys et al. 2012, Jiang et al. 2014b, and Rajan et al. 2015).

⁷ Studies, including Berndt et al. (2010) and Ambrose et al. (2016), provide a detailed description of how a mortgage broker originates a loan funded by lenders such as NCFC.

This paper also provides novel evidence that corporate mortgage brokers tend to exacerbate their reliance on selected reported information in making loan decisions, thereby enlarging the disparity in underwriting criteria. In this regard, this study derives policy implications that call for attention to the heterogeneities between sole and corporate brokers who are subject to different exposure to a financial barrier. Additional regulatory oversights are advocated for the corporate broker-dominated market. Further, from the perspective of welfare analysis, while stricter licensing regulations encourage brokers to apply more stringent screening criteria resulting in reduced default risk, it is possible that such welfare gains for the mortgage industry are achieved at the expense of loan borrowers paying a higher loan price and having reduced credit access. This paper seeks to demonstrate that there is welfare loss related to credit rationing as reasonable loan applications are not funded, including those with potentially lower default risk.

The rest of this paper is organized as follows. Section 2 reviews the literature. Section 3 describes the data and empirical design. Section 4 reports the baseline results. Section 5 presents the robustness test results. Section 6 provides supplemental tests on prepayment risk and welfare loss, and Section 7 concludes.

2. Literature Review

2.1. Agency Problem

Arising from conflicting interests, mortgage brokers tend to focus on extracting profits by originating more loans than be responsible for subsequent performances of the loans they wrote (Alexander et al. 2002). This problem, where the volume of loan originations overweighs the quality, is driven in large part by characteristics of the fee-based compensation structure. Brokers are compensated by both lenders and borrowers. This may encourage them to originate loans to borrowers who may not have been qualified, or ‘steer’ borrowers to select products that maximize broker’s own profit and not serve borrowers’ best interest. Additionally, given that mortgage brokers earn origination fees every time a loan is refinanced, they are incentivized to solicit their former customers to refinance their current loans. Together, these have led

brokers to maximize the volume of loan originations instead of the quality of loans they originated (LaCour-Little and Chun 1999, Keys et al. 2009, LaCour-Little 2009, Jiang et al. 2014a).

Consequently, loans originated through mortgage brokers tend to exhibit less satisfactory *ex-post* performances. Alexander et al. (2002) find evidence that loans originated through brokers exhibit higher default incidents than otherwise similar retail loans. Garmaise (2010) notes that because their earlier good performances will weigh in their favor during subsequent bank evaluations, brokers are incentivized to originate loans with decreasing quality as their interactions with the banks become more frequent. Evidence is also furnished by Berndt et al. (2017) who demonstrate that when lenders have fewer incentives to screen borrowers, there is a strong association between broker revenue and delinquency risk. Borrowers who pay higher fees are inherently more risky. Conklin (2017) shows that mortgage brokers are able to improve economic outcomes when there is face-to-face interaction between them and a prospective borrower. *Ex-post* default risk is reduced especially among borrowers with low levels of financial literacy.

2.2. Occupational Licensing Oversight

Analogous to Barker (2008) who shows that state bond requirement is associated with improved service quality by real estate agents, Keys et al. (2009) note that stringent broker laws serve to align the perverse incentives stemming from compensation structure. Berndt et al. (2010) demonstrate that while brokers earn smaller profits in states with stricter regulations, they make higher profits in states with higher financial requirement due to elevated entry barrier. However, neither of these studies formally test regulatory effect on mortgage brokers.

This study extends the literature on several dimensions. First, we explicitly account for fundamental heterogeneities between sole and corporate brokers, and examine their individual responses to licensing regulations. Second, we do not restrict the analysis to simply identifying the presence of regulatory effects on broker behavior. Rather, we go a step further by exploring the underlying channels through which

brokers promote their screening standards in response to stringent regulations. Third, compared to Kleiner and Todd (2009) who use state- and broker-level data and observe a positive relationship between bond and net worth requirements and broker earnings to arrive at the counter-intuitive conclusion that a higher financial requirement is associated with increased home foreclosures, we employ loan-level data with a rich set of loan and borrower characteristics to minimize bias potentially induced by omitted variables.

3. Data and Empirical Design

3.1. Occupational Licenses

In the United States, occupational licensing regulations for mortgage brokers are laid down at the state level and subject to annual adjustments. Existing license holders are usually required to renew their license on an annual basis. In other words, existing license holders, like new applicants, are subject to the latest licensing regulations which are updated every year. In this regard, one can observe variations in broker licensing regulations across states over time, allowing for a formal test on whether sole and corporate brokers respond differently to stricter occupational licensing provisions by improving their screening standards and eventually, better loan outcomes. To measure the restrictions of legal entry barriers for mortgage brokers, we use Pahl's (2007) Index from 1996 to 2006 that measures each of the 24 occupational licensing components to derive the relative restrictiveness of each state's broker regulation. In particular, we follow the method used in Kleiner and Todd (2009) to create a Regulation Index by subtracting the numerical codes assigned to surety bond and net worth requirements from Pahl's Index. This Regulation Index measures the overall intensity of licensing provisions exclusive of the bond and net worth requirements.

Table 1 summarizes the average dollar-amount of *bond_net worth*, the summation of the minimum dollar amount of surety bonds and net worth requirements, by state over the period of 1996-2006. There are several features noteworthy. First, there are 10 states with no financial credibility requirement in 2006 compared to 19 states in 1996. Second, more than half of the states experience at least one change in the

bond_net worth, suggesting the presence of within-state variations over time. Third, in changing the *bond_net worth*, the authority makes monotonically upward adjustments and seldom lowers the standard.⁸ As Pahl (2007) documented, the bond and net worth requirements increase at both the extensive and intensive margins over time. Fourth, the high Regulation Index in California, Florida, and Oklahoma suggests that despite no financial requirement, there are stringent broad controls in governing broker license on other dimensions in these states. Last, most states have regulation oversights on either financial credibility requirement or other licensing components except for Alaska, Colorado, and Minnesota, where provisions regulating mortgage brokers are practically absent. Among sole brokers, the average financial requirement or *bond_net worth* is \$8,541. Its large standard deviation is consistent with existing substantial differences in this financial requirement across states over time. By contrast, the average financial requirement value of *bond_net worth* among corporate brokers is more than double that of sole brokers, implying that sole brokers are more active in states with lax regulations while corporate brokers in states with stricter regulations. This observation is consistent with Figure 1 that shows continuous growth in financial credibility requirement is accompanied by a decreasing fraction of sole brokers. Note that we lag all the licensing regulation variables by one year to capture their effects on brokers at the time when the loan processing started.

3.2. Data

The main dataset is sourced from NCFC, one of the largest subprime lenders in the United States prior to the mortgage crisis. Although the NCFC dataset contains loans written by a single lender,⁹ borrowers and mortgage brokers who have cooperated with NCFC come from all over the country. The dataset contains loan-level information of over 0.9 million funded loans and 1.5 million loan applications, together with subsequent monthly performances of each funded loan. It also includes abundant information on loan

⁸ The only exception is Indiana that temporarily lowered the requirement from \$20,000 to \$10,000 in 2003, and immediately raised it to 25,000 in 2004.

⁹ Studies using loan-level data from a single mortgage lender include LaCour-Little (2009), Jiang et al. (2014a), Ambrose et al. (2016), and Conklin (2017).

origination channels, contractual features, property attributes, and borrower characteristics, thus reducing the risk of omitted variable bias in the analyses. More importantly, for each wholesale mortgage,¹⁰ the broker's name, the brokerage company name, and the identity of the broker are disclosed: a person or a company. In most cases, a broker marked as "person" has a first name, last name (a name for a natural person), and the brokerage company name; whereas a broker marked as "company" has only the brokerage company name, with first and last names missing. This allows us to classify a broker with the identity of a "person" as a sole proprietor, i.e., a sole broker; and a broker with the identity of a "company" as a corporate broker, i.e., an employee of a brokerage entity that can be a partnership, corporation, or limited liability corporation.¹¹ The starting sample includes a total of over 50,000 corporate brokers who originate nearly 90% of wholesale loans and the remaining loans by approximately 7,000 sole brokers.

To synchronize the sample period with broker license regulations, we restrict the sample to funded 30-year wholesale loans to single-family residences originating between 1997 and 2006. We remove loans where the pledged property is located in a different state as the broker's licensed state to minimize the possibility that a broker originates loans in multiple states.¹² We also exclude loans originating through inactive brokers (those with less than two originations), and observations with obvious error input, outliers, or missing values with respect to the variables applied in this study, giving a sample of 449,087 loans involving 33,294 mortgage brokers.

There are three subsamples based on broker identity. The sole broker sample contains 45,172 loans originated through 4,359 sole brokers. The corporate broker sample has 403,915 loans originated through

¹⁰ Wholesale loans account for over 80% of the mortgages funded by NCFB.

¹¹ This classification is supported by a stylized fact that there is only 3.89% of sole brokers in the top seven states ranked by the amount of bond/net worth, compared with a much higher fraction of 16% in states with no bond/net worth requirement. We conduct a series of robustness tests in Section 5 and conclude that the main results are insensitive to the classification of sole brokers and corporate brokers.

¹² There exists the possibility that brokers, including but not limited to those having business connection with NCFB, may be subject to regulatory requirements in other states, i.e., a broker may conduct brokerage activities in multiple states, which may counter the regulatory effect on brokers. Even with the bias that goes against the regulatory effect, we still find consistent results that favor our conclusions.

28,935 corporate brokers. A third sample consists of loans originated through both broker types. Since corporate brokers have a wider geographical spread than sole brokers, we control for this potential geographic bias by restricting the pooled sample to loans in zip codes with both sole and corporate brokers. This restricted pooled sample contains 226,094 loans, of which 18% are originated through 3,927 sole brokers and the remaining through 13,601 corporate brokers.

3.3. Variables

Table 2 presents the summary statistics by sample.¹³ *Sole* is an indicator that takes a value of 1 if the loan is originated through a sole broker, and 0 if it is originated through a corporate broker. A loan is defined as *Default* if it becomes delinquent for 60 days within the first 24 months following origination and the default is not preceded by a prepayment event.¹⁴ The average default rate remains constant at 4% in both samples. A loan is defined as *Prepay* if it has been paid in full within the first 24 months following origination and the prepayment is not preceded by a delinquency event. Sole brokers have a prepayment rate of 0.77 on average,¹⁵ slightly lower than corporate brokers' rate of 0.78.

For the sole broker sample, the average Annual Percentage Rate (*APR*) of 9% is used as a proxy for loan price which represents the annual cost of a loan. The average *loan amount* is \$191,684. *FICO* is the score that summarizes the borrower's creditworthiness at loan origination. Interestingly, the sole broker sample has an average *FICO* of 626, higher than that for the corporate broker sample, thus suggesting that their borrowers have potentially higher credit quality compared to those who go to corporate brokers. As an

¹³ Detailed definitions of each variable are given in the Appendix Table A1.

¹⁴ The alternative measure of default is defined as the loan becoming delinquent for 90 days within the first 36 months following origination. All results remain unchanged when this alternative measure is used.

¹⁵ Using the loan-level dataset from Lender Processing Services (LPS) Applied Analytics Inc., Krainer and Laderman (2011) document that prepayment rate ranges from 32% to 90 % during 2001-2006. Note that LPS data covers prime loans, subprime loans, and Alt-A loans, and include loans that are privately securitized, loans that are sold to Government-Sponsored Enterprises (GSEs), and loans that banks hold on their balance sheets. It is not surprising that the prepayment rate in NCFC data is relatively high since it exclusively includes subprime loans and consists of substantially higher proportion of adjustable-rate mortgages (ARMs), which is expected to experience higher prepayment risk.

additional credit measure, *Internal rating*¹⁶ ranging between 1 and 20 is used where a higher rating indicates a higher loan risk. Loans by sole brokers are rated at 2.48 on average. Note that this *Internal rating* is exclusively evaluated and observed by the lender NCFC and is not revealed to investors. Debt-to-income (*DTI*) ratio and combined loan-to-value (*CLTV*) ratio are 40% and 85%, respectively. Nearly 25% of mortgages are fixed-rate loans (*Fixed rate*), and approximately 82% of the loans come with a *Prepayment penalty*. These figures remain largely stable across samples.

Additionally, *Interest-only* loans account for 18% of loans on average. Some 46% of loans by sole brokers are *Stated-doc* mortgages. Borrowers holding this type of mortgage have limited or no income. Although corporate brokers appear to have a lower proportion of stated-doc loans than sole brokers, we will show in the subsequent analysis that once other licensing regulations and fixed effects are controlled for, sole brokers are less likely to originate stated-doc loans in response to the elevated financial barrier for licensing.

Conklin (2017) discusses the possibility that face-to-face interaction between a mortgage broker and a prospective borrower prior to the loan funding may reduce *ex-post* default risk. We account for this and find that nearly 47% (43%) of the loans by sole (corporate) brokers involve face-to-face interview (*Face*) in loan origination. Concerning loan purposes, 41% of loans by sole brokers are for *Purchase*, while 57% are for *No cash-out refinance*. Both samples exhibit a similar pattern in terms of property features. An overwhelming majority (91%) of mortgages are originated for properties as a *Primary Residence*, with a trivial proportion made for *Second Home* and *Investment* properties.

Turning to borrower demographic characteristics, *Single* makes up 42% of the sole broker sample. The average borrower age is 43, and 38% of borrowers are *Minority*. On average, borrowers have eight years of working experience (*Job years*), and surprisingly, only 5% have *Fixed income*. In addition, 29% of borrowers are *Self-employed*. There are four dependents on average attached to each borrower (*Number of dependents*). A borrower with a larger number of dependents indicates higher exposure to unanticipated

¹⁶ This variable is also used by Rajan et al. (2015).

expenditures since income may be stretched across more individuals, thus indicating higher default risk (Keys et al. 2012). The corporate broker sample and the pooled sample have similar statistics and distribution. These attributes arguably reflect the relatively lower quality of borrowers in the subprime market sector. The descriptive statistics in the samples are broadly in line with that in prior research using NCFD data (e.g., Berndt et al. 2010, Ambrose et al. 2016, Berndt et al. 2017, Conklin 2017).

3.4. Empirical Design

We hypothesize that a sole broker, as the single owner of the brokerage business, will be more sensitive to the provisions adjustments compared to a corporate brokerage company. In this regard, the bond and net worth requirements are expected to intensively align with sole broker behavior, while having little impact on corporate broker behavior. We test whether bond and net worth requirements contribute to the stricter screening process by sole brokers and result in ameliorated subsequent loan performance. We estimate the following equation:

$$Y_{i,j,s,t} = \alpha_0 + \alpha_1 \text{Log}(\text{Bond_Net worth}_{s,t}) + M' \gamma + B' \delta + \mu_s + \tau_t + \omega_j + \varepsilon_{i,j,s,t}$$

Eq. 1

The dependent variable $Y_{i,j,s,t}$ represents the outcome (*Default* or *Prepay*) of loan i originated through broker j in state s in year t . $\text{Log}(\text{Bond_Net Worth}_{s,t})$ denotes the logarithm of the dollar amount of surety bond and net worth requirements in state s in year t . M' is a vector of loan and property characteristics, and B' is a vector of borrower demographic features. These three vectors include variables described in Section 3.3. μ_s , τ_t , and ω_j are state, year, and broker fixed effects,¹⁷ respectively. To explore how brokers improve their screening criteria, we subsequently replace the dependent variable $Y_{i,j,s,t}$ with loan price (*APR*) and credit supply ($\text{Log}(\text{loan amount})$). By conducting placebo tests based on the corporate broker sample, we expect to observe a different pattern of the estimates on loan performance, APR, and

¹⁷ For analysis using sole broker sample, we include fixed effect for brokers with more than 10 loan originations.

loan amount among mortgages originated through corporate brokers.

We are also interested in uncovering how the dynamic responses of brokers to the financial requirement evolve over time. We conduct an event study by treating the change in the bond and net worth requirements as the occurrence of the event, with year zero (*Year of Change*) being the time when the policy is released. The sole broker sample is further restricted to loans originated in states that experienced one adjustment in the financial requirement. We follow Agarwal et al. (2019) strategy and estimate the following lag model:

$$Y_{i,j,s,t} = \alpha_0 + \sum_{x=-1}^4 \theta_x \text{Change}_{s,t+x} + M'\gamma + B'\delta + \mu_s + \tau_t + \omega_j + \varepsilon_{i,j,s,t}$$

Eq. 2

$\text{Change}_{s,t}$ is a binary variable that indicates whether the surety bond and net worth requirements in state s have changed in year t . The coefficient θ_{-1} reflects the change in $Y_{i,j,s,t}$ (default, APR, and loan amount) in the year prior to the adjustment. The coefficient θ_0 measures the immediate response to the provision adjustment, and the coefficients $\theta_1, \dots, \theta_4$ capture changes in outcomes in each of the four years following the upward adjustment in bond and net worth requirements. As in Eq 1, μ_s , τ_t , and ω_j are state, year, and broker fixed effects, respectively. This analysis enables us to track the dynamics of brokers' screening standards and demonstrates whether brokers adjust their responses to the policy change.

Once the impacts of the enhanced financial credibility requirement on mortgage outcomes are identified, we investigate the mechanisms of how brokers improve the screening criteria in response to the stricter financial provisions. Specifically, we explicitly test how loan and borrower characteristics, including those reported and unreported to investors, vary with the financial requirement.

$$I_{i,j,s,t} = \alpha_0 + \alpha_1 \text{Log}(\text{Bond_Net worth}_{s,t}) + \mu_s + \tau_t + \omega_j + \varepsilon_{i,j,s,t}$$

Eq. 3

$I_{i,j,s,t}$ is a vector of loan and borrower characteristics of loan i originated through broker j in state s in year t , including *FICO* score, *CLTV* ratio, whether the loan is *Stated-doc*, whether the borrower has *Fixed income*, and his *Job years*. Importantly, we also include variables that are unreported to future investors. These include *Internal rating*, *Number of dependents*, and whether the borrower is *Self-employed*. $\text{Log}(Bond_Net\ Worth_{s,t})$ denotes the logarithm of the dollar amount of surety bond and net worth requirements in state s in year t . μ_s , τ_t , and ω_j are state, year, and broker fixed effect, respectively.

4. Results

4.1. Baseline Test: Does a Higher Financial Barrier Improve Sole Brokers' Screening Standards?

We begin the analysis by examining whether licensing regulations for mortgage brokers govern their brokering behavior and thereby contribute to better loan outcomes. The first three columns in Table 3 report the estimates of Eq. 1 with dependent variable being Default using the sole broker sample. Column (1) shows the estimates of the baseline model, Column (2) the results with additional license regulations (*Regulation Index*) controlled for, and Column (3) the results with state and broker fixed effects being replaced by year and zip code fixed effects. The primary interest – the coefficients on $\text{Log}(Bond_Net\ Worth)$ – range from -0.005 to -0.008 across different specifications and are significant at 1% level, suggesting that higher bond and net worth requirements for sole brokers result in lower *ex-post* borrower default risk. Interestingly, *Regulation Index*, a measure of the overall intensity of licensing provisions exclusive of the bond and net worth requirements, exerts no effect on loan performance, thus supporting the hypothesis that financial requirement is the most effective regulatory oversight to impede unqualified candidates and hence, supervise existing license holders.

Columns (4) to (5) present the results based on the entire pooled sample. Note that the interaction $Sole \times \text{Log}(Bond_Net\ Worth)$ has a significant negative coefficient, indicating that higher financial requirement is associated with lower default risk of loans through sole brokers. Additional licensing regulations have little impact on loan performance as the coefficient for $Sole \times Regulation_Index$ is insignificant. This is consistent

with the reasoning that sole brokers, in response to the raised financial requirement for licensing, become more cautious and rigorous in conducting brokerage activities, resulting in better loan performance. To address the concern that corporate brokers have a wider geographical spread than sole brokers, we repeat the regression analysis using a pooled sample which is restricted to zip codes where both sole and corporate brokers have brokerage business.¹⁸ Columns (6) and (7) show that the results remain robust using the restricted pooled sample.

Most of the estimated coefficients on the control variables are intuitive and are as expected. For instance, loans with higher *FICO* scores, lower *Interest rate*, *Log (Loan amount)*, or *CLTV* ratios are related to lower default risk. *Stated-doc* loans and *Single* borrowers exhibit higher default risk, while *Female* borrowers, and those with *Fixed rate* or more *Job years* demonstrate better performance.

4.2. Placebo Tests: Does a Higher Financial Barrier Improve Corporate Brokers' Screening Standards?

Next, we perform placebo tests by comparing the performance of loans submitted by corporate brokers. As shown in Columns (1) to (3) in Table 4, the coefficients on *Log (Bond_Net Worth)* are neither economically nor statistically significant across model specifications, suggesting that corporate brokers do not respond to this provision as much as sole brokers do. Note that *Regulation Index*, which measures the strictness of additional licensing regulation, is weakly related to default risk as the coefficient is relatively small and significant only at 10% level when Year, State and Broker fixed effects are placed. These results support the hypothesis that unlike sole brokers, corporate brokers are not regulated by financial requirements but are likely to be governed by other licensing requirements.

One concern is that sole brokers may sometimes incorporate as a limited liability corporation. In this case, it is possible that the corporate broker sample may be contaminated as some corporate brokers may, in fact, be run by sole owners. Since the effective tax rate of a Corporation-S Corp is more than double that of a

¹⁸ That is, the restricted pooled sample removes loans in zip codes where only one type of brokers (most likely, corporate brokers) has brokerage business.

sole proprietor (26.6% vs. 13.3% in 2004; U.S. Small Business Administration 2012), an individual as the sole owner will be incentivized to choose sole proprietorship than to incorporate. In addition, the Legal Form of Organization of Small Business in 2009-2010 shows that the percentage of businesses run by an individual in the form of a corporation should be at most 20%,¹⁹ thus limiting the number of such incorporated entities. Nonetheless, we create an uncontaminated corporate broker sample by removing loans that are possibly written by sole brokers. We conduct a propensity score match and remove loans in the corporate broker sample that are observationally similar as those in the sole broker sample. Specifically, we perform the nearest-2-neighbor matching based on the propensity scores computed from the logistic regression using all the control variables in Tables 3 and 4. This creates a matched sample of 73,020 loans which are removed from the corporate broker sample, resulting in an uncontaminated corporate broker sample with 330,895 observations.

The results from the uncontaminated corporate broker sample, shown in Table 4 Columns (4) to (6), are consistent with that in Columns (1) to (3). The coefficients on the financial variable remain consistently insignificant, suggesting that corporate brokers have no exposure to the regulatory financial requirement, while additional licensing provisions, measured by the *Regulation Index*, have limited oversight impact on corporate brokers. Compared to the results of sole brokers in Table 3, we observe significant coefficients on more control variables such as *DTI*, *Interest-Only*, *Separated*, *Borrower age*, *Minority*, *Interviewed*, and *Log (Borrower Income)*, that make economic sense. This suggests that compared to corporate brokers, bond and net worth requirements carry more power in explaining default in the sole broker sample, thereby mitigating the explanatory power of control variables, including the *Regulation Index* and some loan and borrower characteristics.

It is noteworthy that the results for corporate brokers (Table 4) exhibit a different pattern compared to the

¹⁹ An individual can register a small business in the form of sole proprietorship, limited liability corporation, Corporation-C Corp, Corporation-S Corp, or Corporation-S Corp (U.S. Small Business Administration). Small employer firms account for 21.5% share, of which 44% is S-corporation; Non-employer firms account for 78.5% share, of which corporations and partnerships make up 7% each. This means that at most $21.5\% \times 44\% + 78.5\% \times 14\% = 20\%$ of firms (other than sole proprietorships) may be run by an individual.

estimates for sole brokers (Table 3), confirming again, the hypothesis that there exists considerable heterogeneous exposure to various licensing regulations between sole and corporate brokers. This underscores the necessity for analyzing broker behavior separately according to their identity and internal structure of brokerage firms.

4.3. Underlying Mechanisms: How do Brokers Adjust their Screening Standards to the Enhanced Financial Requirement?

Having verified that the consolidated bond and net worth requirements are associated with more cautious brokerage activities by sole brokers and improved *ex-post* loan performances, we now explore the channels through which brokers enhance their screening standards in response to the reinforced financial entry barrier. We formally test how the following loan and borrower characteristics vary with regulation adjustment.

As Rajan et al. (2015) noted, since investors purchase securitized loans based on reported information, the ease of securitization may induce mortgage lenders to originate loans to borrowers with decent characteristics that are reported to investors, even though unreported variables imply lower borrower quality. Reported variables such as FICO score and CLTV ratio become increasingly important in affecting lender's funding and pricing decisions as securitization increases, whereas credit-relevant but unreported variables such as *Internal ratings* play a decreasing role. Given that we hypothesize mortgage brokers to follow lender's preference in conducting loan origination activities, we include additional credit-relevant variables that are unreported to investors: employment type and number of dependents. A *Self-employed* borrower carries higher potential risk since he has a highly variable income that is easier to inflate; and a borrower with a greater *Number of dependents* is suggestive of higher exposure to unanticipated expenditures as his income may be stretched across individuals (Keys et al. 2012). In addition, *Stated-doc* loans, especially those originated through the wholesale channel, may involve income falsification that is associated with higher default likelihood (Jiang et al. 2014a). Further, borrowers with fewer *Job years* (as shown in Tables 3 and 4) have higher default risk since they are vulnerable to income shocks. Lastly, borrowers without *Fixed income* normally have irregular income and therefore, carry potential higher default risk.

Table 5 Panel A reports the estimates for sole brokers.²⁰ As shown in Columns (1) and (2), *Log (Bond_Net Worth)* has no effect on *FICO* score and *CLTV* ratio, the reported information that plays a critical role in determining the probability of loan securitization. By contrast, Columns (3) to (5) show that stricter licensing financial requirement is associated with a lower proportion of *Stated-doc* loans, and the fraction of borrowers with *Fixed income* and *Job years* increases with the financial requirement as well. Turning to unreported variables (Columns (6) to (8)), the coefficients for *Internal rating*, *Self-employed* and *Number of dependents* are significantly negative, suggesting higher financial requirement is related to better loan quality. This finding indicates that for sole brokers, the overall loan quality, measured by both reported and unreported variables, has a higher priority than the probability of future securitization. As an alternative estimation, Panel B reports the same pattern of results using the restricted pooled sample.

However, the estimates on loans originated through corporate brokers (Panel C) are in sharp contrast to the estimates based on sole brokers and the pooled sample. As the financial requirement is enhanced, corporate brokers are more attracted to loan applicants with higher *FICO* scores and lower *CLTV* ratios. Moreover, the financial requirement has no impact on *Stated-doc*, *Fixed income*, and *Job years*. In particular, corporate brokers even submitted loans with higher *Internal ratings*, and are more likely to serve *Self-employed borrowers* and borrowers with greater *Number of dependents*. These results indicate that corporate brokers are more incentivized to place emphasis more on reported information such as *FICO* scores and *CLTV* ratio, ignoring the overall loan and borrower quality measured by variables unreported to investors during the origination screening process. These informative results further underscore the importance of accounting for the heterogeneities between sole and corporate brokers. The benefits from the increased *FICO* score and lower *CLTV* ratio are probably offset by the adverse effect reflected in higher *Internal ratings*, which arguably explains the absence of financial regulatory effect on defaults in corporate broker-generated loans shown in Table 4.

²⁰ For brevity, these results are not reported in detail.

To sum up, sole brokers and corporate brokers differ in their screening standards when confronted with the consolidated financial requirements. Sole brokers are inclined to select borrowers exhibiting overall higher quality in terms of unreported variables and information that does not rate high in future securitization (and therefore, lender's loan decision), whereas corporate brokers prefer borrowers with decent reported information such as high FICO score and low CLTV ratio, even if other information, in particular unreported variables, may imply deteriorated borrower quality. This finding lends support to the notion that reported information such as FICO score can be a poorer predictor of loan defaults during the expansion of mortgage securitization (Rajan et al. 2015). Further, the results corroborate discussions regarding differential in loan screening intensity caused by easing mortgage securitization (Keys et al. 2009, 2010, Keys et al. 2012, Jiang et al. 2014b). The results suggest the possibility that corporate brokers exacerbate the tendency to rely more heavily on reported information such as FICO score and CLTV ratio at the expense of unreported information when pricing loans or making loan decisions.

4.4. Loan Price, Credit Supply, and Response Dynamics

To further explore how brokers improve their screening process in response to the consolidated licensing regulations, we investigate broker responses in terms of price and credit supply. Table 6 Columns (1) to (4) show that for sole brokers, higher bond and net worth requirements are associated with higher loan price and lower credit supply. This implies that sole brokers become more cautious and rigorous in conducting brokerage activities by proposing lower credit supply along with higher loan price. By contrast, as shown in Columns (5) and (6) for corporate brokers, higher financial provision is associated with lower APR and a slightly lower loan amount.

We are also interested in understanding the response dynamics before and after the change in financial requirement. To this end, we conduct an event study to explore the dynamic evolution of broker response. The sample is further restricted to loans originated through sole brokers from states with only one adjustment in surety bond or net worth requirements from 1997 to 2006. Table 7 presents the estimates of

Eq. 2. Note that Columns (1) to (3) are estimates from the model with event year dummies included, and in Columns (4) to (6), each of the year dummies interacts with the bond and net worth requirements ($\text{Log}(\text{Bond_Net Worth})$) as an alternative specification.

There is no significant change in APR, loan amount, or defaults in years prior to or undergoing the change. This reinforces the exogeneity of policy changes in broker licensing provisions. As shown in Columns (1) and (4), APR starts to increase one year after the adjustment, with growth decelerating immediately and disappearing in the following three years. Similarly, as shown in Columns (3) and (6), there is essentially no temporal variation in defaults until one year after the policy change. Interestingly, the decrease becomes vague in the second year after the event and resumes significance from the third year following the change. Moreover, Columns (2) and (5) show no temporal variation in loan amount until the third year following the occurrence of the event. It is noteworthy that even if the *Year* controls are replaced with the interaction terms between *Year* dummy and $\text{Log}(\text{Bond_Net Worth})$, the results are robust in terms of the significance of the coefficients and the dynamic pattern.

Figure 2 plots the average APR, loan amount, and default over a seven-year window. Remarkably, the trend in loans by sole brokers (represented by the solid line) closely corresponds to the results reported in Table 7. This reinforces the validity of the analysis on response dynamics. Moreover, the path for loans originated through corporate brokers (plotted by the dashed line) indicates the differences when compared to sole brokers. Given the policy change, there is essentially no variation in loan defaults by corporate brokers. Although APR experiences a small decrease after the change, it is higher than that by sole brokers throughout the period. Sole brokers tend to originate loans with larger size before the event, and gradually reduce the loan amount after the event. By contrast, corporate brokers maintain a steady loan amount prior to the event and begin to raise loan amount immediately after the event, and eventually reduce the quantum to the pre-event level.

5. Robustness

5.1. Consolidated Classification for Sole and Corporate Brokers

We perform a series of in-depth robustness tests to further justify the stability of the baseline results. Beginning with the classification of sole and corporate brokers, we construct a subsample from the baseline sole broker sample as follows: we remove brokers whose first name or last name is missing or does not seem like a name for a natural person; we further exclude brokers with common company name with any corporate broker, i.e., each of the company names is exclusive to sole brokers. This leaves 38,787 loans in the sole broker sample. Similarly, we create a subsample of the corporate broker sample, where each employee of the broker company has no first or last name, and each of the company names is exclusive to corporate brokers. In other words, sole brokers and corporate brokers have no common company name. This leaves 386,990 loans in the corporate broker sample.

We repeat the default analysis with the consolidated samples. Panel A in Table 8 reports results consistent with the baseline results in Tables 3 and 4. Higher bond and net worth requirements are associated with lower default risk for loans originated through sole brokers, whereas there is no impact on loans submitted by corporate brokers. *Regulation Index* per se has limited regulatory effect on corporate brokers, but it does not eliminate the binding impact of the financial variable.

5.2. Small Brokers versus Medium and Large Brokers

We argue that a sole broker, compared to a corporate broker with multiple owners and a relatively larger operating scale, is more sensitive to changes in the bond and net worth requirements when conducting brokerage activities. In other words, the financial requirement places a significant binding impact on sole brokers due to its smaller operating size. As such, one would expect to observe the same binding impact on a corporate broker with a business scale similar as that of a sole broker; while on large corporate brokers, an absence of such regulatory effect.

To test this argument, we categorize brokers by size and examine whether small brokers demonstrate

different responses to the bond and net worth requirements compared to medium and large brokers. The small broker sample includes loans submitted by sole brokers and corporate brokers with four or fewer employees engaging in brokerage activities with NCFE. The medium and large broker sample contains loans through corporate brokers with five or more employees with brokerage business with NCFE.²¹

We repeat the estimation of default risk and loan and borrower characteristics based on the small broker sample.²² Column (1) in Table 8 Panel B shows that the financial requirement is related to better performance of loans originated through small brokers, consistent with the baseline results of sole brokers in Table 3.

We further investigate the mechanisms under which small brokers enhance their screening standards in response to the consolidated financial provision. Results in Columns (2) to (9) exhibit the same pattern as that of sole brokers presented in Table 5 Panel A. The bond and net worth requirements have no impact on borrower's *FICO* score or *CLTV* ratio, but are associated with better loan quality evidence in a smaller proportion of *Stated-doc* loans and *Self-employed* borrowers, fewer *Number of dependents*, a higher proportion of borrowers with *Fixed income* and borrowers with more *Job years*, and lower *Internal rating*. By contrast, medium and large brokers exhibit a different pattern. Panel C in Table 8 shows that financial requirement has no impact on default risk or loan/borrower characteristics including *Stated-doc*, *Fixed income*, and *Job years*, but is significantly related to *FICO* score and *CLTV* ratio. We also find significant positive coefficients on unreported variables, i.e., *Internal rating*, *Self-employed*, and *Number of dependents*. These findings are in line with the results from the baseline corporate broker sample (Table 4 and Panel C Table 5), suggesting that the financial requirement has a binding impact on mortgage brokers depending on their operating size. Like sole brokers, small corporate brokers in responding to the tightened financial regulation become more cautious and rigorous in conducting brokerage activities. They consider both

²¹ There are 91,900 loans originated through small brokers, compared to 357,187 loans originated through medium and large brokers.

²² Alternatively, a small broker is defined as a sole brokers or corporate broker in the lower 25th percentile in terms of the number of loan applications among corporate brokers in the NCFE dataset. We obtain similar results based on this alternative classification.

reported information and unreported information, which encapsulate more comprehensive information regarding the overall loan quality in the screening process, resulting in better loan performance. By contrast, medium and large brokers prefer borrowers with decent reported information such as high FICO score and low CLTV ratio, even if other credit-relevant but unreported information imply deteriorated borrower quality.

5.3. Alternative Measures of the Financial Requirement

A potential concern is that the binding effect of the financial requirement may be weaker if mortgage brokers could obtain the surety bond via insurance. As specified in Phal (2007), only Missouri allowed bond requirement paid via insurance during 1996-2000. Hence, we repeat the default analysis by removing loans from Missouri from the baseline sole broker sample. In Panel D of Table 8, Columns (1) and (2) show that the coefficient on the bond and net worth requirements is -0.008 and significant at 1% level, regardless of the inclusion of *Regulation Index*. Consistent with the baseline results in Table 3, the coefficient of *Regulation Index* remains insignificant. In addition, we perform additional tests with an alternative financial requirement that focuses only on the *Net worth* requirement. Still, we observe significant negative coefficients in Columns (3) and (4), although they are smaller in size. This is probably because net worth requirement alone²³ is less binding as only 13 states had the net worth requirement in 2006, compared to 42 states with the bond requirement.

5.4. Loan Type and Geography

Considering the potential higher default risk in stated documentation loans, it may well be that the improved loan performances observed in earlier analyses are attributed to the inherent better quality of full documentation loans. To alleviate this concern, we further categorize the sole broker sample into two groups based on loan type, and analyze the performances of stated-doc and full-doc loans separately.

²³ The average dollar amount of net worth requirement is \$4,656 in the sole broker sample.

As shown in Columns (1) and (2) in Panel E of Table 8, both stated-doc and full-doc loans exhibit reduced default risk as the bond and net worth requirements are raised. These results appear to be inconsistent with the conclusion by Jiang et al. (2014a) that mortgage brokers worsen the agency problems among low-doc loans.²⁴ Considering that Jiang et al. (2014a) do not differentiate sole brokers from corporate brokers, it may be that their results are due to the misbehavior of corporate brokers, who constitute a dominant share in the mortgage broker industry. Again, this inconsistency underscores the importance of accounting for the heterogeneity between sole and corporate brokers when studying the role of brokers in mortgage lending.

Moreover, we are interested in identifying whether broker responses to the tightened licensing regulations are subject to regional heterogeneity. We compare the performances of loans originated in four sand states – namely, Arizona, California, Florida, and Nevada – that were hit severely by the housing bubble burst to those in the remaining 47 states (Columns (3) and (4) respectively). Further, as shown in Column (5), we exclude states that never have surety bonds or net worth requirement throughout the sample period of 1997-2006 and restrict the focus to loans originated in the states with non-zero financial provision.

Again, the estimated coefficients on *Log (Bond_Net Worth)* are largely consistent in terms of the sign and significance. We find no spatial variation in the regulatory effect on sole brokers. Even in sand states that experienced the most acute housing downturn, sole brokers governed by stricter licensing regulations consistently apply more stringent screening standards in conducting origination activities, and consequently, result in better loan performance.

5.5. Falsification Test

One concern is that the improved loan performances by sole brokers could be the result of unobserved factors rather than elevated financial requirement for occupational licensing. We address this by conducting a falsification test (Agarwal et al. 2012). The intuition is that if this concern were correct, then one should

²⁴ Stated-doc in the NCFE is frequently referred to as low-doc in the industry and some literature.

find similar outcomes if values of bond and net worth requirements in any state were randomly picked. We randomize the values and loans in the sole broker sample and randomly assign a value to each loan. Alternatively stated, each of the loans in the sole broker sample is randomly assigned a value representing bond and net worth requirements. We subsequently repeat the baseline default analysis as specified in Eq. 1, and collect the statistics obtained from each regression.²⁵ This randomization process was performed 1000 times.

Figure 3 illustrates the distribution of parameter estimates and the corresponding t-values obtained from each of the randomization regressions. As shown in Figure 3(a), the magnified parameter estimates closely fit a normal distribution,²⁶ with the mean estimated coefficients infinitely close to zero. The coefficient estimated at -0.05 from the baseline analysis (represented by the solid line), is located far outside the 95% confidence interval. Similarly, as shown in Figure 3(b), the t-values for the parameter estimates largely follow a normal distribution, with roughly 95% of the area under the kernel density curve laid within 1.96 standard deviations of the mean. Taken together, the falsification test shows that loan defaults do not respond to randomized bond and net worth requirements, which reinforces the baseline results.

6. Extensions and Discussion

6.1. Prepayment Risk

It is noteworthy that our sample period covers the progressive expansion of mortgage securitization from 2003 through 2006. Given that prepayment risk is not shared between mortgage brokers and lenders (or ultimate investors), brokers are incentivized to “churn” borrowers and earn additional fees every time a loan is refinanced (LaCour-Little and Chun 1999). We investigate whether stricter licensing regulations curb the “churn” behavior of mortgage brokers, resulting in reduced prepayment risk.²⁷

²⁵ The estimation is conducted in the same way as those presented in Columns (1) to (3) in Table 3.

²⁶ Note that since the parameter estimates are extremely small, they are magnified 10,000 times to facilitate graphing.

²⁷ Note that although the state-level licensing regulations for mortgage brokers generally do not consider issues related to prepayment risks, the financial requirement may still have a binding impact on brokers in that a borrower may claim

Table 9 presents the estimates of Eq. 1 using *Prepay* as the dependent variable.²⁸ Columns (1) and (2) show the results based on the sole broker sample, and Columns (3) and (4) for the restricted pooled sample. We find that higher bond and net worth requirements are associated with lower prepayment risk of loans submitted by sole brokers, with the coefficients ranging from -0.005 to -0.006, regardless of whether it is the sole broker or pooled sample. Again, the coefficients on *Regulation Index* are insignificant. This reinforces our earlier findings that the financial requirement plays a critical role in governing sole brokers who are motivated to provide higher quality service in conducting loan origination activities to achieve better loan performance as evidenced in lower default and prepayment risks.

6.2. Welfare Loss

The above results provide evidence that stricter occupational regulation of mortgage brokers, especially sole brokers, is associated with lower default and prepayment risks. However, this welfare gain may have been realized at the cost of higher APR paid by borrowers and lower credit supply. We investigate whether sole brokers over-react in response to the higher financial requirement by employing a more stringent screening standard that leads to suppressed credit access and eventually, welfare loss. To this end, we estimate Eq. 1 with the dependent variable being *Reject*. In Table 10 Panel A, Column (1) reports the estimates using 78,759 loan applications submitted by sole brokers, Column (3) presents the estimates based on 701,527 loan applications submitted by corporate brokers, and Column (2) presents results based on the entire sample pooling all 780,286 loan applications. The rejection rate ranges from 17.44% to 19.74% across samples.

We obtain significant positive coefficients on bond and net worth requirements. In particular, the estimates for sole brokers are more than doubled compared to those for corporate brokers, suggesting a stronger binding impact on sole brokers who have “skin in the game” with respect to the enhanced bond and net

up to the amount of the surety bond from for the broker’s misconduct including the “churn” behavior. A broker may also be confronted with reduced probability of engaging in long-term business with a lender if loans originated through him consistently exhibit high prepayment risk.

²⁸ We found similar results under a competing risk framework where Multinomial Logistic Regression is applied.

worth requirements.

We further investigate whether the elevated financial requirement causes brokers to over-screen borrowers with good credit quality by analyzing the loan performance of those funded loans in the corporate broker sample that are similar as the rejected loans submitted by sole brokers. In doing so, we can examine the counterfactual loan performance as if these rejected loans were funded. First, we create a “treated sample” containing 15,247 unfunded loans submitted by sole brokers.²⁹ Second, we have a “control sample” which contains all funded loans submitted by corporate brokers. After which, we perform the nearest-neighbor matching based on the propensity scores computed from a logistic regression using all the control variables in Tables 3 and 4, and additional borrower characteristics including citizenship, total assets, and whether the borrower is a first-time homebuyer.³⁰ Matching the “treated sample” in the “control sample” gives a matched sample containing 14,267 loans – loans funded through corporate brokers but observationally similar to those rejected loans submitted by sole brokers. Lastly, this matched sample is merged with the baseline corporate broker sample. The intersection furnishes 5,998 propensity-score matched loans which are marked as *Sole-Rejected* in Column (1) in Table 10 Panel B. Accounting for borrower characteristics, we further refine the “treated sample” to those unsuccessful applicants with sole brokers but with high-FICO scores, giving us 9,515 matched loans in the “control sample,” and 2,773 propensity-score matched loans in the corporate broker sample, marked as *Sole-rejected_High FICO* shown in Panel B Column (2). Similarly, we refine the “treated sample” to those low-income unsuccessful applicants.³¹ Panel B Column (3) shows the 5,767 matched loans in the “control sample,” and 2,350 propensity-score matched loans in the corporate broker sample, marked as *Sole-rejected_Low Income*. Panel B Columns (1) to (3) show that Sole-Rejected loans, if funded, exhibit better loan performances, especially those with decent FICO scores.

²⁹ There are 0.3 million unfunded loan applications involving sole brokers. To improve the matching similarity, we include a wide range of borrower characteristics with non-missing observations. Therefore, the final “treated sample” size is reduced to 15,247.

³⁰ These additional variables are not included in our previous analyses since they are largely missing in observations and including them may cause significantly reduction in sample sizes.

³¹ An applicant is considered as having low income if his income is below the bottom 25th percentile among all applicants in the sample.

To conclude, when the financial requirement of licensing regulations is elevated, mortgage brokers especially sole brokers who have “skin in the game,” apply more stringent screening criteria, resulting in better loan performances. Corporate brokers, though not sensitive to the financial requirement, are governed by other licensing regulations measured by *Regulation Index*. Loan borrowers are paying this welfare gain with higher APR and lower loan amount. More importantly, there is welfare loss related to credit rationing as many reasonable loan applications, including those with potentially lower default risk, are not funded.

7. Conclusion

While once lauded as matchmakers who significantly improve efficiency in loan originations, mortgage brokers are now confronted with growing criticisms given their perceived misbehavior stemming from agency problem. This paper sheds light on this debate by exploring the effectiveness of occupational licensing regulations in governing the behavior of mortgage brokers. In the United States, a prospective mortgage brokerage firm can be licensed either as a sole proprietorship or an entity such as partnership, corporation or limited liability corporation. Among the various occupational licensing regulations for mortgage brokers, there is a particular provision that explicitly requires both sole and corporate brokers to maintain a certain amount of net worth to demonstrate their ability to fulfill their financial obligations, or alternatively to obtain surety bonds to show financial credibility and willingness to perform as set forth in the bond (Pahl 2007). Although compared to corporate brokers, sole brokers are subject to the same dollar amount as per bond and net worth requirements, they are more exposed to this provision since they are the sole owner of the broker business. Corporate brokers, on the other hand, operate at a relatively larger scale and have multiple owners to jointly and severally fulfill this financial requirement. We hypothesize that sole brokers are more sensitive to the changes in this financial requirement and therefore, exhibit a more stringent screening process in loan origination.

Our results consistently indicate that sole brokers react to the consolidated financial requirement by performing more cautiously and rigorously in conducting brokerage services, as evidenced in originating

lower loan amount, negotiating higher loan price, and improved subsequent loan performances that result in reduced default and prepayment risks. However, these findings are absent in the analysis among corporate brokers, which supports our hypothesis that sole brokers are more affected by the elevated financial requirement in occupational licensing. Reinforced regulatory oversights are therefore needed for corporate brokers beyond financial requirements.

We provide further evidence that the underlying mechanisms under which sole brokers adjust their screening standards in response to more stringent licensing regulations stand in sharp contrast to that of corporate brokers. When making loan decisions, lenders increasingly rely on borrower characteristics such as FICO score and CLTV ratio, variables that are reported to future investors for securitization. However, there are some credit-relevant information such as internal rating, employment type and number of dependents that are unreported to investors, which consequently become less important to lenders (Keys et al. 2012; Rajan et al. 2015). We find that although corporate brokers use reported variables to help them make better assessments of loan quality, unreported credit relevant variables that are suggestive of inherent risks in loans are not accounted for. By contrast, sole brokers consider borrower characteristics that are unreported or less critical to investors. They prefer borrowers with better internal ratings and are less likely to select borrowers with implicitly risky characteristics such as not having fixed income, being self-employed, and having more dependents. Sole brokers are also less likely to engage in stated-doc loans. An array of robustness tests justifies that the financial regulatory effects on sole brokers are consistent across classifications of broker type, loan types and regions.

This paper contributes to the existing literature on mortgage brokers on several dimensions. First, it extends previous studies by explicitly accounting for the heterogeneous responses to consolidated occupational licensing regulations between sole and corporate brokers. The study provides evidence that sole and corporate brokers exhibit different responses to regulatory oversights. Second, this paper extends the existing literature, which is restricted to detect the regulatory effect on mortgage brokers, by exploring the mechanisms under which sole and corporate brokers react to financial regulations by adjusting their

screening strategies accordingly. Our analysis on welfare loss indicates that stricter licensing regulations may encourage brokers to over-react when screening loan applicants, causing reduced credit access as some reasonable loan applications may not be funded, including those with potentially lower default risk. Third, this paper contributes to the fast-growing literature that examines the misaligned incentives for loan screening due to the expansion in mortgage securitization. Reported information such as FICO scores becomes increasingly important for lenders in making loan funding and pricing decisions but becomes a poorer predictor of loan defaults (Keys et al. 2010, Keys et al. 2012, Rajan et al. 2015). Our findings provide novel evidence that in responding to the elevated financial requirement for occupational licensing, corporate brokers exacerbate this tendency. As the intermediary and the major player in the loan origination process, they serve to tilt the screening standards toward heavy reliance on reported information and push away from the unreported credit-relevant information.

Finally, this paper broadly contributes to the growing controversy over the role of mortgage brokers in causing the financial crisis. This paper presents evidence that even in states undergoing the most severe economic downturn, the financial requirement is effective in mitigating moral hazards among sole brokers. We provide evidence that the agency problem among sole brokers can be mitigated by the consolidated financial requirement for occupational licensing. However, such a provision is ineffective in governing corporate brokers where agency problems may be exacerbated. Current occupational licensing regulations have limited oversight impact on corporate brokers who dominate mortgage brokerage market. From a policy perspective, this analysis provides insights into how occupational licensing regulations for mortgage brokers should be reformed.

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Table 1 Summary of License Regulations for Mortgage Broker by State during 1996-2006

State	Number of Changes	Bond_Net Worth (dollar amount)	Regulation Index	State	Number of Changes	Bond_Net Worth (dollar amount)	Regulation Index
AK	0	0	0	MT	1	6,818	3.27
AL	1	11,364	1.82	NC	1	22,727	5.09
AR	2	60,455	1.82	ND	0	25,000	1
AZ	0	10,000	5	NE	1	54,545	1
CA	0	0	10	NH	0	20,000	1.55
CO	0	0	0	NJ	2	120,455	8
CT	1	51,364	4.27	NM	0	25,000	1
DC	0	22,500	1	NV	1	18,182	7
DE	0	25,000	1	NY	1	2,727	2
FL	0	0	14.45	OH	1	36,364	6.55
GA	1	34,091	3.18	OK	0	0	5.18
HI	0	15,000	5.64	OR	1	20,909	4.55
IA	1	18,182	2.18	PA	0	0	2.64
ID	2	20,455	4.55	RI	0	20,000	4.64
IL	1	59,091	5.18	SC	0	10,000	5.82
IN	1	43,182	3.73	SD	0	0	1.82
KS	2	31,818	3.09	TN	1	85,455	1.18
KY	1	45,455	3.27	TX	1	15,909	5.18
LA	2	38,636	4.27	UT	0	0	3.73
MA	0	0	3.45	VA	1	15,909	1
MD	1	14,773	3.18	VT	2	11,818	2.91
ME	1	12,727	1.27	WA	0	20,000	5
MI	0	25,000	1	WI	1	8,182	2.18
MN	0	0	0.73	WV	2	27,273	2.64
MO	1	40,455	1	WY	1	4,545	0.36
MS	0	25,000	4.27				

Data source: Pahl (2007), "A Compilation of State Mortgage Broker Laws and Regulations, 1996–2006"

This table presents 1. Number of changes in surety bond/ net worth requirement in each state during 1996-2006;

2. State-level average value of surety bond and net worth requirements during 1996-2006;

3. State-level average Regulation Index which measures the overall restrictiveness of various licensing regulations (calculated as Pahl's Index after subtracting the numerical codes assigned to surety bond and net worth requirements).

Table 2 Descriptive Statistics

Variables	Sole Brokers		Corporate Brokers		Diff.	Restricted Pooled Sample	
	Mean	Std.Dev.	Mean	Std.Dev		Mean	Std. Dev.
	(1)	(2)	(3)	(4)		(6)	(7)
<i>Sole</i>						0.18	0.38
<i>Default</i>	0.04	0.21	0.04	0.20	0	0.04	0.19
<i>Prepay</i>	0.77	0.42	0.78	0.42	-0.01***	0.78	0.41
LICENSE REGULATION VARIABLES							
<i>Bond_Net Worth</i>	8541	19748	17980	29307	-9440**	8167.42	18712.61
<i>Log (Bond_Net Worth)</i>	2.72	4.52	4.87	5.15	-2.15**	2.74	4.51
<i>Regulation Index</i>	8.56	3.00	7.39	4.28	1.17***	8.46	3.35
<i>Sole×Log (Bond_Net Worth)</i>						0.42	2.02
LOAN CHARACTERISTICS							
<i>APR</i>	8.93	1.65	8.89	1.60	0.04**	8.79	1.62
<i>Interest rate</i>	7.62	1.42	7.80	1.42	-0.18***	7.57	1.37
<i>Loan amount</i>	191684	120902	231199	139357	-39515**	228045	131251
<i>FICO</i>	626	63	614	61	12**	621	62
<i>DTI</i>	85.06	14.68	83.88	14.22	1.18**	83.49	15.00
<i>CLTV</i>	40.18	8.76	39.97	8.94	0.21**	40.42	8.71
<i>Internal rating</i>	2.48	3.29	2.42	2.94	0.06**	2.43	3.09
<i>Fixed rate</i>	0.25	0.43	0.26	0.44	-0.01**	0.25	0.43
<i>Interest only</i>	0.21	0.41	0.13	0.34	0.08***	0.18	0.39
<i>Prepayment penalty</i>	0.82	0.38	0.78	0.41	0.04**	0.85	0.36
<i>Stated-doc</i>	0.46	0.50	0.40	0.49	0.06**	0.43	0.50
<i>Interviewed</i>	0.47	0.50	0.43	0.49	0.04**	0.42	0.49
<i>Purchase</i>	0.41	0.49	0.33	0.47	0.08**	0.34	0.47
<i>No cash-out refinance</i>	0.57	0.50	0.64	0.48	-0.07**	0.64	0.48

<i>Cash-out refinance</i>	0.02	0.15	0.03	0.16	-0.01**	0.03	0.16
PROPERTY CHARACTERISTICS							
<i>Primary residence</i>	0.91	0.28	0.91	0.28	0	0.92	0.27
<i>Second home</i>	0.012	0.11	0.013	0.11	0.001**	0.01	0.11
<i>Investment</i>	0.07	0.26	0.07	0.26	0	0.07	0.25
BORROWER CHARACTERISTICS							
<i>Fixed income</i>	0.05	0.22	0.07	0.26	-0.02**	0.06	0.24
<i>Borrower income</i>	8.61	0.66	8.48	0.67	0.13***	8.58	0.66
<i>Married</i>	0.57	0.49	0.60	0.49	-0.03**	0.60	0.49
<i>Single</i>	0.42	0.49	0.40	0.49	0.02**	0.39	0.49
<i>Separated</i>	0.01	0.08	0.01	0.08	0	0.01	0.08
<i>Borrower age</i>	42.5	11.83	43.22	11.91	-0.72**	43.18	11.89
<i>Minority</i>	0.38	0.49	0.31	0.46	0.07**	0.36	0.48
<i>Female</i>	0.38	0.49	0.37	0.48	0.01**	0.37	0.48
<i>Job years</i>	7.77	7.63	8.04	8.22	-0.27**	8.06	7.95
<i>Self-employed</i>	0.29	0.45	0.23	0.42	0.06**	0.25	0.44
<i>Number of dependents</i>	3.92	1.78	3.76	1.89	0.16**	3.85	1.83
<i>Market size (1 year lagged)</i>	0.11	0	0.07	0	-0.42***	0.11	0.06
Number of loans	45,172		403,915		226,094		
Number of brokers	4,359		28,935		17,528		

1. *** p<0.01, ** p<0.05, * p<0.1.

2. Column (5) reports the statistical significance of the mean differences between Columns (1) and (3) based on t-test.

Table 3 Baseline Test: Does a Higher Financial Barrier Improve Sole Brokers' Screening Standards?

Dependent Variable: *Default*

<i>VARIABLES</i>	Sole Brokers			Full Pooled Sample		Restricted Pooled Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Sole</i>				0.074 (0.065)	0.084 (0.065)	0.007 (0.017)	0.025 (0.023)
<i>Log (Bond_Net Worth)</i>	-0.006*** (0.002)	-0.005*** (0.001)	-0.008*** (0.002)				
<i>Sole×Log (Bond_Net Worth)</i>				-0.004*** (0.001)	-0.003** (0.001)	-0.004*** (0.001)	-0.003** (0.001)
<i>Regulation Index</i>		-0.002 (0.002)	-0.000 (0.002)				
<i>Sole×Regulation_Index</i>					-0.002 (0.002)		-0.002 (0.002)
<i>FICO/100</i>	-0.032*** (0.003)	-0.032*** (0.002)	-0.032*** (0.003)	-0.025*** (0.001)	-0.025*** (0.001)	-0.023*** (0.001)	-0.023*** (0.001)
<i>CLTV/100</i>	0.050*** (0.009)	0.050*** (0.009)	0.053*** (0.011)	0.031*** (0.003)	0.031*** (0.003)	0.034*** (0.004)	0.034*** (0.004)
<i>DTI/100</i>	0.014 (0.014)	0.014 (0.012)	0.009 (0.013)	0.009** (0.004)	0.009** (0.004)	0.010* (0.005)	0.010* (0.005)
<i>Interest rate</i>	0.010*** (0.001)	0.010*** (0.001)	0.009*** (0.001)	0.012*** (0.000)	0.012*** (0.000)	0.012*** (0.001)	0.012*** (0.001)
<i>Log (Loan amount)</i>	0.008** (0.003)	0.008*** (0.003)	0.010** (0.004)	0.008*** (0.001)	0.008*** (0.001)	0.009*** (0.001)	0.009*** (0.001)
<i>Fixed rate</i>	-0.009** (0.003)	-0.009*** (0.003)	-0.007* (0.004)	-0.012*** (0.001)	-0.012*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)
<i>Interest-only</i>	0.002 (0.003)	0.002 (0.003)	0.003 (0.002)	0.003*** (0.001)	0.003*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
<i>Second home</i>	0.003 (0.012)	0.004 (0.009)	-0.001 (0.012)	-0.004 (0.003)	-0.004 (0.003)	0.000 (0.004)	0.000 (0.004)
<i>Investment</i>	-0.002 (0.003)	-0.002 (0.004)	-0.000 (0.004)	-0.002* (0.001)	-0.002* (0.001)	-0.004** (0.002)	-0.004** (0.002)
<i>No cash-out refinance</i>	-0.016*** (0.004)	-0.016*** (0.003)	-0.016*** (0.004)	-0.011*** (0.001)	-0.011*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)
<i>Cash-out refinance</i>	-0.022** (0.010)	-0.021** (0.009)	-0.017* (0.010)	-0.031*** (0.003)	-0.031*** (0.003)	-0.028*** (0.004)	-0.028*** (0.004)
<i>Log (Borrower income)</i>	0.001 (0.002)	0.001 (0.002)	0.000 (0.002)	-0.002*** (0.001)	-0.002*** (0.001)	-0.001 (0.001)	-0.001 (0.001)

<i>Prepayment penalty</i>	0.005 (0.004)	0.005 (0.003)	0.006* (0.004)	0.008*** (0.001)	0.008*** (0.001)	0.007*** (0.002)	0.007*** (0.002)
<i>Single</i>	0.011*** (0.002)	0.011*** (0.002)	0.011*** (0.002)	0.011*** (0.001)	0.011*** (0.001)	0.011*** (0.001)	0.011*** (0.001)
<i>Separated</i>	0.000 (0.013)	0.000 (0.012)	0.002 (0.014)	0.008** (0.004)	0.008** (0.004)	0.005 (0.005)	0.005 (0.005)
<i>Borrower age</i>	-0.005 (0.010)	-0.005 (0.009)	-0.007 (0.011)	-0.019*** (0.003)	-0.019*** (0.003)	-0.004 (0.004)	-0.004 (0.004)
<i>Minority</i>	0.002 (0.003)	0.002 (0.002)	0.002 (0.002)	0.006*** (0.001)	0.006*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
<i>Female</i>	-0.005** (0.002)	-0.005** (0.002)	-0.006** (0.002)	-0.005*** (0.001)	-0.005*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)
<i>Interviewed</i>	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.000 (0.001)	-0.000 (0.001)	-0.002* (0.001)	-0.002* (0.001)
<i>Stated-doc</i>	0.008*** (0.002)	0.009*** (0.002)	0.009*** (0.002)	0.005*** (0.001)	0.005*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
<i>Job years/100</i>	-0.028** (0.013)	-0.029** (0.014)	-0.031** (0.014)	-0.023*** (0.004)	-0.023*** (0.004)	-0.027*** (0.006)	-0.027*** (0.006)
<i>Self-employed</i>	-0.001 (0.003)	-0.002 (0.003)	-0.003 (0.003)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
<i>Market size (%)</i>	-0.005** (0.002)	-0.005** (0.002)	-0.005** (0.002)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002** (0.001)	-0.002** (0.001)
<i>Constant</i>	0.093** (0.047)	0.108** (0.047)	0.092 (0.066)	0.015 (0.014)	0.016 (0.014)	-0.018 (0.020)	-0.017 (0.020)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes		Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes		Yes	Yes	Yes	Yes
Zip code Fixed Effects			Yes				
Observations	45,172	45,172	45,172	449,085	449,085	226,094	226,094
R-squared	0.074	0.074	0.130	0.140	0.140	0.133	0.133

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table reports the estimates of Eq. 1 with the dependent variable being *Default*. Columns (1) to (3) show the results using the baseline sole broker sample, i.e., loans originated through sole brokers. In Columns (1) and (2), we include fixed effects for year, state, and brokers with more than 10 loan originations; In Column (3), Year and Zip Code Fixed Effects are included.
3. Columns (4) and (5) show the results using the entire pooled sample containing loans through both types of brokers; Columns (6) and (7) show the results using the pooled sample restricted to zip codes with both types of brokers, i.e., loans from zip codes with only one type of brokers are removed. Year, State, and Broker Fixed Effects are included.
4. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Table 4 Placebo Tests: Does a Higher Financial Barrier Improve Corporate Brokers' Screening Standards?

Dependent Variable: *Default*

VARIABLES	Corporate Brokers			Uncontaminated Corporate Broker Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Log (Bond_Net Worth)</i>	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.000)
<i>Regulation Index</i>		-0.002* (0.001)	-0.002*** (0.001)		-0.002* (0.001)	-0.002*** (0.000)
<i>FICO/100</i>	-0.022*** (0.001)	-0.022*** (0.002)	-0.023*** (0.002)	-0.023*** (0.002)	-0.023*** (0.002)	-0.013*** (0.001)
<i>CLTV/100</i>	0.027*** (0.003)	0.027*** (0.003)	0.033*** (0.003)	0.029*** (0.003)	0.027*** (0.003)	0.029*** (0.003)
<i>DTI/100</i>	0.011*** (0.004)	0.012*** (0.005)	0.008* (0.004)	0.009* (0.005)	0.012** (0.005)	0.004 (0.004)
<i>Log (Loan amount)</i>	0.011*** (0.001)	0.012*** (0.002)	0.011*** (0.002)	0.009*** (0.002)	0.010*** (0.002)	0.008*** (0.001)
<i>Interest Rate</i>	0.014*** (0.001)	0.014*** (0.001)	0.014*** (0.001)	0.014*** (0.001)	0.014*** (0.001)	0.010*** (0.000)
<i>Fixed rate</i>	-0.013*** (0.001)	-0.013*** (0.001)	-0.013*** (0.001)	-0.013*** (0.001)	-0.014*** (0.001)	-0.009*** (0.001)
<i>Interest-only</i>	0.003** (0.001)	0.002** (0.001)	0.002* (0.001)	0.002** (0.001)	0.002 (0.001)	0.003*** (0.001)
<i>Second home</i>	-0.002 (0.003)	-0.002 (0.003)	-0.004 (0.003)	-0.003 (0.003)	0.000 (0.003)	-0.002 (0.003)
<i>Investment</i>	-0.003* (0.002)	-0.003 (0.002)	-0.003 (0.002)	-0.002 (0.002)	-0.002 (0.002)	0.002 (0.001)
<i>No cash-out refinance</i>	-0.012*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)	-0.009*** (0.001)
<i>Cash-out refinance</i>	-0.036*** (0.003)	-0.036*** (0.005)	-0.037*** (0.005)	-0.038*** (0.005)	-0.038*** (0.005)	-0.024*** (0.003)
<i>Log (Borrower income)</i>	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.003*** (0.001)	-0.002*** (0.001)
<i>Prepayment penalty</i>	0.008*** (0.001)	0.008*** (0.002)	0.008*** (0.002)	0.008*** (0.001)	0.007*** (0.001)	0.006*** (0.001)
<i>Single</i>	0.012*** (0.001)	0.012*** (0.001)	0.013*** (0.001)	0.012*** (0.001)	0.012*** (0.001)	0.010*** (0.001)

<i>Separated</i>	0.009*	0.009**	0.012***	0.009*	0.008	0.011***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
<i>Borrower age</i>	-0.015***	-0.017***	-0.017***	-0.018***	-0.021***	-0.007**
	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)
<i>Minority</i>	0.006***	0.006***	0.007***	0.007***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Female</i>	-0.004***	-0.004***	-0.004***	-0.005***	-0.005***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Interviewed</i>	-0.002**	-0.003***	-0.002***	-0.003**	-0.003***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Stated-doc</i>	0.004***	0.004***	0.003***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Job years/100</i>	-0.029***	-0.026***	-0.021***	-0.027***	-0.025***	-0.021***
	(0.005)	(0.005)	(0.000)	(0.005)	(0.006)	(0.004)
<i>Self-employed</i>	0.002*	0.002**	0.003***	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Market size (%)</i>	0.002**	0.002	-0.000	0.003**	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Constant</i>	-0.077***	-0.074***	-0.049*	-0.053**	-0.041*	-0.059***
	(0.016)	(0.022)	(0.025)	(0.026)	(0.024)	(0.014)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes		Yes	Yes	
Broker Fixed Effects	Yes	Yes		Yes	Yes	
Zip Code Fixed Effects			Yes			Yes
Observations	403,915	403,915	403,915	330,895	330,895	330,895
R-squared	0.119	0.122	0.075	0.066	0.136	0.080

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table reports the estimates of Eq. 1 with the dependent variable being *Default*. Columns (1) to (3) show the results using the corporate broker sample, i.e., loans originated through corporate brokers; In Columns (1) and (2), Year, State, and Broker Fixed Effects are included; in Column (3), Year and Zip Code Fixed Effects are included.
3. Columns (4) and (6) show the results using the uncontaminated corporate broker sample which removes loans that are likely to be conducted by incorporated individuals (i.e., a sole broker running as an incorporated entity). We conduct a propensity score match and remove loans in the corporate broker sample that are observationally similar as those in the sole broker sample. Specifically, we perform the nearest-2-neighbor matching based on the propensity scores computed from the logistic regression using all the loan and borrower characteristics specified in Tables 2. This creates a matched sample of 73,020 loans which are removed from the corporate broker sample, resulting in an “uncontaminated” corporate broker sample with 330,895 observations. In Columns (4) and (5), Year, State, and Broker Fixed Effects are included; in Column (6), Year and Zip Code Fixed Effects are included.
3. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Table 5 How Do Loan and Borrower Characteristics Vary with the Bond and Net Worth Requirement?

Panel A. Sole Brokers

VARIABLES	Sole Brokers							
	<i>FICO/100</i>	<i>CLTV/100</i>	<i>Stated-doc</i>	<i>Fixed income</i>	<i>Job years</i>	<i>Internal rating</i>	<i>Self-employed</i>	<i>Number of Dependents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Log (Bond_Net Worth)</i>	0.004 (0.006)	-0.077 (0.079)	-0.008** (0.003)	0.003** (0.001)	0.122** (0.001)	-0.046** (0.023)	-0.005** (0.003)	-0.050*** (0.012)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	45,172	45,172	45,172	45,172	45,172	45,172	45,172	45,172
R-squared	0.325	0.481	0.217	0.137	0.209	0.202	0.150	0.176

Panel B. Restricted Pooled Sample

VARIABLES	Restricted Pooled Sample							
	<i>FICO/100</i>	<i>CLTV/100</i>	<i>Stated-doc</i>	<i>Fixed income</i>	<i>Job years</i>	<i>Internal rating</i>	<i>Self-employed</i>	<i>Number of Dependents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Sole</i> × <i>Log (Bond_Net Worth)</i>	-0.008 (0.005)	0.022 (0.032)	-0.006*** (0.001)	0.002*** (0.000)	0.133** (0.003)	-0.066*** (0.022)	-0.007** (0.003)	-0.029** (0.013)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	226,094	226,094	226,094	226,094	226,094	226,094	226,094	226,094
R-squared	0.307	0.073	0.142	0.092	0.215	0.227	0.264	0.268

Panel C. Corporate Brokers

VARIABLES	Corporate Brokers							
	<i>FICO/100</i>	<i>CLTV/100</i>	<i>Stated-doc</i>	<i>Fixed income</i>	<i>Job years</i>	<i>Internal rating</i>	<i>Self-employed</i>	<i>Number of Dependents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Log (Bond_Net Worth)</i>	0.005*** (0.001)	-0.083*** (0.031)	-0.001 (0.001)	0.002 (0.001)	0.018 (0.017)	0.014*** (0.005)	0.003*** (0.001)	0.013*** (0.004)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	403,915	403,915	403,915	403,915	403,915	403,915	403,915	403,915
R-squared	0.335	0.239	0.222	0.138	0.172	0.161	0.170	0.248

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. Panel A presents the estimates using a sample containing loans originated through sole brokers. We include fixed effects for year, state, and brokers with more than 10 loan originations.
3. Panel B presents the estimates using the pooled sample restricted to zip codes with both types of brokers. Year, State, and Broker Fixed Effects are included.
4. Panel C presents the estimates using the corporate broker sample, i.e., loans originated through corporate brokers. Year, State, and Broker Fixed Effects are included.
5. The results remain robust regardless of the inclusion of Regulation Index.
6. We lag all the licensing regulation variables one year to capture their effects on brokers at the time when the loan processing started.

Table 6 Annual Percentage Rate (APR) and Loan Amount

Variables	Sole Brokers		Restricted Pooled Sample		Corporate Brokers	
	<i>APR</i>	<i>Log (loan amount)</i>	<i>APR</i>	<i>Log (loan amount)</i>	<i>APR</i>	<i>Log (loan amount)</i>
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Log (Bond_Net Worth)</i>	0.026*** (0.006)	-0.008** (0.004)			-0.014*** (0.002)	-0.002** (0.001)
<i>Sole</i> × <i>Log (Bond_Net Worth)</i>			0.012** (0.006)	-0.006** (0.003)		
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	45,172	45,172	226,094	226,094	403,915	403,915
R-squared	0.764	0.700	0.785	0.634	0.751	0.678

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. Base on the baseline sole broker sample, Columns (1) and (2) present the estimates of Eq.1 with the dependent variable being *APR and Log (loan amount)*. We include fixed effects for Year, State, and Brokers with more than 10 loan originations
3. Based on the restricted pooled sample, Columns (3) and (4) present the estimates of Eq.1 with the dependent variable being *APR and Log (loan amount)*, with Year, State and Broker Fixed Effects include.
4. Based on the corporate brokers sample, Columns (5) and (6) present the estimates of Eq.1 with the dependent variable being *APR and Log (loan amount)*, with Year, State and Broker Fixed Effects include.
5. The results remain robust regardless of the inclusion of Regulation Index.
6. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Table 7 Response Dynamics to Changes in Surety Bond/Net Worth Requirement

VARIABLES	Event Year Dummies in level			Event Year Dummies in interaction with <i>Log (Bond_Net Worth)</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>APR</i>	<i>Log (loan amount)</i>	<i>Default</i>	<i>APR</i>	<i>Log (loan amount)</i>	<i>Default</i>
1 year prior to the change	0.062 (0.125)	0.044 (0.054)	-0.048 (0.032)	-0.010 (0.015)	0.002 (0.004)	-0.001 (0.005)
Year of change	0.137 (0.087)	-0.027 (0.040)	-0.009 (0.019)	0.014 (0.015)	-0.005 (0.004)	-0.001 (0.004)
1 year after the change	0.157* (0.087)	-0.005 (0.038)	-0.065*** (0.019)	0.014** (0.007)	-0.006 (0.004)	-0.007*** (0.002)
2 years after the change	0.047 (0.069)	-0.018 (0.029)	0.012 (0.015)	0.002 (0.005)	-0.001 (0.003)	0.001 (0.002)
3 years after the change	0.070 (0.078)	-0.056* (0.029)	-0.050*** (0.014)	0.002 (0.006)	-0.006** (0.003)	-0.005*** (0.002)
4 years after the change	-0.053 (0.088)	-0.060* (0.034)	-0.024* (0.013)	-0.004 (0.006)	-0.006* (0.004)	-0.003* (0.001)
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,554	9,554	9,554	9,554	9,554	9,554
R-squared	0.741	0.678	0.216	0.741	0.677	0.216

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the analyses on the response dynamics as specified in Eq. 2. The estimates are based on a subsample that is restricted to loans originated through sole brokers from states with only one change in surety bond or net worth requirement from 1997 to 2006. The dependent variables are *APR*, *Log (loan amount)*, and *default*, respectively.
3. Note that there are two model specifications: Columns (1) to (3) are estimates from the model with only event year dummies; and in Columns (4) to (6), each of the year dummies interact with bond and net worth requirements (*Log (Bond_Net Worth)*) as an alternative specification. To conserve space, the estimates for control variables are not reported. Regulation Index, controls for loan, property, and borrower characteristics remain the same as specified in Table 3. Year, State, and Broker Fixed Effects are included.
4. The results remain robust regardless of the inclusion of Regulation Index.
5. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Table 8 Robustness

Panel A. Default Risk Using Consolidated Sole Broker and Corporate Broker Samples

VARIABLES	Sole Brokers: Consolidated		Pooled Sample: Consolidated		Corporate Brokers: Consolidated	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Log (Bond_Net Worth)</i>	-0.005*** (0.001)	-0.004*** (0.002)			0.000 (0.001)	0.000 (0.001)
<i>Sole×Log (Bond_Net Worth)</i>			-0.003** (0.001)	-0.003** (0.001)		
<i>Regulation Index</i>		-0.002 (0.002)				-0.002* (0.001)
<i>Sole×Regulation_Index</i>				-0.002 (0.002)		
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,787	38,787	423,777	423,777	384,990	384,990
R-squared	0.073	0.073	0.138	0.127	0.061	0.119

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table reports the estimates of Eq. 1 with the dependent variable being *Default*. Columns (1) and (2) show the results using a subsample of the baseline sole brokers sample, where each broker has the first and last name (a name for a natural person), and the company name is exclusive to sole brokers (i.e., sole brokers and corporate brokers have no common company name).
3. Columns (3) and (4) show the results using the pooled sample of consolidated sole and corporate brokers.
4. Columns (5) and (6) reports the results using a subsample of the corporate brokers sample, where each employee of the broker company has no first or last name, and the company name is exclusive to corporate brokers (i.e., sole brokers and corporate brokers have no common company name).
5. Controls for loan, property, and borrower characteristics remain the same as specified in Tables 3 and 4. Year, State, and Broker Fixed Effects are included.
6. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Panel B. Default Risk and Loan/Borrower Characteristics: Small Brokers

VARIABLES	Small Brokers								
	<i>Default</i>	<i>FICO/100</i>	<i>CLTV/100</i>	<i>Stated-doc</i>	<i>Fixed income</i>	<i>Job years</i>	<i>Internal rating</i>	<i>Self-employed</i>	<i>Number of dependents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Log (Bond_Net Worth)</i>	-0.004*** (0.001)	-0.003 (0.003)	0.029 (0.054)	-0.007*** (0.003)	0.003** (0.001)	0.116*** (0.032)	-0.042*** (0.014)	-0.008*** (0.002)	-0.048*** (0.008)
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	91,900	91,900	91,900	91,900	91,900	91,900	91,900	91,900	91,900
R-squared	0.067	0.469	0.169	0.210	0.364	0.176	0.132	0.169	0.160

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the results from repeating the estimate of Table 3 (Column(1)) and Table 5A (Columns(2) to (9)) using the small broker sample which is restricted to loans originated through sole brokers and corporate brokers with four or fewer employees engaging in brokerage activities with New Century. We include fixed effects for Year, State, and Brokers with more than 10 loan originations.
3. The results remain robust regardless of the inclusion of Regulation Index.
4. We lag all the licensing regulation variables one year to capture their effects on brokers at the time when the loan processing started.

Panel C. Default Risk and Loan/Borrower Characteristics: Medium and Large Brokers

VARIABLES	Medium and Large Brokers								
	<i>Default</i>	<i>FICO/100</i>	<i>CLTV/100</i>	<i>Stated-doc</i>	<i>Fixed income</i>	<i>Job years</i>	<i>Internal rating</i>	<i>Self-employed</i>	<i>Number of dependents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Log (Bond_Net Worth)</i>	0.000 (0.000)	0.004*** (0.001)	-0.057** (0.028)	-0.001 (0.001)	0.002 (0.001)	0.022 (0.018)	0.016*** (0.006)	0.003*** (0.001)	0.017*** (0.004)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	357,187	357,187	357,187	357,187	357,187	357,187	357,187	357,187	357,187
R-squared	0.131	0.289	0.199	0.227	0.141	0.186	0.164	0.173	0.252

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the results from repeating the estimate of Table 4 (Column (1)) and Table 5C (Columns (2) to (9)) with the medium and large broker sample which is restricted to loans originated through corporate brokers with at least five employees engaging in brokerage activities with NCFC. Year, State and Broker Fixed Effects are included.
3. The results remain robust regardless the inclusion of Regulation Index.
4. We lag all the licensing regulation variables one year to capture their effects on brokers at the time when the loan processing started.

Panel D. Alternative Measures of Financial Requirement

Dependent Variable: *Default*

Variables	Sole Brokers: Remove Missouri		Sole Brokers	
	(1)	(2)	(3)	(4)
<i>Log (Bond_Net Worth)</i>	-0.008*** (0.002)	-0.008*** (0.002)		
<i>Log (Net worth)</i>			-0.006*** (0.002)	-0.004** (0.002)
<i>Regulation Index</i>		-0.001 (0.002)		-0.004 (0.002)
Loan characteristics	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Zip code Fixed Effects	Yes	Yes	Yes	Yes
Observations	44,968	44,968	45,172	45,172
R-squared	0.128	0.128	0.129	0.129

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the estimates with the dependent variable being *Default*.
3. Columns (1) and (2) report the results from repeating the estimate of Table 3 with loans from Missouri being removed. Columns (3) and (4) report the results from repeating the estimate of Table 3 with the alternative financial requirement – *Log (Net worth)*.
4. We lag all the licensing regulation variables one year to capture their effects on brokers at the time when the loan processing started.

Panel E. Heterogeneity Analysis by Loan Type and Geography

Dependent Variable: *Default*

VARIABLES	Stated-doc Loans (1)	Full-doc Loans (2)	Sand States (3)	Other States (4)	States with Financial Requirement (5)
<i>Log (Bond_Net Worth)</i>	-0.006** (0.003)	-0.004** (0.002)	-0.067*** (0.014)	-0.005** (0.002)	-0.005** (0.002)
Loan characteristics	Yes	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	20,780	24,392	27,439	17,688	13,416
R-squared	0.281	0.228	0.174	0.193	0.183

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the results from repeating the estimate of Table 3 using five different subsamples of the baseline sole brokers. The results shown in Column (1) are confined to stated documentation loans originated through sole brokers, and Column (2) represents results from full documentation loans with sole brokers. Column (3) represents the result from sole broker-originated loans from sand states (AR, CA, FL and NV), and Column (4) shows the estimates based on sole broker-originated loans from the remaining 47 states. Lastly, the results shown in Column (5) are based on a subsample that excludes sole broker-originated loans from states where the bond and net worth requirements are absent throughout the sample period 1997–2006.
3. The results remain robust regardless of the inclusion of Regulation Index.
4. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Table 9 Prepayment Risk

Dependent Variable: *Prepay*

Variables	Sole Brokers		Restricted Pooled Sample	
	(1)	(2)	(3)	(4)
<i>Sole</i>			0.040 (0.027)	-0.002 (0.038)
<i>Log (Bond_Net Worth)</i>	-0.005*** (0.002)	-0.006** (0.002)		
<i>Sole</i> × <i>Log (Bond_Net Worth)</i>			-0.005** (0.002)	-0.006** (0.002)
<i>Regulation Index</i>		0.001 (0.003)		
<i>Sole</i> × <i>Regulation Index</i>				0.005 (0.03)
Loan characteristics	Yes	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,172	45,172	226,094	226,094
R-squared	0.422	0.422	0.488	0.488

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table reports the estimates of Eq. 1 with the dependent variable being *Prepay*. Columns (1) and (2) show the results using the baseline sole broker sample. Columns (3) and (4) show the results using the pooled sample restricted to zip codes with both types of brokers, i.e., loans from zip codes with only one type of brokers are removed.
3. Controls for loan, property, and borrower characteristics remain the same as specified in Tables 3 and 4. Year, State, and Broker Fixed Effects are included.
4. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

Table 10 Welfare Loss: Do Sole Brokers Overreact in Response to Higher Financial Requirement?

Panel A: Rejection Rate

Variables	Sole Brokers	Pooled Sample	Corporate Brokers
	(1)	(2)	(3)
<i>Log (Bond_Net Worth)</i>	0.011*** (0.002)		0.004** (0.002)
<i>Sole×Log (Bond_Net Worth)</i>		0.007*** (0.002)	
Loan characteristics	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes
Rejection rate (%)	19.74	18.27	17.44
R-squared	0.263	0.264	0.264
Observations	78,759	780,286	701,527

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the estimates of Eq. 1 with the dependent variable being *Reject*. Columns (1) and (2) are estimates using a sample with loan applications with sole brokers. Columns (3) and (4) are estimates using a sample with loan applications with corporate brokers. Column (5) shows the result based on a sample with loan applications with both sole and corporate brokers. Regulation Index, controls for loan, property, and borrower characteristics remain the same as specified in Tables 3 and 4. Year, State, and Broker Fixed Effects are included.
3. The results remain robust regardless of the inclusion of Regulation Index.
4. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started.

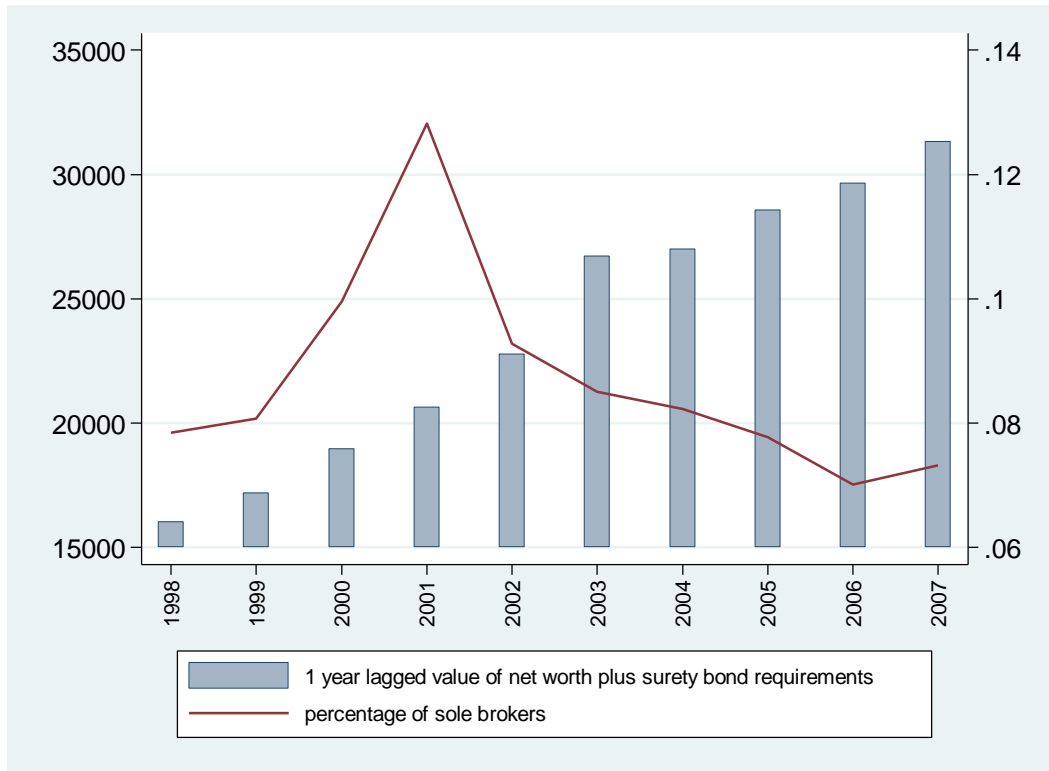
Panel B: Default Risk of Counterfactual Funded Loans

Dependent Variable: *Default*

Variables	Corporate Brokers		
	(1)	(2)	(3)
<i>Sole-rejected</i>	-0.007*** (0.003)		
<i>Sole-rejected_High FICO</i>		-0.015*** (0.004)	
<i>Sole-rejected_Low Income</i>			-0.014*** (0.004)
Loan characteristics	Yes	Yes	Yes
Property characteristics	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Broker Fixed Effects	Yes	Yes	Yes
No. of counterfactual funded loans	5,998	2,773	2,350
Observations	403,915	403,915	403,915
R-squared	0.123	0.123	0.123

1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.
2. This table presents the estimates using the baseline corporate brokers sample, with the dependent variable being *Default*.
3. Column (1) reports the estimates using the baseline corporate brokers sample which includes 5,998 matched loans that are observationally similar as those unfunded loans with sole brokers. *Sole-rejected* is an indicator that takes a value of 1 if the loan among the 5,998 matched loans.
4. Column (2) reports the estimates using the baseline corporate brokers sample which includes 2,773 matched loans that are observationally similar as those unsuccessful but high-FICO scores applicants with sole brokers. *Sole-rejected_High FICO* is an indicator that takes a value of 1 if the loan is among the 2,773 matched loans.
5. Column (3) reports the estimates using the baseline corporate brokers sample which includes 2,350 matched loans that are observationally similar as those low-income unsuccessful applicants with sole brokers. *Sole-rejected_Low Income* is an indicator that takes a value of 1 if the loan is among the 2,350 matched loans.
6. The results remain robust regardless of the inclusion of Regulation Index.
7. We lag all the licensing regulation variables and market size one year to capture their effects on brokers at the time when the loan processing started. Year, State, and Broker Fixed Effects are included.

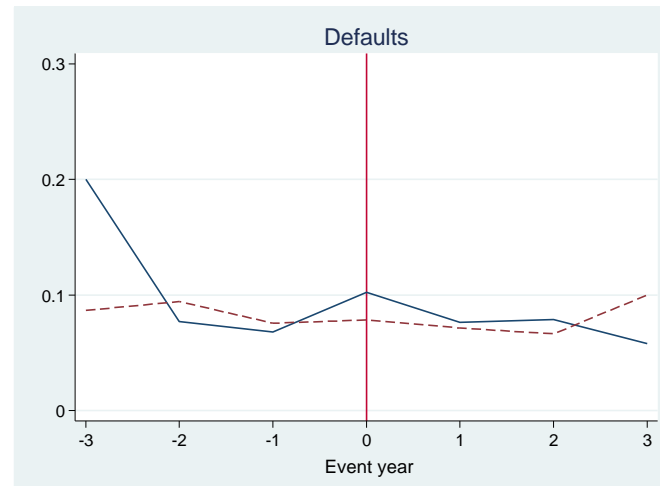
Figure 1 Percentage of Sole Brokers and Bond and Net Worth Requirements Over the Years



Source: NCFC dataset and authors' self-calculation.

The line represents the fraction of sole brokers out of all brokers in each of the years from 1998 to 2007. The bar chart represents the one year lagged national average value of bond and net worth requirements. This figure shows that the fraction of sole brokers to corporate brokers is decreasing as bond and net worth requirements increase over time.

Figure 2 Response Dynamics to Changes in the Financial Credibility Requirement

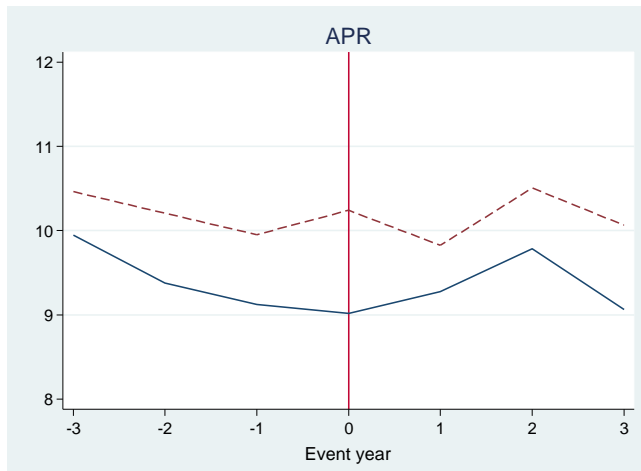


— Loans originated by sole brokers
 - - - Loans originated by corporate brokers

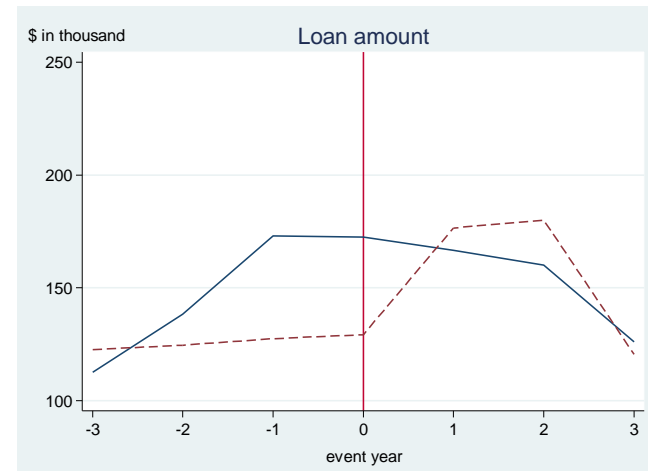
Source: NCFC dataset and authors' self-calculation.

The figures show (a) the average default rate, (b) APR, and (c) loan amount of loans originated through sole brokers and corporate brokers before and after the adjustment in surety bond and net worth requirements. Note that the sample for Figure 2 (a) to (c) are restricted to states with one change in surety bond and net worth requirements.

(a)

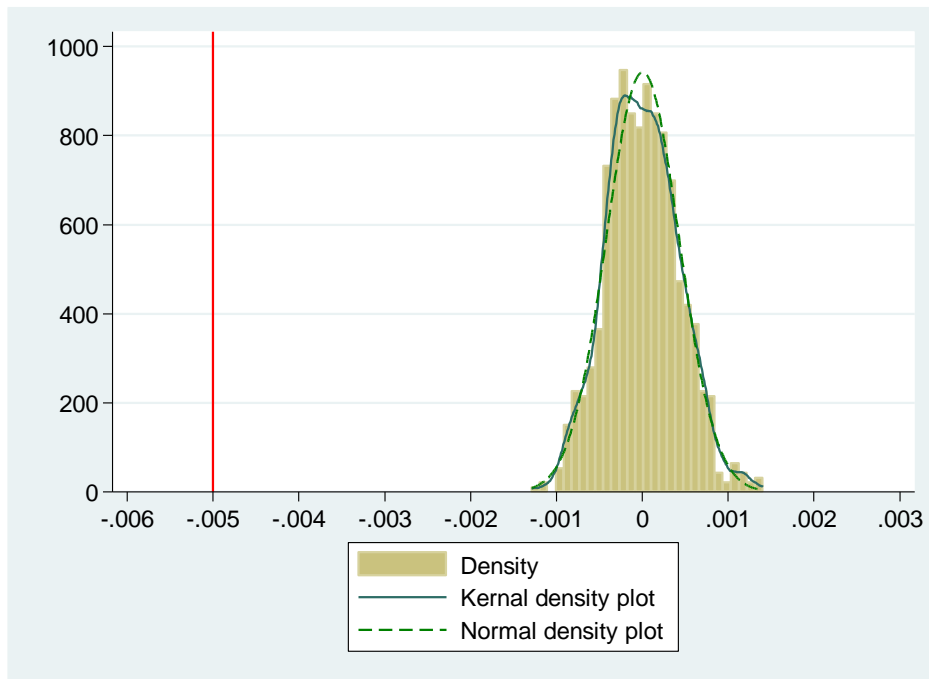


(b)

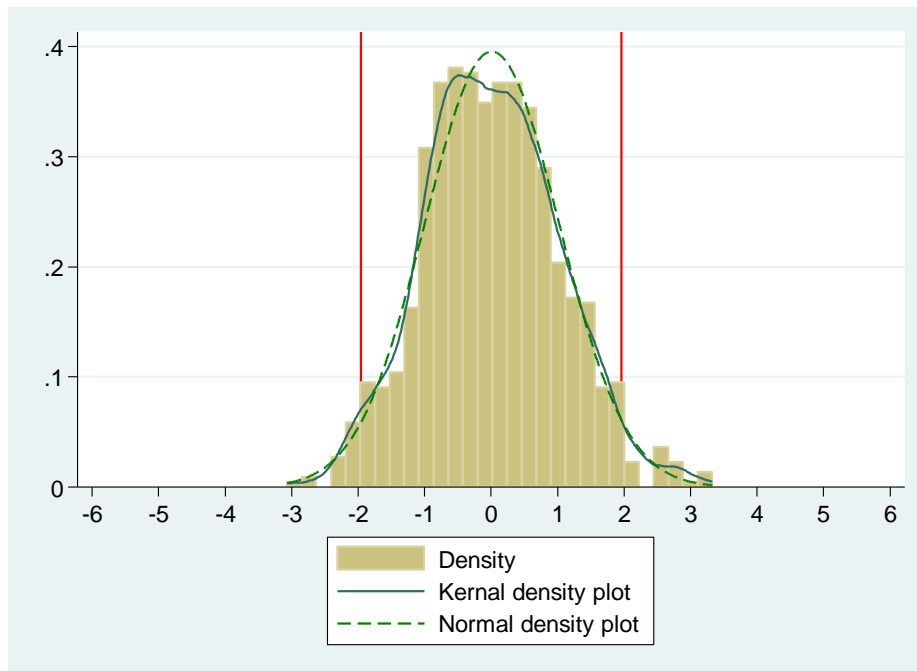


(c)

Figure 3 Distribution Plots on Parameter Estimates and t-values from Falsification Tests



(a) Distribution of Parameter estimates
Note that the estimated coefficients are multiplied by 10000



(b) Distribution of T-values

These figures present (a) the distribution of parameter estimates, and (b) the corresponding t-value of loan defaults in response to randomly assigned bond and net worth requirements. The estimates are calculated in the same way as those presented in Column (2) in Table 3.

Appendix

Table A 1 Variable Definitions

Variable name	Definition
<i>Sole</i>	An indicator variable takes a value of 1 if the loan was originated through a sole broker and 0 otherwise.
<i>Default</i>	An indicator variable takes a value of 1 if the loan has become delinquent for 60 days within the first 24 months following origination and the default is not preceded by a prepayment event, and 0 otherwise.
<i>Prepay</i>	An indicator variable takes a value of 1 if the loan has been paid in full within the first 24 months following origination and the prepayment is not preceded by a delinquency event, and 0 otherwise.
<i>Reject</i>	An indicator variable takes a value of 1 if the loan application is denied (i.e., HMDA action taken code=3), and 0 otherwise.
<i>Sole-rejected</i>	An indicator variable that takes a value of 1 if the loan is propensity-score matched, i.e., a loan that would not be rejected if a corporate broker was involved instead of a sole broker.
LICENSE REGULATIONS	
<i>Bond_Net Worth</i>	Sum of the dollar amount of surety bonds and net worth requirements for licensing.
<i>Log (Bond_Net Worth)</i>	The logarithm of one plus <i>Bond_Net Worth</i> .
<i>Log (Net Worth)</i>	The logarithm of one plus the dollar amount of net worth requirement.
<i>Regulation Index</i>	An index calculated by subtracting the numerical codes assigned to surety bond and net worth requirements from the summated value, i.e., the Pahl's index. In other words, this index represents the summation of the remaining 22 occupational licensing components which exclude net worth and surety bonds requirements.
LOAN CHARACTERISTICS	
<i>APR</i>	A proxy for loan price, representing the annual cost of a loan.
<i>Interest Rate</i>	The interest rate on a loan.
<i>Log (Loan amount)</i>	The natural logarithm of the unpaid principal balance at origination.
<i>FICO</i>	The score that summarizes the borrower's creditworthiness at loan origination.
<i>DTI</i>	Disclosure of the borrower's debt to income ratio at loan origination.
<i>CLTV</i>	Disclosure of the combined loan-to-value ratio at loan origination.
<i>Internal rating</i>	An integer ranging between 1 and 20 assigned by the lender with the intention to measure the riskiness of the loan. This variable was assigned during the loan application process.
<i>Fixed rate</i>	An indicator variable takes a value of 1 if the loan is a fixed-rate loan, and 0 otherwise.
<i>Interest-only</i>	An indicator variable takes a value of 1 if the loan is an interest-only mortgage, and 0 otherwise.
<i>Prepayment penalty</i>	An indicator variable takes a value of 1 if the loan comes with a prepayment penalty, and 0 otherwise.
<i>Stated doc</i>	An indicator variable takes a value of 1 if the loan is a stated documentation loan, and 0 otherwise.
<i>Interviewed</i>	An indicator variable takes a value of 1 if there was a face-to-face interaction between a mortgage broker and the borrower prior to the funding of the loan, and 0 otherwise.
<i>Purchase</i>	An indicator variable takes a value of 1 if the loan is for home purchase purpose, and 0 otherwise.

<i>No cash-out refinance</i>	An indicator variable takes a value of 1 if the loan is to refinance without cash-out, and 0 otherwise.
<i>Cash-out refinance</i>	An indicator variable takes a value of 1 if the loan is to refinance with cash-out, and 0 otherwise.
PROPERTY CHARACTERISTICS	
<i>Primary residence</i>	An indicator variable takes a value of 1 if the pledged property is owner-occupied, and 0 otherwise.
<i>Second home</i>	An indicator variable takes a value of 1 if the pledged property is the second home, and 0 otherwise.
<i>Investment</i>	An indicator variable takes a value of 1 if the pledged property is an investment property, and 0 otherwise.
BORROWER CHARACTERISTICS	
<i>Married</i>	An indicator variable takes a value of 1 if the borrower is married, and 0 otherwise.
<i>Single</i>	An indicator variable takes a value of 1 if the borrower is single, and 0 otherwise.
<i>Separated</i>	An indicator variable takes a value of 1 if the marital status of the borrower is separated, and 0 otherwise.
<i>Borrower age</i>	Indicates the age of the primary borrower (in years).
<i>Minority</i>	An indicator variable takes a value of 1 if the borrower is a minority (not a member of the white race), and 0 otherwise.
<i>Female</i>	An indicator variable takes a value of 1 if the borrower is a female, and 0 otherwise.
<i>Job years</i>	Indicates the borrower's working experience (in years).
<i>Fixed income</i>	An indicator variable takes a value of 1 if the borrower has fixed income, and 0 otherwise.
<i>Log (Borrower income)</i>	The logarithm of one plus borrower's income.
<i>Self-employed</i>	An indicator variable takes a value of 1 if the borrower is self-employed, and 0 otherwise.
<i>Number of dependents</i>	Indicates the number of dependents the primary borrower has.
<i>Low-income borrowers</i>	An indicator variable takes a value of 1 if the borrower's income is below the bottom 25th percentile among all borrowers in the sample, and 0 otherwise.
<i>Market size</i>	Number of HMDA loan originations in a given state each year divided by the sum of HMDA loan originations in all 50 states each year.