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ESSAYS ON BROKERS, FINANCIAL INTERMEDIARIES, AND SECURITIZED MORTGAGES

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Abstract

This dissertation examines the behaviors of brokers and intermediaries in various sectors of the real estate market. The first two chapters focus on real estate brokers in the housing market while the latter two focus on financial intermediaries in the securitized mortgage market. The purpose is to draw lessons or policy implications.

In Chapter 1, for instance, I find that homes owned by real estate agents sell at a premium of 2.7 percent (or $4,900) above the sale price of clients' homes. Homes of relatives sell at a premium of 1.3 percent (or $2,360). While prior literature attributes the price disparity to the agents' exploitation of information asymmetry about the market, I argue that the disparity likely derives from the contract rigidity in listing agreements. I show that real estate agents enjoy a low cost to breach contracts and can, therefore, enter or exit the market more easily than clients to obtain desirable prices. The policy implication is that reducing the agents' advantage requires increasing the households' power to breach listing agreements but at the trade-off of reducing the willingness of agents to participate in the market.

In Chapter 2, using use artificial intelligence, I identify financial steering activity that is fostered by real estate agents representing sellers. Examining data that allows me to observe private information exchanges between listing and buyer agents, I find that over 13 percent of the homes sold had bidding constraints requiring financed buyers to obtain a pre-qualification letter from an affiliated lender even if pre-qualified with another lender. I also find that while steering decreases the transaction costs sellers experience by screening buyers (as agents representing sellers often proclaim), it decreases the equilibrium price of the average home by about 1 percent (or $1,900). Financial steering also displaces financed buyers (especially African Americans and Hispanics) while it favors cash or corporate investors. These findings present a trade-off that policymakers encounter when designing and enforcing anti-steering or pro-competition regulations in financial markets.

In Chapter 3, I empirically examine the monitoring role of trustees in the securitization market for commercial mortgages. Using a natural experiment around mergers that result in servicers (i.e., agents) and trustees (i.e., monitors)

falling under the same institutional umbrella, I present evidence that affiliation is associated with a decrease in the servicers' effort made on behalf of investors (i.e., principals). I also find that a servicer-trustee affiliation causes distortions to the cash flows to bondholders and a decrease in the average recovery rate of a delinquent commercial mortgage by up to $0.07 per dollar of outstanding debt, accounting for an economic impact of about $4.53 billion in market-wide liquidation losses. The policy implication is that third-party oversight plays an imperative role in aligning incentives.

Finally, in Chapter 4, I examine how affiliation to senior bondholders can influence servicing decisions on delinquent loans in non-agency residential mortgage-backed securities. Making use of a natural experiment involving mergers and acquisitions that resulted in servicers owning investors who in turn have ownership of the bonds the servicers manage, I find that affiliation improves the chances that a loan is liquidated through a non-foreclosure avenue by about 33 percent relative to foreclosure. Moreover, analyzing investment-grade bond holdings, I find no evidence of senior investors responding negatively to servicer-investor affiliations in the RMBS market. Overall, these results suggest that exposing servicers to senior bond holdings through an affiliation with their own investors significantly improves the servicers' behavior.

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Dedication

I dedicate this dissertation to Patricia Zavala, my wife, love and best friend, who stood by me in this quest to seek a PhD; Javier A. Lopez, my father, for inspiring me to pursue real estate research; Teresa Lopez, my mother, for installing in me the basics of academic discipline; and Carla G. Mowen, my sister, for her optimism and words of encouragement. ¡*Si se pudo*!

Chapter 1
Asymmetric Information and Entrenchment in Brokered Housing Transactions

1.1 Introduction

Interactions between agents and property owners exemplify principal-agency concerns in financial transactions. The commission for selling a house should theoretically motivate the agent to find the highest bidder on behalf of the client (Arnold, 1992; Williams, 1998). But, the standard commission scheme often does not perfectly align the agent's incentives with those of the property owner as discussed by Rutherford, Springer and Yavas (2005, 2007) and Levitt and Syverson (2008*b*). Levitt and Syverson (2008*b*), for example, show that real estate agents consequently sell their clients' homes too quickly and below market value relative to their own homes. They attribute the discrepancies to information asymmetry about the property's market value. Follow up studies support this hypothesis (e.g., Bernheim and Meer, 2013; Stroebel, 2016; Allen et al., 2019). However, the growth of FinTech platforms such as Realtor, Redfin, Trulia, and Zillow that provide consumers easy access to automatic property valuation models along with a rich set of information about neighborhoods and historical or nearby sales challenge the asymmetric information hypothesis. Furthermore, as Hayunga and Munneke (2019) point out, the literature documents inconsistencies on whether agents sell

their own homes faster or slower than homes of clients.[1] Recent studies also posit that the price and marketing time discrepancies can be attributed to unobservable seller (Xie, 2018), buyer (Hayunga and Munneke, 2019) or property (Liu, Nowak and Smith, 2018) characteristics. This paper contributes to the debate on the asymmetric information hypothesis by quantifying the effect of varying ownership interests on market outcomes and providing an alternative explanation for the observable discrepancies—the cost to breach agency contracts.

I begin by exploiting a peculiar requirement in the laws governing brokered real estate transactions in Nevada that allows me to test the effect of varying ownership interests on market outcomes. According to Section 640 in Chapter 645 of the Nevada Administrative Codes (NAC), besides disclosing any direct ownership interests in real property for sale, real estate agents must also disclose whether they are related or affiliated to the property's owner.[2] The disclosure requirements hold irrespective of whether the owner is a person, corporation, or a trust, and even when the agent is not representing herself in the transaction. Hence, I identify and examine three forms of self-reported affiliations: (1) when the owner of the property is an agent ("agent-owned"), (2) when the owner is related to an agent ("agent-related"), and (3) when the owner and agent are at arm's-length ("arms-length"). Agency theory predicts that in the agent-owned affiliation type, agency costs dissipate if the agent and principal become the same entity. The agent-related affiliation type results in the second best arrangement if the agent develops an indirect interest in the ex-post performance of the principal and reacts accordingly even though the agent does not own the property. Finally, in the arms-length affiliation type, the agent's incentive mechanisms are reduced to reputation and state/performance-dependent compensation concerns.

Using single-family and condominium homes sold in the Greater Las Vegas area from 2008 to 2018, I find that agent-owned homes sell at an average premium of about 2.7 percent (or $4,900) relative to arms-length homes. Likewise, the average premium on agent-related homes exceeds 1.3 percent (or $2,360). The results

[1] For example, Rutherford, Springer and Yavas (2005) find that agents do not sell their own single-family homes any faster than those of their clients while Levitt and Syverson (2008*b*) find that agent-owned homes stay on the market longer. Rutherford, Springer and Yavas (2007), likewise, find that agents are more patient with their own condominiums. Xie (2018), however, find that the opposite results—agents sell their own homes faster than those of clients.

[2] See NAC, Chapter 645, Section 640: available at `https://www.leg.state.nv.us/NAC/NAC-645.html#NAC645Sec637`.

account for differences in structural, neighborhood, and contract characteristics along with location, time, property and agent fixed effects. The baseline results remain virtually unchanged when accounting for time-varying agent characteristics including the agents' years of experience in the real estate market and active license type, which I obtain from a novel administrative dataset on agent licensee records. The results also hold with a two-step Heckman correction for the impact of the agent's affiliation on the sale likelihood of homes. The results complement the asymmetric information hypothesis from the perspective that variation in the skills of interpreting real estate market data varies and may create advantages for experts. For instance, I show that real estate agents with intensive training in appraisal valuation obtain up to 11.4 percent (or $20,680) more when selling their own homes compared to what other agents obtain for their own homes, on average.

However, I hypothesize that agent affiliation premiums exist because arms-length clients unlike agents and relatives can be entrenched to sell even if below market value. This occurs because of contract rigidity.[3] When listing a home for sale on a multiple listing service (MLS), the owner of the property typically signs a contract (or listing agreement) that grants the agent an "Exclusive Right to Sell" whereby the listing agent may collect a commission in the event of a sale even if the agent herself did not procure the buyer.[4] Under this agreement, the listing agent could sue the property owner for breach of contract and collect unpaid commissions (e.g., *Kislak Co., Inc. v. Geldzahler* (1986); *Century 21 Butler Realty, Inc. v. Vasquez* (1995)). While termination of a listing agreement is possible and the success of a dispute depends on mediation and litigation decisions, clients affiliated to their agents likely do not encounter the same costs to breach the typical listing agreement. For example, affiliates can avoid the non-pecuniary costs of negotiating with the listing agent a request for early termination that will result in withdrawing the home from the market. Therefore, the entrenchment hypothesis is that the option to delay a sale by withdrawing from the market varies by agent-owner affiliation and subsequently affects market outcomes.

To test the entrenchment hypothesis, I analyze the outcome of all homes for sale,

[3] The following New York Times article discusses examples of contract rigidity in real estate listing agreements: https://www.nytimes.com/1987/03/08/realestate/talking-brokers-breaking-a-listing-agreement.html.

[4] In our sample, 98.4 percent of the listing agreements are described by the "Exclusive Right to Sell" contract type.

including over 91,000 failed listings that expired (i.e., never found a willing and able buyer) or were withdrawn from the market. Using a competing risk framework estimated with a multinomial logit model, I discover patterns that reflect differences in the flexibility to time the market by affiliation type. Specifically, during a period of market expansion (i.e., "the price is rising"), agents are patient. Agent-owned and agent-related listings are withdrawn from the market more often than arms-length listings; agent-owned and agent-related listings also expire more often than arms-length listings. During a period of market contraction (i.e., "the price is falling"), arms-length clients seem to be just as likely as their agents to withdraw their listings. Yet arms-length listings are more likely to expire than agent-owned and agent-related listings during a contraction. In other words, agents are impatient with their own listings when re-listing at a later date can result in a lower price. The time-on-market (TOM) measure for sold homes reflects patterns consistent with this behavior; for agents and relatives, TOM is marginally longer during expansions but shorter in contractions when compared to arm's-length transactions. In sum, the findings imply that arms-length clients do not exhibit the same flexibility to time the market as agents or relatives of agents.

To further validate the entrenchment hypothesis, I study how agent affiliations impact the market outcomes of residential property across seller type. The assumption is that institutional investors encounter a lower cost to breach a listing agreement than households and can enjoy the same flexibility to time the market. This assumption is reasonable because institutional sellers are less likely to encounter non-pecuniary costs relative to households when deciding whether to continue or withdraw from the housing market. For example, the former group may be risk neutral while that latter group is risk adverse towards litigation costs or even social frictions. Institutional sellers may also have greater ease at breaching listing agreements since they typically have more experience than households in transacting property or more resources to win a court battle. To perform this analysis, I identify the property's notarized owner recorded on deeds provided by CoreLogic. Analyzing the sold price and withdrawal behavior, I discover that the variation in agent affiliations within households, and not other seller types, drive the baseline results, which is consistent with the entrenchment hypothesis.

This paper contributes to the literature on agency frictions in financial transactions by being the first to show that relatives and affiliates of real estate agents also

enjoy a premium relative to clients at arm's length. Prior literature does not observe relatives and focuses instead on agents' direct ownership interests. Moreover, this paper documents that contract rigidity besides asymmetric information varies by the degree of ownership interests and influences market outcomes. The subsequent flexibility to withdraw from the market, coupled with variation in the market conditions, explains the variation in the agent's patience to accept an offer that puzzles prior literature (e.g., Rutherford, Springer and Yavas, 2005; Levitt and Syverson, 2008*b*; Rutherford, Springer and Yavas, 2007; Xie, 2018).

This paper relates to studies on how agents steer buyers to in-house transactions (e.g., Gardiner et al., 2007; Han and Hong, 2016), flat-fee brokerages (Levitt and Syverson, 2008*a*), listings with low commission rates (Barwick, Pathak and Wong, 2017), and racial neighborhoods (Ondrich, Ross and Yinger, 2003).[5] This paper also relates to Woodward and Hall (2010), Ambrose and Conklin (2014), and Ambrose, Conklin and Yoshida (2016) who study the incentive structure of mortgage brokers and the subsequent market consequences. In this genre, prior studies have also documented discrepancies in the secondary mortgage market by the financial institutions delegated to originate, underwrite, or service residential mortgages (e.g., Adelino, Gerardi and Willen, 2009; Piskorski, Seru and Vig, 2010; Keys et al., 2010; Agarwal et al., 2011; Piskorski, Seru and Witkin, 2015). Similar behaviors have also been documented in the domain of commercial mortgages (e.g., Christopoulos, Jarrow and Yildirim, 2008; Titman and Tsyplakov, 2010; Liu and Quan, 2013; Ambrose, Sanders and Yavas, 2016; Wong, 2018).

The findings complement the discussion on the incentive structure of intermediaries that surrounds the recent housing market crash in the United States and the government interventions aimed at improving consumer welfare and market efficiency (e.g., Eberly and Krishnamurthy, 2014; Agarwal et al., 2017). To discern the policy implications from this research, however, it is imperative to recognize the practical limitations of real estate agents. According to conversations with real estate brokers in Nevada, agents are contracted to sell or buy real estate; they are also advised to not encroach into other services they are not licensed to provide such as speculation about future market conditions or appraisals.[6] Moreover, agents

[5] Prior studies provide insights into the incentives that sellers and real estate brokers encounter: see, for example, Springer (1996), Glower, Haurin and Hendershott (1998), Munneke and Yavas (2001), and Allen et al. (2003).

[6] For legal advice given to real estate agents, see `http://red.nv.gov/uploadedFiles/`

risk not making a commission after investing marketing efforts, and failing to sell reflects poorly on an agent's performance. Hence, the imposed higher cost on a client to exit the market provides the agent an incentive to risk effort into selling a home. The "Exclusive Right to Sell," for example, protects the agent from a client using the listing agent to market the property while colluding with another agent to complete the transaction at a lower commission rate.[7] Coupling these stylized facts and my findings imply that reducing the consumers' disadvantage relative to agents and affiliates requires re-designing listing contracts to not only motivate but also empower the real estate agent to advise timely withdrawals from the market.

The rest of the paper proceeds as follows. In Section 1.2, I discuss the data and the institutional context surrounding disclosure requirements about ownership interests and affiliations. In Section 1.3, I present the baseline model and analysis along with a set of robustness checks. In Section 1.4, I examine how patterns of market timing ability vary by affiliation and over the real estate cycle. Finally, in Section 1.5, I provide policy implications and conclude.

1.2 Context and Data

I examine data on homes for sale from the Multiple Listing Service at the Greater Las Vegas Association of Realtors. The available dataset contains over 428,000 listings of single family and condominium homes put on the market between the 2008Q1 and 2018Q1. Real estate agents that subscribe to the MLS generally upload homes for sale to the MLS. Upon adding a home, the MLS generates a listing sheet populated by tax assessor records. The listing agent can make adjustments to the listing sheet and add additional details about the property for sale or transaction such as the property conditions, occupancy status, broker commission, and so forth. I further supplement the data with property ownership records from CoreLogic and licensee records from the Nevada Real Estate Division (NRED).

rednvgov/Content/Publications/References/lawguide2014.pdf.

[7] Rutherford, Springer and Yavas (2001), for example, find that listings with the "Exclusive Right to Sell," relative to those that only grant "Exclusive Agency" whereby the seller does not need to compensate the agent if the seller himself finds the buyer, motivate the listing agent to exert high e□ort in searching for a buyer; the incentive of the exclusive right to sell subsequently results in marginally higher prices but at the trade-o□ of slower transactions as measured by time-on-the-market.

1.2.1 Sample Selection

I exclude outliers and observations with missing fields. Specifically, I exclude sale records of homes 1) sold for a price above $769,000 or below $30,000, 2) with a living area above 5,000 square feet or below 700 square feet, 3) with a lot size larger than 50,000 square feet, 4) with more than six bedrooms or six bathrooms or four fireplaces, 5) with a garage that holds more than four cars, and 6) older than 65 years. To assuage concerns about heterogeneity in the dimension of property conditions, I also remove "flipled" properties. For the purposes of this study, flips are homes that re-sold within a year of its prior sale date, or has appeared on the market more than once during the same quarter and sold successfully. The final sample includes about 294,700 residential sale records. Applying similar restrictions to expired and withdrawn listings, I obtain a sample of more than 91,650 unsold homes.

Table 1.1 provides the definitions for variables in this study, and Table 1.2 reports the corresponding summary statistics of the property's structure, contract, and neighborhood characteristics for the sample of sold listings. The typical home in the sample is a single-family residence that has "Good" property conditions at an age of about 17 years with 1,876 square-feet of livable area, three bedrooms, two and a half bathrooms, a fireplace, and a two-car garage. A vast proportion belong to a Homeowners' Association but rarely have a gated community or age restrictions. The typical transaction offers buyer agents a commission rate of 2.89 percent and include the dishwasher as part of the property sale. Dryers and Washers are less often bundled into the sale. About half the observations in the sample represent re-sales (i.e., or used home sales). The remaining half of the observations comprise Real Estate Owned sales (REO, 34 percent), residential short sales (15 percent), and new home sales (3 percent).[8]

Table 1.3 reports the summary statistics for unsold listings. Unsold listings appear in the data as expired or withdrawn and have unique MLS numbers—an internal identification tag. An expired listing occurs when the listing agreement on a home for sale reaches its expiration date before finding an able and willing

[8]REO sales are bank-owned properties that were repossessed through foreclosure and placed on the MLS for sale. Residential short sales are homes sold with the expectation that the sold price will fall below the outstanding balance on the mortgage and result in a default on the loan application.

buyer. When a listing expires, the owner may elect to stay off the market or re-list the property at a later date creating a new listing with a different MLS number. The owner may also choose a different real estate agent. A withdrawn listing occurs when the property is removed from the market before the listing agreement expires and without finding an able and willing buyer. When re-listing a withdrawn property, the property enters the MLS as a new listing with a new MLS number. As Table 1.3 reveals, 68.8 percent of the unsold listings exit the market by expiring relative to being withdrawn. The typical unsold home is similar to the typical sold home but has a slightly larger average living area and lot size. Unsold listings are are also more often re-sales (60 percent) and short sales (33 percent) than in the sold sample.

1.2.2 A□liations and Disclosure Requirements in Listings

To identify whether a real estate agent owns the property for sale or is related to the owner of the property, I take advantage of the reporting requirements of Chapter 645 of the Nevada Administrative Code that governs the intermediation of real property in Nevada. Specifically, the code states:

> A licensee [i.e., real estate agent] shall not acquire, lease or dispose of any time share, real property or interest in any time share or real property for himself or herself, any member of his or her immediate family, his or her firm, or any member thereof, or any entity in which the licensee has an interest as owner unless the licensee first discloses in writing that:
>
> (a) He or she is acquiring, leasing or disposing of the time share or property for himself or herself or for a member, firm, or entity with which the licensee has such a relationship; and
>
> (b) He or she is a licensed real estate broker, licensed real estate broker-salesperson or licensed real estate salesperson, whether his or her license is active or inactive. This disclosure may be accomplished with a reference to himself or herself as an agent, licensee, salesperson, broker or broker-salesperson, whichever is appropriate (NAC.645.640).

The NAC continues by specifying that the real estate agent must disclose in marketing materials whether she holds any ownership interests or affiliations.

In practice, real estate agents check a couple of boxes on the MLS at the time of listing a property for sale that ask whether the owner is a licensee or related or neither. Buyer agents with access to the MLS will subsequently observe the self-reported affiliation on the corresponding MLS listing. Using the self-reported affiliation indicators, I construct three dummy variables: "arms-length," "agent-related," and "agent-owned." "Agent-owned" takes the value of one if the owner holds a real estate license; it is zero otherwise. "Agent-related" takes the value of one if the owner is related to the listing agent; it is zero otherwise. Finally, "arms-length" takes the value of one if the owner does not hold a license and is not affiliated or related to the listing agent; it is zero otherwise.

As shown in Table 1.2, there are 4,244 agent-related homes sold while there are 21,606 agent-owned homes sold in the sample, jointly representing about 8.8 percent of all the brokered homes sold between 2008Q1 and 2018Q1. The average price of an agent-owned home is $212,489, or about 17 percent more than an arms-length home. Similarly, the average price of an agent-related home is $215,586, or 18.8 percent above the price of the average arms-length home. Panel A of Table 1.4 reports the mean differences in price sold and the corresponding t-statistics, documenting that the observable mean differences in price are statistically significant at the 1 percent level. Figure 1.1 provides the kernel price distribution by agent affiliation type in the natural log form. As figure 1.1 shows, the distribution of arms-length homes sharply sits to the left of the distribution for each of the other two affiliations types: "Agent-Owned" and "Agent-Related."

The summary statistics in Panel A of Table 1.4 likewise suggest that agent-owned homes and agent-related homes have shorter times on the market by approximately 3 to 7 days. Moreover, Table 1.3 reveals that agents and agents of relatives voluntarily exit the market more often than clients at arm's length. For instance, Panel B of Table 1.4 shows that agent-owned listings are 5 percentage points (or 16.7 percent relatively) more likely to be withdrawn from the market than arms-length listings. Arms-length listings are more likely to exit the market when the listing contract expires. Agent-related listings feature similar exit statistics as agent-owned listings.

However,there are observable differences by affiliation type. Tables 1.5 displays the mean differences among the affiliation groups and the corresponding t-statistics

for each variable. As Table 1.5 reports for sold and unsold listings, there are observable differences in the structure, contract, and neighborhood characteristics that should be taken into consideration before presenting formal causal-inferences. For example, agent-owned and agent-related listings offer an average commission to buyer's brokers that is closer to 3 percent than arms-length listings—the mean differences are statistically significant at the 1 percent level. The concern is that sellers that offer to buyer brokers a commission rate at or above 3 percent enjoy a premium relative to listings offering a commission rate below 3 percent (Barwick, Pathak and Wong, 2017) and those held by flat-fee brokerages (Levitt and Syverson, 2008*a*) or discount brokerages (Rutherford and Yavas, 2012). The property transaction types are also different across the subsamples. For example, among arms-length listings that sold, 46 percent are resales, 1 percent are new homes, 16 percent are short sales, and 37 percent are REOs. Among agent-related listings that sold, 83 percent are re-sales, 11 percent are new homes, 6 percent are short sales, and 1 percent are REOs. Likewise, among the agent-owned listings that sold, 73 percent are re-sales, 15 percent are new home sales, 7 percent are short sales, and 4 percent are REOs. These mean differences are also statistically significant at the 1 percent level. There is a rich literature documenting that distressed sale including REOs and Short Sales encounter a discount relative to non-distressed properties (e.g., Pennington-Cross, 2006; Clauretie and Daneshvary, 2009; Campbell, Giglio and Pathak, 2011; Harding, Rosenblatt and Yao, 2012). These observable differences will be taken into account.

1.3 Analysis of Agent A□liation Advantage

This section lays out the empirical framework to test the impact of affiliation on the sold price of residential listings, and presents the baseline results. This section subsequently presents a series of robustness checks on the baseline results including two-step Heckman corrections, and assessments on the influence of agent and seller heterogeneity.

1.3.1 Methodology

To analyze the causal effect of the agent-owned and agent-related affiliation status on market outcomes, I consider the following model:

$$Y_{it} = \delta_1 \textit{Agent-Owned}_{it} + \delta_2 \textit{Agent-Related}_{it} + X_{it}\beta + \tau_t + \zeta_z + \alpha_a + \varepsilon_{it} \qquad (1.1)$$

where Y_{it} stands for the log sold price, and ε_{it} is an error term clustered two-ways at the year-quarter and zip code level. $\textit{Agent-Owned}_{it}$ and $\textit{Agent-Related}_{it}$ are the independent variables of interest; and δ_1 and δ_2 stand for the corresponding coefficients of interest. The parameters τ_t, ζ_z, and α_a are fixed effects for property i's year-quarter listing date t, zip code location z, and listing agent a, respectively. The fixed effects account for observable and unobservable characteristics. For example, the agent fixed effects account for innate agent abilities, skills, or knowledge that are constant throughout time. The time fixed effects control for temporal changes in the market conditions while the location fixed effects capture spatial differences in the supply and demand for real estate.

X_{it} stands for a matrix of non-outcome controls that account for structural, neighborhood, and contractual characteristics. The structural characteristics include property conditions (New, Excellent, Very Good, Good (base), Fair, Poor), bedrooms, bathrooms, garage size, fireplaces, property age, log living area square-footage, log lot area square-footage, and binary variables for the presence of a private pool or spa. The neighborhood characteristics include time-varying categorical variables for the property's high school, middle school, and elementary school. The school assignment categorical variables account for specific time-varying neighborhood amenities affecting the sold price that the zip code fixed effects might not capture (e.g., Haurin and Brasington, 1996). The neighborhood category also includes indicators for whether the home belongs to a home-owners association, a gated community, or an age restricted neighborhood. Finally, the contract characteristics capture the commission rate offered to buyer agents, the occupancy of the property (owner-occupied, tenant-occupied, or vacant), whether particular appliances (i.e., dishwasher, dryer, and washer) are part of the sale, and the type of transaction (i.e., re-sale, new home sale, REO sale, and short sale).[9]

[9] Several of these variables often appear in hedonic price models. For details, see Sirmans, Macpherson and Zietz (2005).

The conditional identification assumption (CIA) is that once controlling for observable and unobservable attributes as described by model 1.1, the agent-owned and agent-related variables approximate random assignment. Note that all the right-hand-side variables specified in model 1.1 obtain a value at the same time or before the assignment of the agent-owned and agent-related variables. Thus, given the model's specification, meeting the CIA allows for causal interpretation of δ_1 and δ_2, the coefficients on agent-owned and agent-related, respectively (Angrist and Pischke, 2008).

1.3.2 Baseline Results

Table 1.6 reports the coefficient estimates of model 1.1 using the Ordinary Least Squares (OLS) regression methodology. Column (1) reports the effect of agent-owned and agent-related on the log sold price using only year-quarter fixed effects. The results suggest that agents sell their own homes at a premium of 16.7 percent above the price they negotiate for their unrelated clients. The premium on homes that belong to a related owner is approximately 10 percent. Each of the following columns incrementally adds additional controls until reaching the full specification of model 1.1. Column (2) adds the structural, neighborhood, and contract controls, and Column (3) adds zip code fixed effects. The results adjust to around 1.6 percent and 1 percent for agent-owned and agent-related, respectively.

Column (4) takes advantage of the multiplicity of repeated sales in the sample and includes fixed effects at the property level.[10] While a drawback of the approach is that properties with a single transaction record (e.g., new home sales) must be dropped out the of the sample, the methodology exploits the variation in the price differential between the first and second transaction of the sample property to "wash out" any idiosyncratic elements. The effect of agent-owned and agent-related increase to 2.1 percent and 2.9 percent, respectively.

Column (5) replaces the property fixed effects with agent fixed effects to exploit the variation within the transactions portfolio of each of the 25,000 real estate agents in the sample. The purpose is to compare, for example, the performance of a property for sale when the agent owns the property to the performance of a similar property for sale by the same real estate agent but without an ownership

[10] Ben-David (2011) similarly uses the repeat sales methodology to achieve identification in a study analyzing the impact of concessions on home values and subsequent loan amounts.

interest. The results suggest that the premium on agent-owned homes is 1.3 percent while it is 2 percent on agent-related homes. Both marginal effects are statistically significant at the 1 percent level. Since the specifications of column (5) provide a conservative estimate relative to columns (2) through (4), the rest of the paper uses the specification of column (5) as described by model 1.1.

1.3.3 Sale Likelihood Correction

Since the MLS also contains over 91,000 withdrawn and expired listings of single family and condominium homes that did not sell successfully, I exploit the variation in the outcome of listings to incorporate a correction to the baseline estimates for the possibility that the agent affiliation type also influences the sale likelihood of a property. In particular, I estimate model 1.1 using the inverse mills ratio as an additional covariate (See Heckman, 1979, 1990).

To calculate the inverse mills ratio, I first estimate the likelihood of sale using the baseline covariates with time and location fixed effects using a probit regression model. The dependent variable is Sold, which takes the value of one if the property is sold, and zero if the listing is expired or withdrawn from the market. I then calculate the inverse mills ratio for each listing as the home's predicted probability of sale over the home's cumulative probability of sale. Due to computational difficulty the probit model excludes the 25,000 agent fixed effects.

Table 1.7 reports in column (1) the estimated coefficients for the probit model of Sold on the affiliation type, and in column (2), the estimated coefficients of the baseline model including the inverse mills ratio.[11] The results in column (1) suggest that agent-owned and agent-related listings encounter a lower likelihood of sale relative to arms-length listings. The statistical significance of the inverse mills ratio in column (2) suggest that it controls for the sale hazard's influence on the sold price. Yet the coefficients for agent-owned and agent-related shown in column (2) are positive and statistically significant at the 1 percent level despite the two-step Heckman correction. Thus, the baseline specification of model 1.1 is robust to the Heckman correction.

The result with the Heckman correction imply economically meaningful impacts on the welfare of households. Given that the average price on a home for sale by an

[11] The inverse mills ratio is estimated using the coe□cients in column (1).

arms-length agent is $181,441, the results suggest that the agent-owned premium amounts to an increase of about 2.7 percent (or $4,900) while the agent-related premium amounts to an increase of about 1.3 percent (or $2,360). Moreover, the results imply that unaffiliated households in Las Vegas could have obtained $400 million more in aggregate sales from 2008 to 2018 if they had performed at least as well as agent-owned home sales.[12]

1.3.4 Listing Agent Heterogeneity and Appraisal Knowledge

While agent fixed effects capture innate abilities, skills, effort, and knowledge that could influence the observable price premium for agent-owned or agent-related homes, unobservable time-varying agent attributes could have an impact and bias the coefficient estimates. Hence, using license records from NRED, I collect and incorporate into the analysis a set of time-varying characteristics about the agent: the agent's experience in the real estate market and license type. Furthermore, I construct using the MLS data information about the agent's aggregate commission income during the prior month of listing each property, and the transactions sold during the prior year. Finally, I identify the quantity of photos that an agent uploads to the MLS for each property she sells. These variables jointly proxy for time-varying heterogeneity in an agent's skills, ability, effort, and knowledge.

Matching the NRED records to the MLS records,[13] I identify licensing information for over 16,000 real estate agents of homes available for sale from 2008 to 2014.[14] Specifically, for each agent I observe her Nevada license records; and for each license record within an agent's license history, I observe the license number, license type, issue date, and expiration date.[15] The richness of the data allows me to flag whether the real estate agent at the time of listing a home for sale holds a broker license, broker-salesperson license, or salesperson license.[16] I can also

[12] Using the summary statistics in Table 1.2 and the coe□cient estimates in column (5) of Table 1.6, I calculate $400 million as $2.7\% \quad \$181,441 \quad 81,683$.

[13] The merge depends on a crosswalk that links license numbers in the NRED records to public identification numbers that uniquely identify real estate agents in the MLS.

[14] The crosswalk ends in 2014 because the GLVAR contracted CoreLogic as a data refiner around this date, which obscured the subsequent records on real estate agents in the MLS.

[15] Nevada real estate license records are publicly available and scrapable at `https://red.prod.secure.nv.gov/Lookup/LicenseLookup.aspx`.

[16] The broker license, broker-salesperson license, and salesperson license grant the holder the right to represent buyers or sellers in real estate transactions. However, the broker license also grants the holder the right to open a brokerage and hire people that hold either a broker-salesperson

observe the exact time the agent has been participating in the Nevada real estate market. As a result, I construct time-varying indicators for the agent's license type, and precisely calculate the agent's experience as the number of months between the date that the agent acquires her first real estate (or appraiser) license and the date that the property is listed for sale.[17]

Table 1.8 reports the results using homes sold between 2008 and 2014. Column (1) provides the baseline estimates restricted to the 2008 to 2014 period as a reference point since the sample is slightly different from the previous section. Column (2) contains the point estimates of the baseline regression using the time-varying agent characteristics. Experience, license type (Broker, Broker-salesperson, Salesperson (base)), transactions, and photos impact the sold price at statistically significant levels while controlling for agent fixed effects. The independent variables of interest remain positive and statistically significant at the conventional levels, supporting the earlier findings. Column (3) adds agent-office fixed effect to the analysis. The purpose is to control for the possibility that a real estate agent can move to different brokerages that offer different services that may uniquely influence the agent's or listing's performance (e.g., Yinger, 1981; Anderson, Lewis and Zumpano, 2000; Lewis and Webb, 2007). However, even after accounting for agent-brokerage office fixed effects the coefficients on agent-owned and agent-related remain virtually unchanged relative to the case when using only agent fixed effects in column (2). They are also comparable to those in column (1). I next add a Heckman correction to the model specification in column (5); column (4) provides the results from the first step that estimates the likelihood of sale. The purpose is to consider that agent characteristics can influence the likelihood of sale (e.g., Johnson, Zumpano and Anderson, 2008). The coefficients on agent-owned and agent-related remain positive and statistically significant. The results are therefore robust to agent and brokerage office heterogeneity.

I examine whether information asymmetry influences the differences in sold price between agents and clients by studying the effect of formal real property

license or salesperson license as independent contractors. The broker-salesperson license grants the holder the right to be a manager at a real estate brokerage, often at a satellite office. Each license type requires the holder to satisfy a different set of education or experience criteria. For further details, see http://red.nv.gov/Content/Licensing/Initial_Requirements/.

[17] Since some agents renounce their license for a few years and later reactive it, in such cases I discount an agent's inactive time from the agent's experience. Barwick and Pathak (2015) provide an analysis on entry and exit decisions of real estate agents in the Greater Boston area.

appraisal training. The NRED license records allow me to observe that a subset of the homes are put on the market by real estate agents that obtained training as an appraiser. Appraisers undergo an intensive training program. Specifically, an appraiser must have completed 153 hours of state required courses, 30 semester hours of college-level courses, and 2,400 hours as an appraiser-intern to be a fully licensed appraiser. Real estate agents, on the other hand, receive at most 45 hours of appraisal principles.[18] Therefore, I assume that real estate agents with an appraiser license have more knowledge about the market value of a property than real estate agents without an appraiser license. Hence, to test whether the knowledge gap makes a difference, I flag appraiser agents and interact the flag with the agent-owned and agent-related variables in the baseline regression using time-varying agent controls and agent fixed effects.

Table 1.9 reports the results with only listing agent fixed effects in column (1) and agent-office fixed effects in column (2). In either case, agents with an appraiser license, on average, sell at a discount; but it is statistically insignificant at the conventional levels. The coefficients on agent-owned and agent-related also remain as previously estimated: positive and statistically significant. However, the coefficient on the interaction between the appraiser licensee flag and agent-owner is 0.10 and statistically significant at the 1 percent level. The following two columns (3) and (4) add the results for a Heckman correction; but the results remain qualitatively unchanged. Overall, the results imply that agents with an appraiser license that sell their own homes obtain up to 12.4 percent (or $22,500) more than their arms-length clients, on average.

While the former finding implies that knowledge about the property's market value exacerbates the price differentials that agent affiliations create, it is difficult to completely attribute the affiliation disparities to asymmetric information. One reason is that the agent-related affiliation type fails to replicate the results. That is, the coefficient is not significant on the interaction of the agent-related and appraisal license indicators. The appraisal training also affects only a small subset of the sample. Out of the 208,993 homes sold from 2008 to 2010, about 1,192 transactions are carried out by an agent with an appraisal license, representing about 0.6 percent of the sample. Among these transactions, there are only 48 instances when the

[18] For further details on the education requirements for Nevada Appraisers, see NAC 645C.240 "Required instruction: Certification as general appraiser," and for Nevada Real Estate agents, see NAC 645 "Education in Real Estate."

appraiser owns the home, and 18 instances when the appraiser is related to the owner. The results, therefore, must be taken with caution.

1.3.5 Seller Heterogeneity and Entrenchment

As discussed in the introduction, various sellers exhibit different costs to exit the market. Hence, to examine the impact of heterogeneity across seller type, I merge to the MLS data ownership information from CoreLogic's records on deeds. I next identify whether the owner of each property is a household, corporation, builder, or non-bank trust using the property's parcel number and sale date.[19] I identify 124,760 home sales by households, 19,110 home sales by corporations, 25,555 home sales by family trusts, and 16,452 home sales by home builders.

Within each seller group, the agent can be affiliated to the seller, like in household (i.e., person-to-person) transactions. For corporate sellers, for example, the agent may be the owner of the firm or hold an ownership stake in the firm. In such cases, the corporate seller will, therefore, be required to disclose his ownership interest in the listing. A relative of the listing agent that has an ownership interest in the firm would also need to disclose the affiliation when selling the property. Family trusts and home builders must also follow similar disclosure requirements per the laws governing Nevada real estate transactions (i.e., NAC 645C.240).

Figure 1.2 displays the variation in agent affiliation type across seller type (Builder, Corporation, Household, and Trust). As figure 1.2 reveals, in about 44.3 percent of the transactions when the seller is a home builder, the agent is the builder; while in 4.4 percent of the transactions, the agent is related to the builder. In about 30 percent of the transactions when the seller is a corporation, the agent is the owner of the corporation; while in 5.7 percent of the transactions, the agent is related to the corporation. Among trusts, the agent is the owner of the trust in 8.3 percent of the home sales, and related to the trust in about 2 percent of

[19] Specifically, I classify the owner as a corporation if the reported seller's name includes "LLC", "INC", "INVESTOR", "GROUP", "CORP", "PARTNER", "LP', or "FUND". I classify the owner as a trust when the reported seller's name includes "TRUST" (e.g., the Goodman Family Trust) and the property is not bank-owned. Finally, I classify the owner as a household if the property is not bank-owned and CoreLogic reports a first and last name for the seller. While I observe variation in the agent a□liation type across bank-owned and government-owned properties, I exclude these observation from the analysis since the variation is likely due to error. I also exclude observation where I cannot determine who is the seller. Since unsold properties do not have a sale date, I am unable to identify the owner and incorporate a two stage analysis.

the home sales. Among households, in contrast, the agent is the property owner in about 3.9 percent of the home sales while related to the owner in about 1.4 percent of the homes sales. These statistics imply that seller type correlates with the agent's ownership interest, and may therefore influence the previous estimates on the impact of affiliation on market outcomes.

Since each seller type has different implications for the costs to exit the market, I estimate the baseline regression model by seller type. Table 1.10 reports the results.[20] The effects of agent-owned and agent-related on price continue to be positive and significant within the household subgroup reported in column (1). But in the other seller subgroups, the effect of agent-owned and agent-related affiliation on the sold price is null. Table 1.11 provides estimates of the baseline, two-step Heckman model with indicators for each seller type interacted with the agent-owned and agent-related variables. The affiliation premium appear to be significant for each seller group with the Heckman correction. However, the price premiums on agent-owned and agent-related homes are higher among the households than among corporations, trusts, and builders. Overall, the results are consistent with the prior findings and the entrenchment hypothesis.

1.4 Analysis of Market Timing Flexibility

While the previous section examines the premium on agent-owned and agent-related listings, this section focuses on the outcome of listings. The purpose is to evaluate the outcomes for patterns of market timing flexibility and variation of this behavior across affiliation type over market cycles. The principle finding is that agents and relatives enjoy an advantage in withdrawing listings that they exploit during a market expansion more often than clients at arms-length.

[20] Since Trusts and Corporations do virtually have no new homes, columns (2) and (3) excludes a dummy for "New Home". Similarly column (4) excludes a dummy for "Short Sale". Since most listings held by households feature a tenant- or owner- occupied home, column (1) sets the occupancy status of "Owner Occupied" as the base and omits the previous base: "Vacant," which lacks variation.

1.4.1 Listing Outcomes: Sold, Expired, or Withdrawn?

I incorporate a hazard function for each listing outcome into the analysis in a competing risk framework to examine the effect of agent affiliation on the outcome of homes for sale. The hazard function specifies the risk that a house for sale encounters a particular outcome during the next period given the time on the market. I define the hazard function of outcome j as

$$h_j(t) = b_j(t)\exp(\text{Agent-Owned}_j\lambda_{1,y} + \text{Agent-Related}_j\lambda_{2,y} + Z_t\beta_j) \tag{1.2}$$

where $b_j(t)$ stands for the baseline hazard rate for event j at time t, Agent-Owned$_j$ and Agent-Related$_j$ are the dummy variables of interest, and Z_t stands for a matrix of time-varying characteristics.

For each listing, one of three events may occur: sell successfully ($j = 1$), expire ($j = 2$), or withdraw ($j = 3$). The conditional probability of event $y \in \{j\}$ is

$$Pr(y|t, X_t, \text{Agent Affiliation}; \beta_y, \lambda_{1,y}, \lambda_{2,y}) = \frac{h_y(t)}{\sum_{j=1}^{3} h_j(t)}. \tag{1.3}$$

The numerator is the hazard function of event y while the denominator is the cumulative hazard of the three possible events. To estimate the parameters β_y and λ_y, I use a multinomial logit model with the sold outcome as the base since over 76 percent of the listings in the sample resulted in a sale. Z_t stands for a matrix of controls similar to those specified in the baseline model 1.1.[21]

Table 1.12 reports the estimated multinomial logit coefficients for each affiliation type on the risk of expiring in column (1) and the risk of being withdrawn in column (2) both relative to the risk of selling. The results in column (1) indicate that the multinomial logit of an agent-owned listing expiring relative to selling decreases by 0.14 units when compared to listings at arm's length, holding all else constant. Interpreted in term of the relative risk, the odds ratio of agent-owned to arms-length listings for expiring instead of selling decreases by approximately 14.7 percent.[22] Agent-related listings, on the other hand, encounter an increase

[21] To reduce the computational difficulty of the multinomial logit model, however, I exclude the agent and zip code fixed effects along with the categorical variables for high school, middle school and elementary school.

[22] The change in the odds ratio is estimated as follows: $\exp\{\lambda_{k,y}\} - 1$ where $k \in \{1, 2\}$.

in the multinomial logit by 0.27 units for expiring relative to selling; that is, an approximate 30.5 percent increase in the odds ratio of agent-related to arms-length listings for expiring relative to selling. Column (2) indicates that the relative risk for both agent-owned and agent-related listings of being withdrawn instead of selling increases by 0.29 and 0.37 multinomial logit units, respectively. Specifically, the respective odds ratio of withdrawing a listing increases by about 33.3 percent for agent-owned listings, and 45 percent for agent-related listings.

In other words, an agent is more likely to sell an arms-length client's home than allow her listing to expire or be withdrawn from the market. Relatives have a strong chance of withdrawing their homes from the market but often encounter a high risk of not finding an able and willing buyer (i.e., expiring) when they do not withdraw. Finally, agents often find an able and willing buyer for their own homes and enjoy an advantage at withdrawing their homes from the market when compared to their clients.

I next examine the flexibility to exit the market by seller type, and fit the multinomial logit model within each seller subgroup. Table 1.13 reports the results for households in columns (1) and (2), trusts in columns (3) and (4), corporations in columns (5) and (6), and builders in columns (7) and (8). The coefficients for agent-owned and agent-related listings are the strongest in the household and builder subsamples. The results overall suggest that market entrenchment is more likely among households and home-builders than corporations or trusts.

1.4.2 Market Timing Patterns and Real Estate Cycles

The previous subsection reveals that the outcome of listings exhibit patterns in the outcomes that vary by affiliation. Namely, clients rarely exit the market while agents and relatives exit more often. A possible explanation for this pattern is that agents and relatives have the flexibility to "time the market." For instance, similar to a private-equity entrepreneur seeking for the most successful time to invest in an industry (e.g., Gompers et al., 2010), an astute seller disposing real estate with a profit maximization goal may time the market by strategically withdrawing listings. Specifically, the seller may choose to not withdraw his listing from the market and accept a bid quickly when the market price is falling since future bids may be low. On the other hand, when the market price is rising, the seller can delay accepting a

bid and even withdraw the property and re-list it at a later date to obtain a higher bid. If ease of withdrawing varies by affiliation and the demand to withdraw is low during market contractions, then differences in market timing patterns will likely appear during market expansions.

To examine market timing strategies across real estates cycles exhibiting market contractions and expansions, I examine the share of withdrawn listings over time and compare it to changes in the market price of residential property. Depicting this examination, figure 1.3 plots the share of withdrawn listings by affiliation type (Affiliated and Arms-Length) with the Case-Shiller Home Price Index (HPI) for the Las Vegas MSA overlaying the graph. As figure 1.3 shows, while the HPI is decreasing, the share of withdrawn listings is close to zero irrespective of the agent affiliation type. However, when the HPI begins to rise, the share of withdrawn listings also rise. Moreover, I observe that the withdrawal rate for affiliated listings is higher than the withdrawal rate of arms-length listings in every year following 2012 but not prior. In 2017, for example, 13.5 percent of the affiliated listings were withdrawn while 10.3 percent of the arms-length listings were withdrawn. In 2009, the withdrawal rates of affiliated listings were closer to the withdrawal rate of arms-length listings, floating slightly above zero.

Besides withdrawing a property from the market, a passive market timing strategy is to allow the listing to sit on the market until finding an able and willing buyer. If the seller does not receive a bid that meets his reservation price and the listing agreement reaches its expiration date, the listings is automatically dropped from the MLS. The seller may then choose to re-list and repeat the strategy until obtaining the desired bid. Figure 1.4 plots the share of expired listings by affiliation type with the Las Vegas HPI overlaying the graph over year listed. As figure 1.4 shows, the share of expired listings increases over time, peaking in 2010 at about 33 percent. Over the following years, the share drops to about 21 percent of all listings. After 2012, when the Las Vegas HPI begins to increase, the share of expired listings floats without any obvious pattern between 10 and 15 percent. Clients affiliated to the agents have proportionately more expired listings than clients at arm's length prior to 2012; but after 2012 the pattern reverses. The pattern suggests that arms-length listings exhibit passive market timing strategies during expansions while affiliated-listings exhibit active market timing strategies.

To formally examine the propensity of market timing across the real estate

cycle, I fit a multinomial logit model of listing outcome on affiliation interacted with "expansion"—an indicator that equals one if the listing date is after January 2012 (when the Las Vegas HPI begins to rise), and zero otherwise. Table 1.14 reports the results. The results suggest that when the market is contracting, the agent is not more likely to withdraw her own home from the market nor that of a relative or affiliate. However, when the market is expanding, the agent is more likely to withdraw her own home from the market. The agent is also more likely to allow her listings and those of relatives or affiliates to expire when compared to the listings held by her clients at arm's length. Overall, the results suggest that agents actively time the market.

1.4.3 Market Duration of Sold Listings

Since prior studies identify a relation between the time a property is on the market and the agent's ownership, in this subsection I examine how time-on-market (TOM) varies across agent-owned, agent-related, and arms-length listings. The general argument is that an agent is more patient with her own homes than with the homes of her clients when looking for a buyer (e.g., Levitt and Syverson, 2008*b*; Xie, 2018). Consequently, the agent encounters an incentive to pressure a client into accepting a bid too early even if another buyer may make a higher offer at a later date.

Table 1.15 reports regression results of the baseline model (1.1) using the natural log of TOM as the dependent variable. The affiliation indicators do not seem to influence TOM in the full sample or in the sub samples broken out by the market contraction years or the market expansion years. Column (4), however, interacts the expansion dummy with the independent variables of interest. The results suggest that during a market contraction, agents sell their own homes quickly. During a market expansion, however, agents sell their own homes slowly.

1.5 Conclusion

This paper identifies and explains the causal impact of agent-owned and agent-related affiliations on the market outcomes of single-family and condominium homes for sale using brokered housing transactions from the Greater Las Vegas area that were on the market between 2008 and 2018.

The principle findings are twofold. First, affiliated listings sell at a premium that reaches an average of $4,900 when compared to arms-length listings. Second, real estate agents and their relatives or affiliates have flexibility to time the market since their option to withdraw from the market and re-list at a later date is less costly to exercise relative to the cost that their unaffiliated clients encounter. Disparities to withdraw and delay a sale are observable during market expansions. However, agents have no advantage in the price they obtain for their own homes when compared to clients that can equally terminate listing agreements and exit the market (e.g., corporation). These results are consistent with the entrenchment hypothesis. That is, contract rigidity impacts market outcomes. The policy implication is that reducing the premium agents and relatives enjoy entails increasing the households' ability to terminate listing agreements but at the cost of reducing the agent's motivation to perform. Alternatively, the standard listing contracts could be redesigned to empower and motivate agents to provide market timing advice to clients at arm's length.

The results can be generalized to settings outside the housing market. Examples include a CEO's capital structure decisions made on behalf of shareholders v. the CEO's own borrowing behavior, a stock trader's behavior on behalf of clients v. the trader's own portfolio decisions, and so on. The key ingredient is a principal-agency framework that gives the agent a short-term incentive mechanism (i.e., commission) but also features a performance contract that ties the principal to the agent.

Table 1.1. Variables and Definitions

Variable	Definition
Dependent Variables	
ln(Price)	The natural log of the sale price.
ln(TOM)	The natural log of days between the listing and contract date.
Structure Controls	
Condominium	1 if the property is a condo, and 0 if it is a single family residence.
Living Area Square Footage	The property's living area square footage.
Lot Square Footage	The property's lot square footage.
Bedrooms	The total number of bedrooms in the property for sale.
Bathroom	The total number of bathrooms in the property for sale.
Fireplaces	The total number of fireplaces in the property for sale.
Private Pool	1 if the property has a private pool, and 0 otherwise.
Private Spa	1 if the property has a private spa, and 0 otherwise.
Garage Spaces	The number of car spaces in the garage.
Age	The difference between the property's current sale year less its built year.
New Quality	1 if the property is in new-like physical conditions, and 0 otherwise.
Excellent Quality	1 if the property is in excellent physical conditions, and 0 otherwise.
Very Good Quality	1 if the property is in very good physical conditions, and 0 otherwise.
Good Quality (b)	1 if the property is in good physical conditions, and 0 otherwise.
Fair Quality	1 if the property is in fair physical conditions, and 0 otherwise.
Poor Quality	1 if the property is in poor property conditions, and 0 otherwise.
Contract Controls	
Commission	The commission rate offered to the buyer's agent as a percent of the price.
Owner Occupied	1 if the property is owner occupied, and 0 otherwise.
Tenant Occupied	1 if the property is occupied by the tenant, and 0 otherwise.
Vacant (b)	1 if the property is vacant while on the market for sale, and 0 otherwise.
Includes Dishwasher	1 if the purchase contract includes a dishwasher, and 0 otherwise.
Includes Dryer	1 if the purchase contract includes a dryer, and 0 otherwise.
Includes Washer	1 if the purchase contract includes a washer, and 0 otherwise.
Re-Sale (b)	1 if the purchase contract is for a re-sold property, and 0 otherwise.
New Home	1 if the purchase contract is for a new property, and 0 otherwise.
Short Sale	1 if the purchase contract is for a short sale property, and 0 otherwise.
Real Estate Owned	1 if the purchase contract is for a foreclosed property, and 0 otherwise.
Neighborhood Controls	
Age Restriction	1 if the property is in an age restricted neighborhood, and 0 otherwise.
Gated	1 if the property is in a gated community, and 0 otherwise.
Homeowners Association	1 if the property belongs to a homeowners' association, and 0 otherwise.
Elementary School	A categorical variable for the elementary school assigned to the property.
Middle School	A categorical variable for the middle school assigned to the property.
High School	A categorical variable for the high school assigned to the property.

Note that "(b)" indicates that the variable is the reference group for the categorical variable.

Table 1.2. Summary Statistics of Sold Listings

Variable	Full	Arms-Length	Agent-Related	Agent-Owned
Outcomes				
Sold Price ($)	184,209	181,441	215,586	212,489
	(110,356)	(109,289)	(113,511)	(117,771)
Time-on-Market	60.1	60.4	53.4	57.5
	(84.5)	(85.2)	(72.0)	(77.6)
Structure				
Condominium	0.12	0.12	0.1	0.08
	(0.32)	(0.33)	(0.30)	(0.28)
Living Area Square Footage	1,876.48	1,867.37	1,908.31	1,983.65
	(729.54)	(726.60)	(728.40)	(757.18)
Lot Square Footage	5,847.44	5,834.24	5,859.59	6,009.22
	(4,490.61)	(4,498.85)	(4,532.56)	(4,375.24)
Bedrooms	3.25	3.24	3.25	3.38
	(0.86)	(0.86)	(0.85)	(0.85)
Bathroom	2.6	2.59	2.63	2.69
	(0.72)	(0.72)	(0.73)	(0.73)
Fireplaces	0.58	0.59	0.55	0.55
	(0.62)	(0.62)	(0.62)	(0.63)
Private Pool	0.18	0.18	0.17	0.18
	(0.39)	(0.39)	(0.38)	(0.39)
Private Spa	0.12	0.12	0.12	0.12
	(0.33)	(0.33)	(0.32)	(0.32)
Garage Ports	1.85	1.85	1.85	1.95
	(0.91)	(0.91)	(0.91)	(0.86)
Age	16.62	16.72	17.46	15.19
	(12.96)	(12.83)	(14.90)	(14.04)
New Quality	0.01	0.01	0.06	0.09
	(0.12)	(0.09)	(0.23)	(0.28)
Excellent Quality	0.18	0.16	0.35	0.41
	(0.38)	(0.36)	(0.48)	(0.49)
Very Good Quality	0.11	0.11	0.17	0.1
	(0.31)	(0.31)	(0.38)	(0.30)
Good Quality	0.52	0.54	0.34	0.34
	(0.50)	(0.50)	(0.47)	(0.48)
Fair Quality	0.15	0.16	0.08	0.05
	(0.36)	(0.37)	(0.26)	(0.22)
Poor Quality	0.03	0.03	0.01	0.01
	(0.17)	(0.17)	(0.12)	(0.09)

(Continued)

Table 1.2. Summary Statistics of Sold Listings (Continued)

Variable	Full	Arms-Length	Agent-Related	Agent-Owned
Contract				
Commission (%)	2.89	2.88	2.94	2.98
	(0.47)	(0.45)	(0.34)	(0.67)
Owner Occupied	0.26	0.27	0.23	0.12
	(0.44)	(0.45)	(0.42)	(0.33)
Tenant Occupied	0.06	0.06	0.07	0.06
	(0.24)	(0.24)	(0.25)	(0.24)
Vacant	0.68	0.67	0.7	0.82
	(0.47)	(0.47)	(0.46)	(0.39)
Includes Dishwasher	0.75	0.74	0.86	0.89
	(0.43)	(0.44)	(0.35)	(0.31)
Includes Dryer	0.3	0.3	0.37	0.32
	(0.46)	(0.46)	(0.48)	(0.47)
Includes Washer	0.3	0.3	0.37	0.32
	(0.46)	(0.46)	(0.48)	(0.47)
Re-Sale	0.48	0.46	0.83	0.73
	(0.50)	(0.50)	(0.38)	(0.44)
New Home	0.03	0.01	0.11	0.15
	(0.16)	(0.12)	(0.31)	(0.36)
Short Sale	0.15	0.16	0.06	0.07
	(0.36)	(0.36)	(0.24)	(0.26)
Real Estate Owned	0.34	0.37	0.01	0.04
	(0.48)	(0.48)	(0.09)	(0.20)
Neighborhood				
Age Restriction	0.01	0.01	0.01	0.01
	(0.08)	(0.09)	(0.09)	(0.07)
Gated	0.17	0.16	0.21	0.18
	(0.37)	(0.37)	(0.40)	(0.38)
Homeowners Association	0.71	0.71	0.71	0.72
	(0.46)	(0.46)	(0.45)	(0.45)
Observations	294,705	268,855	4,244	21,606

This table reports the mean and standard deviation of independent variables in this study for the full sample and by whether the listing is at arms-length, agent-related, or agent-owned. The sample includes sold single-family and condominium listings.

Table 1.3. Summary Statistics of Expired and Withdrawn Listings

Variable	Full	Arms-Length	Agent-Related	Agent-Owned
Outcome				
Expired	0.688	0.694	0.641	0.642
	(0.46)	(0.46)	(0.48)	(0.48)
Withdrawn	0.312	0.306	0.359	0.358
	(0.46)	(0.46)	(0.48)	(0.48)
Structure				
Condominium	0.09	0.09	0.07	0.08
	(0.28)	(0.29)	(0.26)	(0.28)
Living Area Square Footage	2,062.51	2,053.28	2,109.92	2,145.32
	(884.92)	(879.25)	(836.05)	(948.37)
Lot Square Footage	6,543.25	6,507.29	6,393.42	6,951.65
	(5,507.96)	(5,457.29)	(5,476.56)	(5,997.13)
Bedrooms	3.34	3.33	3.39	3.4
	(0.94)	(0.94)	(0.86)	(0.96)
Bathroom	2.73	2.72	2.76	2.77
	(0.85)	(0.84)	(0.78)	(0.91)
Fireplaces	0.65	0.65	0.59	0.68
	(0.70)	(0.70)	(0.68)	(0.73)
Private Pool	0.21	0.21	0.18	0.23
	(0.41)	(0.41)	(0.38)	(0.42)
Private Spa	0.14	0.14	0.12	0.16
	(0.35)	(0.35)	(0.32)	(0.36)
Garage Ports	1.85	1.85	1.92	1.87
	(0.99)	(0.99)	(0.91)	(1.03)
Age	17.97	17.96	15.92	18.58
	(13.85)	(13.72)	(14.70)	(14.87)

(Continued)

Table 1.3. Summary Statistics of Expired and Withdrawn Listings (Continued)

Variable	Full	Arms-Length	Agent-Related	Agent-Owned
Contract				
Commission (%)	2.9	2.88	2.95	3.0
	(0.36)	(0.36)	(0.32)	(0.41)
Owner Occupied	0.43	0.46	0.26	0.25
	(0.50)	(0.50)	(0.44)	(0.43)
Tenant Occupied	0.15	0.14	0.14	0.18
	(0.35)	(0.35)	(0.35)	(0.38)
Vacant	0.42	0.4	0.6	0.58
	(0.49)	(0.49)	(0.49)	(0.49)
Includes Dishwasher	0.83	0.83	0.89	0.85
	(0.37)	(0.38)	(0.32)	(0.35)
Includes Dryer	0.34	0.34	0.32	0.31
	(0.47)	(0.48)	(0.47)	(0.46)
Includes Washer	0.34	0.34	0.33	0.32
	(0.47)	(0.48)	(0.47)	(0.47)
Re-Sale	0.6	0.58	0.71	0.76
	(0.49)	(0.49)	(0.45)	(0.43)
New Home	0.02	0.01	0.17	0.07
	(0.14)	(0.11)	(0.38)	(0.25)
Short Sale	0.33	0.35	0.11	0.17
	(0.47)	(0.48)	(0.31)	(0.37)
Real Estate Owned	0.05	0.05	0	0.01
	(0.22)	(0.23)	(0.06)	(0.10)
Neighborhood				
Age Restriction	0.01	0.01	0.01	0.01
	(0.11)	(0.11)	(0.09)	(0.10)
Gated	0.23	0.23	0.23	0.23
	(0.42)	(0.42)	(0.42)	(0.42)
Homeowners Association	0.71	0.71	0.71	0.69
	(0.46)	(0.46)	(0.45)	(0.46)
Observations	91,655	81,683	2,034	7,938

This table reports the mean and standard deviation of independent variables in this study for the full sample of unsold listings and by whether the listing is at arms-length, agent-related, or agent-owned. The sample includes unsold single-family and condominium listings.

Table 1.4. Mean Differences and t-Tests of Outcomes in Listings

Panel A		Sold Listings	
	Agent-Owned -Arms-Length	Agent-Related -Arms-Length	Agent-Owned -Agent-Related
Sold Price ($)	31,048	34,145	-3,097
	(-39.94)	(-20.18)	(1.58)
Time-on-Market	-2.95	-7.07	4.11
	(4.93)	(5.37)	(-3.20)

Panel B		Unsold Listings	
	Agent-Owned -Arms-Length	Agent-Related -Arms-Length	Agent-Owned -Agent-Related
Expired	-0.05	-0.05	0.00
	(9.50)	(5.09)	(-0.08)
Withdrawn	0.05	0.05	0.00
	(-9.50)	(-5.09)	(0.08)

This table reports the mean differences of outcome variables in this study between agent-owned, agent-related, and arms-length listings. The t-statistics are reported in parentheses.

Table 1.5. Mean Di□erences and t-Test of Controls in Listings

	Sold Listings			Unsold Listings		
	Agent-Owned -Arms-Length	Agent-Related -Arms-Length	Agent-Owned -Agent-Related	Agent-Owned -Arms-Length	Agent-Related -Arms-Length	Agent-Owned -Agent-Related
Condominium	-0.04	-0.02	-0.02	-0.01	-0.02	0.01
	(16.31)	(3.84)	(3.79)	(1.80)	(2.95)	(-1.90)
Living Area Square Footage	116.28	40.94	75.33	92.04	56.64	35.40
	(-22.56)	(-3.64)	(-5.96)	(-8.84)	(-2.87)	(-1.54)
Lot Square Footage	174.97	25.35	149.62	444.35	-113.87	558.23
	(-5.51)	(-0.36)	(-2.02)	(-6.86)	(0.93)	(-3.81)
Bedrooms	0.14	0.01	0.13	0.06	0.06	0.01
	(-23.58)	(-0.93)	(-9.26)	(-5.80)	(-2.79)	(-0.24)
Bathrooms	0.10	0.03	0.07	0.05	0.04	0.01
	(-19.45)	(-2.87)	(-5.46)	(-4.92)	(-1.94)	(-0.57)
Fireplaces	-0.04	-0.04	0.00	0.03	-0.06	0.09
	(8.11)	(3.93)	(-0.19)	(-3.92)	(3.73)	(-5.06)
Private Pool	0.00	-0.01	0.01	0.02	-0.03	0.05
	(0.27)	(2.28)	(-2.00)	(-3.79)	(3.46)	(-4.86)
Private Spa	0.00	0.00	0.00	0.02	-0.03	0.04
	(1.74)	(0.31)	(0.45)	(-3.82)	(3.40)	(-4.79)
Garage Ports	0.11	0.00	0.11	0.02	0.07	-0.06
	(-16.57)	(-0.08)	(-7.21)	(-1.41)	(-3.24)	(2.21)
Age	-1.53	0.74	-2.27	0.62	-2.04	2.66
	(16.71)	(-3.72)	(9.52)	(-3.80)	(6.63)	(-7.22)
New Quality	0.08	0.05	0.03			
	(-100.72)	(-34.15)	(-7.17)			
Excellent Quality	0.26	0.19	0.07			
	(-97.24)	(-33.86)	(-8.03)			
Very Good Quality	-0.01	0.06	-0.07			
	(3.98)	(-13.28)	(13.82)			
Good Quality	-0.19	-0.20	0.00			
	(55.13)	(25.63)	(-0.49)			
Fair Quality	-0.11	-0.09	-0.03			
	(44.63)	(15.56)	(6.64)			
Poor Quality	-0.02	-0.02	-0.01			
	(18.35)	(6.06)	(3.46)			

(Continued)

Table 1.5. Mean Differences and t-Test of Controls in Listings (Continued)

	Sold Listings			Unsold Listings		
	Agent-Owned -Arms-Length	Agent-Related -Arms-Length	Agent-Owned -Agent-Related	Agent-Owned -Arms-Length	Agent-Related -Arms-Length	Agent-Owned -Agent-Related
Commission (%)	0.10	0.07	0.03	0.12	0.07	0.05
	(-29.64)	(-9.37)	(-3.20)	(-27.23)	(-8.21)	(-5.19)
Owner Occupied	-0.15	-0.04	-0.11	-0.21	-0.19	-0.02
	(49.02)	(6.21)	(18.92)	(36.42)	(17.27)	(1.70)
Tenant Occupied	0.00	0.01	-0.01	0.03	0.00	0.04
	(1.11)	(-1.45)	(1.81)	(-8.38)	(0.62)	(-4.26)
Vacant	0.15	0.04	0.12	0.18	0.20	-0.02
	(-46.57)	(-5.11)	(-17.40)	(-30.53)	(-17.95)	(1.75)
Includes Dishwasher	0.15	0.12	0.03	0.02	0.06	-0.03
	(-49.89)	(-17.49)	(-6.26)	(-5.46)	(-6.74)	(3.79)
Includes Dryer	0.02	0.07	-0.06	-0.03	-0.02	-0.01
	(-5.63)	(-10.43)	(7.08)	(5.28)	(1.90)	(0.80)
Includes Washer	0.02	0.07	-0.05	-0.03	-0.02	-0.01
	(-5.89)	(-10.34)	(6.88)	(4.88)	(1.66)	(0.82)
Re-Sale	0.28	0.37	-0.09	0.18	0.13	0.05
	(-78.91)	(-47.98)	(12.77)	(-30.69)	(-11.65)	(-4.38)
New Home	0.14	0.09	0.05	0.05	0.16	-0.11
	(-134.42)	(-49.95)	(-8.06)	(-33.92)	(-56.79)	(15.74)
Short Sale	-0.09	-0.10	0.01	-0.18	-0.24	0.06
	(34.02)	(17.36)	(-2.67)	(33.31)	(22.57)	(-6.27)
Real Estate Owned	-0.33	-0.36	0.03	-0.04	-0.05	0.01
	(99.87)	(49.08)	(-10.79)	(17.38)	(9.94)	(-2.40)
Age Restriction	0.00	0.00	0.00	0.00	0.00	0.00
	(3.63)	(-0.36)	(2.11)	(1.59)	(1.87)	(-1.05)
Gated	0.01	0.04	-0.03	0.01	0.00	0.01
	(-5.33)	(-7.21)	(4.22)	(-1.23)	(0.32)	(-0.87)
Homeowners Association	0.01	0.00	0.01	-0.01	0.01	-0.02
	(-4.07)	(-0.30)	(-1.45)	(2.50)	(-0.52)	(1.64)

This table reports the mean differences of independent variables in this study between agent-owned, agent-related, and arms-length listings. The t-statistics are reported in parentheses.

Table 1.6. E□ect of A□liation on Sold Price

	(1)	(2)	(3)	(4)	(5)
Agent-Owned	0.167***	0.016***	0.016***	0.021***	0.013***
	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
Agent-Related	0.099***	0.008**	0.009***	0.029***	0.020***
	(0.009)	(0.003)	(0.003)	(0.004)	(0.003)
Condominium		-0.223***	-0.227***	-0.058	-0.228***
		(0.005)	(0.005)	(0.095)	(0.005)
Log Living Area Square Feet		0.804***	0.788***	0.489***	0.776***
		(0.005)	(0.005)	(0.037)	(0.004)
Log Lot Square Feet		0.008***	0.008***	-0.002***	0.008***
		(0.001)	(0.001)	(0.001)	(0.001)
Bedrooms		-0.031***	-0.027***	0.027***	-0.022***
		(0.001)	(0.001)	(0.002)	(0.001)
Bathrooms		-0.015***	-0.014***	0.024***	-0.014***
		(0.001)	(0.001)	(0.004)	(0.001)
Fireplaces		0.038***	0.038***	0.000	0.036***
		(0.001)	(0.001)	(0.004)	(0.001)
Private Pool		0.091***	0.089***	0.016***	0.089***
		(0.001)	(0.001)	(0.006)	(0.001)
Private Spa		0.028***	0.027***	0.003	0.027***
		(0.001)	(0.001)	(0.004)	(0.001)
Garage Spaces		0.080***	0.078***	0.026***	0.078***
		(0.001)	(0.001)	(0.004)	(0.001)
Age		-0.006***	-0.006***	-0.000	-0.006***
		(0.000)	(0.000)	(0.003)	(0.000)
Property Condition: New		-0.039***	-0.042***	-0.029**	-0.019***
		(0.008)	(0.008)	(0.012)	(0.007)
Property Condition: Excellent		0.050***	0.048***	0.015***	0.048***
		(0.001)	(0.001)	(0.002)	(0.001)
Property Condition: Very Good		0.004***	0.003**	-0.003	0.006***
		(0.001)	(0.001)	(0.002)	(0.001)
Property Condition: Fair		-0.069***	-0.068***	-0.071***	-0.070***
		(0.001)	(0.001)	(0.002)	(0.001)
Property Condition: Poor		-0.190***	-0.189***	-0.254***	-0.196***
		(0.003)	(0.003)	(0.004)	(0.003)

(Continued)

Table 1.6. E□ect of A□liation on Sold Price (Continued)

	(1)	(2)	(3)	(4)	(5)
Age Restriction		0.041***	0.027***	-0.034***	0.011*
		(0.007)	(0.007)	(0.008)	(0.006)
Gated		0.028***	0.025***	-0.035***	0.022***
		(0.002)	(0.002)	(0.002)	(0.002)
Homeowners Association		-0.029***	-0.035***	-0.004	0.035***
		(0.002)	(0.002)	(0.005)	(0.002)
Commission		0.020***	0.020***	0.018***	0.026***
		(0.001)	(0.001)	(0.001)	(0.001)
Owner Occupied		0.007***	0.006***	-0.013***	0.007***
		(0.001)	(0.001)	(0.001)	(0.001)
Tenant Occupied		-0.017***	-0.017***	0.007***	-0.013***
		(0.002)	(0.002)	(0.002)	(0.002)
Includes Dishwasher		0.016***	0.015***	0.010***	0.016***
		(0.001)	(0.001)	(0.002)	(0.001)
Includes Dryer		-0.007*	-0.007**	-0.002	-0.006
		(0.004)	(0.004)	(0.006)	(0.004)
Includes Washer		0.010***	0.009**	0.013**	0.009**
		(0.004)	(0.004)	(0.006)	(0.004)
New Home		0.132***	0.135***	0.119***	0.058***
		(0.007)	(0.006)	(0.006)	(0.007)
Short Sale		-0.114***	-0.113***	-0.147***	-0.105***
		(0.002)	(0.001)	(0.002)	(0.002)
Real Estate Owned		-0.107***	-0.106***	-0.140***	-0.086***
		(0.002)	(0.002)	(0.002)	(0.002)
Observations	294,705	294,705	294,705	89,291	294,700
Adjusted R^2	0.216	0.917	0.921	0.740	0.926
School Controls		✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓	✓
Zip Code FE			✓		✓
Property FE				✓	
Agent FE					✓

This table reports OLS estimates using the natural log of property's sold price as the dependent variable. "Agent-Owned" is a dummy variable that equals one when the listing agent is the property's owner; it is zero otherwise. "Agent-Related" equals one when the listing agent is related to the property's owner; it is zero otherwise. Each column uses a di□erent set of controls. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.7. E□ect of A□liation on Sold Price with Heckman Correction

	(1) Sold	(2) ln(Price)		(1) Sold	(2) ln(Price)
Agent-Owned	-0.026***	0.027***	Commission (%)	-0.034***	0.023***
	(0.009)	(0.001)		(0.006)	(0.001)
Agent-Related	-0.187***	0.013***	Owner Occupied	-0.210***	0.011***
	(0.017)	(0.003)		(0.006)	(0.001)
Condominium	0.523***	-0.219***	Tenant Occupied	-0.493***	-0.027***
	(0.015)	(0.002)		(0.008)	(0.002)
ln(Living Area Square Footage)	-0.616***	0.781***	Includes Dishwasher	0.101***	0.025***
	(0.015)	(0.002)		(0.007)	(0.001)
ln(Lot Square Footage)	0.056***	0.008***	Includes Dryer	0.066**	-0.006
	(0.002)	(0.000)		(0.026)	(0.004)
Bedrooms	0.048***	-0.027***	Includes Washer	-0.029	0.011***
	(0.004)	(0.001)		(0.026)	(0.004)
Bathrooms	-0.066***	-0.016***	New Home	0.202***	0.108***
	(0.005)	(0.001)		(0.017)	(0.002)
Fireplaces	-0.028***	0.039***	Short Sale	-0.333***	-0.148***
	(0.005)	(0.001)		(0.007)	(0.001)
Private Pool	0.079***	0.092***	Real Estate Owned	0.965***	-0.124***
	(0.009)	(0.001)		(0.010)	(0.002)
Private Spa	0.042***	0.029***	Age Restriction	-0.187***	0.026***
	(0.010)	(0.001)		(0.026)	(0.004)
Garage Spaces	0.142***	0.083***	Gated	-0.067***	0.024***
	(0.005)	(0.001)		(0.007)	(0.001)
Age	-0.001***	-0.007***	Homeowners Association	-0.046***	-0.033***
	(0.000)	(0.000)		(0.009)	(0.001)
(Continued)			Inverse Mills Ratio		0.037***
					(0.005)
Observations				385,719	385,719
Censored Observations					91,014
School Controls				✓	✓
Year-Quarter FE				✓	✓
Zip Code FE				✓	✓

This table reports the two step Heckman correction using the sold indicator as the dependent variable in column (1) and the natural log of property's sold price as the dependent variable in column (2). "Agent-Owned" equals one when the property's owner is an agent; it is zero otherwise. "Agent-Related" equals one when the property's owner is related to an agent; it is zero otherwise. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.8. E□ect of A□liation on Sold Price using Agent Controls

	(1) OLS	(2) OLS	(3) OLS	(4) Two-Step	(5) Heckman
	ln(Price)	ln(Price)	ln(Price)	Sold	ln(Price)
Agent-Owned	0.010***	0.011***	0.011***	0.008	0.022***
	(0.002)	(0.002)	(0.002)	(0.011)	(0.002)
Agent-Related	0.020***	0.020***	0.021***	-0.125***	0.015***
	(0.005)	(0.005)	(0.005)	(0.025)	(0.004)
Experience (Years)	-0.028***	-0.030***		0.001***	0.001***
	(0.007)	(0.008)		(0.000)	(0.000)
Broker License	0.004	0.021***		-0.053***	0.006***
	(0.004)	(0.006)		(0.008)	(0.001)
Broker-salesperson License	0.013***	0.021***		0.021**	0.005***
	(0.004)	(0.004)		(0.009)	(0.001)
ln(Income)	-0.000	-0.000		0.011***	-0.000
	(0.000)	(0.000)		(0.001)	(0.000)
ln(Transactions)	0.001**	-0.000		0.031***	0.001**
	(0.001)	(0.001)		(0.003)	(0.000)
Photos	0.002***	0.002***		0.013***	0.002***
	(0.000)	(0.000)		(0.000)	(0.000)
Condominium	-0.218***	-0.218***	-0.218***	0.352***	-0.212***
	(0.005)	(0.005)	(0.005)	(0.018)	(0.003)
Living Area Square Footage	0.800***	0.799***	0.806***	-0.489***	0.815***
	(0.005)	(0.005)	(0.005)	(0.018)	(0.003)
Lot Square Footage	0.008***	0.008***	0.008***	0.040***	0.007***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Bedrooms	-0.021***	-0.021***	-0.021***	0.051***	-0.027***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.001)
Bathrooms	-0.016***	-0.016***	-0.016***	-0.066***	-0.018***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.001)
Fireplaces	0.038***	0.038***	0.038***	-0.032***	0.039***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.001)
Private Pool	0.092***	0.092***	0.092***	0.053***	0.094***
	(0.002)	(0.002)	(0.002)	(0.011)	(0.001)
Private Spa	0.031***	0.031***	0.032***	0.058***	0.032***
	(0.002)	(0.002)	(0.002)	(0.012)	(0.002)
Garage Spaces	0.082***	0.082***	0.082***	0.126***	0.085***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.001)
Age	-0.007***	-0.007***	-0.007***	-0.003***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Property Condition: New	-0.002	0.007	0.007		
	(0.009)	(0.009)	(0.008)		
Property Condition: Excellent	0.046***	0.045***	0.050***		
	(0.002)	(0.002)	(0.002)		
Property Condition: Very Good	0.003*	0.004**	0.006***		
	(0.002)	(0.002)	(0.002)		
Property Condition: Fair	-0.065***	-0.066***	-0.067***		
	(0.001)	(0.001)	(0.001)		
Property Condition: Poor	-0.187***	-0.189***	-0.192***		
	(0.004)	(0.004)	(0.004)		

(Continued)

Table 1.8. E□ect of A□liation on Sold Price using Agent Controls (Continued)

	(1) OLS	(2) OLS	(3) OLS	(4) Two-Step	(5) Heckman
	ln(Price)	ln(Price)	ln(Price)	Sold	ln(Price)
Age Restriction	0.101**	0.092**	0.108**	-0.302	0.115***
	(0.041)	(0.037)	(0.043)	(0.210)	(0.041)
Gated	0.027***	0.029***	0.029***	-0.015	0.031***
	(0.003)	(0.003)	(0.003)	(0.010)	(0.001)
Homeowners Association	-0.031***	-0.031***	-0.031***	-0.065***	-0.031***
	(0.002)	(0.002)	(0.002)	(0.011)	(0.001)
Commission (%)	0.026***	0.027***	0.027***	-0.048***	0.022***
	(0.001)	(0.001)	(0.001)	(0.007)	(0.001)
Owner Occupied	0.009***	0.009***	0.010***	-0.225***	0.015***
	(0.001)	(0.001)	(0.001)	(0.007)	(0.001)
Tenant Occupied	-0.007***	-0.007***	-0.014***	-0.386***	-0.011***
	(0.002)	(0.002)	(0.002)	(0.011)	(0.002)
Includes Dishwasher	0.019***	0.019***	0.020***	0.107***	0.026***
	(0.001)	(0.001)	(0.001)	(0.009)	(0.001)
Includes Dryer	-0.005	-0.005	-0.004	0.013	-0.007
	(0.005)	(0.005)	(0.005)	(0.035)	(0.005)
Includes Washer	0.010**	0.009*	0.009*	0.009	0.015***
	(0.005)	(0.005)	(0.005)	(0.035)	(0.005)
New Home	0.042***	0.035***	0.032***	0.474***	0.147***
	(0.008)	(0.008)	(0.007)	(0.025)	(0.003)
Short Sale	-0.102***	-0.101***	-0.109***	-0.237***	-0.138***
	(0.002)	(0.002)	(0.002)	(0.008)	(0.001)
Real Estate Owned	-0.081***	-0.082***	-0.084***	0.965***	-0.120***
	(0.002)	(0.002)	(0.002)	(0.012)	(0.002)
Inverse Mills Ratio					.026***
					(0.005)
Observations	208,993	208,993	220,887	269,234	269,234
Censored Observations					60,241
Adjusted R^2	0.921	0.922	0.921		
School Controls	✓	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓	✓
Zip Code FE	✓	✓	✓	✓	✓
Agent FE	✓		✓		
Agent-O□ce FE		✓			

The header reports the model specification and dependent variable. "Agent-Owned" equals one when the property's owner is an agent; it is zero otherwise. "Agent-Related" equals one when the property's owner is related to an agent; it is zero otherwise. Experience is the agent's years holding a real estate license. Broker and Broker-salesperson indicate whether the agent has a Broker or Broker-salesperson license; the base is Salesperson license. ln(Income) is the agent's commission income during the previous month in natural log form. ln(Transactions) is the number of transactions the agent facilitated last year in natural log form. Photos is the count of pictures of the property in the MLS. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. Robust standard errors clustered by zip code and year-quarter are in parentheses (but not for the Heckman model). The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.9. E□ect of A□liation and Appraisal Knowledge on Sold Price

	(1) OLS	(2) OLS	(3) Two-Step Heckman	(4)
	ln(Price)	ln(Price)	Sold	ln(Price)
Agent-Owned	0.010***	0.011***	0.009	0.022***
	(0.002)	(0.002)	(0.011)	(0.002)
Agent-Related	0.019***	0.020***	-0.130***	0.015***
	(0.005)	(0.005)	(0.025)	(0.004)
Appraiser Licensee	-0.020	0.012	0.105***	-0.009
	(0.014)	(0.014)	(0.039)	(0.005)
Agent-Owned Appraiser Licensee	0.114***	0.129***	-0.272*	0.150***
	(0.030)	(0.032)	(0.157)	(0.026)
Agent-Related Appraiser Licensee	0.014	0.002	0.965**	0.070*
	(0.055)	(0.058)	(0.399)	(0.042)
Experience (Years)	-0.028***	-0.031***	0.001***	0.001***
	(0.007)	(0.008)	(0.000)	(0.000)
Broker License	0.005	0.021***	-0.054***	0.006***
	(0.004)	(0.006)	(0.008)	(0.001)
Broker-salesperson License	0.013***	0.021***	0.021**	0.005***
	(0.004)	(0.004)	(0.009)	(0.001)
ln(Income)	-0.000	-0.000	0.011***	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)
ln(Transactions)	0.001**	-0.000	0.031***	0.001**
	(0.001)	(0.001)	(0.003)	(0.000)
Photos	0.002***	0.002***	0.013***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Condominium	-0.218***	-0.218***	0.352***	-0.212***
	(0.005)	(0.005)	(0.018)	(0.003)
ln(Living Area Square Footage)	0.800***	0.799***	-0.489***	0.815***
	(0.005)	(0.005)	(0.018)	(0.003)
ln(Lot Square Footage)	0.008***	0.008***	0.040***	0.007***
	(0.001)	(0.001)	(0.002)	(0.000)
Bedrooms	-0.021***	-0.021***	0.051***	-0.027***
	(0.001)	(0.001)	(0.006)	(0.001)
Bathrooms	-0.016***	-0.016***	-0.066***	-0.018***
	(0.001)	(0.001)	(0.006)	(0.001)
Fireplaces	0.038***	0.038***	-0.032***	0.039***
	(0.001)	(0.001)	(0.006)	(0.001)
Private Pool	0.092***	0.092***	0.053***	0.094***
	(0.002)	(0.002)	(0.011)	(0.001)
Private Spa	0.031***	0.031***	0.058***	0.032***
	(0.002)	(0.002)	(0.012)	(0.002)
Garage Spaces	0.082***	0.082***	0.126***	0.085***
	(0.001)	(0.001)	(0.006)	(0.001)
Age	-0.007***	-0.007***	-0.003***	-0.008***
	(0.000)	(0.000)	(0.001)	(0.000)
Property Condition: New	-0.002	0.007		
	(0.009)	(0.009)		
Property Condition: Excellent	0.046***	0.045***		
	(0.002)	(0.002)		
Property Condition: Very Good	0.003*	0.004**		
	(0.002)	(0.002)		
Property Condition: Fair	-0.065***	-0.066***		
	(0.001)	(0.001)		
Property Condition: Poor	-0.187***	-0.189***		
	(0.004)	(0.004)		

(Continued)

Table 1.9. E□ect of A□liation and Appraisal Knowledge on Sold Price (Continued)

	(1) OLS	(2) OLS	(3) Two-Step Heckman	(4)
	ln(Price)	ln(Price)	Sold	ln(Price)
Age Restriction	0.100**	0.092**	-0.300	0.115***
	(0.041)	(0.037)	(0.210)	(0.041)
Gated	0.027***	0.029***	-0.015	0.031***
	(0.003)	(0.003)	(0.010)	(0.001)
Homeowners Association	-0.031***	-0.031***	-0.066***	-0.031***
	(0.002)	(0.002)	(0.011)	(0.001)
Commission (%)	0.026***	0.027***	-0.048***	0.022***
	(0.001)	(0.001)	(0.007)	(0.001)
Owner Occupied	0.009***	0.009***	-0.225***	0.015***
	(0.001)	(0.001)	(0.007)	(0.001)
Tenant Occupied	-0.007***	-0.007***	-0.386***	-0.012***
	(0.002)	(0.002)	(0.011)	(0.002)
Includes Dishwasher	0.019***	0.019***	0.107***	0.026***
	(0.001)	(0.001)	(0.009)	(0.001)
Includes Dryer	-0.005	-0.005	0.013	-0.007
	(0.005)	(0.005)	(0.035)	(0.005)
Includes Washer	0.009**	0.009*	0.009	0.015***
	(0.005)	(0.005)	(0.035)	(0.005)
New Home	0.042***	0.035***	0.474***	0.147***
	(0.008)	(0.008)	(0.025)	(0.003)
Short Sale	-0.102***	-0.101***	-0.237***	-0.139***
	(0.002)	(0.002)	(0.008)	(0.001)
Real Estate Owned	-0.081***	-0.081***	0.965***	-0.120***
	(0.002)	(0.002)	(0.012)	(0.002)
Inverse Mills Ratio				0.026***
				(0.005)
Observations	208,993	208,993	269,234	269,234
Adjusted R^2	0.921	0.922		
School Controls	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓
Zip Code FE	✓	✓	✓	✓
Agent FE	✓			
Agent-O□ce FE		✓		

The header reports the model specification and dependent variable. "Agent-Owned" equals one when the property's owner is an agent; it is zero otherwise. "Agent-Related" equals one when the property's owner is related to an agent; it is zero otherwise. Experience is the agent's years holding a real estate license. "Appraiser Licensee" is a dummy variable that takes the value of one if the listing agent holds an appraiser licensee at the time of listing the property for sale; it is zero otherwise. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For other variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.10. E□ect of A□liation on Sold Price by Seller Type

Subsample:	(1) Household	(2) Trust	(3) Corporation	(4) Builder
Agent-Owned	0.017***	0.001	-0.003	-0.002
	(0.003)	(0.006)	(0.004)	(0.007)
Agent-Related	0.020***	0.010	0.005	-0.021
	(0.005)	(0.010)	(0.009)	(0.020)
Condominium	-0.241***	-0.231***	-0.253***	-0.027
	(0.006)	(0.011)	(0.011)	(0.030)
ln(Living Area Square Footage)	0.772***	0.819***	0.722***	0.762***
	(0.005)	(0.011)	(0.010)	(0.011)
ln(Lot Square Footage)	0.010***	0.011***	0.008***	0.038***
	(0.001)	(0.001)	(0.001)	(0.005)
Bedrooms	-0.025***	-0.042***	-0.014***	-0.028***
	(0.001)	(0.003)	(0.003)	(0.003)
Bathrooms	-0.015***	0.007**	-0.011***	-0.010***
	(0.002)	(0.003)	(0.003)	(0.003)
Fireplaces	0.034***	0.027***	0.031***	0.041***
	(0.001)	(0.003)	(0.003)	(0.003)
Private Pool	0.090***	0.084***	0.083***	0.091***
	(0.002)	(0.004)	(0.005)	(0.006)
Private Spa	0.026***	0.023***	0.038***	0.034***
	(0.002)	(0.004)	(0.005)	(0.007)
Garage Spaces	0.072***	0.058***	0.076***	0.066***
	(0.001)	(0.003)	(0.003)	(0.004)
Age	-0.005***	-0.004***	-0.003***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
Property Condition: New	0.004	-0.127	0.035	-0.005
	(0.036)	(0.077)	(0.037)	(0.007)
Property Condition: Excellent	0.056***	0.070***	0.042***	
	(0.001)	(0.004)	(0.004)	
Property Condition: Very Good	0.020***	0.028***	0.020***	-0.025***
	(0.001)	(0.004)	(0.004)	(0.009)
Property Condition: Fair	-0.054***	-0.069***	-0.058***	-0.051***
	(0.002)	(0.006)	(0.007)	(0.014)
Property Condition: Poor	-0.163***	-0.190***	-0.281***	-0.277***
	(0.005)	(0.016)	(0.023)	(0.046)

(Continued)

Table 1.10. Effect of Affiliation on Sold Price by Seller Type (Continued)

Subsample:	(1) Household	(2) Trust	(3) Corporation	(4) Builder
Age Restriction	0.034***	-0.002	0.014	0.025
	(0.006)	(0.009)	(0.015)	(0.035)
Gated	0.046***	0.045***	0.030***	0.021***
	(0.002)	(0.004)	(0.004)	(0.005)
Homeowners Association	-0.032***	-0.034***	-0.028***	-0.031***
	(0.002)	(0.005)	(0.005)	(0.006)
Commission	-0.004**	0.007	-0.011***	-0.004*
	(0.002)	(0.006)	(0.003)	(0.002)
Owner Occupied		0.034***	0.038***	0.027***
		(0.003)	(0.008)	(0.009)
Tenant Occupied	-0.022***	-0.014***	-0.035***	-0.068***
	(0.002)	(0.005)	(0.004)	(0.014)
Includes Dishwasher	0.016***	0.018***	0.012***	0.011
	(0.002)	(0.005)	(0.005)	(0.008)
Includes Dryer	-0.003	0.005	-0.010	0.017
	(0.005)	(0.012)	(0.012)	(0.016)
Includes Washer	0.007	-0.000	0.006	-0.014
	(0.005)	(0.012)	(0.012)	(0.016)
New Home	0.090***			0.014*
	(0.026)			(0.007)
Short Sale	-0.107***	-0.098***	-0.086***	
	(0.002)	(0.007)	(0.015)	
Observations	124,758	25,554	19,109	16,452
Adjusted R^2	0.927	0.925	0.939	0.940
School Controls	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓
Zip Code FE	✓	✓	✓	✓
Agent FE	✓	✓	✓	✓

This table reports OLS estimates using the natural log of property's sold price as the dependent variable by seller type. "Agent-Owned" is a dummy variable that equals one when the listing agent is the property's owner; it is zero otherwise. "Agent-Related" equals one when the listing agent is related to the property's owner; it is zero otherwise. Each column uses a different set of controls. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.11. E□ect of A□liation and Seller Type on Price with Heckman Correction

	(1) Sold	(2) ln(Price)		(1) Sold	(2) ln(Price)
Agent-Owned	-0.270***	0.019***	Private Pool	0.095***	0.091***
	(0.016)	(0.002)		(0.010)	(0.001)
Agent-Related	-0.357***	0.020***	Private Spa	0.032***	0.028***
	(0.026)	(0.004)		(0.011)	(0.001)
Builder	-1.565***	0.038***	Garage Ports	0.135***	0.071***
	(0.010)	(0.005)		(0.005)	(0.001)
Corporation	0.564***	0.019***	Age	-0.004***	-0.005***
	(0.016)	(0.002)		(0.001)	(0.000)
Trust	0.961***	0.023***	Commission	-0.014*	0.004***
	(0.015)	(0.002)		(0.008)	(0.001)
Builder Agent-Owned	0.929***	-0.005	Owner Occupied	-0.245***	0.022***
	(0.022)	(0.004)		(0.007)	(0.001)
Corporation Agent-Owned	1.060***	-0.009**	Tenant Occupied	-0.479***	-0.020***
	(0.049)	(0.004)		(0.010)	(0.002)
Trust Agent-Owned	0.300***	-0.018***	Includes Dishwasher	0.130***	0.031***
	(0.052)	(0.004)		(0.009)	(0.001)
Builder Agent-Related	0.298***	-0.061***	Includes Dryer	0.050	-0.004
	(0.044)	(0.007)		(0.031)	(0.004)
Corporation Agent-Related	1.272***	-0.007	Includes Washer	-0.042	0.008**
	(0.117)	(0.007)		(0.031)	(0.004)
Trust Agent-Related	0.741***	-0.001	New Home	1.153***	0.111***
	(0.132)	(0.008)		(0.019)	(0.004)
Condominium	0.495***	-0.230***	Short Sale	-0.426***	-0.141***
	(0.018)	(0.003)		(0.008)	(0.002)
ln(Living Area Square Footage)	-0.590***	0.788***	Age Restriction	-0.240***	0.027***
	(0.017)	(0.003)		(0.031)	(0.004)
ln(Lot Square Footage)	0.053***	0.010***	Gated	-0.075***	0.044***
	(0.002)	(0.000)		(0.008)	(0.001)
Bedrooms	0.054***	-0.033***	Homeowners Association	-0.065***	-0.035***
	(0.005)	(0.001)		(0.010)	(0.001)
Bathrooms	-0.064***	-0.011***	Inverse Mills Ratio		.004
	(0.006)	(0.001)			(0.005)
Fireplaces	-0.037***	0.037***			
	(0.006)	(0.001)			
(Continued)					
Observations				264,346	264,346
Censored Observations					78,469
Constant				✓	✓
Structural				✓	✓
Neighborhood				✓	✓
Contract				✓	✓
Year-Quarter FE				✓	✓
Zip Code FE				✓	✓

This table reports the two step Heckman correction using the sold indicator as the dependent variable in column (1) and the natural log of property's sold price as the dependent variable in column (2). "Agent-Owned" equals one when the property's owner is an agent; it is zero otherwise. "Agent-Related" equals one when the property's owner is related to an agent; it is zero otherwise. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.12. Multinomial Logit of Expired, Withdrawn, or Sold

	(1) Expired	(2) Withdrawn		(1) Expired	(2) Withdrawn
Agent-Owned	-0.138***	0.289***	Commission (%)	0.065***	0.004
	(0.019)	(0.025)		(0.013)	(0.019)
Agent-Related	0.266***	0.371***	Owner Occupied	0.459***	0.201***
	(0.036)	(0.044)		(0.012)	(0.016)
ln(Living Area Square Footage)	0.994***	1.722***	Tenant Occupied	0.971***	0.614***
	(0.030)	(0.039)		(0.018)	(0.024)
ln(Lot Square Footage)	0.043***	-0.568***	Includes Dishwasher	-0.177***	-0.257***
	(0.013)	(0.010)		(0.015)	(0.021)
Bedrooms	-0.084***	-0.129***	Includes Dryer	-0.057	-0.291***
	(0.009)	(0.012)		(0.056)	(0.071)
Bathrooms	0.160***	0.064***	Includes Washer	0.050	0.158**
	(0.010)	(0.014)		(0.056)	(0.070)
Fireplaces	-0.004	0.064***	New Home	-0.406***	-0.149***
	(0.009)	(0.013)		(0.037)	(0.043)
Private Pool	-0.178***	-0.108***	Short Sale	0.295***	0.983***
	(0.017)	(0.023)		(0.014)	(0.020)
Private Spa	-0.068***	-0.042*	Real Estate Owned	-1.880***	-1.683***
	(0.019)	(0.025)		(0.023)	(0.056)
Garage Spaces	-0.216***	-0.231***	Age Restriction	0.656***	0.756***
	(0.009)	(0.013)		(0.052)	(0.052)
Age	0.009***	0.011***	Gated	0.099***	0.235***
	(0.001)	(0.001)		(0.016)	(0.017)
(Continued)			Homeowners Association	-0.102***	-0.121***
				(0.016)	(0.022)
Observations				343,436	343,436
Pseudo R^2				0.205	0.205
Year-Quarter FE				✓	✓

This table reports the coe□cient estimates of a multinomial logit model using only single-family listings. The dependent variable is a categorical variable that takes the values of "Expired", "Withdrawn", or "Sold". Sold is set as the base. The sample includes successful and unsuccessful listings. "Agent-Owned" equals one when the property's owner is an agent; it is zero otherwise. "Agent-Related" equals one when the property's owner is related to an agent; it is zero otherwise. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.13. Multinomial Logit by Seller Type

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Household		Trust		Corporation		Builder	
	Expired	Withdrawn	Expired	Withdrawn	Expired	Withdrawn	Expired	Withdrawn
Agent-Owned	0.258***	0.426***	0.125	-0.226	-0.221	-1.097**	-1.058***	-0.567***
	(0.033)	(0.044)	(0.161)	(0.320)	(0.294)	(0.530)	(0.034)	(0.041)
Agent-Related	0.332***	0.263***	0.454	0.096	0.106	-0.207	0.270***	0.599***
	(0.054)	(0.074)	(0.450)	(0.789)	(0.866)	(1.524)	(0.075)	(0.083)
ln(Living Area Square Footage)	0.901***	1.684***	0.517*	-0.034	1.274**	0.945	0.859***	1.271***
	(0.042)	(0.054)	(0.265)	(0.421)	(0.528)	(0.678)	(0.083)	(0.094)
ln(Lot Square Footage)	0.095***	-0.571***	-0.158	-0.487***	-0.237	-0.954***	0.033	-0.419***
	(0.018)	(0.013)	(0.097)	(0.103)	(0.212)	(0.216)	(0.029)	(0.027)
Bedrooms	-0.056***	-0.124***	0.038	-0.039	-0.303**	0.111	-0.232***	-0.250***
	(0.012)	(0.016)	(0.076)	(0.121)	(0.150)	(0.191)	(0.024)	(0.027)
Bathrooms	0.136***	0.045**	-0.010	0.285**	0.088	-0.270	0.211***	0.109***
	(0.014)	(0.019)	(0.084)	(0.140)	(0.172)	(0.237)	(0.028)	(0.032)
Fireplaces	0.025**	0.094***	-0.047	0.001	-0.591***	-0.423**	0.024	0.081***
	(0.013)	(0.017)	(0.080)	(0.128)	(0.160)	(0.215)	(0.027)	(0.030)
Private Pool	-0.169***	-0.129***	-0.258*	0.476**	0.281	0.777	-0.405***	-0.264***
	(0.022)	(0.031)	(0.156)	(0.234)	(0.375)	(0.496)	(0.050)	(0.057)
Private Spa	-0.084***	-0.005	-0.209	-0.664***	-0.645	-0.519	0.040	-0.044
	(0.025)	(0.034)	(0.166)	(0.256)	(0.409)	(0.557)	(0.056)	(0.064)
Garage Spaces	-0.188***	-0.202***	-0.183**	-0.182	-0.293	-0.437*	-0.175***	-0.181***
	(0.013)	(0.017)	(0.086)	(0.135)	(0.181)	(0.246)	(0.026)	(0.030)
Age	0.012***	0.017***	-0.013**	-0.002	-0.035***	-0.047***	0.030***	0.021***
	(0.001)	(0.001)	(0.006)	(0.010)	(0.012)	(0.017)	(0.002)	(0.002)

(Continued)

Table 1.13. Multinomial Logit by Seller Type (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Household		Trust		Corporation		Builder	
	Expired	Withdrawn	Expired	Withdrawn	Expired	Withdrawn	Expired	Withdrawn
Commission (%)	0.065***	-0.171***	0.014	-0.569**	-0.344	-0.737**	0.097***	0.265***
	(0.024)	(0.029)	(0.171)	(0.239)	(0.249)	(0.315)	(0.025)	(0.032)
Owner Occupied			0.203**	0.402**	1.286***	1.487***	1.145***	0.764***
			(0.101)	(0.170)	(0.224)	(0.272)	(0.042)	(0.045)
Tenant Occupied	0.427***	0.383***	0.341**	0.270	-0.023	0.079	1.626***	1.024***
	(0.023)	(0.031)	(0.137)	(0.229)	(0.207)	(0.302)	(0.061)	(0.067)
Includes Dishwasher	-0.253***	-0.291***	-0.103	-0.176	-0.138	-0.347	-0.079	-0.225***
	(0.022)	(0.029)	(0.137)	(0.200)	(0.251)	(0.308)	(0.053)	(0.057)
Includes Dryer	-0.020	-0.195**	0.341	-0.316	0.839	-0.503	-0.172	-0.320*
	(0.073)	(0.097)	(0.518)	(0.819)	(0.872)	(1.103)	(0.178)	(0.195)
Includes Washer	-0.041	0.084	-0.708	0.245	-0.767	0.217	0.357**	0.343*
	(0.073)	(0.097)	(0.519)	(0.817)	(0.863)	(1.095)	(0.178)	(0.194)
New Home	2.027***	2.819***					-1.958***	-2.457***
	(0.123)	(0.135)					(0.050)	(0.060)
Short Sale	-0.110***	0.759***	7.046***	7.226***	10.980***	10.959***		
	(0.019)	(0.025)	(0.347)	(0.423)	(0.937)	(1.285)		
Age Restriction	0.890***	1.050***	-0.026	-0.572	-13.642	0.361	0.865***	0.754***
	(0.073)	(0.078)	(1.161)	(1.135)	(2,684.211)	(7.540)	(0.154)	(0.150)
Gated	0.087***	0.300***	-0.323**	-0.005	0.249	0.076	0.158***	0.103**
	(0.021)	(0.024)	(0.145)	(0.187)	(0.267)	(0.297)	(0.042)	(0.043)
Homeowners Association	-0.112***	-0.133***	0.016	0.310	0.402	0.565	0.004	0.023
	(0.021)	(0.030)	(0.137)	(0.238)	(0.300)	(0.428)	(0.046)	(0.053)
Observations	155,228	155,228	24,301	24,301	17,265	17,265	40,905	40,905
Year-Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓

This table reports the coe□cient estimates of a multinomial logit model. The dependent variable is a categorical variable that takes the values of “Expired”, “Withdrawn”, or “Sold”. Sold is set as the base. The sample includes successful and unsuccessful listings. “Agent-Owned” equals one when the property’s owner is an agent; it is zero otherwise. “Agent-Related” equals one when the property’s owner is related to an agent; it is zero otherwise. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.14. Multinomial Logit with Market Conditions

	(1) Expired	(2) Withdrawn		(1) Expired	(2) Withdrawn
Agent-Owned	-0.268***	-0.234	Age	0.009***	0.011***
	(0.027)	(0.246)		(0.001)	(0.001)
Agent-Related	0.023	-0.039	Commission (%)	0.064***	0.004
	(0.062)	(0.583)		(0.013)	(0.019)
Expansion	-1.212***	4.125***	Owner Occupied	0.460***	0.201***
	(0.052)	(0.169)		(0.012)	(0.016)
Agent-Owned Expansion	0.250***	0.548**	Tenant Occupied	0.971***	0.615***
	(0.037)	(0.248)		(0.018)	(0.024)
Agent-Related Expansion	0.370***	0.440	Includes Dishwasher	-0.178***	-0.257***
	(0.076)	(0.585)		(0.015)	(0.021)
ln(Living Area Square Footage)	0.993***	1.722***	Includes Dryer	-0.056	-0.291***
	(0.030)	(0.039)		(0.056)	(0.071)
ln(Lot Square Footage)	0.042***	-0.568***	Includes Washer	0.051	0.158**
	(0.013)	(0.010)		(0.056)	(0.070)
Bedrooms	-0.083***	-0.129***	New Home	-0.413***	-0.155***
	(0.009)	(0.012)		(0.037)	(0.043)
Bathrooms	0.161***	0.064***	Short Sale	0.286***	0.980***
	(0.010)	(0.014)		(0.014)	(0.020)
Fireplaces	-0.004	0.064***	Real Estate Owned	-1.899***	-1.686***
	(0.009)	(0.013)		(0.023)	(0.056)
Private Pool	-0.178***	-0.108***	Age Restriction	0.661***	0.757***
	(0.017)	(0.023)		(0.052)	(0.052)
Private Spa	-0.068***	-0.041*	Gated	0.097***	0.234***
	(0.019)	(0.025)		(0.016)	(0.017)
Garage Spaces	-0.216***	-0.231***	Homeowners Association	-0.102***	-0.121***
	(0.009)	(0.013)		(0.016)	(0.022)
(Continued)					
Observations				343,436	343,436
Pseudo R^2				0.206	0.206
Year-Quarter FE				✓	✓

This table reports the coe□cient estimates of a multinomial logit model. The dependent variable is a categorical variable that takes the values of "Expired", "Withdrawn", or "Sold". Sold is set as the base. The sample includes successful and unsuccessful listings. "Agent-Owned" equals one when the property's owner is an agent; it is zero otherwise. "Agent-Related" equals one when the property's owner is related to an agent; it is zero otherwise. "Expansion" equals one if listed on or after 2012; it is zero otherwise. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 1.15. E□ect of A□liation and Market Conditions on TOM

	(1) 2008-2018	(2) 2008-2012	(3) 2012-2018	(4) 2008-2018
Agent-Owned	0.001	-0.022	-0.013	-0.050**
	(0.013)	(0.023)	(0.017)	(0.020)
Agent-Related	0.011	0.060	-0.003	-0.040
	(0.024)	(0.053)	(0.027)	(0.043)
Expansion				-1.446***
				(0.030)
Agent-Owned Expansion				0.079***
				(0.024)
Agent-Related Expansion				0.066
				(0.048)
Condominium	0.139***	-0.009	0.287***	0.138***
	(0.017)	(0.022)	(0.026)	(0.017)
ln(Log Area Square Footage)	0.640***	0.344***	0.918***	0.640***
	(0.018)	(0.022)	(0.024)	(0.018)
ln(Lot Square Footage)	-0.004**	-0.010***	-0.004	-0.004**
	(0.002)	(0.003)	(0.003)	(0.002)
Bedrooms	-0.049***	-0.047***	-0.056***	-0.049***
	(0.005)	(0.006)	(0.006)	(0.005)
Bathrooms	0.021***	0.024***	0.021***	0.021***
	(0.006)	(0.008)	(0.008)	(0.006)
Fireplaces	-0.021***	-0.024***	-0.014**	-0.021***
	(0.005)	(0.007)	(0.007)	(0.005)
Private Pool	-0.062***	-0.065***	-0.064***	-0.062***
	(0.009)	(0.014)	(0.012)	(0.009)
Private Spa	-0.035***	-0.073***	-0.022*	-0.035***
	(0.010)	(0.016)	(0.013)	(0.010)
Garage Spaces	-0.067***	-0.059***	-0.074***	-0.067***
	(0.005)	(0.006)	(0.006)	(0.005)
Age	0.003***	0.002**	0.003***	0.003***
	(0.000)	(0.001)	(0.001)	(0.000)
Property Condition: New	-0.111**	-0.504**	-0.127	-0.130**
	(0.056)	(0.251)	(0.086)	(0.056)
Property Condition: Excellent	-0.170***	-0.150***	-0.217***	-0.171***
	(0.009)	(0.015)	(0.010)	(0.009)
Property Condition: Very Good	-0.114***	1.186***	-0.131***	-0.115***
	(0.010)	(0.094)	(0.010)	(0.010)
Property Condition: Fair	0.080***	0.120***	0.068***	0.080***
	(0.008)	(0.010)	(0.013)	(0.008)
Property Condition: Poor	0.014	0.114***	-0.066***	0.015
	(0.016)	(0.021)	(0.025)	(0.016)

(Continued)

Table 1.15. E□ect of A□liation and Market Conditions on TOM (Continued)

	(1) 2008-2018	(2) 2008-2012	(3) 2012-2018	(4) 2008-2018
Commission	-0.006	-0.032***	0.039***	-0.006
	(0.007)	(0.009)	(0.013)	(0.007)
Owner Occupied	-0.301***	-0.293***	-0.307***	-0.300***
	(0.007)	(0.016)	(0.009)	(0.007)
Tenant Occupied	-0.221***	-0.270***	-0.191***	-0.221***
	(0.012)	(0.028)	(0.013)	(0.012)
Includes Dishwasher	0.009	-0.021**	0.018*	0.010
	(0.007)	(0.009)	(0.011)	(0.007)
Includes Dryer	-0.038	-0.005	-0.044	-0.038
	(0.024)	(0.037)	(0.031)	(0.024)
Includes Washer	-0.012	-0.025	-0.004	-0.011
	(0.023)	(0.036)	(0.031)	(0.023)
New Home	0.261***	0.197***	0.334***	0.267***
	(0.047)	(0.059)	(0.082)	(0.047)
Short Sale	0.493***	0.688***	0.315***	0.492***
	(0.016)	(0.025)	(0.018)	(0.016)
Real Estate Owned	-0.197***	-0.239***	0.040*	-0.201***
	(0.014)	(0.020)	(0.021)	(0.014)
Age Restriction	0.207***		0.255***	0.208***
	(0.043)		(0.042)	(0.043)
Gated	0.203***	0.768***	0.092***	0.203***
	(0.010)	(0.035)	(0.010)	(0.010)
Homeowners Association	0.011	-0.004	0.049***	0.011
	(0.009)	(0.012)	(0.012)	(0.009)
Observations	294,700	133,055	161,645	294,700
Adjusted R^2	0.186	0.214	0.171	0.186
School Controls	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓
Zip Code FE	✓	✓	✓	✓
Agent FE	✓	✓	✓	✓

This table reports OLS estimates using the natural log of property's time-on-market (TOM) as the dependent variable. "Agent-Owned" is a dummy variable that equals one when the listing agent is the property's owner; it is zero otherwise. "Agent-Related" equals one when the listing agent is related to the property's owner; it is zero otherwise. "Expansion" is a dummy variable that equals one when the property was listed on or after 2012; it is zero otherwise. Each column uses a di□erent set of controls. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the baseline controls, see Table 1.1. Robust standard errors clustered by zip code and year-quarter are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

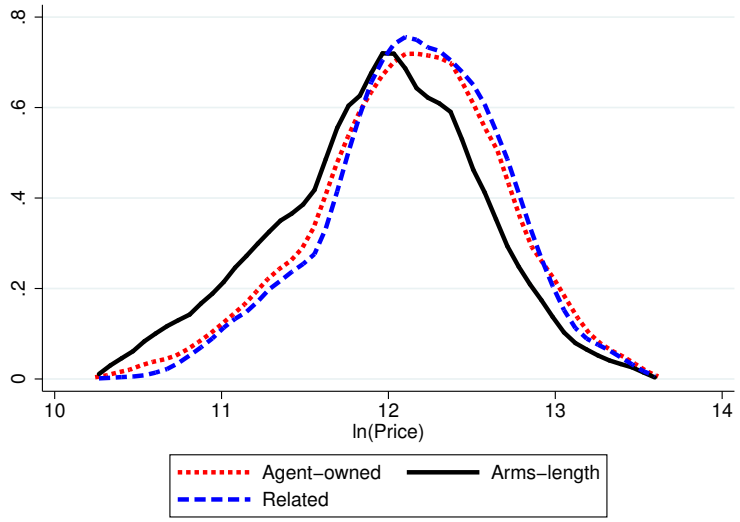


Figure 1.1. Kernel Distribution of ln(Price) by Steering Class

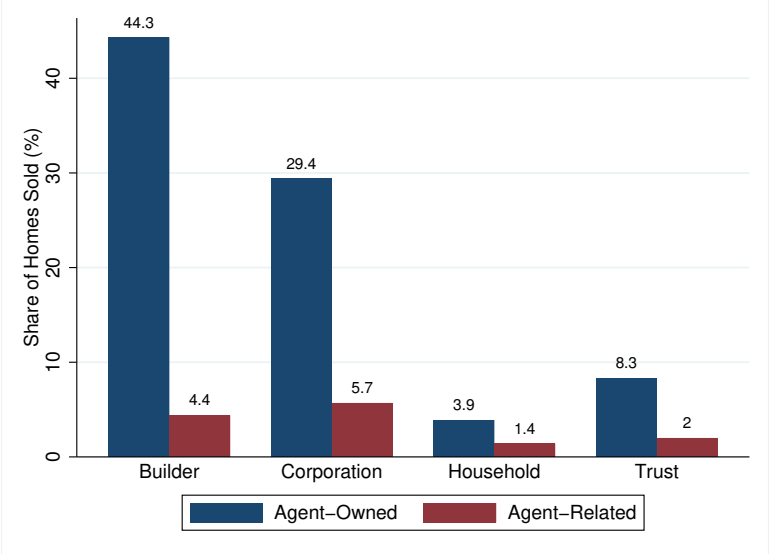


Figure 1.2. Share of Homes Sold as Percent by Seller Type

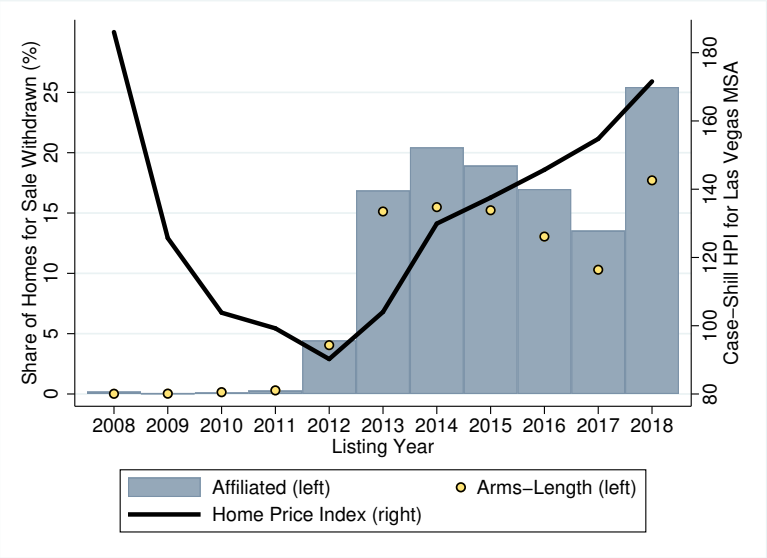


Figure 1.3. Share of Homes for Sale Withdrawn as Percent by A□liation Type

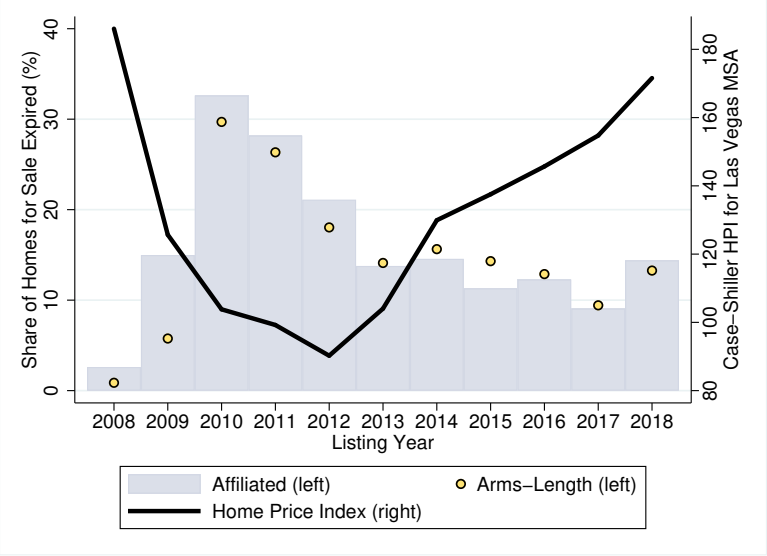


Figure 1.4. Share of Homes for Sale Expired as Percent by A□liation Type

Chapter 2
Steering Consumers to Affiliated Financial Services: Evidence from Brokered Housing Transactions[1]

2.1 Introduction

Following the Subprime Mortgage Crisis in 2007, mortgage providers and real estate brokerages have faced increasingly more scrutiny for entering into financial agreements that involved steering buyers to specific lenders. This scrutiny derives from a more general concern in the United States that intermediaries in credit markets (e.g., student loans, credit cards, auto loans, and so on) encounter perverse incentives to push consumers into taking high cost or risky debt. But in recent years, financial steering in the residential mortgage market has become a focal point among regulators and economists (Foote et al., 2008; Agarwal, Ambrose and Yao, 2016; Agarwal et al., 2016). Yet little to no research has been devoted to identifying the prevalence of steering and its impact on market outcomes. This is mostly because an empirical challenge in studying the impact of steering is identifying whether buyers were steered, or not.

I circumvent the difficulty of identifying financial steering by leveraging an

[1]This chapter was inspired by conversations with Shawn McCoy and Vivek Sah. Portions of this work have been subsequently incorporated into a co-authored working paper with the same title.

important observation by the Consumer Finance Protection Bureau (CFPB). In a recent settlement with a major mortgage lender that gave kickbacks to real estate brokers in exchange for mortgage referrals,[2] the CFPB discovered that the principal method used to steer buyers was a process more commonly referred to as "writing in" whereby a lender encourages a broker to write in their real estate listings an explicit bidding constraint that any interested buyer is required to obtain a "free" pre-qualification letter from an affiliated lender in order to purchase the listed property.[3] A pre-qualification letter is a standard document in the home-buying process, which states that after reviewing the buyer's financial records (i.e., pay stubs, tax returns, account statements, and so on) the mortgage broker or lender certifies that the buyer qualifies to obtain sufficient financing to purchase the property. However, requiring or motivating buyers to obtain a pre-qualification letter from an affiliated lender in exchange for kickbacks has been found to violate sections of the Real Estate Settlement Procedures Act (i.e., 12 U.S.C. §2607(a) and 12 C.F.R. part 1024) and Title X of the Consumer Financial Protection Act (i.e., 12 U.S.C. §5536). One reason is that mandatory use of a preferred lender eradicates the buyer's option of exclusively pre-qualifying with a lender that is of the buyer's choosing and unaffiliated to the seller.

In practice, listing agents write the bidding constraint in private agent-to-agent remarks found on listings in multiple listing services (MLS) making steering activity relatively easy for an individual with MLS access to identify. But the variation in the verbiage and quantity of remarks in a population of listings makes systematically flagging steering activity challenging. I overcome this challenge by using IBM's Watson Natural Language Classifier—a technology that uses machine learning algorithms to classify observations into categories pre-defined by the user. Since the development of this technology to win Jeopardy in 2011,[4] businesses have been adopting Watson to improve customer service.[5] For this paper's purposes, this interface for artificial intelligence allows me to flag listings with remarks that instruct potential buyers to obtain a pre-qualification letter from the listing agent's

[2] See the CFPB press release at https://www.consumerfinance.gov.

[3] See, for instance, https://files.consumerfinance.gov/f/documents/201701_cfpb_ProspectMortgage-consent-order.pdf and https://www.consumerfinance.gov/about-us/newsroom/cfpb-orders-prospect-mortgage-pay-35-million-fine-illegal-kickback-scheme/.

[4] For details, see the YouTube video located at https://youtu.be/P18EdAKuC1U.

[5] The following Wall-Street article by Steve Lohr (dated Oct. 17, 2016) provides further details: https://www.nytimes.com.

preferred lender.[6] Whereas analog methods are vulnerable to inconsistencies and biases in coding large data sets, this use of artificial intelligence allows me to bypass such criticisms. Thus, this innovative method, enabling me to identify steering with high precision, allows me to examine the impact of financial steering on real estate market outcomes.

To preview the results, using an administrative dataset from the Greater Las Vegas Association of Realtors, I observe that over 13 percent of all single-family and condominium transactions involved financial steering in the Las Vegas Metropolitan Area from 2008 to 2018. Steering was most prevalent during the Great Recession and declined precipitously after 2012. Steering peaked in 2009 with agents requiring pre-qualification from their preferred lenders in nearly 30 percent of all transactions. As real estate markets tend to be relatively opaque and private, the potential impacts of financial steering on real estate market outcomes are ultimately unclear, ex-ante. However, the model estimates indicate that steering led to a 1 percent (or $1,900) reduction in the equilibrium sale price of the average home.

The empirical strategy compares the economic performance of listings with remarks flagged for steering (i.e., the treatment group) to that of listings with neutral remarks (i.e., the control group). The baseline model uses a rich set of controls for the property, neighborhood, and sale contract characteristics. This model is robust to alternative specifications including use of subdivision fixed effects, propensity score matching, and the two-step Heckman correction for sample selection concerns. The implicit identification assumption of random treatment assignment relies on the independence of flagged remarks from the choices of sellers on unobservable attributes, which the subdivision fixed effects capture.

I consider that the variation in the equilibrium sale price may originate from impacts on the transaction costs, borrowing costs, and buyer-side responses to steering. In theory, by requiring the buyer to use an affiliated lender, the listing agent potentially reduces transaction costs. The seller, for instance, can create efficiencies in qualifying potential buyers by working with a lender of a known work capability. Furthermore, the listing agent could use the affiliated lender as a

[6] Use of IBM's Watson in the financial literature is relatively new. However, example studies using Watson include Balan and Rege (2017) who analyze Tweets to better understand the behavior of small businesses, Cervenka et al. (2016) who evaluate brand recognition by studying unstructured data from social media platforms, and Dabirian, Kietzmann and Diba (2017) who develop a framework for businesses to improve their workplace.

mechanism to screen out bids with a bogus pre-qualification letter that resembles "cheap talk" or an overstatement of their willingness to pay (e.g., Wan and Beil, 2009). A buyer without the proper qualification could fail to obtain financing during the transaction, nullifying the purchase contract and thereby forcing the seller back to the market in search for another buyer. Another competing consequence is that the seller must extend the close of escrow until the buyer finds a willing lender at the agreed purchase price. In either case, steering can be used to reduce the uncertainty of a bid in the best interest of the seller, possibly motivating the seller to relax his reservation price.

Moreover, steering can affect the cost of credit by requiring buyers to consider an origination offer from an affiliated lender, especially if the buyer already holds a pre-approved loan from a competing lender. The seller, for example, may offer the buyer an incentive like paying a required appraisal report (i.e., $500-$1,200) in exchange for using an affiliated lender. The buyer's current lender may even respond by reducing her fees to retain the loan origination—decreasing the buyer's effective cost of borrowing. Such outcomes are possible since home buyers commonly lack a shopping experience for loan origination services (Woodward and Hall, 2012).[7] Yet a concern is that home buyers often do not fully understand how mortgage financing works (Woodward and Hall, 2010) and risk encountering hidden costs if "write ins" are a preemptive to loan product steering.[8] Overall, steering can impact the price home buyers pay for mortgage credit and in turn influence the transaction price of the property.[9]

Finally, given the potential consequences that buyers face, sellers could encounter unintended consequences. The real estate agents representing home buyers, herein defined as buyer agents, can easily spot steering activity and respond by steering buyers away to other properties for sale.

Hence, I apply the model to investigate the impact of financial steering on non-pecuniary transaction costs including the time-on-the-market (TOM) and

[7] According to a report by the CFPB (2015), fewer than half of the borrowers who obtain a purchase mortgage consider no more than a single lender before applying for credit.

[8] For example, I find in the data a subset of real estate brokers who require buyers to obtain pre-qualification from the Castle & Cooke mortgage brokerage who the CFPB took action against for steering borrowers into high cost mortgages. For details, see www.consumerfinance.gov.

[9] Che and Gale (1998) show that financial constraints in auctions such as those in the residential housing market can reduce the equilibrium bid size and ultimately a□ect the price of the auctioned good.

time-in-contract (TIC) of each listing in the data. Specifically, TOM is the number of days from the first day that a property is put on the market for sale and the date that a successful bid is accepted. TIC is the number of days from the date of an accepted bid until the close of escrow, which marks the completion of the housing transaction. I also study the impact of financial steering on the seller's contribution towards the buyer's closing costs as a proxy for the buyer's marginal borrowing costs. High contributions from the seller reduce the upfront costs that borrowers encounter at closing. I find that financial steering reduces the TOM by about a week but increases the TIC by about a day. Furthermore, the results indicate that borrowers receive about 48 percent (or $758) less in seller concessions to support closing costs, suggesting that borrowers encounter higher upfront closing costs in transactions with steering. I further investigate the impact on the borrower's cost of credit by merging the dataset to loan data from CoreLogic. The database gives me access to information on the loan amount and interest rate along with other mortgage characteristics. I find that borrowers in transactions with remarks flagged for steering face a lower cost of credit (i.e., interest rate) than borrowers in transactions with neutral remarks by about 0.1 percent. But the interest rate savings amount to about $98, which fall below the reduction in closing cost assistance that the average seller provides when steering. Nonetheless, these findings warrant further scrutiny that current data-limitations prevents me from pursing. Analyzing the buyer-side responses, I determine that financial steering reduces the chances that a financed buyer purchase the property while it increase the chances for cash or corporate investors. Among financed transactions, steering creates a disparate impact among Hispanics and African American borrowers. Overall, steering presents a trade-off. One the one hand, the seller encounters efficiencies in the transaction by screening buyers. But on the other hand, steering pushes households that depending on FHA, VA, and conventional mortgages out of the market in favor of cash or corporate investors.

This paper contributes to the literature through three fronts. First, I quantify of the prevalence of steering borrowers to affiliated financial services providers in a consumer market. While prior literature focuses on loan product steering (e.g., Agarwal, Ambrose and Yao, 2016; Agarwal et al., 2016), and other potential avenues of predatory lending (e.g., Griffin and Maturana, 2016), my study enriches the understanding of early-stage aspects of the relatively opaque home-buying process on

market outcomes. Related studies have documented evidence of predatory lending practices or mortgage fraud in the form of knowingly lending to unqualified borrowers (Foote et al., 2008; Bond, Musto and Yilmaz, 2009), relaxing underwriting screening criteria (Keys et al., 2010; Agarwal and Ben-David, 2014), inflating appraisal valuations (Ben-David, 2011), overcharging or confusing borrowers on mortgage fees (Woodward and Hall, 2012; Ambrose and Conklin, 2014), misrepresenting borrower income (Ambrose, Conklin and Yoshida, 2016) or loan quality (Piskorski, Seru and Witkin, 2015; Griffin and Maturana, 2016) information, and engaging in loan product steering (Agarwal, Ambrose and Yao, 2016; Agarwal et al., 2016).[10]

Second, this paper relates and contributes to the prior studies that focus on steering activity by real estate agents. For example, Han and Hong (2016) and Gardiner et al. (2007) both find that buyer agents encounter strong incentives to steer buyers to in-house transactions. Levitt and Syverson (2008*a*) document that buyer agents steer buyers away from listings held by minimal service ("flat-fee") brokerages while Barwick, Pathak and Wong (2017) point out that real estate agents actively nudge buyers to purchase properties from sellers that offer a commission rate at or above 3 percent. Others have even found evidence that buyer agents steer ethnic minority groups to minority neighborhoods while retain white homeowners in affluent neighborhoods (Ondrich, Ross and Yinger, 2003).

Finally, this paper is the first study in the financial literature to provide a framework for identifying steering with artificial intelligence. The timeliness of this approach arrives with a growing interest in applying machine learning techniques to advance the understanding of financial markets. For example, Butaru et al. (2016) use machine learning techniques to predict defaults on credit cards while Renault (2017) uses a similar method to evaluate online investor sentiment about the stock market. The methodology for flagging steering activity is transferable to other applications in the financial literature.

The rest of the paper proceeds as follows. In Section 2.2, I describe the data source, how I identify steering activity, and the prevalence of steering the the Las Vegas Valley. In Section 2.3, I examine the impact of financial steering on the equilibrium price, time on market, time in contract, and seller's contribution. In

[10] Additional studies in the literature of predatory lending include Bostic et al. (2008), Pennington-Cross and Ho (2008), Ding et al. (2012), and Agarwal et al. (2014). Renuart (2004) provide a discussion on the definitions, incentives, and outcomes of predatory mortgage lending.

Section 2.4, I analyze how seller heterogeneity influences the results. Finally, in Section 2.5, I offer a discussion and conclude.

2.2 Data

I use data on single-family homes and condominiums sold in Las Vegas MSA, Nevada from March 2008 to March 2018. The data source is the MLS from the Greater Las Vegas Association of Realtors (GLVAR). The database includes transaction records on homes for sale by owners receiving services from real estate brokerages with membership to the GLVAR. When a listing agent puts a home on the MLS, the listing sheet automatically updates with information from the most recent local tax assessor records. The listing agent may then supplement the listing sheet with additional information relating to the property or transaction (e.g., property conditions, if it is renter occupied, pets on premises, seller concessions, other salient feature, etc...). Furthermore, I supplement the data with data on real estate licenses from the Nevada Real Estate Division, mortgages from CoreLogic's Deed Records, and borrowers from Home Mortgage Disclosure Act (HMDA) loan application records.

2.2.1 Identifying Steering Activity

As mentioned in the introduction, I use IBM's Watson Natural Language Classifier to identify steering activity. IBM's Watson Natural Language Classifier is an application that uses machine learning algorithms to classify tweet size passages into user-defined categories. The application is part of the IBM Cloud and one of many services that Watson provides. Broadly speaking, I train Watson to read and identify agent remarks for steering activity until it performs this task with a high accuracy rate; I then send the population of remarks to Watson using a unique application programming interface (API) key and Python coding. Watson in turn reads the remarks and sends them back reporting a "score" (i.e., the likelihood of steering activity) for each remark. I ultimately use this score to flag steering.[11]

To train Watson, I begin by defining financial steering as the event in which the

[11]For general instructions on using Watson visit the following website: https://www.ibm.com/watson/developercloud/natural-language-classifier.

real estate listing agent writes into the agent remarks a strict mandate requiring financed buyers to use a specific lender or mortgage broker for pre-qualification even if the buyer already holds a pre-qualification letter from another lender. If the financed buyer does not have to obtain pre-qualification from an affiliated lender, then I consider the remark to feature no steering activity. For precision, I establish three classes that partition the remarks into mutually exclusive groups: Class I, Class II, and Class III. Class I (CI) remarks clearly require pre-qualification with an affiliated lender. Class II (CII) remarks mention but do not explicitly require the buyer to pre-qualify with an affiliated lender. Class III (CIII) remarks make no mention of an affiliated lender.

Table 2.1 provides examples of the steering definition and classification strategy. Remarks 1 and 2, for instance, clearly signal steering by including the language "Buyer must be prequalified with Saul Goodman... no exceptions" and "Buyers to pre-qual with Saul...," respectively. I therefore consider remarks 1 and 2 to feature steering activity, and code them as CI remarks. Remark 5 provides an additional example of a CI remark by stating that "the seller requests for the buyer to be pre-qualified with preferred lender..." In contrast, remark 3 mentions that there is an available lender that the buyer may use to obtain a pre-qualification letter but does not require the buyer to use this lender. Meanwhile, remark 4 requires a pre-qualification letter but does not specify from whom. Thus, I consider these remarks to feature no steering activity, but label remark 3 as CII and remark 4 as CIII. CIII remarks generally include sentences that represent a null option for Watson such as sentence 6 which discusses other topics about the transaction expectations (e.g., "No repairs or closing costs offered," "For faster response, please submit all offers through our ebrokerhouse online..."). Not providing a null option will bias the machine learning algorithm towards falsely identifying steering activity.

The next phase in training Watson is an iterative process, which mimics human learning behavior—this is the flagship of the artificial intelligence technology. The algorithm can be described in three steps.

- First, I build a "training" sample by drawing from the MLS a random sample of unique agent remarks that I manually flag for steering activity as discussed above. I then upload the training sample to Watson's Natural Language Classifier program. Watson uses the training sample to find combinations of words or phrases that most likely reflect each class of remarks using a

proprietary machine learning algorithm owned by IBM.

- Second, I send Watson a random "out-of-sample" set of remarks to classify on the basis of the initial training sample using an API key as the catalyst. But before I feed Watson the "out-of-sample" set of remarks, I hand code them. This allows me to identify Watson's errors and update the training sample accordingly. Thus, for each "out-of-sample" remark hand coded as CI (or CII or CIII), if Watson's score for this class falls below 99 percent, I flag the remark as an error and add it to the initial training sample with the correct classification. This "learning" procedure helps Watson improve its machine learning algorithm for classifying agent remarks.[12]

- Finally, I repeat the previous step but using a third, random, "out-of-sample" set of remarks to further improve the accuracy rate of Watson's machine learning algorithm.[13]

The benefits of using Watson for classification is that it categorizes remarks much faster than humans and with more accuracy. Watson, for instance, classifies 1,500 requests (i.e., remarks) per minute, saving approximately hundreds of hours in manual labor. So, while 375,000 remarks could take 3,125 hours (30 seconds per remark) to classify by hand, Watson completed task within 4 and a half hours.

To test the accuracy of Watson's classification algorithm, I examine a fourth "out-of-sample" set of remarks that I also hand code. Specifically, I classify a random sample of 300 remarks from the MLS by hand as described above and examine how the classification of the remarks using Watson's probability scores compares to the hand coded version. I explore various confidence thresholds. At a confidence

[12]Since Watson encounters di□culties in classifying paragraphs, I execute this procedure by breaking up remarks into sentences, and feeding each sentence to Watson to score individually as CI, CII, or CIII. Within each remark, I allow the top score for CI sentences to drive the steering flag.

[13]Each random sample contains 600 observations of unique remarks of which 300 are pulled randomly from the population of agent remarks and the rest are also pulled randomly but from a subset of remarks that I flagged for containing words or phrases such as "pre-qualify" and "preferred lender." In total, I use three random samples of 600 remarks to train Watson, giving me a total sample of 1,800 remarks. Since I break up the remarks by sentence, the final training sample comprises of 3,847 unique sentences: 581 reflect steering activity (CI) while 3,466 reflect no steering activity (CII or CIII). Note that I clean the population of remarks and sentences by removing special characters but allow for spelling errors and abbreviations to capture the colloquialism of real estate agents.

threshold of 90 percent, for example, I code remarks with a Watson score (for CI) of at least 90 percent as "Steering" and remarks with a Watson score below 10 percent (for CII or CIII) as "Not Steering." I code remarks with a Watson score (for CI, CII, or CIII) between 10 and 90 percent as "Unknown." To further elucidate on this strategy, Table 2.1 provides examples of how I use Watson's scores to flag steering. As Table 2.1 reports, Watson scored remarks 1 and 2 with a steering likelihood of 99.5 and 99.6 percent, respectively. I therefore classified the remarks as "Steering." Meanwhile, Watson scores remarks 3 and 4 with a steering likelihood of 0.5 and 2.1 percent, respectively. Thus, I classified the remarks as "Not Steering." Finally, I classified the last two remarks (5 and 6) as "Unknown" since Watson classified them with a confidence below 90 percent.

Panel A of Table 2.2 reports the accuracy rate of using Watson's scores to classify remarks by confidence threshold for a testing sample from a hold-out-sample of remarks. The table also reports the accuracy rates conditional on remarks hand coded as "Steering" and the remarks hand coded as "Not Steering." Note that all the reported accuracy rates are conditional on observations without a classification of "Unknown." The last column reports the share of observations that have a Watson classification of "Unknown." Bootstrapped standard errors provided in parentheses are estimated using the variation in the accuracy rate from sampling the testing set of remarks 300 times with replacement. For context, Panel B of Table 2.2 tabulates the observations by their hand coded class and Watson's implied class using a 90 percent confidence threshold.

The results reveal that as I increase the confidence threshold from 50 percent to 97 percent, Watson's accuracy rate increases from 97.7 percent to 98.8 percent. But it drops slightly to 98.7 percent if I further increase the confidence threshold rate to 99 percent. A similar pattern is observable when conditioning the accuracy rates to observations hand coded as Steering or Not Steering. The bootstrapped standard errors range from 0.7 to 0.9 percent for the testing sample, 3.6 to 5.1 for the Steering sub-sample, and 0.5 to 0.8 for the Not Steering sub-sample. The trade-off I face is that as I increase the confidence threshold, the share of remarks with an unknown classification increases. For example, at the 99 percent threshold, almost a fifth of the remarks are given an unknown classification whereas none have an unknown classification at the 50 percent threshold. Since I observe that at the 90 percent confidence threshold, the accuracy is 98.6 percent while the share of

dropped observations is 4 percent, I adopt the 90 percent threshold to classify the population of remarks.[14]

2.2.2 Sample Selection, Summary Statistics, and Steering Activity

The rich size of the MLS database at about 429,000 observations of single-family or condominium homes for sale allows me to obtain a large sample of more than 276,000 observations of sold listings and more than 86,000 of unsold listings despite setting strict standards. The sample of residential transactions excludes observations with missing fields or when they feature an anomaly such as 1) a sale price above $769,000 or below $30,000 (if sold), 2) a living area above 5,000 square feet or below 700 square feet, 3) a lot larger than 50,000 square feet, 4) a property with more than six bedrooms or six bathrooms or four fireplaces, 5) a garage that fits more than four cars, 6) and a structure age of 65 years or more. I also remove flips from the sample since the reported quality of the listing can fail to capture recent structural or aesthetic changes to the property. A flip is a property that re-sold within a year of its prior sale date or has been put on the market more than once during the same quarter and sold successfully. Table 2.3 provides a list of variables found in this study along with definitions.

Table 2.4 displays the mean and standard deviations of the controls found in this study for the sold listings. The typical property in the sample is a three-bedroom, two-and-a-half bathroom, single-family residence with a two-car garage in a neighborhood with a home-owner association. Most homes are reported to be in good physical conditions while the rest are in excellent (14 percent), very good (8 percent), fair (12 percent), or poor (2 percent) property conditions. The average commission for finding a buyer is 2.89 percent. Moreover, about half of the properties in the sample are re-sales (51 percent) or new homes (2 percent) while the rest are distressed sales. In particular, 27 percent are foreclosure (or Real Estate Owned, "REO") sales, and 19 percent are short sales.[15]

[14] Using other thresholds or classification rules to identify steering activity does not materially a□ect the results or conclusions.

[15] A foreclosure sale involves the disposition of a repossessed or real estate owned (REO) property by a mortgage servicer, while a short sale describes a negative equity sale in which the home owner must acquire approval from the mortgage servicer to sell the property.

Using Watson, I identify that 41,948 of the listings have remarks featuring steering activity, 321,547 have neutral remarks, and 22,225 have remarks with an unknown steering classification. These numbers suggest that approximately 11.5 percent of the listings in the Las Vegas Valley feature steering activity. To understand the market-wide prevalence of financial steering activity over time among sales, Figure 2.1 graphs the share of sold listings with steering activity for each year from 2008 to 2018. Steering activity peaked in 2009 with 30 percent of the listings requiring the use of an affiliated lender for pre-qualification. Since then, steering activity has fallen but persists. As of the first quarter of 2018, about 2.9 percent of the listings steer buyers to affiliated lenders. But, overall, about 13.3 percent of the sales in the Valley were steering buyers over the past ten years.

Table 2.4 also breakouts the summary statistics of the full sample by the steering class: Steering, Not Steering or Unknown. Table 2.5 reports the mean differences between the listings with and without known steering status (i.e., steering or not steering vs. unknown) along with the corresponding t-statistics and p-values. Economically minor differences in the summary statistics exist between the observations that enter the sample as steering or not steering relative to those with an unknown steering class, which reduces concerns of sample selection as a results of the Watson based classification of remarks.[16] However, across listings with remarks labeled as Steering or Not Steering, larger observable differences exist. For example, about 64 percent of the listings with steering are REO sales, 21 percent are re-sales, 1 percent are new home sales, and 14 percent are short sales. Meanwhile, among listings with neutral remarks, about 22 are REO sales, 56 percent are re-sales, 3 percent are new home sale, and 2 percent are short sales. Table 2.5 reveals that these differences are large and statistically significant at the 1 percent level. Thus, a multivariate approach is necessary to evaluate the impact of steering on transaction outcomes.

2.3 Empirical Analysis

To establish a reference point, I turn to Table 2.6, which reports statistics from standard t-tests of mean differences by steering activity for the sale price (and

[16] Since Table 2.5 reveals that some differences in the characteristics are statistically significant, I examine this issue in Section 2.3.

other outcome variables to be discussed in Section 2.4). I observe that listings with remarks requiring buyers to use an affiliated lender sell at an average discount of $31,513 (or 16.7 percent) relative to listings with neutral remarks. Figure 2.2 provides a kernel density plot for the natural log of prices by steering activity. I observe that the distribution of prices for listings that require buyers to use an affiliated lender (labeled "Steering") sits to the left of the price distribution for listings with neutral remarks (labeled "Not Steering"). Together, these results suggest that steering correlates with a decrease in the sale price. These results, however, lack a controlled environment, which I address next.

2.3.1 Baseline Model

I approach the ideal controlled experiment setting by designing a model that compares the economic outcomes for home sales on the basis of steering activity. To build this model, I recognize that the future sale of homes is less likely to influence past characteristics of their listings because prices (or transaction costs) are determined "after" the homes are listed, mitigating endogeneity concerns. I also follow advice from Angrist and Pischke (2008) on avoiding the "bad control" problem by including on the right-hand-side only controls that obtain a value at the same time or before assignment of the treatment variable for steering. Thus, the baseline model for property i at time t takes the following form:

$$Y_{it} = \delta \text{Steering}_{it} + X_{it}\beta + \tau_t + \alpha_s + \varepsilon_{it} \tag{2.1}$$

where Y_{it} stands for a sales performance metric (i.e., log sale price, log time-on-the-market, log time-in-contract, or log seller's contribution), and ε_{it} is a robust standard error clustered by the property's location. Steering_{it} is the treatment indicator that takes the value of one when the listing agent requires the buyer to use services from an affiliated lender, and zero otherwise; and δ represents the average treatment effect of financial steering. The parameters τ_t and α_s stand for the year-quarter that the property was put for sale and the property's neighborhood subdivision location s, respectively.

Finally, the matrix X_i contains a constant and an exhaustive list of non-outcome baseline controls to account for structural attributes, neighborhood characteristics, and contractual features. Specifically, the structural characteristics include the

number of bedrooms, bathrooms, car spaces in the garage, and fireplaces. They also include the property's age, log square living area footage, the log lot square footage, and indicators for whether the property features a pool or a spa in the backyard. To control for the property's quality, I include a categorical variable that describes the property's physical conditions as viewed by the listing agent with the Good condition as the base.

The neighborhood characteristics include categorical variables for the high school, middle school, and elementary school that children in the property would attend at the listing date. I also add indicators for whether the property is in a age restricted community, gated community, or homeowners' association. Other time-invariant neighborhood attributes unobservable by the econometrician are captured by subdivision fixed effects. The contractual features include the commission rate that the listing agent offers to other agents for finding a buyer. Commissions reported as a flat fee dollar amount are converted to a percent of the sale price. I also specify whether the property is vacant, occupied by the homeowner, or occupied by a tenant. Additional contract controls are indicators for whether the purchase includes a dishwasher, dryer, or washer. I also include a categorical variable for whether the contract features a re-sale, new home, foreclosure, or short sale transaction, using re-sales as the base.

Hence, identification hinges on the choices of sellers on unobservable attributes being similar within subdivisions and unobserved neighborhood quality and characteristics, which are reasonably captured by the subdivision fixed effects.

2.3.2 Baseline Analysis of Sale Price

Table 2.7 provides the baseline results for the full sample while using the natural log of the property's sale price as the dependent variable and an ordinary least squares (OLS) functional form. Column (1) reports the coefficient estimates for the baseline model controlling only for year-quarter fixed effects. Column (2) adds controls for the structural, neighborhood, and contract characteristics. Column (3) adds zip code fixed effects while column (4) interacts the zip code fixed effects with the year-quarter fixed effects. Column (5) replaces the zip code fixed effects with subdivision fixed effects.

The results in column (1) suggest that requiring the buyers to use an affiliated

lender to obtain a pre-qualification letter as a bidding constraint reduces the sale price by about 4 percent. Columns (2) through (5) correct the discount to a value around 1 percent of the purchase price. In each column, the discount for steering is statistically significant at the 1 percent level. Given that the average sale price of a home with neutral remarks is $188,919, steering activity appears to cost the seller approximately $1,900. In contrast, if the agent earns 3 percent on the sale, steering activity appears to cost the listing agent approximately $57. Hence, the larger costs of steering activity are borne by the homeowner.

2.3.3 Propensity Score Matching

Since using OLS to estimate equation 2.1 imposes a linearity assumption that could influence the results, I relax this assumption and build off the Agarwal, Ambrose and Yao (2016) analysis of loan product steering in residential mortgage markets by employing a propensity score matching model to balance the treatment and control groups. Given the finding by Rosenbaum and Rubin (1985) that matching on propensity scores mimics random sampling, the process depends on the implicit identification assumption that the remarks of listings randomly feature steering activity once conditioning matches on observable attributes.

I obtain the propensity scores from fitting the following Probit regression on the likelihood that a listing features steering activity

$$Pr(\text{Steering}_{it} = 1 | X_{it}, \tau_t) = \quad (X_{it}\gamma + \tau_t + \epsilon_{it}) \tag{2.2}$$

where stands for the cumulative density function, and ϵ_{it} is the model's error term. I next find for every home sale that features agent remarks flagged for financial steering an observably similar sale within the same zip code that features agent remarks that have not been flagged for steering buyers to an affiliated lender. The matching procedure permits replacement and uses a caliper around the propensity scores of 0.02. Once balancing the treatment and control groups, I estimate the baseline model described by equation 2.1.

Column (6) uses the balanced treatment and control groups obtained from propensity score matching. Column (6) confirms the earlier results as a "doubly robust" estimate of the average treatment effect, ex-post propensity score matching. Since propensity score matching does not influence the results substantially, I retain

the specification of column (5) as the baseline regression model for the remainder of this paper.

2.3.4 Two-step Heckman Correction

The prior estimates rely on a sample of listings that sold successfully. However, the sample contains over 86,000 expired or withdrawn listings of single family homes and condominiums that did not sell successfully between 2008Q1 to 2018Q1. I take advantage of the variation in the listings' outcomes to account for the expected sale likelihood in the baseline analysis.

In particular, I estimate a two-step Heckman model that corrects for the likelihood of sale.[17] In the fist step, using a Probit regression as the selection model, I predict the likelihood of sale and retrieve the inverse mills ratio for each listing. The inverse mills ratio is the predicted probability that a home for sale is sold over the cumulative probability of the listing's outcome. In the second step, I calculate the causal model for log sale price. That is, equation 2.1 with the inverse mills ratio as an additional regressor. Both models have fixed effects for the listing date and zip code. The selection model, however, excludes the quality indicators because the property's condition is not reported in the GLVAR's MLS unless the property is sold. Since both the selection and causal model essentially use the same covariates other than the quality categorical variable, identification relies on the assumption of bivariate normality in the errors of both models.[18]

Table 2.8 reports the results for the selection model in column (1) and the baseline model with the Heckman correction in column (2). The results reveal that steering increases the sale likelihood by approximately 0.14 Probit units, representing a marginal effect at the mean of about 3.5 percentage points. Relative to the average sale rate rate of 75 percent, steering appears to increase the sale likelihood by about 4.7 percent. The inverse mills ratio in column (2) is calculated using the point estimates from column (1). The coefficient on the inverse mills ratio can be interpreted as the covariance in the sale likelihood and sale price over the variation in the probability of sale. The statistically significance on the

[17] For standard details on this approach, see Heckman (1979, 1990); Heckman and Urzua (2010).

[18] Since identification of the two-step Heckman model depends on the exclusion of the inverse mills ratio from the first step, I rely on the assumption of bivariate normality of the errors in the first and second stage equations. Xie (2018) apply a similar assumption in their hedonic price model to analyze the information advantage of di□erent types of sellers.

coefficient of the inverse mills ratio suggests that sale likelihood influences the sale price. However, as column (2) reveals, even after correcting for the sale likelihood, the discount for steering remains economically and statistically significant at the conventional levels. In fact, the discount for steering at 1.1 percent is identical to the point estimate for steering reported in column (3) of Table 2.7.

2.3.5 Alternative Steering Flags

To ensure that the results are not driven by the Watson-based classification standards I use for flagging financial steering, I explore other methods of constructing the Steering dummy in the baseline model. First, I consider the Score that Watson provides for steering activity. Since the score is a continuous likelihood between 0 and 1 that the listing's remarks features steering activity, using the score as the dependent variable allows me to avoid dropping observations with an unknown classification. Next, I consider classifying steering activity at the 50 percent, 95 percent and 99 percent confidence thresholds. At higher thresholds, Watson performs more accurately at identifying steering (or no steering) activity in the remarks, but at the cost of a decrease in usable observations. Table 2.9 reports the results in columns (1) to (4). Overall, these estimates virtually produce the same marginal effects as the baseline results.

Finally, I consider an analog method to flag steering activity. Working off a sample of remarks with steering activity provided by a real estate broker in Nevada, I identify the most common key words and phases using WordStata. The principal keywords I find are: "Lender," "Loan," "Mortgage," "Finance," "Incentive," "Pre-qualification," "Pre-approval," "Preferred," and "Letter." I also observe qualifying words such as "From," "With," "By," "Through," and "Must." I then flag all listings with agent remarks that use phrases such as "preferred lender," "to pre-qualify with," "must pre-qualify with," and so on. This analog approach flags 39,333 listings in the MLS for steering activity. However, using this analog measure as the steering flag instead produces results inconsistent with the measure. Table 2.9 reports the results in column (5). Although positive and significant, the marginal effect is small and close to zero.

The analog method produces results that are inconsistent with the baseline results because the analog method is prone to substantial measurement error. This

is because the analog method has difficulty in distinguishing remarks with subtle phrases that signal steering from the standard requirements for financed buyers. For example, while Watson recognizes that remark number 4 in Table 2.1 does not reflect steering, the analog method will flag it for steering since it contains the phrase "Prequal letter." Furthermore, for a similar reason, the analog method has difficulty in distinguishing when use of a preferred lender is required versus encouraged such as remark number 3 in Table 2.1. Relative to the baseline steering measure, the analog method flagged 10,221 false positives (steering activity) and 15,719 false negatives (no steering activity), representing a measurement error of about 9.5 percent. Such measurement error produces biased estimates and incorrect inferences.

2.3.6 Broker Heterogeneity

Although intermediaries such as brokers generally have a rough time beating an efficient market irrespective of their experiences, skills and abilities (Jensen, 1968; Fama, 1998; Berk and Green, 2004), prior literature in the real estate space finds that agent-specific qualities can influence housing transactions. Skilled agents, for instance, have been found to increase the probability of sale (Munneke and Yavas, 2001) or reduce transaction costs including the time on the market (e.g., Allen et al., 2003; Johnson, Zumpano and Anderson, 2008). From an agency cost perspective, agents have been considered less patient than homeowners and sell at a discount relative to homes for sale by owners (Rutherford, Springer and Yavas, 2005, 2007; Levitt and Syverson, 2008*b*; Bernheim and Meer, 2013). Hence, failing to control for the heterogeneity of brokers could consequently bias the estimated average treatment effect of financial steering. To reduce these concerns, I obtain historical license records for 16,302 out of 25,000 agents in the sample from the Nevada Real Estate Division. The license records allow me to construct variables to proxy for an agent's ability, skills, knowledge, and motivation to sell a property successfully.

I start by identifying for each listing agent whether the individual holds a broker, broker-salesperson, or salesperson license to practice real estate in Nevada during the listing's year. All three license types provide individuals with the right to represent buyers or sellers during real estate transactions in Nevada. However,

there are key differences among the licenses. Broker-salespersons and salespersons must work for a broker to practice real estate. Broker-salespersons, however, have the right to be a branch manager for a brokerage firm, and they encounter fewer requirements to acquire a broker license in the future. Finally, the broker license gives the holder the right to open a brokerage and contract other agents with a real estate license as subordinates. Since the data on license records include information on the date that the agent/broker first enters the real estate market as real estate agent or even as an appraiser, I am able to calculate the exact number of months that an agent participated in the Nevada real estate market at the time of listing a property for sale. The unique feature about this variable is that the measure of experience derives from official records rather than survey responses and captures relevant experience that predate the MLS data.

The license records also include information on whether the real estate agent resides out-of-state. Furthermore, I use the agent's first name to deduce the agent's gender using a file of frequently occurring first names from the 1990 Census.[19] Additionally, using the MLS data, I aggregate for each agent his or her commission income during the prior month to capture the agent's motivation or ability to transact. Likewise, I count the number of residential transactions the agent facilitated as a listing or buyer agent during the prior year. Finally, I include the number of photos that a real estate agent uploads to the MLS for the listed property as a proxy for effort.

Table 2.10 reports two sets of results: the marginal impact of broker attributes on the likelihood of steering in column (1), and the marginal impact of broker attributes on the log sale price in columns (2) through (5). The results in column (1) suggest highly experienced agents and out-of-state agents are less likely to engage in financial steering activity. Likewise agents with a broker or broker-salesperson license are less likely to engage in financial steering activity relative to agents with the salesperson license. Male real estate agents are more likely to engage in financial steering relative to Females. Agents' income, transactions, and effort also appear to influence the likelihood of steering activity but not at economically significant levels.

Controlling for broker attributes, the results in column (2) reveal a negative coefficient of 1.1 percent on financial steering that is statistically significant at the 1

[19] For details see, https://www.census.gov/topics/population/genealogy/data/.

percent level. The other covariates including experience, out-of-state status, license type, gender, income, transactions, and photos also affect the sale price. Column (3) adds fixed effects for the listing agent's brokerage office while column (4) uses fixed effects at the individual broker/agent level. The fixed effects account for unobservable agent- or broker- specific attributes that observable attributes in the model fail to capture. Yet, the results in columns (2) to (4) are qualitatively similar to the baseline results, which are displayed in column (5) for ease of comparison. Therefore, the results are not driven by the brokers' heterogeneity.

2.3.7 Seller Heterogeneity

In Table 2.11, I examine whether seller heterogeneity drives the results since steering could correlate with omitted seller characteristics that in turn influence the transaction price. Stroebel (2016) points out the builders often have a lending arm and an informational advantage about the property in providing financing to the buyer relative to other lenders. Builders are therefore intuitively more likely to engage in steering buyers through the "write in" method. Other sellers with a lending arm such as mortgage servicers disposing of repossessed properties likewise have an incentive to steer buyers to obtain origination fees. Xie (2018) finds that different types of sellers produce various discounts or premiums in the home buying process.

To reduce seller heterogeneity concerns, using the CoreLogic data I flag whether the seller is a bank, builder, non-bank firm, government (sponsored) institution, household, or trust.[20] Out of the 276,723 home sales in the sample, about 22 percent of the sellers are banks, 6 percent are builders, 7 percent are non-bank firms, 12 percent are government institutions, 43 percent are households, and 9

[20] Specifically, I label the seller to be a government institution when the reported name for the seller is the U.S. Department of Housing and Urban Development, U.S. Department of Veterans A□airs, Federal Deposit Insurance Corporation, Federal Housing Finance Association, Fannie Mae, or Freddie Mac. I label the seller to be a builder when the property is new, the seller is not a government institution, and the property is not in repossessed. I label the seller to be a firm if the property is not repossessed and the seller's name includes "LLC", "INC", "INVESTOR", "GROUP", "CORP", "PARTNER", "LP", or "FUND". I label the seller to be a bank if the property is repossessed but the seller is not a government institution. I then label the seller to be a trust fund when the name includes "TRUST" (e.g., the Goodman Family Trust) and the property is not repossessed. Finally, I label the seller to be a household if the property is not repossessed and CoreLogic reports a first and last name. I flag observations that I cannot fit into any of the above categories as "Unknown".

percent are trust funds. I also flag transactions in which the seller holds a real estate license or is a relative of the listing agent. I then fit a linear probability model of steering on the seller characteristics. Column (1) of Table 2.11 reports the results. The results suggest that banks, builders, and firms are more likely to engage in steering relative to households. Meanwhile, government institutions and trust funds are less likely to engage in steering activity. Moreover, sellers with a real estate license and relatives of the listing agents are less likely to engage in steering activity.

Next, I examine how adding seller characteristics to the baseline regression influences the marginal effect of steering in the baseline regression model of log sale price. Column (2) of Table 2.11 reports the results. I observe that firms sell properties at a premium. I also observe that builders and government institutions sell at a premium. Banks sell at a discount relative to households. Sellers with a real estate license, and sellers related to the listing agent, sell their homes at a premium of 1.5 percent.[21] However, despite the addition of these controls to the baseline regression model, the marginal effect of steering on price continues to be negative and statistically significant at the 1 percent level. The results are therefore robust to seller heterogeneity.[22]

2.4 Why does Steering A□ect Price?

In the prior section, I demonstrate a causal relation between sale price and steering activity. The results persist using a rich set of controls for property, neighborhood, and contract attributes along with fixed effects for the listing date and property's subdivision. They even remain when using a two-step Heckman correction or propensity score matches that balance the sample. In this section, I examine channels through which steering could be influencing the price. I begin by presenting

[21] Levitt and Syverson (2008*b*) attribute the premium on homes sold by licensed real estate agents to an informational advantage over households in the home buying or selling process.

[22] In unreported regressions, I also control for whether the seller is motivated to sell the property by finding key phrases such "Motivated Seller" or "Seller Must Move Soon" in the agent or public remarks. The Motivation variable appears in the following studies: Glower, Haurin and Hendershott (1998), Springer (1996), and Soyeh, Wiley and Johnson (2014). I also control for whether the homeowner has pets, which I identify by flagging listings with agent or public remarks that mention the presence of dogs, cats, birds, or other pets at the property as in the study by Stroebel (2016). But I find similar results.

a conceptual framework that theorizes why steering can reduce the sale price. I then analyze empirically three channels: 1) the seller's transaction costs, 2) the buyer's cost of borrowing, and 3) the winning bidder.

2.4.1 Conceptual Framework

To rationalize how steering could cause the price to fall, I follow Krishna (2009) and consider a plain vanilla first-price, sealed-bid auction to derive the equilibrium price of residential properties and hypothesize about the impact of steering on market outcomes.[23] Suppose that each potential home buyer visits a property available for sale, obtains a price signal x, and privately bids b by emailing the listing agent a purchase agreement. The most important rule of the auction is that the bidder who submits the highest bid Y wins relative to the other $N - 1$ bidders. Let Y have a cumulative distribution function of G and a probability density function of g. If all bidders are rational and risk neutral, then the marginal bidder's objective function is

$$\max_b \pi(b, x) = G(\beta^{-1}(b))(x - b) \tag{2.3}$$

where $\beta^{-1}(b) = Y$ denotes the inverse bid function. Equation 2.3 is the bidder's expected profit where $(x - b)$ denotes the profit at stake, and $G(\beta^{-1}(b))$ stands for the likelihood of winning the auction, which increases monotonically with the bid b.

Maximizing equation 2.3 by choosing b yields the first-order condition

$$\frac{g(\beta^{-1}(b))}{\beta'(\beta^{-1}(b))}(x - b) - G(\beta^{-1}(b)) = 0, \tag{2.4}$$

which at the symmetric equilibrium of $b = \beta(x)$ implies

$$\beta(x) = \frac{1}{G(x)} \int_0^x yg(y)dy$$

when assuming that $\beta(x)$ is continuous and twice differentiable. Krishna (2009) shows that if all bidders follow this bidding strategy above, then the symmetric equilibrium strategy is given by

$$\beta(x) = E[Y|Y < x]. \tag{2.5}$$

[23] Ambrose and Conklin (2014) follow a similar strategy in modeling mortgage brokerage fees.

Now let r denote the seller's reservation price such that the seller will only sell to bidders who submit a bid at or above r. The symmetric equilibrium strategy can be adjusted as follows:

$$\begin{aligned}\beta(x) &= E[\max\{Y, r\} | Y < x] \\ &= r\frac{G(r)}{G(x)} + \frac{1}{G(x)}\int_r^x yg(y)dy\end{aligned}$$

where the additional term $r\frac{G(r)}{G(x)}$ represents the bidder's expected minimum payment discounted by his likelihood of winning the auction given that the bidder holds a value above the reservation price ($x > r$). Thus, the equilibrium price P^e or the seller's expected payment from a bidder with a value $x > r$ is

$$\begin{aligned}P^e \quad m(x, r) &= G(x)\beta(x) \\ &= rG(r) + \int_r^x yg(y)dy \qquad (2.6)\end{aligned}$$

where the first term represents the seller's expected minimum payment, and the second term represents the economic rent that the seller can extract from the highest bidder. Note that equation 2.6 implies that the seller will not consider bids from buyers who bid below the reservation price: $b < r$. Using equation 2.6, and a few assumptions about steering as delineated below, I can derive a set of expectations.

Case 1: Suppose that steering buyers to use an affiliated lender lowers the transaction costs of the purchasing process in terms of completing the transaction in fewer days than otherwise (from listing to sale date). If the seller's reservation price is a positive function $r = h(t)$ of the transaction costs t, then equation 2.6 implies that steering invokes a decrease in price as $\frac{\partial P^e}{\partial r} > 0$. Intuitively, a homeowner who can reduce the cost of selling her home by steering, will accept a lower price.

Case 2: Suppose that steering affects the borrowing costs that a potential buyer faces. According to Che and Gale (1998), a buyer facing a financial constraint can at most bid $x = \min\{x^0, w\}$ where x^0 stands for the buyer's willingness to pay, and w stands for the total financing supported by a loan from an arm's length lender net of borrowing costs that the buyer can afford to pay. Given that $x^0 > w$, a common situation in traditional resale markets, as the cost of borrowing increases,

the bid that the borrower can afford decreases since $\frac{\partial P^e}{\partial x} > 0$. Thus, the equilibrium price should decrease if steering increases the cost of borrowing.

Case 3: Suppose that the steering results in the highest bidder not bidding. For example, if the highest bidder foresees (perhaps with help from the buyer agent) potential consequences of bidding on a property with steering activity, the bidder may respond by choosing to bid on a different property. As a result, the winning bid on the property with steering activity will be determined by the value of the second highest bidder, and therefore the equilibrium bidding strategy will be that of the second-price auction. The revenue equivalence principle states that the equilibrium bid and thus price is not contingent on the structure of the auction (Krishna, 2009). However, Che and Gale (1998) show that in auctions with financially constrained bidders (as in the residential market), second-price auctions produce lower equilibrium prices (or expected seller's revenue) than first-price auctions. Thus, in this case, steering results in a decrease of the equilibrium price by driving away the highest bidder.

2.4.2 Seller's Transaction Costs and Reservation Price

To proxy for the seller's reservation price, I consider three measures of transaction costs that the seller encounters when transacting: the time-on-market (TOM), the time-in-contract (TIC), and the contribution towards the buyer's closing costs. The TOM is the number of days from the date that the sellers lists the property for sale until the date that the seller finds a willing and able buyer. The TIC is the number of days from the date that the seller accepts a buyer's bid until the date that contract is complete and the property exchanges ownership from the seller to the buyer. The seller's contributions towards the buyer's closing costs are the funds that the seller pays at the close of escrow to pay for transactions costs that are commonly held by the buyer such as the property transfer tax, mortgage insurance premium, and loan origination fees. Generally, sellers offer contributions (or closing cost assistance) to motivate a buyer to purchase the property.

I begin by establishing a reference point. Panel A of Table 2.12 reports that the non-pecuniary transaction cost proxy variables (TOM and TIC) are lower when requiring the buyer to use an affiliated lender. I observe that listings with remarks that feature steering activity stay on the market by 7 to 8 days (or about

a week) fewer than listings with neutral remarks. Furthermore, steering seems to associate with faster closing times. The TIC for listings that require the use of an affiliated lender is on average 51 days and 53 days for listings with neutral remarks. However, although steering seems to reduce the non-pecuniary transactions costs that the seller encounters, the seller on average contributes more funds towards to buyer's closing costs in listings with remarks labeled as "Steering" than listings with remarks labeled as "Not Steering." The kernel distributions for the natural log form of each transaction cost proxy provide supportive results. See Figures 2.3, 2.4, and 2.5.

I next analyze the transaction cost proxy variables in a controlled environment, and use the baseline model (equation 2.1). Table 2.12 reports the results. Column (1) suggests that requiring the buyer to use an affiliated lender reduces the TOM by up to 11.5 percent (or a week), confirming the summary statistics. However, column (2) suggests that listings with remarks flagged for steering have 1.4 percent (or a day) longer TICs than listings with neutral remarks. In other words, financial steering seems to reduce the time in finding a buyer that is not only willing to purchase the property but also qualifies to purchase the property. Steering slightly lengthens the time it takes the seller to close escrow: perhaps to process the paperwork of qualifying the buyer with the affiliated lender. Focusing on seller's contribution costs in the natural log form, column (3) reveals that sellers who engage in steering contribute less towards the buyer's closing costs.

Next, I net the sale price of the seller's contribution and fit the baseline model using this measure as the dependent variable. To account for the impact of steering on the non-pecuniary transaction costs, the regression includes two additional covariates:the natural log of TOM, and the natural log of TIC. Yet column (4) reveals that the OLS of the net sale price also has a negative coefficient for steering activity that is similar to the previous estimates and statistically significant at the 1 percent level. Hence, while financial steering seems to reduce the transaction costs that the seller encounters, the seller ultimately encounters a penalty.

2.4.3 Buyer's Cost of Borrowing

To examine how steering impacts the cost buyers encounter to finance a residential purchase, I focus on mortgage outcomes that I obtain from CoreLogic. That is, I

look at the mortgage characteristics of financed buyers at properties with steering activity relative to those financed buyers at properties without steering activity from the perspective of the lender. Panel B of Table 2.4 reports the summary statistics for standard underwriting criteria and loan characteristics. The typical mortgage is a 30-year loan with a fixed-rate interest rate and an amortization schedule of 30 years. The typical mortgage type is either conventional or FHA. Usually, FHA mortgages require a down-payment of 3.5 percent while a conventional mortgage requires a down-payment of at least 10 to 20 percent. Thus, the average loan-to-value is 90 to 91 percent.

Since some buyers (fewer than 10 percent) use a second or piggyback loan to purchase the property, I focus on the weighted-average coupon rate on the mortgage contract(s). I observe that the average coupon rate is higher when the listing features steering activity than otherwise. Specifically, the mean difference is 55.2 basis points, which is significant at the 1 percent level. Figure 2.6 reports the distribution of the contract rate in log form. As Figure 2.6 shows, the distribution of the contract rate for steering is shifted to the right of that for listings with no steering. These summary statistics on mortgage characteristics suggest that steering adversely affects the cost of borrowing. These results, however, do not account for observable differences.

I estimate the log interest rate R_i for mortgage i

$$R_i = \delta \text{Steering}_{it} + M_{it}\theta + X_{it}\beta + \tau_t + \alpha_s + \gamma_l + \eta_{it} \tag{2.7}$$

where M_{it} stands for standard mortgage characteristics, γ_l stands for lender fixed effects, and η_{it} stands for the standard error clustered by lender.[24][25] The independent variable of interest is the indicator for steering activity, which equals one when the lender issues a loan where the listing has steering activity, and zero otherwise. The controls include the log loan amount, combined loan-to-value, and indicators for the term type of the loans, interest rate type of the loans, and the loan types (i.e., FHA, VA, and others). To account for contemporaneous changes in the opportunity cost of credit, I increase the frequency of the time fixed effects τ_t to be monthly

[24] The dependent variable R_i is measured as the log of the initial contract rate on the mortgage or the weighted average interest rate if there are multiple loans for a single property.

[25] Stroebel (2016) uses a similar approach to analyze the asymmetric information advantages of builders with a lending arm.

and commensurate with the origination date of the mortgage. Hence, model 2.7 compares the cost of credit of two similar mortgages originated by the same bank but one with steering activity and the other without steering activity.

Focusing on mortgages in the sample, Table 2.13 reports the baseline model using the natural log of the weighted-average coupon rate as the left-hand-side variable. Columns (1) through (5) incrementally add controls from none to the full set specified in model 2.7. The results suggest that steering activity reduces the cost of credit by about 0.1 percent (or about $97.31 in net present value savings for the average loan in the sample). While the results suggest that the competition among lenders through financial steering translates into lower financing costs for borrowers, steering could also affect upfront borrowing costs such as the application fee, loan origination points, and so on. Unfortunately, these upfront costs are unobservable in the dataset. However, a close measure to the upfront costs available in this paper is the seller's contributions reported in Table 2.12, which suggests that the average buyer receives less support from the seller to cover the closing costs when purchasing the property of a listing with steering activity.

2.4.4 Winning Bidders

To evaluate whether steering activity deters bidders from a listing, I focus on the likelihood that a financed buyer purchases the property. Intuitively, requiring buyers with financing to seek a pre-approval from a preferred lender increases the buyers' search cost by adding paperwork to bidding process. Cash buyers, however, do not need to seek a pre-approval from a preferred lender since cash buyers will not use a mortgage to finance the property acquisition. Thus, if steering motivates financed buyers to seek a different listing, then the likelihood that a financed buyer purchases a listing with steering activity should decrease. Using similar reasoning, I consider that corporate buyers have an advantage over individuals or households when bidding for listings with steering activity.

Using the baseline regression model displayed in equation 2.1, Table 2.14 reports the impact of steering activity on the winning bidder. I observe that steering correlates negatively with the likelihood of the listing being purchased by a financed buyer. Specifically, column (1) reports that the likelihood of a financed buyer decreases by approximately 4.3 percentage points (or 9.3 percent relatively). This

result suggests that imposing additional constrains on a group of buyers, motivates this group to seek a purchase elsewhere. Column (2) replaces the dependent variable with an indicator variable for the likelihood that the winning bidder is a corporation. This variable derives from CoreLogic's Deeds database. The results suggest that steering activity increases the likelihood that the winning bidder is a cooperation by about 1 percent. A consequence of steering, therefore, appears to have disparate impacts across buyer groups that depend on financing to purchase a home.

I further examine whether steering activity creates disparate impacts across borrower demographic groups (i.e., race and gender). To do so, I merge the MLS data to HMDA data on originated loan applications. While the merge does not capture the full sample of loans, I successfully match approximately 31.5 percent of the MLS transactions purchased by financed buyers. The purpose is to collect data on the borrowers' self-reported gender, race, and ethnicity on their loan applicants. Hence, I construct two variables: Minority and Female. Minority is an indicator variable that takes a value of one when the borrower's self-reported race/ethnicity is African American or Hispanic, and zero when the borrower identifies as a non-Hispanic white only. Female is an indicator variable that takes a value of one when the borrower identifies as Female, and zero when the borrower identifies as Male. For simplicity, I ignore the gender, race, and ethnicity of the co-borrower.

I use the Minority and Female binary variables as dependent variables and examine how steering affects them. Columns (3) and (4) of Table 2.14 report the results. I find that steering reduces the chances that a financed minority borrower purchases the property by approximately 1.7 percentage points (or about 5.2 percent relative to the base rate).[26] But I find no evidence that steering led to disparate impacts across gender. The results therefore suggest that financial steering creates a disparate impact across race and ethnicity but not gender.

2.4.5 Summary

Steering appears to reduce transactions costs that the seller faces in terms of finding an able and willing buyer quickly. This section, for instance, identifies that steering

[26] I identify the race and ethnicity for 58,597 observations as either African American (5.87 percent), Hispanic (26.73 percent), or white (67.4 percent). The racial distribution matches the demographics in the Las Vegas Valley. Among the observations without steering, minority borrowers make up 32.4 percent.

reduces the time-on-market of homes for sale. This form of financial steering, however, does not reduce the time it takes to close a deal. It also does not reduce the closing costs that buyers encounter. In fact, it increases them by reducing the seller's contribution towards the buyer's closing costs. Furthermore, steering drives away financed buyers (especially Hispanics and African Americans) while it favors Cash and Corporate investors. Therefore, the decrease in the sale price from steering activity can be attributed to a combination of a reduction in demand and the seller's reservation price.

2.5 Conclusion

This paper offers a method to circumvent the difficulty in identify financial steering during the home-buying process with the use of artificial intelligence. I begin by recognizing the CFPB's observation that lenders tend to steer buyers using the "write in" method. A lender using this method motivates real estate brokers to require or encourage potential buyers to obtain a pre-qualification letter from the affiliated lender as a bidding constraint in order to purchase the property. I then use a machine learning algorithm provided by IBM's Watson to flag listings with such bidding constrains in the Las Vegas housing market during the decade following the start of the subprime mortgage crisis in 2007.

Using over 276,000 sales transactions, I find that the share of homes sold with steering activity peaked in 2012 at a level around 30 percent, and financial steering activity continues to have a presence in the housing market. The variation in the agent remarks allows me to examine the impact of steering buyers to financial services on real estate market outcomes including the sale price, sale likelihood, time-on-market, and time-in-contract of each transaction in the data. As a result, I find that steering associates with a 1 percent reduction in the sale price of a home but also significant reductions in its time on the market. I also find that steering does not affect the borrowing cost in terms of the interest rate, but drives financed buyers away in favor of cash and corporate buyers. The results therefore imply that requiring potential buyers to seek pre-qualification from an affiliated lender can reduce the non-pecuniary costs of finding an able and willing buyer by about a week. However, sellers encounter a steep trade-off by incurring a reduction in the price they ultimately receive for their home. This trade-off is important to

recognize, particularly in aligning the interests of the broker and homeowner. Given the standard commission rate of 3 percent, the listing agent faces an opportunity cost of about $57 for adding a bidding constraint whereas the seller incurs an average loss of $1,900, invoking a potential agency cost.

Overall, this study is the first to explore the link between steering buyers to affiliated financial services in housing transactions and market outcomes. Results from this study have implications for housing market participants and policy makers alike. Moreover, this study opens the door for future research in identifying steering activity in other financial markets and the subsequent economic consequences.

Table 2.1. Classification Examples using Watson

#	Agent Remark	Hand Code	Probability Scores (%)		Implied Class at 90%
			Steering	Not Steering	
1	Buyer must be prequalified with Saul Goodman from Goodman & Associates (505-503-4455) prior to submitting any o□ers, no exceptions.	CI	99.5	0.5	Steering
2	Buyers to pre-qual with Saul Goodman at Goodman & Associates 505-503-4455. Alarm Code 1965 OFF and when leaving 1965 AWAY. Show & Sell!!	CI	99.6	0.04	Steering
3	Please consider Saul Goodman at Goodman & Associates for special financing incentive 505-503-4455.	CII	0.5	99.5	Not Steering
4	Agents must verify school zoning and all room measurements. Prequal letter and Proof of Funds to close required with all o□ers. O□ers subject to inspection.	CIII	2.1	97.9	Not Steering
5	The seller requests for the buyer to be pre-qualified with preferred lender, Saul Goodman at Goodman & Associates. 505-503-4455 (o□ce).	CI	73	27	Unknown
6	Sold AS-IS. No repairs or closing costs o□ered. For faster response, please submit all o□ers through our ebrokerhouse online o□er submissions system. Must include purchase agreement, emd, pre-qual and/or proof of funds to be considered complete.	CIII	23.8	76.2	Unknown

This table provides example remarks and reports Watson's score (i.e., likelihood) for steering activity. "Steering" means that the buyer must use an a□liated lender for pre-qualification. "Not Steering" means that the buyer may use any lender for pre-qualification. "Unknown" means that Watson's score falls below the confidence threshold of 90% for each class. The last column reports the remark's steering class assigned at the 90 percent confidence threshold. Note that the agent remarks have minor edits, and actual names have been replaced to respect anonymity.

Table 2.2. Watson's Accuracy at Identifying Steering

Panel A	Accuracy Rates (%)			Share
Confidence	Full	Steering	Not Steering	Unknown
At 50%	97.7	91.2	98.5	0.0
	(0.9)	(5.1)	(0.8)	(0.0)
At 60%	98.0	93.9	98.5	0.3
	(0.8)	(4.2)	(0.7)	(0.3)
At 70%	98.3	93.9	98.9	0.7
	(0.8)	(4.1)	(0.7)	(0.5)
At 80%	98.6	93.5	99.2	3.3
	(0.7)	(4.5)	(0.5)	(1.1)
At 90%	98.6	93.5	99.2	4.0
	(0.7)	(4.7)	(0.5)	(1.1)
At 95%	98.5	93.5	99.2	8.7
	(0.7)	(4.4)	(0.6)	(1.6)
At 97%	98.8	96.6	99.1	14.7
	(0.7)	(3.6)	(0.6)	(2.0)
At 99%	98.7	94.4	99.1	21.3
	(0.7)	(5.6)	(0.7)	(2.4)

Panel B	Watson Class at the 90% Threshold			
Hand Coded	Total	Steering	Not Steering	Unknown
Steering	34	29	2	3
Not Steering	266	2	255	9
Total	300	31	257	12

Panel A reports Watson's accuracy rates at identifying steering activity in agent remarks. Each row uses the confidence threshold noted in the first column. The accuracy rates are based on a random sample of 300 hand coded agent remarks from the available MLS data. The "Full" column provides the accuracy rates conditional on having a non-unknown classification. The "Steering" column provides the accuracy rate conditional on observations hand coded as reflecting financial steering activity. The "Not Steering" column provides the accuracy rate conditional on observations hand coded as not reflecting financial steering activity. The "Share Unknown" column reports the proportion of observation with a Watson probability score that falls below the confidence threshold for each class. Bootstrapped standard errors are reported in parentheses. Panel B tabulates the observations by their hand coded classification (row) and Watson-based classification (column) using a 90 percent confidence threshold.

Table 2.3. Variables and Definitions

Variable	Definition
Dependent Variables	
ln(Price)	Natural log of the sale price.
ln(TOM)	Natural log of days between the listing and contract date.
ln(TIC)	Natural log of days between the contract and sale date.
ln(Contribution)	Amount that the seller provides to the buyer for closing costs.
Structure Controls	
Condominium	1 if the property is a condo; 0 if it is a single family residence.
Living Area Square Footage	Property's living area square footage.
Lot Square Footage	Property's lot square footage.
Bedrooms	Total number of bedrooms in the property for sale.
Bathroom	Total number of bathrooms in the property for sale.
Fireplaces	Total number of fireplaces in the property for sale.
Private Pool	1 if the property has a private pool; 0 otherwise.
Private Spa	1 if the property has a private spa; 0 otherwise.
Garage Spaces	Number of car spaces in the garage.
Age	Difference between the year sold and year built.
New Quality	1 if the property is in like new physical conditions; 0 otherwise.
Excellent Quality	1 if the property is in excellent physical conditions; 0 otherwise.
Very Good Quality	1 if the property is in very good physical conditions; 0 otherwise.
Good Quality (b)	1 if the property is in good physical conditions; 0 otherwise.
Fair Quality	1 if the property is in fair physical conditions; 0 otherwise.
Poor Quality	1 if the property is in poor property conditions; 0 otherwise.
Contract Controls	
Commission	Commission rate for buyer's agent as a percent of the price.
Owner Occupied	1 if the property is owner-occupied; 0 otherwise.
Tenant Occupied	1 if the property is tenant-occupied; 0 otherwise.
Vacant (b)	1 if the property is vacant; 0 otherwise.
Includes Dishwasher	1 if the purchase contract includes a dishwasher; 0 otherwise.
Includes Dryer	1 if the purchase contract includes a dryer; 0 otherwise.
Includes Washer	1 if the purchase contract includes a washer; 0 otherwise.
Re-Sale (b)	1 if the purchase contract is for a re-sold property; 0 otherwise.
New Home	1 if the purchase contract is for a new property; 0 otherwise.
Short Sale	1 if the purchase contract is for a short sale property; 0 otherwise.
Real Estate Owned	1 if the purchase contract is for an REO property; 0 otherwise.
Neighborhood Controls	
Age Restriction	1 if age restricted neighborhood; 0 otherwise.
Gated	1 if the property is in a gated community; 0 otherwise.
Homeowners Association	1 if part of a homeowners' association; 0 otherwise.
Elementary School	Categorical variable for the assigned elementary school.
Middle School	Categorical variable for the assigned middle school.
High School	Categorical variable for the assigned high school.

Note that "(b)" indicates that the variable is the reference group for the categorical variable.

Table 2.4. Summary Statistics

Variable	Full	Steering	Not Steering	Unknown
Structure				
Condominium	0.11	0.10	0.11	0.11
	(0.31)	(0.30)	(0.31)	(0.31)
Living Area Square Footage	1,920.74	1,899.63	1,924.03	1,913.11
	(773.20)	(754.37)	(776.50)	(759.75)
Lot Square Footage	6,012.56	5,747.29	6,058.86	5,843.34
	(4,760.30)	(4,310.99)	(4,829.15)	(4,539.94)
Bedrooms	3.27	3.31	3.27	3.29
	(0.88)	(0.86)	(0.89)	(0.87)
Bathroom	2.63	2.65	2.63	2.64
	(0.75)	(0.72)	(0.76)	(0.74)
Fireplaces	0.6	0.56	0.61	0.59
	(0.64)	(0.62)	(0.64)	(0.64)
Private Pool	0.19	0.17	0.19	0.18
	(0.39)	(0.38)	(0.40)	(0.39)
Private Spa	0.13	0.11	0.13	0.12
	(0.33)	(0.31)	(0.34)	(0.32)
Garage Spaces	1.85	1.86	1.85	1.85
	(0.93)	(0.90)	(0.94)	(0.92)
Age	16.94	14.64	17.3	16.1
	(13.19)	(12.40)	(13.25)	(13.19)
New Quality	0.01	0.01	0.01	0.01
	(0.11)	(0.10)	(0.11)	(0.10)
Excellent Quality	0.14	0.06	0.15	0.13
	(0.35)	(0.24)	(0.36)	(0.33)
Very Good Quality	0.08	0.04	0.09	0.07
	(0.28)	(0.18)	(0.29)	(0.26)
Good Quality	0.41	0.56	0.39	0.45
	(0.49)	(0.50)	(0.49)	(0.50)
Fair Quality	0.12	0.2	0.11	0.14
	(0.33)	(0.40)	(0.31)	(0.35)
Poor Quality	0.02	0.02	0.02	0.02
	(0.15)	(0.15)	(0.15)	(0.15)

This table reports mean and standard deviation of variables in this study for the full sample and by whether the listing agent is steering or not steering. “Steering” means that the listing agent requires the buyer to use an a□liated lender. “Not Steering” means that the listing agent does not require the buyer to use an a□liated lender.

Table 2.4. Summary Statistics (Continued)

Variable	Full	Steering	Not Steering	Unknown
Contract				
Commission (%)	2.89	2.83	2.9	2.88
	(0.45)	(0.47)	(0.44)	(0.45)
Owner Occupied	0.3	0.15	0.33	0.23
	(0.46)	(0.36)	(0.47)	(0.42)
Tenant Occupied	0.08	0.03	0.09	0.05
	(0.28)	(0.17)	(0.29)	(0.23)
Vacant	0.62	0.82	0.58	0.72
	(0.49)	(0.39)	(0.49)	(0.45)
Includes Dishwasher	0.77	0.64	0.79	0.69
	(0.42)	(0.48)	(0.41)	(0.46)
Includes Dryer	0.31	0.16	0.33	0.25
	(0.46)	(0.37)	(0.47)	(0.43)
Includes Washer	0.31	0.16	0.33	0.25
	(0.46)	(0.37)	(0.47)	(0.43)
Re-Sale	0.51	0.21	0.56	0.39
	(0.50)	(0.41)	(0.50)	(0.49)
New Home	0.02	0.01	0.03	0.03
	(0.15)	(0.12)	(0.16)	(0.17)
Short Sale	0.19	0.14	0.2	0.17
	(0.39)	(0.35)	(0.40)	(0.37)
Real Estate Owned	0.27	0.64	0.22	0.42
	(0.45)	(0.48)	(0.41)	(0.49)
Neighborhood				
Age Restriction	0.01	0	0.01	0.01
	(0.09)	(0.04)	(0.10)	(0.07)
Gated	0.18	0.09	0.2	0.15
	(0.39)	(0.29)	(0.40)	(0.36)
Homeowners Association	0.71	0.71	0.71	0.71
	(0.46)	(0.45)	(0.46)	(0.46)
Observations	385,720	41,948	321,547	22,225

This table reports mean and standard deviation of variables in this study for the full sample and by whether the listing agent is steering or not steering. “Steering” means that the listing agent requires the buyer to use an a□liated lender. “Not Steering” means that the listing agent does not require the buyer to use an a□liated lender. “Unknown” are the remarks have a Watson score below 90 percent for each class.

Table 2.5. Mean Differences and t-Tests of Control Variables

	Known vs. Unknown			Steering vs. Not Steering		
Variables	Difference	t-stat	p-value	Difference	t-stat	p-value
Condominium	0.00	1.23	0.218	-0.01	-5.26	0.000
Living Area Square Footage	8.10	1.52	0.130	-24.39	-6.07	0.000
Lot Square Footage	179.56	5.46	0.000	-311.57	-12.58	0.000
Bedrooms	-0.02	-3.66	0.000	0.04	8.59	0.000
Bathrooms	-0.01	-1.08	0.282	0.02	3.80	0.000
Fireplaces	0.02	3.59	0.000	-0.04	-13.05	0.000
Private Pool	0.01	3.81	0.000	-0.02	-11.79	0.000
Private Spa	0.01	3.72	0.000	-0.02	-13.63	0.000
Garage Spaces	0.01	1.49	0.136	0.01	1.18	0.238
Age	0.90	9.83	0.000	-2.66	-38.92	0.000
New Quality	0.00	1.68	0.092	0.00	-2.28	0.023
Excellent Quality	0.01	5.75	0.000	-0.09	-50.60	0.000
Very Good Quality	0.01	5.65	0.000	-0.06	-39.14	0.000
Good Quality	-0.05	-13.34	0.000	0.18	68.68	0.000
Fair Quality	-0.02	-10.54	0.000	0.10	56.37	0.000
Poor Quality	0.00	-0.18	0.858	0.00	1.17	0.241
Commission ($)	0.01	1.55	0.120	-0.06	-26.68	0.000
Owner Occupied	0.08	24.45	0.000	-0.17	-72.48	0.000
Tenant Occupied	0.03	15.57	0.000	-0.06	-43.51	0.000
Vacant	-0.11	-31.88	0.000	0.24	93.76	0.000
Includes Dishwasher	0.08	28.74	0.000	-0.15	-69.39	0.000
Includes Dryer	0.06	19.34	0.000	-0.17	-72.14	0.000
Includes Washer	0.06	19.48	0.000	-0.17	-72.12	0.000
Re-Sale	0.13	37.97	0.000	-0.35	-138.61	0.000
New Home	-0.01	-5.16	0.000	-0.01	-14.07	0.000
Short Sale	0.03	10.49	0.000	-0.06	-29.18	0.000
Real Estate Owned	-0.15	-50.20	0.000	0.42	193.34	0.000
Age Restriction	0.00	6.21	0.000	-0.01	-16.00	0.000
Gated	0.03	12.46	0.000	-0.11	-52.98	0.000
Homeowners Association	0.00	-0.30	0.768	0.01	2.79	0.005

This table reports the mean difference between listings with and without known steering status (i.e., steering or not steering vs unknown) along with the corresponding t-statistic and p-value for each control variable in the study. This table also reports similar statistics for listings with and without steering activity. The sample includes both sold and unsold listings.

Table 2.6. Steering Activity t-Tests of Outcome Variables

Panel A: Transaction Outcomes				
Variables	Steering	Not Steering	Difference	p-value
Price ($)	157,406	188,919	-31,513	0.000
TOM	53.2	61.1	-7.9	0.000
TIC	51.1	52.9	-1.8	0.000
Contribution	2,098	1,587	511	0.000
Financed Buyers	0.56	0.62	-0.05	0.000
Sold Likelihood	0.88	0.75	0.14	0.000
Sold Observations	36,991	239,732		
Total Observations	41,948	321,547		

Panel B: Mortgage Outcomes				
Variables	Steering	Not Steering	Difference	p-value
Weighted-Average Coupon	4.831	4.279	0.552	0.000
Combined LTV	0.903	0.904	-0.001	0.948
Combined Loan Amount ($)	165,121	191,395	-26,274	0.000
Term: 15 years	0.032	0.034	-0.002	0.156
Term: 30 years	0.906	0.889	0.017	0.000
Term: other	0.062	0.077	-0.015	0.000
Fixed-Rate Mortgage	0.985	0.982	0.003	0.004
Piggyback Loan	0.066	0.073	-0.007	0.000
Type: Conventional	0.435	0.481	-0.046	0.000
Type: FHA	0.463	0.388	0.075	0.000
Type: VA	0.092	0.109	-0.017	0.000
Type: Other	0.01	0.022	-0.012	0.000
Mortgage Observations	19,694	140,130		

This table reports the p-value from a t-test of mean difference in outcome variables between listings with and without steering activity. “Steering” means that the listing agent requires the buyer to use an affiliated lender. “Not Steering” means that the listing agent does not require the buyer to use an affiliated lender. “Unknown” are the remarks have a Watson score below 90 percent for each class.

Table 2.7. Baseline Analysis of Financial Steering on Sale Price

	(1)	(2)	(3)	(4)	(5)	(6)
Steering	-0.040***	-0.011***	-0.011***	-0.010***	-0.009***	-0.008***
	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Condominium		-0.225***	-0.229***	-0.231***	-0.163	-0.028
		(0.010)	(0.010)	(0.010)	(0.153)	(0.146)
ln(Living Area Square Footage)		0.804***	0.788***	0.783***	0.542***	0.539***
		(0.008)	(0.008)	(0.007)	(0.006)	(0.008)
ln(Lot Square Footage)		0.008***	0.008***	0.009***	0.001**	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bedrooms		-0.031***	-0.027***	-0.025***	0.014***	0.018***
		(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Bathrooms		-0.015***	-0.014***	-0.015***	0.008***	0.005**
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Fireplaces		0.038***	0.038***	0.037***	0.011***	0.008***
		(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Private Pool		0.091***	0.090***	0.090***	0.077***	0.076***
		(0.002)	(0.002)	(0.002)	(0.001)	(0.003)
Private Spa		0.028***	0.027***	0.027***	0.015***	0.021***
		(0.002)	(0.002)	(0.002)	(0.001)	(0.003)
Garage Spaces		0.080***	0.078***	0.078***	0.045***	0.054***
		(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Age		-0.006***	-0.006***	-0.006***	-0.006***	-0.007***
		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Property Condition: New		-0.030***	-0.033***	-0.003	-0.018**	-0.031
		(0.010)	(0.010)	(0.010)	(0.007)	(0.026)
Property Condition: Excellent		0.051***	0.049***	0.052***	0.035***	0.031***
		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Property Condition: Very Good		0.004***	0.003**	0.013***	0.002***	0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Property Condition: Fair		-0.069***	-0.068***	-0.061***	-0.065***	-0.049***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Property Condition: Poor		-0.190***	-0.189***	-0.183***	-0.193***	-0.169***
		(0.003)	(0.003)	(0.003)	(0.004)	(0.006)

(Continued)

Table 2.7. Baseline Analysis of Financial Steering on Sale Price (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Age Restriction		0.040***	0.026***	0.093***	-0.062***	-0.018
		(0.008)	(0.008)	(0.008)	(0.005)	(0.022)
Gated		0.029***	0.026***	0.044***	-0.035***	-0.024***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Homeowners Association		-0.029***	-0.035***	-0.036***	-0.003	-0.002
		(0.004)	(0.004)	(0.004)	(0.003)	(0.005)
Commission (%)		0.020***	0.020***	0.019***	0.022***	0.033***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Owner Occupied		0.005***	0.005***	0.009***	-0.002***	-0.009***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Tenant Occupied		-0.019***	-0.018***	-0.019***	-0.011***	-0.012***
		(0.002)	(0.002)	(0.002)	(0.001)	(0.004)
Includes Dishwasher		0.016***	0.015***	0.017***	0.014***	0.016***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Includes Dryer		-0.007*	-0.007**	-0.004	-0.005	-0.000
		(0.004)	(0.004)	(0.003)	(0.003)	(0.008)
Includes Washer		0.009**	0.009**	0.006*	0.006*	0.001
		(0.004)	(0.004)	(0.003)	(0.003)	(0.008)
New Home		0.133***	0.136***	0.126***	0.128***	0.114***
		(0.009)	(0.008)	(0.009)	(0.006)	(0.023)
Short Sale		-0.117***	-0.115***	-0.118***	-0.108***	-0.104***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Real Estate Owned		-0.110***	-0.109***	-0.101***	-0.099***	-0.088***
		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Observations	276,723	276,723	276,723	276,723	276,723	64,795
Adjusted R^2	0.212	0.917	0.921	0.929	0.952	0.948
School Controls		✓	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓		✓	✓
Zip Code FE			✓			
Zip-Year-Quarter FE				✓		
Subdivision FE					✓	✓
Propensity Score Match						✓

This table reports OLS estimates using the natural log of property's sale price as the dependent variable. "Steering" is a dummy variable that equals one when the listing agent requires the buyer to use an a□liated lender for pre-qualification, and zero otherwise. Each column uses a di□erent set of controls. The last column uses balanced treatment and control groups from propensity score matching. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property's subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.8. Heckman Correction

Variables	(1) Sold	(2) ln(Price)	Variables (Continued)	(1) Sold	(2) ln(Price)
Steering	0.135***	-0.011***	Owner Occupied	-0.206***	0.009***
	(0.010)	(0.001)		(0.006)	(0.001)
Condominium	0.520***	-0.222***	Tenant Occupied	-0.491***	-0.027***
	(0.015)	(0.002)		(0.009)	(0.002)
ln(Living Area Square Footage)	-0.614***	0.783***	Includes Dishwasher	0.099***	0.026***
	(0.015)	(0.002)		(0.008)	(0.001)
ln(Lot Square Footage)	0.056***	0.008***	Includes Dryer	0.075***	-0.006
	(0.002)	(0.000)		(0.027)	(0.004)
Bedrooms	0.046***	-0.027***	Includes Washer	-0.038	0.010***
	(0.005)	(0.001)		(0.027)	(0.004)
Bathrooms	-0.065***	-0.016***	New Home	0.164***	0.116***
	(0.005)	(0.001)		(0.018)	(0.002)
Fireplaces	-0.027***	0.039***	Short Sale	-0.331***	-0.150***
	(0.005)	(0.001)		(0.007)	(0.001)
Private Pool	0.080***	0.092***	Real Estate Owned	0.962***	-0.131***
	(0.009)	(0.001)		(0.011)	(0.002)
Private Spa	0.041***	0.028***	Age Restriction	-0.181***	0.025***
	(0.010)	(0.001)		(0.026)	(0.004)
Garage Spaces	0.141***	0.082***	Gated	-0.064***	0.025***
	(0.005)	(0.001)		(0.008)	(0.001)
Age	-0.001**	-0.007***	Homeowners Association	-0.042***	-0.033***
	(0.000)	(0.000)		(0.009)	(0.001)
Commission (%)	-0.022***	0.024***	Inverse Mills Ratio		0.031***
	(0.006)	(0.001)			(0.005)
Observations				363,495	363,495
School Controls				✓	✓
Year-Quarter FE				✓	✓
Zip Code FE				✓	✓

This table reports the two step Heckman correction using the sold indicator as the dependent variable in column (1) and the natural log of property's sale price as the dependent variable in column (2). "Steering" is a dummy variable that equals one when the listing agent requires the buyer to use an a□liated lender for pre-qualification, and zero otherwise. The inverse mills ratio is calculated using the point estimates from column (1). School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property's subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.9. Analysis of Financial Steering using Alternative Steering Measures

	(1) Score	(2) At 50%	(3) At 95%	(4) At 99%	(5) Analog
Steering	-0.009***	-0.009***	-0.008***	-0.008***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Condominium	-0.156	-0.156	-0.171	-0.166	-0.156
	(0.148)	(0.148)	(0.156)	(0.165)	(0.148)
ln(Living Area Square Footage)	0.541***	0.541***	0.543***	0.546***	0.541***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ln(Lot Square Footage)	0.001**	0.001**	0.001*	0.001*	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bedrooms	0.014***	0.014***	0.013***	0.013***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bathrooms	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Fireplaces	0.011***	0.011***	0.012***	0.012***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private Pool	0.077***	0.077***	0.076***	0.077***	0.077***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private Spa	0.015***	0.015***	0.015***	0.014***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Garage Spaces	0.045***	0.045***	0.045***	0.044***	0.045***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Property Condition: New	-0.022***	-0.022***	-0.016**	-0.000	-0.022***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Property Condition: Excellent	0.034***	0.034***	0.035***	0.034***	0.035***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Property Condition: Very Good	0.003***	0.003***	0.003***	0.004***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Property Condition: Fair	-0.065***	-0.065***	-0.064***	-0.063***	-0.065***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Property Condition: Poor	-0.193***	-0.193***	-0.192***	-0.190***	-0.193***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)

(Continued)

Table 2.9. Analysis of Financial Steering using Alternative Steering Measures (Continued)

	(1) Score	(2) At 50%	(3) At 95%	(4) At 99%	(5) Analog
Commission (%)	0.022***	0.022***	0.020***	0.020***	0.022***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Owner Occupied	-0.003***	-0.003***	-0.001*	-0.001	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tenant Occupied	-0.011***	-0.011***	-0.010***	-0.010***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Includes Dishwasher	0.014***	0.014***	0.015***	0.016***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Includes Dryer	-0.005	-0.005	-0.004	-0.006*	-0.005
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Includes Washer	0.005*	0.005*	0.004	0.005	0.005*
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
New Home	0.131***	0.131***	0.128***	0.116***	0.131***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Short Sale	-0.107***	-0.107***	-0.108***	-0.108***	-0.107***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Real Estate Owned	-0.098***	-0.098***	-0.101***	-0.104***	-0.099***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age Restriction	-0.062***	-0.062***	-0.062***	-0.062***	-0.062***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Gated	-0.035***	-0.035***	-0.035***	-0.035***	-0.035***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Homeowners Association	-0.002	-0.002	-0.003	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	294,705	294,514	256,167	210,473	294,705
Adjusted R^2	0.952	0.952	0.953	0.953	0.952
School Controls	✓	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓	✓
Subdivision FE	✓	✓	✓	✓	✓

This table reports OLS estimates using the natural log of property's sale price as the dependent variable. In column (1), "Score" is the probability score that Watson reports for the likelihood that the listing's remark features steering activity. In columns (2) to (4), "Steering" is a dummy variable that equals one when the likelihood that the listing agent requires the buyer to use an a□liated lender for pre-qualification is above the threshold reported on the header, and zero if the score is below the complement of the threshold reported on the header. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property's subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.10. Analysis of Financial Steering and Broker Heterogeneity

	(1) Steering	(2) ln(Price)	(3) ln(Price)	(4) ln(Price)	(5) ln(Price)
Steering		-0.011***	-0.009***	-0.005***	-0.013***
		(0.001)	(0.001)	(0.002)	(0.001)
Experience (Years)	-0.002***	0.001***	0.001***	-0.026***	
	(0.000)	(0.000)	(0.000)	(0.005)	
Out of State Agent	-0.145***	0.008**	0.006		
	(0.004)	(0.004)	(0.004)		
Broker License	-0.047***	0.006***	0.004**	0.004	
	(0.002)	(0.001)	(0.002)	(0.004)	
Broker-salesperson License	-0.052***	0.005***	0.003**	0.012***	
	(0.003)	(0.001)	(0.001)	(0.004)	
Female Agent	-0.069***	0.005***	0.002*		
	(0.002)	(0.001)	(0.001)		
Income Last Month	0.000***	-0.000**	-0.000***	-0.000***	
	(0.000)	(0.000)	(0.000)	(0.000)	
Transactions Last Year	-0.000***	0.000***	0.000***	0.000***	
	(0.000)	(0.000)	(0.000)	(0.000)	
Photos	0.000***	0.001***	0.002***	0.002***	
	(0.000)	(0.000)	(0.000)	(0.000)	
Condominium	-0.012**	-0.219***	-0.221***	-0.220***	-0.218***
	(0.005)	(0.010)	(0.010)	(0.009)	(0.010)
ln(Living Area Square Footage)	0.001	0.820***	0.810***	0.801***	0.825***
	(0.006)	(0.008)	(0.008)	(0.008)	(0.009)
ln(Lot Square Footage)	0.001	0.007***	0.007***	0.008***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bedrooms	0.004***	-0.027***	-0.024***	-0.022***	-0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Bathrooms	0.004**	-0.016***	-0.016***	-0.016***	-0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Fireplaces	0.002	0.039***	0.038***	0.038***	0.039***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Private Pool	-0.002	0.092***	0.091***	0.091***	0.093***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Private Spa	0.003	0.031***	0.031***	0.031***	0.032***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Garage Spaces	0.002	0.081***	0.081***	0.082***	0.082***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Age	-0.001***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Property Condition: New	0.111***	-0.003	-0.000	0.004	-0.004
	(0.038)	(0.014)	(0.011)	(0.010)	(0.014)
Property Condition: Excellent	-0.032***	0.046***	0.043***	0.046***	0.049***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Property Condition: Very Good	-0.011***	0.001	0.002	0.003*	0.002
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Property Condition: Fair	0.005**	-0.062***	-0.064***	-0.064***	-0.065***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Property Condition: Poor	-0.046***	-0.179***	-0.183***	-0.187***	-0.183***
	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)

(Continued)

Table 2.10. Analysis of Financial Steering and Broker Heterogeneity (Continued)

	(1) Steering	(2) ln(Price)	(3) ln(Price)	(4) ln(Price)	(5) ln(Price)
Commission (%)	-0.042***	0.019***	0.023***	0.026***	0.019***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Owner Occupied	-0.015***	0.008***	0.009***	0.009***	0.008***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Tenant Occupied	-0.029***	-0.011***	-0.008***	-0.007***	-0.018***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Includes Dishwasher	-0.000	0.018***	0.020***	0.019***	0.018***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Includes Dryer	0.000	-0.007	-0.008*	-0.004	-0.005
	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
Includes Washer	-0.013	0.012**	0.012***	0.009**	0.011**
	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
New Home	-0.053***	0.142***	0.093***	0.042***	0.132***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Short Sale	0.014***	-0.114***	-0.109***	-0.102***	-0.120***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Real Estate Owned	0.149***	-0.107***	-0.097***	-0.081***	-0.105***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Age Restriction	-0.061***	0.119***	0.111***	0.100**	0.122***
	(0.012)	(0.033)	(0.036)	(0.042)	(0.034)
Gated	-0.012***	0.032***	0.030***	0.028***	0.033***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Homeowners Association	0.001	-0.032***	-0.031***	-0.031***	-0.031***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	195,493	195,493	195,493	195,493	195,493
Adjusted R^2	0.118	0.916	0.920	0.922	0.916
School Controls	✓	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓	✓
Zip Code FE	✓	✓	✓	✓	✓
Office FE			✓		
Broker FE				✓	

This table reports OLS estimates using the natural log of property's sale price as the dependent variable. "Steering" is a dummy variable that equals one when the listing agent requires the buyer to use an affiliated lender for pre-qualification, and zero otherwise. Each column uses a different set of controls featuring listing office or broker characteristics and fixed effects. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property's subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.11. Analysis of Financial Steering and Seller Heterogeneity

Variables	(1) Steering	(2) ln(Price)	Variables (Continued)	(1) Steering	(2) ln(Price)
Steering		-0.005***	Age	-0.001	-0.006***
		(0.001)		(0.000)	(0.001)
Seller Type: Bank	0.080***	-0.013***	Property Condition: Excellent	-0.036***	0.031***
	(0.005)	(0.002)		(0.002)	(0.001)
Seller Type: Builder	0.019***	0.037***	Property Condition: Fair	-0.013***	-0.063***
	(0.004)	(0.002)		(0.002)	(0.001)
Seller Type: Firm	0.043***	0.017***	Property Condition: New	0.043**	-0.023***
	(0.003)	(0.001)		(0.021)	(0.007)
Seller Type: Government	-0.237***	0.008***	Property Condition: Poor	-0.072***	-0.190***
	(0.006)	(0.003)		(0.004)	(0.004)
Seller Type: Trust	-0.009***	0.000	Property Condition: Very Good	-0.013***	0.002***
	(0.002)	(0.001)		(0.002)	(0.001)
Seller Type: Unknown	-0.015***	-0.013***	Commission (%)	-0.016***	0.019***
	(0.004)	(0.002)		(0.002)	(0.001)
Agent-Owned	-0.024***	0.015***	Owner Occupied	-0.001	0.003***
	(0.003)	(0.001)		(0.001)	(0.001)
Agent-Related	-0.028***	0.015***	Tenant Occupied	-0.028***	-0.008***
	(0.004)	(0.002)		(0.002)	(0.001)
Condominium	-0.018	-0.161	Includes Dishwasher	-0.023***	0.015***
	(0.030)	(0.154)		(0.002)	(0.001)
ln(Living Area Square Footage)	-0.001	0.543***	Includes Dryer	0.000	-0.004
	(0.006)	(0.006)		(0.006)	(0.003)
ln(Lot Square Footage)	-0.000	0.001**	Includes Washer	-0.007	0.007**
	(0.001)	(0.001)		(0.006)	(0.003)
Bedrooms	0.000	0.013***	New Home	-0.054***	0.098***
	(0.001)	(0.001)		(0.006)	(0.005)
Bathrooms	0.001	0.008***	Short Sale	0.011***	-0.101***
	(0.002)	(0.002)		(0.002)	(0.001)
Fireplaces	0.000	0.011***	Real Estate Owned	0.221***	-0.085***
	(0.002)	(0.001)		(0.006)	(0.002)
Private Pool	-0.002	0.076***	Age Restriction	0.012***	-0.063***
	(0.002)	(0.001)		(0.005)	(0.005)
Private Spa	0.005*	0.015***	Gated	-0.012***	-0.034***
	(0.002)	(0.001)		(0.003)	(0.003)
Garage Spaces	-0.000	0.045***	Homeowners Association	-0.002	-0.002
	(0.002)	(0.001)		(0.005)	(0.003)
Observations				276,723	276,723
Adjusted R-squared				0.186	0.952
School Controls				✓	✓
Year-Quarter FE				✓	✓
Subdivision FE				✓	✓

This table reports OLS estimates. The headers denote the corresponding dependent variable. “Steering” is a dummy variable that equals one when the listing agent requires the buyer to use an a□liated lender for pre-qualification, and zero otherwise. “ln(Price)” is the natural log of property’s sale price. For variable descriptions of the structural, neighborhood, and contract controls, see Table 2.3. Robust standard errors clustered by the property’s subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.12. Baseline Analysis of Financial Steering on Transaction Costs

VARIABLES	(1) ln(TOM)	(2) ln(TIC)	(3) ln(Contribution)	(4) ln(Net Price)
Steering	-0.115***	0.014***	-0.479***	-0.008***
	(0.007)	(0.004)	(0.023)	(0.001)
ln(TOM)				0.002***
				(0.000)
ln(TIC)				0.014***
				(0.001)
Condominium	0.529***	0.028	-0.730	-0.157
	(0.158)	(0.081)	(0.478)	(0.161)
ln(Living Area Square Footage)	0.675***	0.055***	0.696***	0.540***
	(0.023)	(0.011)	(0.065)	(0.007)
ln(Lot Square Footage)	-0.004	0.004***	-0.032***	0.000
	(0.003)	(0.001)	(0.006)	(0.001)
Bedrooms	-0.029***	0.002	0.029*	0.013***
	(0.005)	(0.003)	(0.016)	(0.001)
Bathrooms	0.017**	0.007*	0.046**	0.007***
	(0.007)	(0.004)	(0.021)	(0.002)
Fireplaces	-0.016**	-0.001	-0.009	0.011***
	(0.007)	(0.003)	(0.020)	(0.002)
Private Pool	-0.069***	0.019***	0.075***	0.077***
	(0.010)	(0.004)	(0.027)	(0.002)
Private Spa	-0.047***	0.004	-0.023	0.015***
	(0.011)	(0.005)	(0.031)	(0.002)
Garage Spaces	-0.080***	0.013***	0.027	0.046***
	(0.007)	(0.003)	(0.018)	(0.002)
Age	0.002	-0.001	0.002	-0.005***
	(0.002)	(0.001)	(0.005)	(0.001)
Property Condition: New	-0.353***	0.104***	0.524***	-0.017**
	(0.065)	(0.036)	(0.203)	(0.009)
Property Condition: Excellent	-0.166***	-0.038***	-0.343***	0.036***
	(0.008)	(0.004)	(0.022)	(0.002)
Property Condition: Very Good	-0.126***	-0.004	-0.113***	0.001
	(0.009)	(0.004)	(0.024)	(0.002)
Property Condition: Fair	0.047***	-0.008**	-0.636***	-0.062***
	(0.007)	(0.004)	(0.022)	(0.002)
Property Condition: Poor	-0.073***	-0.159***	-1.617***	-0.186***
	(0.018)	(0.010)	(0.038)	(0.004)

(Continued)

Table 2.12. Baseline Analysis of Financial Steering on Transaction Costs (Continued)

VARIABLES	(1) ln(TOM)	(2) ln(TIC)	(3) ln(Contribution)	(4) ln(Net Price)
Commission (%)	0.010	0.076***	0.344***	0.017***
	(0.009)	(0.004)	(0.023)	(0.001)
Owner Occupied	-0.290***	0.131***	-0.118***	-0.001
	(0.007)	(0.003)	(0.019)	(0.002)
Tenant Occupied	-0.162***	0.097***	-0.137***	-0.017***
	(0.013)	(0.006)	(0.027)	(0.003)
Includes Dishwasher	-0.083***	0.005	0.154***	0.014***
	(0.006)	(0.003)	(0.020)	(0.001)
Includes Dryer	-0.072***	0.010	0.119	-0.005
	(0.026)	(0.014)	(0.076)	(0.003)
Includes Washer	-0.007	-0.006	-0.044	0.005
	(0.026)	(0.014)	(0.076)	(0.003)
New Home	0.018	0.117***	2.859***	0.120***
	(0.054)	(0.030)	(0.157)	(0.008)
Short Sale	0.580***	1.186***	-0.230***	-0.123***
	(0.011)	(0.005)	(0.023)	(0.002)
Real Estate Owned	-0.092***	0.188***	1.005***	-0.102***
	(0.009)	(0.005)	(0.028)	(0.002)
Age Restriction	-0.000	0.039**	-0.234***	-0.054***
	(0.042)	(0.018)	(0.079)	(0.006)
Gated	0.277***	0.016***	0.212***	-0.040***
	(0.014)	(0.006)	(0.037)	(0.004)
Homeowners Association	0.102***	-0.007	-0.050	-0.001
	(0.021)	(0.011)	(0.061)	(0.004)
Observations	276,723	276,723	276,723	276,566
Adjusted R^2	0.147	0.341	0.162	0.843
School Controls	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓
Subdivision FE	✓	✓	✓	✓

This table reports OLS estimates using the variable specified in the header as the dependent variable. TOM is the time-on-the-market, TIC is the time-in-contract, Contribution is the seller's contribution towards the buyer's closing costs, and Net Price is the sale price less the seller's contribution. "Steering" is a dummy variable that equals one when the listing agent requires the buyer to use an a□liated lender for pre-qualification, and zero otherwise. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property's subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.13. Baseline Analysis of Financial Steering on Borrowing Costs

	(1)	(2)	(3)	(4)	(5)
Steering	-0.001	-0.001*	-0.001*	-0.001*	-0.001*
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Log Loan Amount		-0.002*	0.001	0.001	-0.002
		(0.001)	(0.002)	(0.002)	(0.002)
Combined LTV		0.000	0.005	0.005	0.006
		(0.000)	(0.003)	(0.003)	(0.004)
15-year Term		-0.192***	-0.191***	-0.191***	-0.191***
		(0.004)	(0.004)	(0.004)	(0.004)
Other Term Type		-0.092***	-0.140***	-0.140***	-0.142***
		(0.025)	(0.021)	(0.021)	(0.020)
Adjustable Rate Mortgage		-0.085***	-0.103***	-0.103***	-0.105***
		(0.029)	(0.028)	(0.028)	(0.028)
Piggyback Loan		0.004**	0.005***	0.005***	0.004**
		(0.002)	(0.002)	(0.002)	(0.002)
FHA Loan		0.003***	0.000	0.000	0.001
		(0.001)	(0.001)	(0.001)	(0.001)
VA Loan		0.001	-0.000	-0.000	0.000
		(0.000)	(0.001)	(0.001)	(0.001)
Other Loan Type		0.043***	0.021***	0.021***	0.020***
		(0.008)	(0.007)	(0.007)	(0.007)
Condominium			0.006***	0.006***	-0.016
			(0.002)	(0.002)	(0.015)
ln(Living Area Square Footage)			-0.003**	-0.003**	-0.002
			(0.001)	(0.001)	(0.001)
ln(Lot Square Footage)			0.001***	0.001***	0.001***
			(0.000)	(0.000)	(0.000)
Bedrooms			0.000	0.000	0.001*
			(0.000)	(0.000)	(0.000)
Bathrooms			0.002***	0.002***	0.001
			(0.000)	(0.000)	(0.000)
Fireplaces			0.001***	0.001***	0.000
			(0.000)	(0.000)	(0.000)
Private Pool			0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)
Private Spa			0.001**	0.001**	0.001
			(0.000)	(0.000)	(0.001)
Garage Spaces			-0.001***	-0.001***	-0.001**
			(0.000)	(0.000)	(0.000)
Age			0.000	0.000	-0.000
			(0.000)	(0.000)	(0.000)
Property Condition: New			0.014***	0.014***	0.013***
			(0.004)	(0.004)	(0.004)
Property Condition: Excellent			0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)
Property Condition: Very Good			0.001*	0.001*	0.001*
			(0.000)	(0.000)	(0.000)
Property Condition: Fair			0.001*	0.001*	0.001
			(0.000)	(0.000)	(0.000)
Property Condition: Poor			0.003	0.003	0.003
			(0.002)	(0.002)	(0.002)

(Continued)

This table reports OLS estimates using the natural log of the initial rate (or weighted average rate) on the mortgage as the dependent variable. “Steering” is a dummy variable that equals one when the loan is issued to a buyer purchasing a property where the listing agent requires the buyer to use an a□liated lender for pre-qualification, and zero otherwise. Each column uses a di□erent set of controls. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property’s subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2.14. Baseline Analysis of Financial Steering on Bidders

	(1) Financed	(2) Corporation	(3) Minority	(4) Female
Steering	-0.043***	0.011***	-0.018**	-0.009
	(0.003)	(0.002)	(0.008)	(0.008)
Condominium	-0.114	0.028	-0.000	0.016
	(0.096)	(0.034)	(0.121)	(0.121)
ln(Living Area Square Footage)	0.061***	0.070***	-0.032*	-0.110***
	(0.008)	(0.005)	(0.019)	(0.020)
ln(Lot Square Footage)	0.003***	-0.001	-0.007**	-0.002
	(0.001)	(0.001)	(0.003)	(0.003)
Bedrooms	0.004**	-0.001	0.028***	-0.005
	(0.002)	(0.001)	(0.004)	(0.004)
Bathrooms	0.009***	-0.004**	0.017***	0.002
	(0.002)	(0.002)	(0.006)	(0.006)
Fireplaces	-0.003	-0.001	-0.009*	0.010*
	(0.002)	(0.001)	(0.005)	(0.005)
Private Pool	0.039***	-0.005***	-0.054***	-0.008
	(0.003)	(0.002)	(0.007)	(0.007)
Private Spa	0.007**	-0.005**	-0.011	-0.010
	(0.004)	(0.002)	(0.007)	(0.007)
Garage Spaces	0.014***	-0.012***	-0.014***	-0.022***
	(0.002)	(0.002)	(0.005)	(0.006)
Age	-0.001	0.002***	-0.001	0.000
	(0.001)	(0.000)	(0.001)	(0.001)
Property Condition: New	0.023*	-0.072***	-0.078	0.142**
	(0.013)	(0.006)	(0.081)	(0.062)
Property Condition: Excellent	0.010***	-0.018***	-0.014**	0.001
	(0.003)	(0.002)	(0.006)	(0.006)
Property Condition: Very Good	0.023***	-0.027***	-0.004	0.000
	(0.003)	(0.002)	(0.006)	(0.006)
Property Condition: Fair	-0.104***	0.051***	0.013*	0.001
	(0.003)	(0.002)	(0.008)	(0.008)
Property Condition: Poor	-0.345***	0.175***	0.012	-0.023
	(0.006)	(0.006)	(0.027)	(0.025)

(Continued)

Table 2.14. Baseline Analysis of Financial Steering on Bidders (Continued)

	(1) Financed	(2) Corporation	(3) Minority	(4) Female
Commission (%)	0.039***	-0.022***	-0.005	0.001
	(0.002)	(0.001)	(0.007)	(0.006)
Owner Occupied	0.001	-0.006***	-0.020***	-0.010**
	(0.002)	(0.002)	(0.005)	(0.005)
Tenant Occupied	-0.075***	0.048***	-0.028***	-0.007
	(0.004)	(0.003)	(0.010)	(0.010)
Includes Dishwasher	0.025***	-0.012***	-0.013**	-0.003
	(0.002)	(0.002)	(0.007)	(0.006)
Includes Dryer	0.021**	-0.008	0.045**	-0.006
	(0.009)	(0.007)	(0.023)	(0.022)
Includes Washer	-0.020**	0.001	-0.048**	-0.001
	(0.009)	(0.006)	(0.023)	(0.022)
New Home	0.113***	-0.004	0.073	-0.102**
	(0.011)	(0.004)	(0.063)	(0.049)
Short Sale	-0.094***	0.075***	0.002	0.015*
	(0.003)	(0.003)	(0.008)	(0.008)
Real Estate Owned	-0.039***	0.025***	0.010	0.022***
	(0.003)	(0.002)	(0.008)	(0.008)
Age Restriction	-0.059***	0.017***	-0.006	-0.002
	(0.013)	(0.005)	(0.018)	(0.028)
Gated	0.004	-0.018***	-0.001	-0.005
	(0.004)	(0.003)	(0.012)	(0.013)
Homeowners Association	-0.008	-0.003	-0.010	-0.012
	(0.007)	(0.005)	(0.017)	(0.017)
Observations	276,723	276,723	55,200	65,524
Adjusted R^2	0.245	0.080	0.220	0.019
School Controls	✓	✓	✓	✓
Year-Quarter FE	✓	✓	✓	✓
Subdivision FE	✓	✓	✓	✓

This table reports OLS estimates using the variable specified in the header as the dependent variable. Financed is 1 if the winning bidder uses a mortgage to purchase the property, and 0 otherwise. Corporation is 1 if the winning bidder is a corporation, and 0 otherwise. "Steering" is a dummy variable that equals one when the listing agent requires the buyer to use an a□liated lender for pre-qualification, and zero otherwise. School Controls includes categorical variables for the zoned high school, middle school, and elementary school. For variable descriptions of the other controls, see Table 2.3. Robust standard errors clustered by the property's subdivision are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

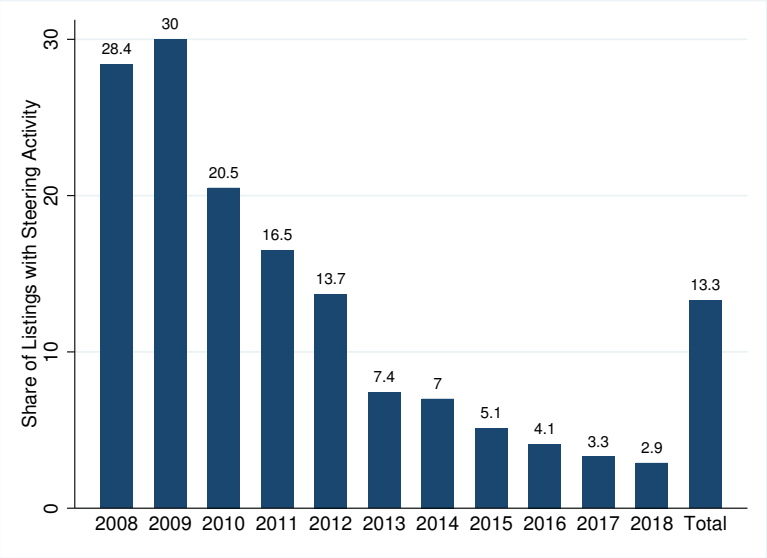


Figure 2.1. Steering Activity

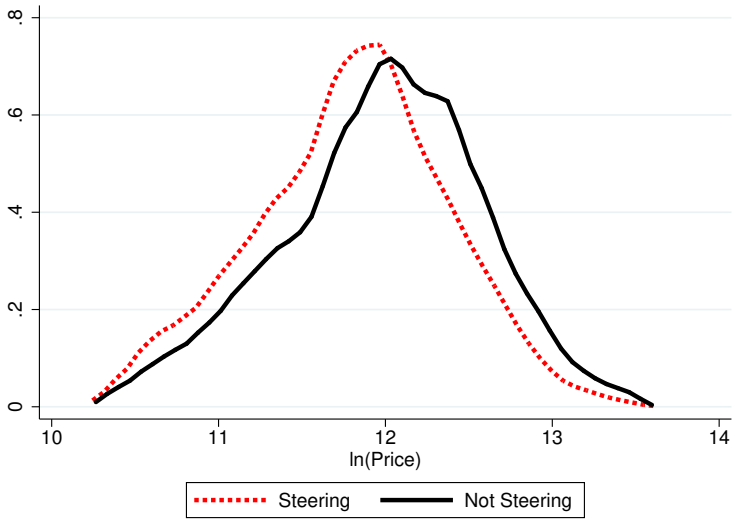


Figure 2.2. Kernel Distribution of ln(Price) by Steering Class

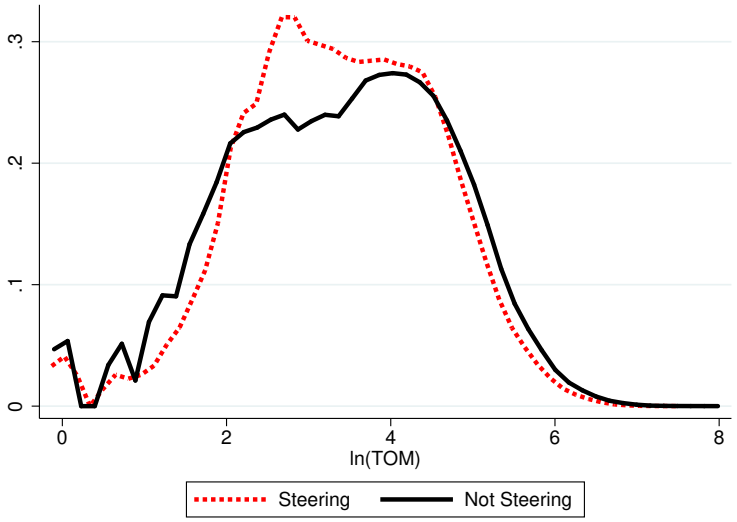


Figure 2.3. Kernel Distribution of ln(TOM) by Steering Class

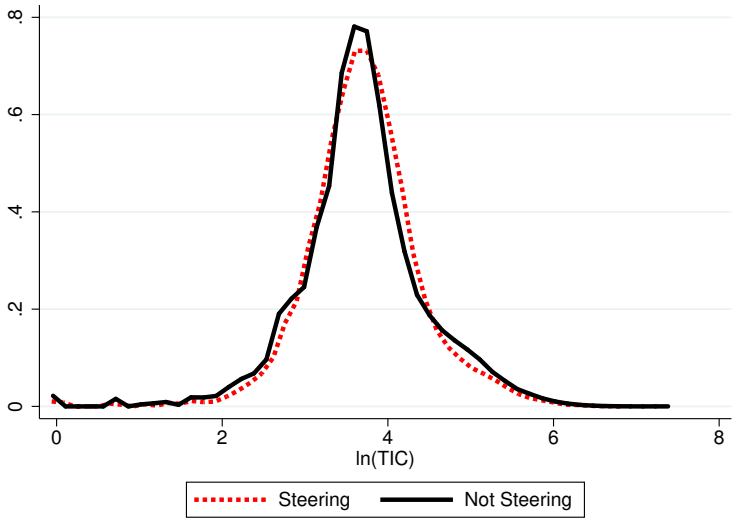


Figure 2.4. Kernel Distribution of ln(TIC) by Steering Class

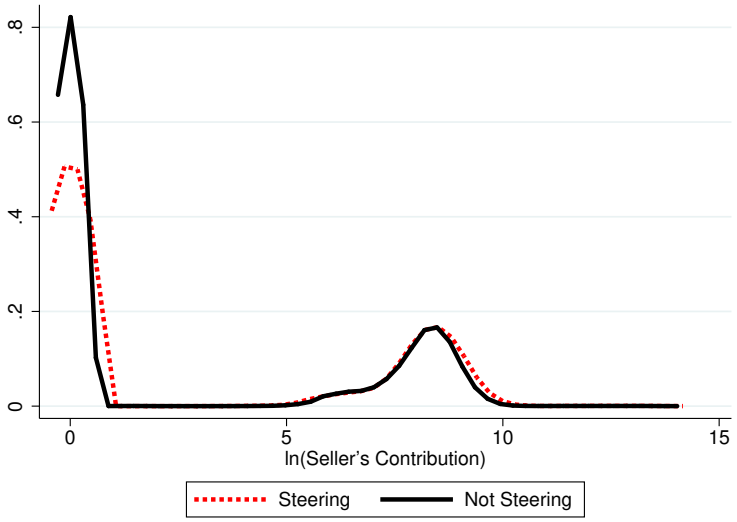


Figure 2.5. Kernel Distribution of ln(Contribution) by Steering Class

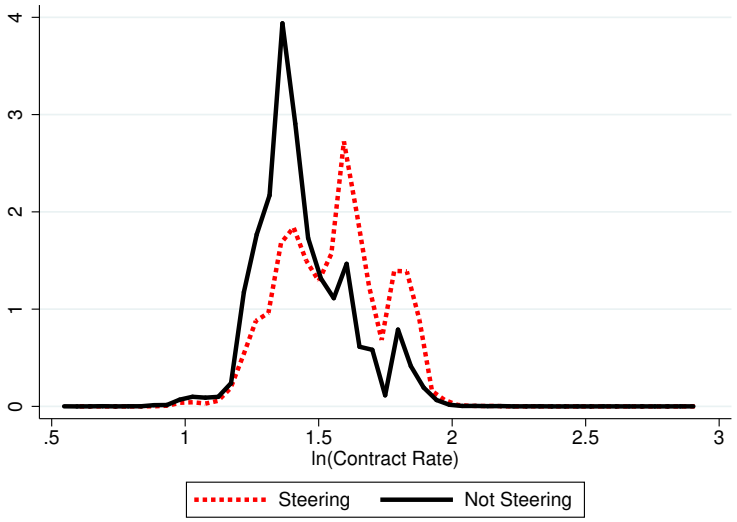


Figure 2.6. Kernel Distribution of ln(Contract Rate) by Steering Class

Chapter 3
Skewed Servicing and Monitoring for Securitized Commercial Mortgages[1]

3.1 Introduction

Trustees play an important role in the financial industry. Besides providing custodial services for financial securities, they oversee and enforce the rights of bondholders by monitoring bond indentures. However, recent litigation has brought to light Great Depression-era concerns about the efficacy and incentive structure of trustees. Of particular interest is a series of lawsuits filed by mortgage-backed security investors alleging breach of duty by trustees. These lawsuits resemble early litigation in the corporate bond market.[2] This paper presents novel evidence of the role of trustees in the securitization process and elucidates the effects of varying incentives on servicer-related outcomes.

This paper focuses on the role of the trustee as an independent monitor by studying servicers' decisions regarding "advances," or revolving credit lines designed to provide short-term liquidity for shortfalls in insurance and principal cash flows.

[1] This chapter was inspired by conversations with Walter D'Lima. Portions of this work have been subsequently incorporated into a co-authored working paper with the title, "Trustee A□liation and Servicer Oversight: Evidence from CMBS Markets."

[2] See the article by Al Yoon (dated June 18, 2014 and located at www.wsj.com/articles/blackrock-pimco-sue-deutsche-bank-u-s-bank-over-trustee-roles-1403124442) for details on the recent litigation involving mortgage-backed securities, and see Posner (1928, 1937) for historical examples.

While advances support the continuation of payments to bondholders when underlying assets underperform, a drawback of advances is that they can mislead bondholders to believe that the underlying assets are performing better than in reality.[3] In principle, servicers determine the level of advances based on costly effort while trustees act as monitors. However, a trustee's incentive to monitor the servicer may be skewed and subsequently influence the level of advancement, and thus, delay performance information to bondholders. This paper capitalizes on a unique natural experiment around mergers to test the effect of skewed trustee incentives on the level of advancement.

Using data on conduit United States' (U.S.) commercial mortgage-backed securities (CMBS) from 1998 to 2016, I observe how long it takes to suspend advances on loans that engender losses to the collateral pool. I call this time frame the "duration of advances." I then examine how the duration of advances varies depending on whether there is an affiliation between the trustee and the mortgage servicer that administer the CMBS collateral. Since I observe information on the trustees and mortgage servicers for various deals over time, I am able to define two forms of affiliations: (1) when the trustee and servicer are the same firm and (2) when the trustee and servicer are co-dealers (i.e., work as trustees for each other across deals). For example, if Bank of America is the servicer and Wells Fargo is the trustee for one CMBS deal and they reverse roles in another CMBS deal, then the two banks are said to be co-dealing. In either case, the servicer-trustee affiliation can undermine the system of checks and balances on advances.

To test the impact of these affiliations, I use a "natural experiment" arising from mergers in the retail banking sector that led to affiliations in deals in which the banks were initially performing as independent servicers or trustees. These mergers are the purchases of LaSalle by Bank of America and Wachovia by Wells Fargo. Bank of America took over LaSalle's trustee position in approximately $350 billion dollars' worth of CMBS deals, or 40 percent of the U.S. CMBS debt, as of the third quarter of 2007.[4] During the following year, Wells Fargo bought Wachovia,

[3] For example, in *MBIA Ins Corp v. Royal Indemnity Co* (2009), Royal alleged that the advances (or "forbearance payments") by the servicer on delinquent and defaulting loans created the illusion that the securitized loans were performing normally. The misunderstanding of the loans' true state prevented Royal from taking defensive action.

[4] The $350 billion figure comes from summing the outstanding balance of commercial loans in which Bank of America or LaSalle is reported as the trustee in the Trepp data set as of November 1, 2007.

the mortgage servicer for about 20 percent of all the CMBS deals securitized between 1994 and 2008. Consequently, the consolidation of the securitization market resulted in affiliations between the servicers and trustees across several existing deals. Although regulations generally prohibit a direct servicer-trustee affiliation, with failure to comply potentially resulting in severe penalties and tax liabilities, these deals were exempted per arguments by the trustees that the exemptions would benefit the bondholders.[5]

The primary findings suggest that affiliation leads to different servicer-related economic outcomes. First, I find that mortgage servicers delay suspending advances by at least five months in the event of a servicer-trustee affiliation. The results remain statistically significant when controlling for loan, property, and deal attributes along with a rich set of fixed effects including the loan's origination year, transfer to special servicing month-year, property's location, and CMBS deal. They even remain statistically significant when examining only those loans in deals affected by the mergers. Finally, these results are robust to alternative explanations including transition delays, coordination difficulties, and heavy workloads.

Second, loans in CMBS deals where the mortgage servicer is also the trustee incur, on average, a statistically significant increase in the loss rate of \$0.04 per dollar of outstanding debt at the 10 percent level relative to similar loans with a trustee at arm's length. Thus, the average delinquent commercial loan with \$9.2 million outstanding incurs approximately \$368,000 more in losses if the mortgage servicer merges with the trustee. Similarly, if the servicer and trustee co-deal, the marginal effect of an indirect affiliation on the loss rate is \$0.07 per dollar of outstanding debt at the 1 percent level. A back-of-envelope calculation suggests that the additional market-wide losses due to affiliation account for about \$4.53 billion, or 24 percent of the total losses for loans with affiliated servicers and trustees.

Third, using a panel of bond tranche-level returns, I find that affiliation shuffles the cash flows of bondholders. In the event of an affiliation, the average junior or senior bondholder experiences shortfalls while the average mezzanine bondholder enjoys higher positive returns. These results are fostered by the impact of affiliation on the duration of advances and the classical waterfall payment structure of private

[5] See the notice of the prohibited transactions exception involving Bank of America at https://www.gpo.gov/fdsys/granule/FR-2008-03-13/E8-4980 or Wells Fargo at https://www.gpo.gov/fdsys/pkg/FR-2009-11-16/pdf/E9-27405.pdf.

CMBS deals.

Overall, these three findings present an initial view of the economic effects produced by varying forms of affiliation between servicers and trustees. While past work has focused on market participants including originators (Keys et al., 2010; Purnanandam, 2010; Titman and Tsyplakov, 2010; Demiroglu and James, 2012), mortgage servicers (Piskorski, Seru and Vig, 2010; Agarwal et al., 2011; Adelino, Gerardi and Willen, 2013; Eberly and Krishnamurthy, 2014; Agarwal et al., 2017), and special servicers (Gan and Mayer, 2007; Liu and Quan, 2013; Ambrose, Sanders and Yavas, 2016; Wong, 2018), scholars have yet to focus on the role of trustees. This paper helps to fill this gap by presenting a view of the independent monitoring of advances, in doing so characterizing different incentives stemming from trustees and servicers being the same firm or having a co-dealing affiliation. Thus, I am able to emphasize the importance of an independent trustee in the securitized mortgage market. Although the focus is on trustees for CMBS, the underlying principles guiding these findings are generalizable to the broader bond market, including asset-backed securities for trade receivables, equipment leasing, operating assets, and small business loans. Corporate bonds also have a structure similar to that of trusteeships.

The findings in this paper also have policy implications. Following the Great Depression, the Securities Exchange Commission (SEC) stressed the importance of employing trustees that do not have conflicts of interest and that look out for the rights of bondholders, especially in the event of default (Jones, 1936). Over time Congress enacted laws such as the Trustee Indenture Act of 1939, which adopts several of the SEC's views on trustees, and sister regulations such as the Internal Revenue Code (Tax Code) of 1986 that strengthen enforcement. The Tax Code, for instance, allows CMBS to obtain a Real Estate Mortgage Investment Conduits (REMIC) tax classification that grants tax deductions in exchange for meeting a set of rules, including the holding of a trustee at arm's length.[6] Yet the monitoring role of the trustee has increasingly been viewed as anachronistic and redundant in modern finance.[7] By exploiting unforeseen mergers and subsequent exceptions to

[6] For further details on the laws and regulations governing a□liations, see Association (1979) and https://www.law.cornell.edu/uscode/text/26/4975

[7] For example, in *MBIA Ins Corp v. Royal Indemnity Co* (2009), the court ruled that the trustee (Wells Fargo) did not have "the contractual obligation to analyze data [from servicers] using certain financial accounting principles and to detect anomalies" even though the pooling

federal regulations, this paper provides evidence that an arms-length trustee plays an instrumental role in the oversight of bondholder rights.

The passage of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 brought sweeping changes to the securitization market. An outcome of this law was the creation of the risk retention provision, a rule designed to align the incentives between servicers and investors such that the banks securitizing (and often servicing) the underlying loans must retain at least 5 percent of the credit risk.[8] That is, the banks must maintain ownership of a piece of the profits or losses of the underlying loans. While risk retention theoretically addresses adverse selection concerns and screening efforts surrounding securitization,[9] the new rule does not address the ex post moral hazard by the servicers delegated to administer the underlying loans (Mooradian and Pichler, 2017). Although residual ownership of the profits can motivate an agent (i.e., servicer) to perform or exert optimal effort (DeMarzo and Sannikov, 2006), the residual piece is often sold off to a collateralized debt obligation (Ashcraft, Gooriah and Kermani, 2014). Servicing contracts may thus include specific covenants coupled with penalties to motivate optimal behavior. As Piskorski and Westerfield (2016) show, a contract using random audits at the proper frequency with an adequate penalty can replace the need for residual ownership to motivate optimal behavior by the agent. Nonetheless, monitoring by an independent party is necessary to legitimize such penalties and yield the desired outcome (e.g., Tirole, 1986). This paper, emphasizing the role

and servicing agreement requires the trustee to "perform rote comparison between that data and data contained in various other sources, and to report any numerical inconsistencies." The monitoring role of the trustee, however, continues to be debated in court (e.g., *BlackRock Core Bond Portfolio et al. v. US Bank National Association*, number 654285/2018). See Schwarcs and Sergi (2007) for further details about the legal view on the monitoring role of trustees.

[8] For further information on risk retention rules, see Section 24 CFR Part 267, available at `https://www.gpo.gov/fdsys/pkg/FR-2014-12-24/pdf/2014-29256.pdf`.

[9] Adverse selection in this context refers to the information asymmetry concern of investors that the banks with more knowledge about securitized loans sell CMBS bonds that are truly riskier than advertised. DeMarzo and Du□e (1999) show that holding on to an ownership share in a project (i.e., risk retention) acts as a costly and thus legitimate signal of the project's quality. DeMarzo (2005) apply this concept to the asset-backed security market. Supporting this concept empirically, Keys et al. (2010) find that the ease securitization reduces screening incentives by the bank originating or underwriting the loans, Purnanandam (2010) shows that banks practicing an originate-to-distribute model face strong incentives to issue low-quality loans, and Keys, Seru and Vig (2012) demonstrate that securitized loans tend to be much riskier than counter-factual loans held in portfolios. Other key papers in this area include Ambrose, LaCour-Little and Sanders (2005), Chari, Shourideh and Zetlin-Jones (2014), Hartman-Glaser, Piskorski and Tchistyi (2012), Bubb and Kaufman (2014), and Gri□n and Maturana (2015).

of the trustee as an independent monitor for asset-backed securities, is consistent with this view.

The paper proceeds as follows. Section 3.2 provides background on the CMBS market and describes a simple principal-agency model to conceptualize the importance of a trustee. Section 3.3 introduces the empirical platform; this is followed by primary analyses of the effect of affiliation on related economic outcomes in Section 3.4. I present robustness checks of the findings in Section 3.5 and the economic significance of the results in Section 3.6. In Section 3.7, I examine the impact of affiliation on the return of bonds in the senior, mezzanine, and junior tranches. Finally, in Section 3.8, I offer some broader implications of the findings and a discussion of potential future work.

3.2 Conceptual Framework

To understand the potential impact of a servicer-trustee affiliation on the duration of advances, it is first necessary to understand the institutional details of the standard conduit CMBS. In this section, therefore, I discuss CMBS deals while highlighting the CMBS participants and their incentives with respect to advances for delinquent loans. I then borrow a simple three-tier agency conceptual framework to construct testable hypotheses.

3.2.1 Background

In the typical conduit CMBS, a firm sponsors a special-purpose vehicle that buys assets (i.e., mortgages) and places them into a pool.[10] Simultaneously, the special-purpose vehicle sells senior, mezzanine, and junior bond certificates that correspond to tranches featuring a waterfall payment structure. The various tranches allow investors to select bonds that meet their particular risk preferences. The sponsoring firm next contracts financial intermediaries including a mortgage servicer and trustee to manage the underlying loans in exchange for monthly fees proportional to the balance of the underlying collateral pool.

If an underlying loan becomes delinquent on debt service payments, the mortgage servicer transfers the loan to a financial institution known as the special servicer.

[10] See Gorton and Souleles (2007) for further details on special-purpose vehicles.

The special servicer is appointed by the most junior bondholder(s) in a first loss position to govern the loss mitigation negotiations with the troubled borrower (Fabozzi, Jacob et al., 1998). The mortgage servicer, meanwhile, begins to advance the missing payments to the trustee, who in turn remits coupon payments to the bondholders. The special servicer periodically appraises the property and uses "debt-to-equity ratio" rules to advise the mortgage servicer on how much to advance missing payments.[11] Nonetheless, the mortgage servicer may continue or discontinue advances if the mortgage servicer considers it in the best interest of the bondholders.[12] A general rule of thumb is to avoid advancing on underperforming assets that are unlikely to generate future cash flows that cover the outstanding advances.

The concern is that the special servicer faces an incentive to prolong foreclosure, and thus advances; meanwhile, the mortgage servicer may make little effort to override bad advice. Liu and Quan (2013) point out that besides a monthly servicing fee, the special servicer receives a share of the advances when holding the most junior bond (or "B-piece"). According to Gan and Mayer (2007), in over half of CMBS deals, the special servicer owns the most junior bond. To continue receiving coupon payments, therefore, the special servicer has little incentive to recommend suspending advances. A special servicer without ownership of the most junior bond could also find a long duration of advances beneficial, however, since growth in outstanding advances increases the option value of delaying foreclosure, which in turn increases the compensation in monthly servicing fees (Liu and Quan, 2013).

In principle, the mortgage servicers' discretion to suspend advances should limit advances. But suspending advances requires costly effort that could accelerate foreclosure and shorten the servicers' marginal compensation. The typical servicing agreement, outlines a compensation package for the mortgage servicer that makes delays attractive. For example, according to Section 3.11 of the PSA in the appendix, the compensation promised to the mortgage servicer for a loan that is delinquent (or in a real estate-owned status) continues to accrue until the mortgage is liquidated. Furthermore, overriding a special servicer on advances requires substantial effort

[11] In the CMBS market, these deterministic rules are commonly referred to as the Appraisal Reduction Amount and the Appraisal Subordinate Entitlement Reduction. For further details from industry professionals, see Mattingly, Jones and Sargent (2009).

[12] For precise details regarding this servicer responsibility, see in the appendix the excerpt of Section 4.03 covering a pooling and servicing agreement (PSA) for a CMBS deal arranged by Bank of America and that exemplifies the servicer's responsibilities.

on part of the mortgage servicer. As Section 4.03 (c) of the PSA in the appendix notes, a decision on limiting advances must have supporting documentation such as an appraisal of the underlying collateral.

In practice, incentives to perform in the best interest of the bondholders as a collective whole come from the threat of disciplinary action for failing to abide by the covenants in the PSA. Section 7.01(a)(i) of the PSA in the appendix, for example, suggests that failing to deposit advances could constitute a default event. Simultaneously Section 7.01(a)(viii) suggests that failing to limit advances can constitute default if the action adversely affects the interest of a particular group of bondholders. The typical PSA also includes language that guides the trustee on how to act in the event of a default by one of the financial intermediaries (e.g., Section 7.01(b) of the PSA in the appendix). The action often begins with the trustee informing the bondholders about the breach of the indentures, and may end with legal intervention.

As Section 8.01 of the PSA in the appendix exemplifies, the duties of the trustee include a fiduciary responsibility to the bondholder. The trustee is bound by the "prudent man" standard, a covenant that commissions CMBS participants to make decisions as if they held the security in their own portfolio (Schwarcs and Sergi, 2007). This oversight responsibility, moreover, is set forth in Section 8.01(a), just prior to the description of the trustee's administrative responsibility in Section 8.01(b). Thus, in this case, if an action by the mortgage servicer constitutes a default, the trustee may, at the direction of the bondholders who collectively hold at least 51 percent of the voting rights, replace the servicer. The PSA for other deals provide similar instructions. For example, according to an excerpt from the Wachovia Bank Commercial Mortgage Trust (WBCMT 2003-C7) prospectus supplement, if an action taken by the mortgage servicer constitutes a default on the servicing agreement, the trustee must notify the servicer of the incident. If the servicer does not correct the default, then the trustee must notify the investors with related bond holdings. Investors who collectively hold at least 25 percent of the voting rights may then request the trustee to remove and replace the servicer. The investors may further request that the trustee file a lawsuit against the servicer to recover damages.

3.2.2 The Optimal Contract and Hypotheses

To develop hypotheses regarding how the servicer-trustee affiliation may impact the duration of advances on a delinquent loan, consider the simple three-tier principal-agency model by Tirole (1986). The servicer is the agent, the trustee is the supervisor, and the bondholders are the principals. An agent managing a project (e.g., a delinquent commercial loan) on behalf of the principals generates the following output

$$x = \theta + e \tag{3.1}$$

that depends on the productivity parameter $\theta \in \{\underline{\theta}, \overline{\theta}\}$ where $0 < \underline{\theta} < \overline{\theta}$; and the effort e that the agent exerts at a cost of $g(e)$, which is strictly convex and twice differentiable. The productivity, effort, and cost of effort are privately observed by the agent. In exchange, the principals compensate the agent with schedule W but also hire a supervisor to monitor the agent for a fixed fee S_0.

By monitoring the agent, the supervisor has the chance to observe the true productivity parameter. Thus, there are four possible states:

1. the agent and supervisor observe $\underline{\theta}$,
2. the agent observes $\underline{\theta}$ while the supervisor observes nothing,
3. the agent observes $\overline{\theta}$ while the supervisor observes nothing, and
4. the agent and supervisor observe $\overline{\theta}$.

The likelihood of each state is p_i, where $i \in \{1, 2, 3, 4\}$. The supervisor can subsequently provide the principals a verifiable report on the true state. Since an honest supervisor has no incentive to lie, the principal effectively "buy" from the supervisor her information set at a cost of S_0, given that this amount exceeds her reservation wage. The principals therefore face the following expected profit objective function:

$$\max_{W;e} \sum p_i(\theta_i + e_i - w_i) \tag{3.2}$$

subject to the agent's individual rationality constraint

$$\sum p_i(w_i - g(e_i)) \geq u, \tag{3.2a}$$

and the agent's incentive compatibility constraint

$$w_3 \quad g(e_3) \quad w_2 \quad g(e_2 \qquad \theta), \tag{3.2b}$$

which is the binding constraint that motivates the agent to truthfully reveal the state (e.g., suspend advances). Note that u is the agent's reservation wage, and the supervision fee S_0 does not enter the principals' objective function because it is a sunk cost. The parameter $\theta \quad \overline{\theta} \quad \underline{\theta}$ is the differences between the "good" and "bad" state of productivity (e.g., outstanding advances). Tirole (1986) proves that in the optimal contract, the principal will choose the compensation structure W (or $w_3 > w_4 = w_1 > w_2$) that motivates the agent to exert high effort ($e = e_3 = e_4 = e_1 > e_2$) and report the true state of productivity ($\theta = 0$).

If there is a possibility of collusion between the agent and supervisor, then the principals will need to discourage the two from side-contracting. Tirole (1986) shows that the principals can achieve a collusion-proof contract by maximizing the following objective function:

$$\max_{S,W;e} \sum p_i(\theta_i + e_i \quad w_i \quad s_i) \tag{3.3}$$

subject to the agent's and supervisor's individual rationality constraints:

$$\sum p_i(w_i \quad g(e_i)) \quad u \tag{3.3a}$$

and

$$\sum p_i V(s_i) \quad v, \tag{3.3b}$$

respectively, where $V(\,)$ stands for the supervisor's indirect utility function, s_i stands for the supervisor's state-contingent fee, and v is the supervisor's reservation wage. An additional constraint includes the agent's incentive compatibility constraint:

$$w_3 \quad g(e_3) \quad w_2 \quad g(e_2 \qquad \theta), \tag{3.3c}$$

and the following coalition incentive constraints:

$$s_1 + w_1 \quad g(e_1) \quad s_2 + w_2 \quad g(e_2), \tag{3.3d}$$

$$s_4 + w_4 \quad g(e_4) \quad s_3 + w_3 \quad g(e_3), \tag{3.3e}$$

$$s_3 \quad s_2. \tag{3.3f}$$

Intuitively, when the supervisor observes the true state of productivity, the agent encounters the opportunity to side-contract with the supervisor at the expense of the principals. However, the coalition incentive constraints require a state-contingent compensation structure for each participant that ultimately removes incentives to collude or form a coalition. Specifically, constraints 3.3d and 3.3e discourage the supervisor and agent from concealing the true state of productivity by paying them more when they both observe the true state than if they did otherwise. Constraint 3.3f discourages the supervisor from "bribing" the agent to behave as if the state is 2 and not 3.[13]

Tirole (1986) shows that the solution to the optimization program depicted by equation 3.3 features the following characteristics:

a. $s_4 > s_1 > s_2 = s_3$

b. $w_3 \quad g(e_3) > w_4 \quad g(e_4) > w_1 \quad g(e_1) > w_2 \quad g(e_2)$

c. $s_4 + w_4 = s_3 + w_3$

d. $e \; = e_1 = e_3 = e_4 > e_2.$

The main takeaway from this solution is that the agent exerts the same amount of effort in the collusion-proof contract and the collusion-free contract. Moreover, in the case of the supervisor being risk-neutral, the principals can ensure the same profit by making the supervisor the residual claimant.[14]

For the purposes of this paper, the results of the collusion-free and collusion-proof contracts, as depicted in Tirole (1986), can be interpreted as follows: If a trustee that is affiliated with the servicer implies a skewed-incentives environment, then a contract that aligns incentives will motivate the agent (servicer) to exert effort in suspending advances on delinquent loans despite the ex ante incentives to delay suspending advances. However, if the possibility of skewed incentives from, say, merger activity between the servicer and the trustee enters into the arrangement, the initial aligned-incentives environment implied contract may fail to motivate the truthful suspension of advances.

[13] Other constraints not reported are non-binding.

[14] See the proof for proposition 3 in Tirole (1986).

The model suggests that in order to motivate both the trustee and servicer to exert high effort, the contract must be adjusted such that the trustee becomes the residual claimant of the CMBS. This would be equivalent to making the trustee the owner of the most subordinate bond in the CMBS deal. However, in practice, it is unlikely that the trustee would become the most junior bondholder. Hence, if the current pooling and servicing agreement that governs the responsibilities of servicers and trustees does not account for the possibility of collusion, the trustees and servicers may encounter an incentive to exert little effort in suspending advances. Given that the duration of advances relates inversely to the mortgage servicer's effort, a short duration of advances reveals high effort while a long duration of advances reveals low effort, holding all else constant. Thus, the following null and alternative hypotheses arise:

H_0: A servicer-trustee affiliation that develops ex-post contracting does not affect the duration of advances.

H_1: A servicer-trustee affiliation that develops ex-post contracting prolongs the duration of advances.

Evidence supporting the alternative hypothesis H_1 will imply that an arms-length trustee serves a key role in aligning the incentives between the mortgage servicer and bondholders. A lack of evidence will fail to support the monitoring role of the trustee.

3.3 Data

This section presents the data, defines the sample of interest, and describes identification of an affiliation between mortgage servicers and trustees. This section also provides summary statistics for the loans in the sample.

3.3.1 Sample Selection

I use data from the Trepp database on CMBS that feeds the "CMBSTrepp" web-based platform that credit agencies, servicers, trustees, and institutional investors use to keep track of the CMBS market.[15] The data include loan-level and deal-level

[15]For further details about this data source, visit the following website: www.trepp.com.

performance records on 111,691 private loans originated nationwide that underlay 855 conduit CMBS deals. Conduit deals consist of loans that were originated with the intention of securitization. Of particular interest are several characteristics of the loan, property, and CMBS deal. Table 3.1 displays these variables along with definitions. Note that I supplement the data with the ten-year constant maturity rate from the Center for Research in Security Prices' database of U.S. Treasury and Inflation Indexes to calculate the spread on the contract rate for each loan.

Following Wong (2018), I focus on over 17,000 loans that were transferred to the special servicer between 2000 and 2016 for missing at least 60 days of debt service payments. Figure 3.1 plots the frequency of loans that become troubled and transferred to the special servicer by year from 2000 to 2016. As Figure 3.1 shows, the frequency of transfers peaked in 2009 at about 3,000. Figure 3.2 shows, that of these loans over 10,000 were liquidated with losses; the frequency of liquidations peaked two years later in 2011 at about 2,023. Approximately 86 percent of the liquidations took place through the foreclosure process, while the rest went through a non-foreclosure avenue such as a discounted payoff in which the loan was sold to the borrower for an amount below the outstanding balance.

For the principal analysis, I set the time-variant fields such as the loan-to-value (LTV) and the debt-service coverage ratio (DSCR) to the month that the loan entered special servicing to account for changes in the economic environment.[16] I then identify and exclude each loan with a spread above 13 percent or below -11 percent, an LTV above 200 percent or below 25 percent, and a DSCR above 2.6 or below 0. The constraints represent the 1 percent tails and remove observations with obviously incorrect values. Lastly, I remove loans with missing fields, as well as loans that appear in multiple deals. The sample of interest totals 17,384 CMBS loans, representing 635 CMBS deals.[17]

[16] The LTV is measured as the outstanding balance on the loan over the appraised value of the collateral; the DSCR is measured as the annual net operating income over the debt service.

[17] Variable Construction Disclosure: Some data fields in the monthly loan performance records are missing. For example, the origination date may be missing for November but not for October or December. In such cases, I impute the missing field by taking the previously reported non-missing value. I use this imputation method on static variables that should not change from one month to the next such as the loan origination date, the contract rate (for fixed-rate mortgages), the loan amortization type, the property type, the total months in the lockout provision, and an indicator for the presence of yield maintenance provisions. If the field for the remaining term is missing, I impute it by taking the previously reported remaining term and subtracting from the value the number of months that have passed. The loan age is calculated as the number of

To gauge the representativeness of the sample, Table 3.2 compares and contrasts the summary statistics of the collected variables (set at the securitization date) according to whether the loans appear in the sample. The selected loans tend to display attributes similar to those of the other conduit loans in the Trepp dataset. Although the mean difference in the attributes between the two groups tend to be statistically significant, the differences appear to be economically meaningless. A couple of exceptions are (1) the LTV and (2) the loan balance. Table 3.2 reveals that at securitization, the sample of liquidated loans had a higher average LTV ratio, and a higher loan amount, than in the complement sample. This is not surprising. Epperson et al. (1985) and Ambrose and Sanders (2003) show that the value of a borrower's option to default increases with the LTV. Therefore, the sample this paper focuses on is representative of the population of private conduit U.S. CMBS loans.

3.3.2 Servicer-Trustee A□liations

I use the deal-level records to determine whether the mortgage servicer and trustee administering the loan's deal are the same institution or are co-dealers. The Trepp database periodically updates the fields for the financial intermediaries administering the loans. Additionally, I adjust the data to reflect three events: when LaSalle became a Bank of America subsidiary in October 2007, when Wachovia became a Wells Fargo subsidiary in December 2008, and when Bank of America sold its trusteeship business to U.S. Bank at the end of the third quarter of 2011. I then construct two dummy variables: Same and Co-dealing. If the mortgage servicer and trustee are the same institution while the loan is delinquent (i.e., in special servicing), then the Same dummy variable has a value of one; it is zero otherwise. If the mortgage servicer and the trustee are working together on another loan but with reverse roles during the loan's delinquency, then the Co-dealing dummy variable has a value of one; it is zero otherwise.[18]

months between the individual loan's origination and securitization date. I compute the LTV as the most recently reported appraised value over the beginning loan balance. I compute the DSCR as the most recently reported annual net operating income over the annual debt service. If the net operating income is missing, I use the most recently reported net cash flow instead.

[18] For 395 loans with a servicer-trustee a□liation, the servicer-trustee a□liation changed during the time that the loan was delinquent. The main results do not rely on this set of loans. Removing these loans from consideration does not significantly a□ect the analyses presented in Sections 3.4 or 3.6.

For context, Table 3.3 tabulates the CMBS deals by the servicers that LaSalle initially oversaw in Panel A and the trustees that initially oversaw Wachovia in Panel B. As Table 3.3 shows, 268 deals had LaSalle as the trustee at securitization, while 146 deals had Wachovia as the mortgage servicer at securitization out of the 855 private CMBS deals in the Trepp dataset. LaSalle does not operate as a mortgage servicer and Wachovia does not operate as a trustee. As a result, these deals initially held no servicer-trustee affiliations. However, among the LaSalle CMBS deals, 12 were initially serviced by Bank of America, 46 by Wachovia, and 65 by Wells Fargo. Meanwhile, among the Wachovia CMBS deals, 46 were initially overseen by LaSalle, and 51 by Wells Fargo. Consequently, after the mergers, servicer-trustee affiliations developed across a total of 174 CMBS deals.

Table 3.4 tabulates the troubled loans in the sample according to the type of affiliation between the mortgage servicer and trustee. Focusing on the loans that initially had LaSalle as the trustee or Wachovia as the mortgage servicer, Panel A suggests that almost 60 percent of the liquidated loans were affected by the LaSalle or Wachovia acquisition. Note that 10,412 loans initially had LaSalle as the trustee or Wachovia as the mortgage servicer at securitization. Among these loans, 2,512 ex post securitization loans had a single firm serving as the mortgage servicer and trustee while delinquent. Similarly, 2,705 loans had co-dealing institutions while delinquent. Panels B and C of Table 3.4 tabulate the loans by holding constant the mortgage servicer or the trustee assigned during the loans' period of delinquency. Panel B shows that Bank of America and Wells Fargo served as the mortgage servicer for 44 percent of the sample, while Panel C shows that they also served as the trustee for 71 percent of the sample. These two banks seem to drive the variation in servicer-trustee affiliations among loans in the sample.

Figure 3.3 graphs the sample of loans by transfer year, segmenting the proportion of loans by the servicer-trustee affiliation type. Notably, most loans with servicer-trustee affiliations were transferred to special servicing after 2008; after the acquisitions of LaSalle and Wachovia. A large portion of the loans that were transferred in 2009 through 2011 exhibit either a direct (Same) or indirect (Co-dealing) servicer-trustee affiliation while the rest have an arms-length trustee. The goal of the analysis to follow in Section 3.4 will be to compare the outcome of loans with a direct or indirect servicer-trustee affiliation to comparable loans with arms-length trustees, conditioning on observable qualities.

3.3.3 Summary Statistics

Table 3.5 reports summary statistics for the full sample of troubled loans according to the type of affiliation between the mortgage servicer and trustee. On the date that a loan entered special servicing, the typical mortgage had a remaining term of 57 out of 120 months and an outstanding balance of $11.3 million, which is about 4.2 percent below the average outstanding balance at securitization. The average DSCR at the transfer date was 0.75, or half its average at securitization (as shown in Table 3.2). Meanwhile, the average LTV was 70 percent, implying the availability of positive equity on the collateral. Together, the statistics suggest that the average loan likely fell delinquent on payments as the operating cash flows from the underlying collateral fell below the debt service due.

Slight differences exist among the loans according to servicer-trustee affiliation. For instance, loans with an affiliated trustee had lower DSCR than loans with a trustee held at arm's length. Moreover, the average CMBS deal with an affiliated trustee seems to have included rather large loans relative to CMBS deals with a trustee held at arm's length. The average CMBS deal with a single firm acting as both the mortgage servicer and trustee held over $2.5 billion in volume. In contrast, the average CMBS deal with a trustee at arm's length held over $1.4 billion in volume. In fact, at the loan-level, the average balance for loans with a trustee at arm's length was about $9.3 million, while it was $17 million when the mortgage servicer was also the trustee. Since the loans that underlie deals across server-trustee affiliation type vary in their attributes, a multivariate analysis is necessary to understand the impact of servicer-trustee affiliation on the duration of advances.

3.4 Empirical Analysis

This section examines the impact of servicer-trustee affiliation on the duration of advances. I begin by examining the duration of advances on loans with liquidation losses using univariate statistics. I then discuss the baseline regression model for the duration of advances. Finally, I present results showing that the duration of advances tends to be longer if an affiliation between the mortgage servicer and trustee exists.

3.4.1 Descriptive Analysis

For each delinquent loan, I observe when the loan first enters special servicing and count the months until advances are suspended, the loan is transferred back to the mortgage servicer, or the loan reaches liquidation.[19] Table 3.6 displays differences in the summary statistics for the duration of advances, outstanding advances, and losses according to the relationship between the mortgage servicer and trustee. Among the sampled loans, the average duration of advances lasted about two years if the trustee was affiliated with the mortgage servicer. If the two banks were at arm's length, the average duration of advances was about five months shorter. Given a delay in suspending advances, the outstanding advances grow naturally. Hence, consistent with a lengthy duration of advances, the average outstanding advances at liquidation were approximately \$649 thousand if the mortgage servicer and trustee were the same or \$550 thousand if they were co-dealing. In contrast, the average outstanding advances if a trustee was held at arm's length were \$410 thousand at liquidation. Overall, the univariate statistics reveal a positive correlation between servicer-trustee affiliation and the timing of suspending advances.

3.4.2 Baseline Regression

I compare the duration of advances on loans that feature a servicer-trustee affiliation during their period of delinquency (the treatment group) to that of loans with an independent trustee throughout their entire time delinquent (the control group). Since observable differences exist among the two groups, the model must account for those differences by only using attributes that achieve a value at the same time or before the assignment of the treatment variable(s). In this way, the "bad control" problem can be avoided (Angrist and Pischke, 2008).

Hence, I estimate at the loan level the impact of servicer-trustee affiliations on the duration of advances using an ordinary least-squares (OLS) regression. The baseline model takes the following form:

$$\text{Duration of Advances}_i = \delta_1 \text{Same}_{Td} + \delta_2 \text{Co-dealing}_{Td} + X_{it}\beta + \tau_t + \kappa_d + \varepsilon_i \quad (3.4)$$

[19] I use Trepp's "nonrecover" and "prepayment code" fields to identify when advances are suspended. When a loan is classified as having "non-recoverable" advances, the subsequent advances are reduced or suspended completely. I provide further details about this process in Section 3.6. For simplicity, the sample excludes observations of re-defaults.

where ε_i is a an error term corrected for heteroskedasticity using robust standard errors clustered according to CMBS deals for loan i. The parameters τ_t and κ_d stand for fixed effects for the year-month (t) that the loan is transferred to special servicing and the loan's CMBS deal (d), respectively. Meanwhile, Same_{Td} and Co-dealing_{Td} are the dummy variables of interest; the δ_1 and δ_2 coefficients represent the point estimates of interest, as they reveal whether a delay in suspending advances forms when the loan lacks an arm's-length trustee. Since the dummies of interest (i.e., Same/Codealing) depend on the delinquency window of the loan and changes to the servicer-trustee affiliation status, the dummies of interest vary within time and deal. The parameter β is a vector of coefficients that corresponds to the matrix of time-varying baseline controls represented by X_{it}. The baseline controls account for factors that may impact the expected liquidation value or timing of the mortgage including loan, property, and deal characteristics.

Specifically, the loan characteristics include the outstanding balance, remaining term, and spread between the contract rate and the ten-year Treasury constant maturity rate at the time of transfer. This category also includes indicators of whether the loan features interest-only debt service payments, a balloon payment, or a full amortization schedule. It also includes the loan's vintage (or age in months from origination to securitization), the LTV ratio, and the DSCR at the time of transfer. Note that I let the vintage be non-linear by adding a squared version of the vintage to equation 3.4. According to Agarwal et al. (2017), the vintage helps control for the adverse selection concern about loan quality at securitization. I also include a categorical variable to account for the loan's origination year.

As in Ambrose, Sanders and Yavas (2016), I include prepayment penalty characteristics such as the lockout length provision in months, as well as an indicator for a yield maintenance prepayment penalty covenant in the mortgage note.[20] Property characteristics include the number of properties that collateralize the loan, the leading property type, and the property location or state fixed effects. The CMBS deal characteristics include the current outstanding balance of the deal at the loan's transfer date and deal fixed effects. The deal characteristics control for the resources available to the mortgage servicer for the continuation of advances. An

[20] The lockout provision indicates the number of months that the borrower may not prepay/liquidate a loan. The yield maintenance is a prepayment penalty that requires the borrower to pay the bondholders the foregone interest payments due to prepayment. For further background about these two variables, see Fabozzi, Jacob et al. (1998).

over-collateralized pool, for instance, produces interest cash flows that exceed the coupon cash flows that could function as a sinking fund to support advances on a non-performing loan without taxing the proceeds of the collateral pool. The deal fixed effects capture observable and unobservable time-invariant attributes specific to the loan's CMBS deal.

Since the identification of deals that feature a servicer-trustee affiliation arises from merger activity, a concern is that the merger activity itself may influence the coefficient estimates for the average treatment effect of the Same or Co-dealing dummy. As discussed in Section 3.4, Bank of America took over LaSalle, the trustee for 44 percent of the full sample. Meanwhile, Wells Fargo took over Wachovia as the mortgage servicer. Hence, I restrict the sample to loans that were affected by the LaSalle or Wachovia acquisition. The identification assumption is that delinquent loans are overseen by a trustee with a randomly chosen affiliation status, once conditioning on the baseline controls.

3.4.3 Results

Table 3.7 presents point estimates that correspond to equation 3.4. The first column shows a positive relation between the duration of advances and each type of servicer-trustee affiliation (i.e., Same and Co-dealing). The advances on missing payments for delinquent loans last about five months longer for deals that have the same mortgage servicer and trustee than for loans in deals with a trustee at arm's length. Likewise, co-dealing activity between the two banks prolong advances by about five months. Columns (2) to (6) incorporate the baseline controls, which include loan, property, and deal characteristics, as well as fixed effects for the loan's transfer month-year and property's location.[21] Columns (3) to (5) incrementally incorporate fixed effects for the special servicer, the mortgage servicer, and the trustee appointed at the loan's securitization date, respectively. Finally, column (6) replaces the fixed effects for the financial intermediaries with fixed effects for the CMBS deal.[22] With each specification, the point estimates of interest remain positive and significant.

[21] In unreported regressions, I use fixed effects for the metropolitan statistical area (MSA) instead of state fixed effects to control for property location. Though I obtain similar results, I use state fixed effects for the rest of the analysis since the MSA field is less populated than the State field.

[22] Perfect collinearity exists between the fixed effects for the deal and the financial intermediaries and thus cannot keep the fixed effects for both the financial intermediaries and deal.

Using the full baseline specifications, they reveal a coefficient for the Same or Co-dealing dummy of 5.9 months or 1.4 months, respectively.[23]

Table 3.8 provides estimates of equation 3.4 for the two subsamples (not mutually exclusive) that compare loans within observably similar deals. The goal is to exploit the variation in affiliation types among deals that were affected by the same acquisition activity. Column (1) uses loans in deals that initially employed LaSalle as the trustee. Column (2), on the other hand, uses loans that initially employed Wachovia as the mortgage servicer. However, the conclusions remain unchanged across each subsample as the point estimates for Same and Co-dealing tend to remain positive and significant. In fact, the coefficient estimates are slightly larger than estimated using the baseline specifications. For example, the point estimates suggest that a direct servicer-trustee affiliation delays advances by up to ten months on loans affected by the Wachovia acquisition. The previously reported baseline estimates in Column (6) of Table 3.7, therefore, provide conservative estimates of the effect of affiliation on the duration of advances.

3.5 What explains increases in the Duration of Advances?

Section 3.4 finds strong and positive coefficients, implying that long durations of advances are permitted if the trusteeship is held by the mortgage servicer or if the trustee fosters an indirect affiliation with the mortgage servicer. The results remain even when incorporating constant time-sensitive controls including loan, property, and deal characteristics, as well as a rich set of fixed effects for the time of transfer, the financial intermediaries administering the loans, and CMBS deals. They also hold when I compare advances on missing payments for delinquent loans affected by the same acquisition. However, the OLS model imposes a linearity assumption between affiliations and the duration of advances. Thus, I examine in this section alternative specifications that relax the linearity assumption. The robustness checks include the use of propensity score matching and hazard modeling. I also examine

[23] Though it is not reported here, I ran the column (6) regression using robust standard errors with a two-way cluster accounting for the loan's deal and the loan's quarter-year transfer date. The significance of the dummies of interest (Same/Co-dealing) remained unchanged. I also find similar results when estimating them while excluding loans that became delinquent on or before 2006 when little or no servicer-trustee a□liations are observable.

plausible causal mechanisms affecting the duration of advances, including transition delays, coordination difficulties, and the heterogeneity in the workloads of the banks.

3.5.1 Propensity Score Matching

Since loans are not randomly assigned to deals with or without trustees at arm's length, I implement propensity score matching to compare observably similar loans to each other as a way to reduce concerns of endogeneity. To do so, I construct a treatment dummy that takes the value of one if an affiliation between the mortgage servicer and trustee exists (i.e., Co-dealing, Same), and zero otherwise. For every loan in a deal affected by the LaSalle (or Wachovia) acquisition with an affiliated trustee, I identify an observably similar loan in another deal affected by the LaSalle (or Wachovia) acquisition that instead has a trustee at arm's length. I use propensity score matching to find counter-factual observations. According to Rosenbaum and Rubin (1985), matching on propensity scores mimics random sampling, which theoretically eliminates selection bias. Upon matching, the implicit assumption is that loans enter deals with an affiliated trustee at random, conditional on observable loan attributes. Demiroglu and James (2012), adopting a similar approach to assess the quality of residential loans, point out that this assumption is consistent with the observations by Gorton and Souleles (2007).

To obtain propensity scores, I fit the likelihood that a loan belongs to the treatment group using the following probit regression

$$Pr(\text{Treatment}_i = 1 | Z_{it}, \eta_t) = \quad (Z_{it}\gamma + \zeta_t + \epsilon_i) \tag{3.5}$$

where is the cumulative density function, ϵ_i is an error term, and Z_{it} is a matrix of loan- and property-level attributes.[24] The controls in Z_{it} also include fixed effects for the property's state, as well as the loan's origination year. The parameter ζ_t stands for the loan's transfer month-year. Note that equation 3.5 does not include fixed effects for the deal since they perfectly predict treatment once controlling for time. Column (1) of Table 3.9 reports the probit estimates using the sample of loans affected by the LaSalle acquisition, while column (2) reports the probit estimates using the sample of loans affected by the Wachovia acquisition.

[24] To implement the matching procedure, I use the PSMATCH2 command in STATA.

For each treatment loan, the counter-factual loan is the nearest neighbor that holds the closest propensity score value. I allow matching to take place with replacement. Table 3.10 displays the summary statistics of the covariates in equation 3.5, revealing balanced treatment and control groups in which the treatment group includes loans with an affiliated trustee and the control group includes counter-factual loans with a trustee at arm's length. As shown by Panels A and B in Table 3.10, the majority of the loan and property characteristics across the treatment and control groups are statistically similar to each other irrespective of the acquisition under consideration. Next, using the balanced treatment and control groups, I re-estimate the baseline regression (equation 3.4).

Table 3.11 provides the results for the LaSalle acquisition in column (1) and for the Wachovia acquisition in column (2). Both trials reveal results consistent with the earlier findings. In fact, the coefficients of the treatment variables (i.e., Same or Co-dealing) imply that the marginal impact of an affiliation between the mortgage servicer and trustee causes a longer duration of advances than previously estimated.

3.5.2 Hazard Modeling

Mortgage servicers likely consider the time that a loan has been delinquent before making a decision regarding whether to suspend advances supporting its missing payments. Hence, to account for the delinquency time, this section estimates the *hazard* that the mortgage servicer suspends advances. A hazard function specifies the risk that the mortgage servicer suspends advances during the next infinitesimally small period given the time the loan has been delinquent. Specifically, the hazard function, conditional on the loan's time delinquent t, takes the form

$$h_i(t) = b_i(t)\exp(\lambda_1 \text{Same}_{Td} + \lambda_2 \text{Co-dealing}_{Td} + X_{it}\beta_0 + \tau_t + \kappa_d) \tag{3.6}$$

where $b_i(t)$ stands for the baseline hazard rate of loan i, X_{it} stands for a matrix of the baseline controls, and Same and Co-dealing represent the dummy variables of interest. According to equation 3.6, an affiliation between the mortgage servicer and the trustee represents a proportional change of size λ_1 or λ_2 in the hazard of suspending advances.

To prevent economic outcomes from influencing the results, I consider the

hazard of suspending advances within $h \in \{12, 24, 36, 48\}$ months. This approach is similar in spirit to those of studies that focus on foreclosure or modification decisions taken by mortgage servicers (e.g. Piskorski, Seru and Vig, 2010; Agarwal et al., 2011; Adelino, Gerardi and Willen, 2013). Thus, using the terminology of hazard modeling, a loan "fails" if the servicer suspends advances within h months; otherwise, the loan "survives" and is treated as censored.

Table 3.12 reports the λ_k coefficient estimates of the hazard function according to censorship window using the Cox Proportional Hazard model, where $k \in \{1, 2\}$.[25] The marginal hazard ratio can be derived by taking the exponent of the lambda coefficient estimate. The coefficient estimates for each censorship window are negative for both affiliation dummies (Same/Co-dealing). Thus, the hazard ratios for both dummies fall below one, indicating that the likelihood of suspending advances decreases if a servicer-trustee affiliation forms during the time that a loan is delinquent. Overall, the results support the interpretations of the estimates reported in the Section 3.4.

3.5.3 Transition Delays and Coordination Difficulties

Column (1) in Table 3.13 includes two dummy variables that signal when multiple mortgage servicers or trustees participate in the deal. The Trepp data report up to four mortgage servicers, four special servicers, and two trustees per deal. Typically, one of the institutions is assigned as the principal institution for a specific role. Other institutions arrive from subcontracting with the principal institution. If the deal has multiple intermediaries for multiple roles, the chance that the deal realizes a confounding relation among the employed financial intermediaries increases. Moreover, having multiple participants may impact decisions on advances for loans. For example, multiple financial intermediaries could decentralize the management of the loans in deals by considering the particular expertise of institutions that allows the intermediaries to better meet the needs of certain loans. Alternatively, multiple financial intermediaries may impact the coordination among the institutions and cause delays in decisions about advances. However, as shown in column (1), the participation of multiple mortgage servicers or trustees does not significantly impact

[25] Although the model includes the baseline controls, it does not use deal-level fixed effects because the high dimensional of more than 500 dummy variables does not allow the model to converge.

the duration of advances. Furthermore, the positive and significant correlations between the Same/Co-dealing dummies and advances persist.

Column (2) of Table 3.13 adds to the baseline regression indicators of whether the mortgage servicers and trustees are different from the ones assigned at securitization. Interruptions in the operational structure across mortgage-backed securities intuitively correlate with the presence of a trustee held at arm's length since the replacement of a mortgage servicer or trustee sets off observable relations between the two intermediaries. Having a new financial intermediary, moreover, may foster transition costs that impact how the mortgage servicer chooses to advance missing payments. Thus, such interruptions may explain the impact of the Same/Co-dealing dummies on the duration of advances. But as column (2) shows, transitions/interruptions do not seem to influence the duration of advances or the core interpretation of the baseline results.

3.5.4 Large Institutions and Workloads

Agarwal et al. (2017) find that intermediary-specific factors and preexisting organizational capabilities influence the decisions servicers make regarding delinquent loans. For example, small servicers might not have access to credit lines (or other resources) that support advances on missing payments and consequently suspend advances much sooner than large servicers would. Moreover, large servicers that work on many CMBS deals simultaneously could have limited attention to pay to individual loans. If the size, workload, or other idiosyncrasies correlate with the likelihood that a mortgage servicer and trustee have an affiliation, then the differences in the advances could reflect idiosyncratic differences in the institutions administering the given loan.

Column (1) of Table 3.14 adds proxy variables representing the mortgage servicer's and trustee's workload. Specifically, the workload proxy variables represent the number of CMBS deals the servicer (or trustee) is working on as either a servicer or trustee at the time of the loan's transfer. The workload proxy variables vary across institutions and time. Bank of America, for example, was working on 44 deals in 2009, but it had 280 in 2010. Meanwhile, Wells Fargo was working on about 380 deals in 2007 and 435 in 2011. Column (1) shows that the duration of advances decreases by 0.006 months per deal that the servicer manages.

The trustee's workload similarly influences the mortgage servicer's decision to suspend advances. Nevertheless, the Same/Co-dealing dummies continue to correlate positively with the duration of advances and with larger coefficients that overcompensate for the marginal impact of the workloads. Column (2) interacts the workload variables with the dummy variables of interest, but this specification does not eradicate the effect of severing an arm's-length relation on the duration of advances.

3.6 Liquidation Losses and Economic Implications

This section considers the economic impact of affiliation on actual losses that bondholders realize from troubled loans at liquidation. In particular, I examine the liquidation loss rate, which is calculated as the total liquidation losses over the outstanding loan balance in the month before liquidation. Troubled loans that cure or are liquidated with no losses have a loss rate of zero. Demiroglu and James (2012) use a similar measure in an analysis of how an affiliation between the mortgage servicer and the originator affects the quality of residential mortgages. Wong (2018), in testing the impact of self-dealings by special servicers, also focuses on loss rates at liquidation.

Table 3.6 reports the average nominal losses and the loss rate. As Table 3.6 shows, the average losses when two institutions are affiliated total about \$3.1 to \$3.6 million; they are about \$2 million less when the trustee of the loan is held at arm's length. The loss rate per dollar of outstanding debt before liquidation translates to \$0.27 for Same, \$0.38 for Co-dealing, and \$0.22 for Arm's-Length. Figure 3.4 displays the annual volume of related liquidation losses and outstanding advances at liquidation in billions. It shows that most losses were realized after 2009, when they often peaked at more than \$6 billion per year with advances accounting for about 10 to 25 percent of the total losses.

To evaluate the marginal impact of severing the arm's-length trustee relation in a multivariate setting, I estimate the following model

$$\text{Loss Rate}_i = \gamma_1 \text{Same}_{Td} + \gamma_2 \text{Co-dealing}_{Td} + X_{it}\beta + \tau_t + \kappa_d + \epsilon_i \qquad (3.7)$$

where ϵ_i is an error term and γ_k stands for the marginal loss rates attributed to an

affiliation between the mortgage servicer and trustee. I use the same regressors for X_{it} as those in equation 3.4, though I exclude the log loan amount.

Table 3.15 provides OLS regression estimates using the loss rate as the dependent variable and the Same/Co-dealing dummies as the independent variables of interest. Column (1) uses the full sample. Columns (2) and (3) examine the loss rate exclusively within loans affected by the LaSalle and Wachovia acquisitions, respectively. Finally, columns (4) and (5) repeat the previous two regressions but use the balanced subsamples that were constructed using propensity score matching in Section 3.5.1.

Results in column (1) suggest that, on average, the loss rate on loans with a bank serving as both the mortgage servicer and trustee is about \$0.04 per dollar of outstanding debt higher than the loss rate on loans with a trustee at arm's length, while the marginal impact is \$0.07 when co-dealing. The coefficient on Same in column (3) reverses signs but it is not significant at the conventional levels. The loss in significance may be a power issue since the makeup of observations in the LaSalle sample where Bank of America is both the servicer and trustee constitute less than 4 percent (see Table 3.4). However, the results for co-dealing remain positive and significant at the 1 percent level within the acquisition-affected subsamples. Moreover, the predicted marginal impact of either an indirect affiliation on the loss rate among the Wachovia-affected loans is positive and significant whether using balanced samples found from propensity score matching in Section 3.5.1. Column (3), for example, suggests that the loans affected by the Wachovia acquisition incur an increase in the loss rate of \$0.09 per dollar of outstanding debt when the trustee affiliated with the mortgage servicer through co-dealing. Meanwhile, column (5) suggests that both affiliation types significantly influence the loss rate among the loans that initially had Wachovia as the servicer.

Table 3.16 provides a real estate perspective on the losses by dividing the sample according to U.S. Census Region. The purpose is to track the impact of the servicer-trustee affiliations within the United States. The table suggests that loss rates are driven by loans with collateral in the Midwest or South. For instance, in the Midwest (column (2)), when the servicer is also the trustee, the loss rate increases by up to \$0.13 per dollar of outstanding debt, or \$0.11 if the institutions are co-dealing. Meanwhile, in the West (column (4)), only co-dealing servicer-trustee affiliations appear to influence the loss rate significantly. The strongest

geographical influence coincides with the retail bank locations where LaSalle had a market presence prior to the merger activity: the Midwest.

To gauge the average economic impact of the marginal increase in the loss rate due to the lack of an arm's-length trustee relation, I use a back-of-envelope approach. First, I calculate the aggregate marginal losses from an affiliation between the mortgage servicer and trustee as follows:

$$
\begin{aligned}
&= \gamma_1 \quad \overline{\text{Balance}}_1 \quad \text{Loans}_1 + \gamma_2 \quad \overline{\text{Balance}}_2 \quad \text{Loans}_2 \\
&= 0.039 \quad \$17,050 \text{ mil.} \quad 2,512 + 0.72 \quad \$14,694 \text{ mil.} \quad 2,705 \\
&\quad \$4.53 \text{ Billion}
\end{aligned}
$$

where $\overline{\text{Balance}}_k$ stands for the average loan balance of loans with a type k affiliation, Loans_k stands for the number of loans with a type k affiliation, and γ_k stands for the marginal loss rate for a loan with a type k affiliation where $k \in \{1, 2\}$. A type 1 affiliation is where the mortgage servicer and trustee are the same firm. A type 2 affiliation is where the mortgage servicer is co-dealing with the trustee. According to this estimate, a direct or indirect affiliation accounts for nearly $4.53 billion in losses, explaining approximately 24 percent of the total losses by loans affected by an affiliation between the trustee and mortgage servicer.[26]

3.7 Distortions in Bond Returns

Advances distinctly impact the cash flows to bondholders in differing tranches. While advances support the continuation of coupon payments to all the bondholders by using a credit line, the sale proceeds of the loan's collateral are netted of the outstanding advances along with interest on the advances due to the servicer at liquidation of a delinquent loan. Moreover, the remaining proceeds are used to pay off any accrued interest that has not been paid to the investors, including those in the most junior classes. In essence, all the expenditures associated with advances

[26] Using Tables 3.5 and 3.6, the total losses by affected loans can be inferred as follows:

$$
\begin{aligned}
&= \overline{\text{Losses}}_1 \quad \text{Loans}_1 + \quad \overline{\text{Losses}}_2 \quad \text{Loans}_2 \\
&= \$3,092 \text{ mil.} \quad 2,512 + \$3,648 \text{ mil.} \quad 2,705 \\
&\quad \$19.1 \text{ Billion}
\end{aligned}
$$

where $\overline{\text{Losses}}_k$ stands for the average losses of a loan with a type k affiliation.

are paid off with priority over recovering the principal of the senior class. As a result, a lengthy duration of advances (across several loans) can create potential wealth transfers among the senior, mezzanine, and junior bond classes.[27]

Given that lengthy durations of advances potentially distort the cash flows to bondholders, I examine how the returns across bond tranches correlate with an affiliation between the servicer and trustee. I begin by using Trepp's data on CMBS bond tranches from 1998 to 2016. Although I do not observe the returns to individual bonds, the bond tranche data provide the aggregate cash flows to entire classes of bonds for each of the 855 conduit CMBS deals in the Trepp dataset on a monthly basis. A benefit of focusing on these data is that the returns on bond tranches reflect cash flows that originate not only from loans that became troubled and were sent to special servicing but also from loans that perform normally. In other words, the performance of the full population of conduit CMBS loans in the Trepp data is taken into account.

Table 3.17 reports the frequency of bond tranches in the Trepp data (that depend on private U.S. CMBS deals) by their initial standardized rating (score) at issuance. Since each tranche can have a rating from one or more credit rating agencies (i.e., Moody's, Standard & Poor's, or Fitch), each of which has a different rating scale, I find the top rating for each tranche and normalize the top rating as in Cheng and Neamtiu (2009). This approach yields 19 groups in which a score of 1 indicates the highest rating and a score of 19 indicates that the tranche is unrated. Most of the bond tranches either have the Highest Grade (5,765) or no rating (3,400). The bond tranches with the Highest grade represent the senior bond classes, the bond tranches with the unrated grade represent the junior bond classes, while the rest represent the mezzanine bond classes.

Table 3.18 reports descriptive statistics about the panel observations on bond tranches. The highly rated bond tranches have a mean coupon of around 3.86 percent, while the unrated bond tranches have a mean coupon of about 5.32. Moreover, the highly rated bond tranches account for an average balance of about $634.59 million, while the unrated bond tranches have an average balance of $226.16. The bond tranches, representing the mezzanine class, have average balances that range from $7.95 to $180.96 million.

Using the time-series of these tranches, I compute the monthly return r_{bt} for

[27] For other bond payment schemes, see Fabozzi (2009).

each bond tranche b as the interest (INT_{bt}) and principal ($PRIN_{bt}$) cash flows plus the outstanding balance (BAL_{bt}) at time t over the outstanding balance in the previous month ($BAL_{b,t\ 1}$) minus one; that is, $r_{bt} = \frac{INT_{bt}+PRIN_{bt}+BAL_{bt}}{BAL_{b,t-1}}$ 1. The current outstanding balance reflects losses that the bond tranche realizes, while the interest or principal payments reflect advances on under-performing assets, if any. Using the bond return as the dependent variable, I then fit the following panel regression model

$$r_{bt} = \sum_{k=1}^{19} \theta_{1,k}\text{Same}_{dt} \quad 1[k] + \sum_{k=1}^{19} \theta_{2,k}\text{Co-dealing}_{dt} \quad 1[k] + W_{dt}\beta + \tau_t + \zeta_b + \epsilon_{bt} \quad (3.8)$$

where ϵ_{bt} is an error term. The parameter τ_t stands for month-year fixed effects, and ζ_d stands for bond tranche fixed effects. This panel setting eliminates the effects of any unobservable bond tranche-specific or time-specific attributes. The bond tranche fixed effect, therefore, control for attributes such as the coupon and balance at issuance; the time fixed effects control for contemporaneous changes in the interest rate environment including the risk free rate and benchmark rates. To account for CMBS deal specific, time-varying, attributes, the matrix W_{dt} contains a rich set of deal-level controls that vary over time for each deal d. Specifically, the monthly deal-level controls include the log outstanding balance, current loan count, gross weighted average coupon, weighted average DSCR, weighted average LTV, share of loans with yield maintenance, share of loans in the lockout period, count of loans with a prepayment penalty, top share of collateral located in a single state, top loan amount share of outstanding balance, share of warehouse collateral, share of industrial collateral, share of office collateral, share of multifamily collateral, and share of other property type collateral.[28]

Finally, the independent variables of interest: Same and Co-dealing. Same_{dt} takes a value of one if the bond tranche's mortgage servicer and trustee for CMBS deal d are the same firm at time t; it is zero otherwise. Similarly, Co-dealing_{dt} takes a value of one if the bond tranche's mortgage servicer and trustee for CMBS deal d are co-dealing at time t; it is zero otherwise. These dummy variables are

[28] I exclude observations with missing fields or a return that is above 100 percent or below -100 percent. I also exclude observations of bond tranches with a rating score of 17 or 18 due to their scarcity of panel observations. The sample consists of 15,019 unique bond tranches that extend to a panel dataset of 1,210,053 observations.

interacted with the initial rating of the bond tranche. The interactions allow for the average treatment effect of a servicer-trustee affiliation to vary according to the initial rating of the bond tranche. Note that Table 3.17 provides a key for the ratings according to the various credit rating agencies.

Table 3.19 reports the results. Note that the bond return is reported as a percentage. The results suggest that affiliation affects the return of various bond tranches differently. In particular, the results reveal a trade-off in returns across the bond tranches when the trustee becomes the servicer or when the servicer begins to co-deal with the trustee. The pattern suggests that affiliation significantly benefits bonds in the mezzanine tranches at the expense of the most senior bondholders or junior bondholders. For example, the average monthly returns increase for medium-grade bond tranches but decrease for high- or low-grade bond tranches when the servicer and trustee are co-dealing. Most coefficients of the interaction terms are statistically significant at the conventional levels. A similar pattern emerges from the interactions when the servicer and trustee are the same firm. Overall, the results suggest that failure to hold a trustee at arm's length shuffles the returns that bondholders obtain.

3.8 Conclusion

This paper explores the effects of affiliation between a mortgage servicer and trustee on the duration of advances by using a dataset of securitized commercial loans. Using recent acquisitions by Bank of America and Wells Fargo to achieve identification, I find that when the mortgage servicer and trustee are the same or co-dealing—arrangements that undermine the system of checks and balances in the commercial foreclosure process—the duration of advances tends to lengthen.

For instance, a mortgage servicer with a direct affiliation can take an additional five months to suspend advances on a delinquent loan relative to cases in which the deal's trustee is held at arm's length. The results also reveal that the average liquidated loan in a deal with a servicer-trustee affiliation incurs at least $368,000 in additional losses (a marginal loss rate of $0.04 per dollar of outstanding debt). In aggregate, marginal losses account for approximately $4.53 billion in capital losses from loans liquidated from 2001 to 2016. The losses explain approximately 24 percent of the total capital losses produced by loans that lack a trustee at arm's

length. A model using tranche-level returns to bonds suggests that a servicer-trustee affiliation also correlates strongly with distortions to the returns for bondholders, primarily benefiting bondholders in the mezzanine tranches relative to bondholders in the senior or junior tranches. The results persist after controlling for loan, property, and deal characteristics along with a rich set of fixed effects. They also hold when accounting for various robustness checks, including propensity score matching and hazard modeling.

The findings imply that the trustee's independent monitoring role adds value to the securitized lending process. Furthermore, they provide a favorable view of federal regulations such as the Trustee Indenture Act of 1939 and the Tax Code of 1986 that generally require an independent trustee to oversee bondholder rights. Recent public debates have addressed the need to continue having an independent trustee, particularly since trustees are often passive in monitoring for infringements on bond indentures. Exceptions to regulations on having a trustee at arm's length resulted in unanticipated affiliations between the servicer and trustee in several deals during the period following the Great Recession. As a result, this paper is able to reveal the drawbacks of undermining the trustee's role as an independent monitor.

Table 3.1. Variables and Descriptions

Dependent Variables	
Duration of Advances	The number of months the master servicer does not suspend advances
Outstanding Advances	The outstanding P&I advances at liquidation
Loss Rate	The losses realized at liquidation divided by the outstanding balance before liquidation
Covariates of Interest	
Same	1 if the mortgage servicer and trustee are the same firm, and 0 otherwise
Co-dealing	1 if the mortgage servicer co-deals with the trustee, and 0 otherwise
Pool Controls	
Log Pool Balance	The remaining outstanding balance of the pool at default
Loan Controls	
Debt Service Coverage Ratio	The net operating income divided by the debt service at default
Loan-to-Value	The loan amount divided by the appraised property value at default
Log Loan Balance	The natural log of the remaining loan balance at default
Remaining Term	The remaining number of months in the mortgage term at default
Spread	The contract rate less the 10-year Treasury constant maturity rate at default
Full Amortization	1 if the loan has an amortization schedule, and 0 if it has a balloon payment
Interest Only	1 if the loan is interest only payments, and 0 otherwise
Prepayment Penalty	1 if the loan features a yield maintenance prepayment penalty, and 0 otherwise
Lock-out Months	The number of months in the lockout provision in the event of prepayment
Vintage	The age of the loan at securitization in months
Property Controls	
Multiple Properties	1 if multiple properties serve as collateral for the loan, and 0 otherwise
Industrial	1 if the dominant collateral building type is Industrial, and 0 otherwise
Multifamily	1 if the dominant collateral building type is Multifamily, and 0 otherwise
O□ce	1 if the dominant collateral building type is O□ce, and 0 otherwise
Retail	1 if the dominant collateral building type is Retail, and 0 otherwise
Other	1 if the dominant collateral building type is Other, and 0 otherwise

This table presents the descriptions for the variables in this study.

Table 3.2. Summary Statistics: Complement Sample vs Selected Sample

Variables	Complement Sample	Selected Sample	Di□	p-value
Pool Balance in Millions ($)	1,563	2,015	-452	0.000
Loan-to-Value	0.68	0.76	-0.07	0.000
Debt Service Coverage Ratio	0.91	0.92	-0.01	0.226
Loan Balance in Thousands ($)	10,089	11,794	-1,705	0.000
Remaining Term	120	121	-1.10	0.004
Contract Rate	7.66	7.52	0.14	0.614
Full Amortization	0.04	0.05	-0.01	0.000
Interest Only	0.07	0.09	-0.02	0.000
Yield Maintenance	0.25	0.18	0.07	0.000
Lockout Months	91.66	93.33	-1.66	0.000
Vintage	7.01	6.35	0.65	0.000
Multiple Properties	0.04	0.05	0.00	0.204
Industrial	0.13	0.09	0.04	0.000
Multifamily	0.37	0.36	0.02	0.000
O□ce	0.15	0.23	-0.08	0.000
Retail	0.03	0.02	0.01	0.000
Other	0.31	0.30	0.01	0.019
Loan Origination Year	2004	2003	0.95	0.000
Observations	86,081	17,384		

This table compares the summary statistics of the selected sample to the complement sample. The selected sample consists of loans liquidated with losses for a reason other than prepayment. The complement sample include the loans in the parent population but not in the selected sample. The variables are set to their values at the date of securitization. The observations in this table exclude those with missing observations or outliers.

Table 3.3. Tabulation of LaSalle or Wachovia CMBS Deals

Panel A: Servicers that LaSalle Oversees

Master Servicer	Freq.	Share
AMRESCO	4	1.49
Banc One	2	0.75
Bank of America	12	4.48
BNY	1	0.37
CapMark	2	0.75
First Union	14	5.22
GE Capital	4	1.49
GEMSA	2	0.75
GMAC	50	18.66
GreyStone	1	0.37
KeyCorp	8	2.99
Midland	33	12.31
ORIX	7	2.61
Pacific Life	2	0.75
Principal Global Investors	1	0.37
Prudential	12	4.48
Wachovia	46	17.16
Washington Mutual	2	0.75
Wells Fargo	65	24.25
Total	268	100

Panel B: Trustees that Oversee Wachovia Deals

Trustee	Freq.	Share
Bank of America	4	3.81
CHASE	2	1.9
LaSalle	46	43.81
US Bank	2	1.9
Wells Fargo	51	48.57
Total	146	100

This table tabulates the CMBS deals were LaSalle was assigned as the Trustee at securitization or Wachovia was assigned as the mortgage servicer at securitization.

Table 3.4. Tabulation of Liquidated Loans

Panel A: Loans by Assigned Intermediary at Securitization				
	Arms-length	Co-dealing	Same	Total
LaSalle	4,117	1,118	293	5,528
Wachovia	669	0	2,126	2,795
LaSalle and Wachovia	959	1,130	0	2,089
Other	6,422	457	93	6,972
Total	12,167	2,705	2,512	17,384
Panel B: Loans by Mortgage Servicer				
	Arms-length	Co-dealing	Same	Total
Bank of America	232	403	213	848
Wells Fargo	2,165	2,302	2,294	6,761
Other	9,770	0	5	9,775
Total	12,167	2,705	2,512	17,384
Panel C: Loans by Trustee				
	Arms-length	Co-dealing	Same	Total
Bank of America	1,451	2,302	213	3,966
Wells Fargo	5,739	403	2,294	8,436
Other	4,977	0	5	4,982
Total	12,167	2,705	2,512	17,384

Panel A tabulates the liquidated loans in the sample by the financial intermediary (i.e., trustee or mortgage servicer) assigned at securitization and the a□liation between the mortgage servicer and trustee during the loans' time delinquent. Panel B likewise tabulates the loans but holding constant the mortgage servicer while Panel C holds constant the trustee.

Table 3.5. Summary Statistics

Variables	All	Arms-Length	Same	Co-deal
Pool Balance in Millions ($)	1,645	1,359	2,527	2,110
	(1,348)	(1,067)	(1,926)	(1,344)
Debt Service Coverage Ratio	0.79	0.82	0.75	0.72
	(0.50)	(0.52)	(0.44)	(0.44)
Loan-to-Value	0.7	0.7	0.7	0.69
	(0.18)	(0.19)	(0.16)	(0.12)
Loan Balance in Thousands ($)	11,288	9,342	17,050	14,694
	(24,712)	(19,656)	(35,261)	(31,200)
Remaining Term	57.43	60.92	42.04	56.02
	(64.12)	(71.86)	(34.60)	(42.50)
Spread	0.16	0.28	-0.27	0.02
	(5.39)	(5.54)	(5.46)	(4.59)
Full Amortization	0.05	0.07	0	0
	(0.22)	(0.26)	(0.05)	(0.04)
Interest Only	0.09	0.07	0.18	0.12
	(0.29)	(0.25)	(0.39)	(0.33)
Yield Maintenance	0.18	0.2	0.16	0.14
	(0.39)	(0.40)	(0.36)	(0.35)
Lockout Months	93.3	91.99	96.16	96.52
	(44.71)	(47.26)	(37.70)	(38.15)
Vintage	6.36	7.37	4.09	3.92
	(11.63)	(13.05)	(7.75)	(5.67)
Multiple Properties	0.05	0.05	0.06	0.07
	(0.22)	(0.21)	(0.24)	(0.25)
Industrial	0.09	0.08	0.08	0.1
	(0.28)	(0.28)	(0.28)	(0.31)
Multifamily	0.36	0.38	0.29	0.3
	(0.48)	(0.49)	(0.45)	(0.46)
O□ce	0.22	0.21	0.27	0.22
	(0.41)	(0.41)	(0.44)	(0.42)
Retail	0.04	0.03	0.04	0.04
	(0.19)	(0.18)	(0.20)	(0.19)
Other	0.3	0.29	0.32	0.34
	(0.46)	(0.45)	(0.47)	(0.47)
Loan Origination Year	2003.35	2002.78	2004.68	2004.69
	(3.59)	(3.81)	(2.62)	(2.45)
Observations	17,384	12,167	2,512	2,705

This table displays the summary statistics of liquidated loans for all sample observations and by the relation between the mortgage servicer and trustee. Average values are reported without parentheses while standard deviations are reported in parentheses.

Table 3.6. Summary Statistics of Outcomes

Variables	All	Arms-Length	Same	Co-deal
Duration of Advances	18.4	16.93	21.8	21.86
	(14.05)	(13.18)	(16.08)	(14.69)
Outstanding Advances in Thousands ($)	381.48	307.22	624.23	490.06
	(969.03)	(699.62)	(1,737.56)	(969.22)
Outstanding Advances Normalized	0.06	0.06	0.05	0.06
	(0.92)	(1.10)	(0.05)	(0.13)
Losses in Thousands ($)	2,106	1,560	3,092	3,648
	(6,409)	(4,969)	(9,246)	(8,305)
Loss Rate	0.25	0.22	0.27	0.38
	(0.33)	(0.32)	(0.33)	(0.36)
Observations	17,384	12,167	2,512	2,705

This table displays the summary statistics of liquidated loans for all sample observations and by the relation between the mortgage servicer and trustee. Average values are reported without parentheses while standard deviations are reported in parentheses.

Table 3.7. OLS Regressions for Duration of Advances

	(1)	(2)	(3)	(4)	(5)	(6)
Same	4.870***	2.404***	2.535***	2.743***	3.208***	5.867***
	(0.619)	(0.481)	(0.463)	(0.545)	(0.554)	(0.837)
Co-dealing	4.922***	1.061**	1.076**	1.385***	1.315**	1.380**
	(0.496)	(0.485)	(0.471)	(0.536)	(0.556)	(0.654)
Debt Service Coverage Ratio		-1.072***	-1.174***	-1.278***	-1.281***	-1.256***
		(0.229)	(0.220)	(0.226)	(0.227)	(0.218)
Loan-to-Value		0.005	0.003	0.002	0.002	0.013
		(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Log Loan Balance		1.367***	1.370***	1.380***	1.370***	1.401***
		(0.080)	(0.079)	(0.079)	(0.079)	(0.081)
Log Remaining Term		1.331***	1.384***	1.355***	1.349***	1.335***
		(0.119)	(0.117)	(0.117)	(0.118)	(0.125)
Spread		0.366*	0.243	0.214	0.205	0.094
		(0.206)	(0.199)	(0.200)	(0.198)	(0.226)
Full Amortization		-3.588***	-3.747***	-3.933***	-3.875***	-3.186***
		(0.743)	(0.833)	(0.830)	(0.812)	(0.772)
Interest Only		-1.132**	-1.144**	-1.148**	-1.178**	-0.911*
		(0.504)	(0.501)	(0.507)	(0.507)	(0.518)
Yield Maintenance		-0.088	-0.021	-0.013	-0.063	0.215
		(0.404)	(0.447)	(0.447)	(0.451)	(0.474)
Log Lock-out Months		-0.033	-0.047	0.024	-0.005	0.151
		(0.154)	(0.181)	(0.180)	(0.179)	(0.187)
Cross-collateralized		1.682*	1.668*	1.671*	1.620*	1.040
		(0.971)	(0.940)	(0.933)	(0.925)	(0.885)
Vintage		-0.089***	-0.102***	-0.100***	-0.102***	-0.201***
		(0.031)	(0.032)	(0.032)	(0.032)	(0.043)
Vintage Squared		0.001**	0.001**	0.001**	0.001**	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log Pool Balance		1.234***	1.251***	1.254***	1.265***	1.334***
		(0.060)	(0.059)	(0.059)	(0.059)	(0.059)
Multiple Properties		2.937***	2.843***	2.835***	2.794***	3.066***
		(0.777)	(0.780)	(0.776)	(0.776)	(0.768)
Industrial		0.627	0.638*	0.695*	0.689*	0.638
		(0.384)	(0.384)	(0.387)	(0.388)	(0.407)
O□ce		1.619***	1.601***	1.627***	1.610***	1.640***
		(0.319)	(0.317)	(0.320)	(0.320)	(0.323)
Retail		1.503***	1.546***	1.595***	1.556***	1.641***
		(0.301)	(0.299)	(0.299)	(0.299)	(0.300)
Other		2.356***	2.366***	2.461***	2.456***	2.576***
		(0.668)	(0.664)	(0.664)	(0.663)	(0.653)
Observations	17,384	17,384	17,384	17,384	17,384	17,384
R-squared	0.026	0.219	0.226	0.228	0.229	0.269
State FE	No	Yes	Yes	Yes	Yes	Yes
Origination Year FE	No	Yes	Yes	Yes	Yes	Yes
Special Servicer FE	No	No	Yes	Yes	Yes	No
Mortgage Servicer FE	No	No	No	Yes	Yes	No
Trustee FE	No	No	No	No	Yes	No
Transfer Month-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Deal FE	No	No	No	No	No	Yes

This table reports OLS estimates using the full sample. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.8. OLS Regressions for Duration of Advances by Subsample

	(1) LaSalle	(2) Wachovia
Same	5.248**	10.683***
	(2.050)	(1.340)
Co-dealing	3.067***	4.235***
	(0.990)	(1.338)
Debt Service Coverage Ratio	-1.275***	-1.161**
	(0.380)	(0.505)
Loan-to-Value	0.004	0.020
	(0.013)	(0.015)
Log Loan Balance	1.312***	1.373***
	(0.116)	(0.148)
Log Remaining Term	1.292***	1.470***
	(0.202)	(0.265)
Spread	0.154	-0.239
	(0.378)	(0.485)
Full Amortization	-2.829***	-0.471
	(0.961)	(2.749)
Interest Only	-0.829	-0.650
	(0.839)	(0.687)
Yield Maintenance	-0.092	-0.489
	(0.611)	(1.055)
Log Lock-out Months	0.186	-0.258
	(0.273)	(0.423)
Cross-collateralized	0.709	1.207
	(1.339)	(1.430)
Vintage	-0.364***	-0.281**
	(0.075)	(0.112)
Vintage Squared	0.003***	0.002**
	(0.001)	(0.001)
Log Pool Balance	1.333***	1.469***
	(0.103)	(0.122)
Multiple Properties	2.421**	3.787***
	(1.130)	(1.318)
Industrial	0.864	-0.267
	(0.669)	(0.737)
O□ce	1.333***	1.637***
	(0.495)	(0.587)
Retail	1.684***	1.767***
	(0.473)	(0.566)
Other	1.727*	3.695***
	(0.982)	(1.396)
Observations	7,617	4,884
R-squared	0.291	0.327
State FE	Yes	Yes
Origination Year FE	Yes	Yes
Transfer Year-Month FE	Yes	Yes
Deal FE	Yes	Yes

This table reports OLS estimates for each subsample named in the column headers. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.9. Probit Regressions

	(1) LaSalle	(2) Wachovia
Debt Service Coverage Ratio	-0.356***	-0.200**
	(0.049)	(0.080)
Loan-to-Value	-0.010***	-0.000
	(0.002)	(0.002)
Log Loan Balance	0.041**	0.054**
	(0.018)	(0.021)
Log Remaining Term	0.053**	-0.037
	(0.023)	(0.032)
Spread	-0.251***	-0.153**
	(0.048)	(0.075)
Full Amortization	-0.724**	-0.065
	(0.323)	(0.542)
Interest Only	0.094	0.109
	(0.084)	(0.107)
Yield Maintenance	0.153*	0.040
	(0.083)	(0.132)
Log Lock-out Months	0.057*	0.082
	(0.033)	(0.054)
Cross-collateralized	0.154	-0.617***
	(0.100)	(0.149)
Vintage	-0.009	0.018
	(0.007)	(0.012)
Vintage Squared	0.000	-0.000**
	(0.000)	(0.000)
Multiple Properties	0.116	0.160
	(0.106)	(0.165)
Industrial	0.185**	0.034
	(0.080)	(0.132)
O□ce	0.088	0.057
	(0.062)	(0.094)
Retail	0.092	-0.003
	(0.057)	(0.088)
Other	0.379***	-0.067
	(0.131)	(0.183)
Observations	5,107	3,021
Origination Year FE	Yes	Yes
State FE	Yes	Yes
Transfer Month-Year FE	Yes	Yes
Deal FE	No	No

This table reports Probit estimate of treatment. The dependent variable is the treatment dummy, which equals one if an a□liation exists between the mortgage servicer and trustee, and zero otherwise. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.10. Balanced Samples: Control vs Treatment

Panel A: LaSalle Balanced Sample

Variables	Control	Treatment	Di	p-value
Debt Service Coverage Ratio	0.78	0.73	0.06	0.002
Loan-to-Value	0.73	0.69	0.04	0.000
Loan Balance in Thousands ($)	14,152	14,452	-300	0.803
Remaining Term	48	55	-6.70	0.000
Spread	-0.10	0.02	-0.12	0.510
Full Amortization	0.01	0.00	0.00	0.092
Interest Only	0.11	0.12	-0.01	0.458
Yield Maintenance	0.13	0.15	-0.02	0.173
Lockout Months	98.04	96.45	1.59	0.301
Vintage	4.37	3.88	0.49	0.055
Multiple Properties	0.06	0.07	-0.01	0.594
Industrial	0.09	0.10	-0.01	0.297
Multifamily	0.31	0.29	0.02	0.240
O ce	0.24	0.22	0.01	0.529
Retail	0.03	0.04	-0.01	0.290
Other	0.33	0.34	-0.01	0.552
Loan Origination Year	2004	2005	-0.55	0.000
Observations	821	2,539		

Panel B: Wachovia Balanced Sample

Variables	Control	Treatment	Di	p-value
Debt Service Coverage Ratio	0.72	0.74	-0.03	0.265
Loan-to-Value	0.70	0.70	-0.01	0.335
Loan Balance in Thousands ($)	15,203	15,804	-601	0.709
Remaining Term	32	43	-11.16	0.000
Spread	-0.86	-0.35	-0.51	0.103
Full Amortization	0.01	0.00	0.00	0.787
Interest Only	0.18	0.18	0.01	0.777
Yield Maintenance	0.15	0.13	0.03	0.103
Lockout Months	98.66	98.69	-0.02	0.991
Vintage	4.43	3.62	0.81	0.043
Multiple Properties	0.05	0.07	-0.02	0.247
Industrial	0.08	0.08	0.00	0.928
Multifamily	0.25	0.30	-0.05	0.050
O ce	0.27	0.27	0.00	0.918
Retail	0.03	0.04	-0.01	0.354
Other	0.38	0.32	0.06	0.027
Loan Origination Year	2005	2005	0.06	0.678
Observations	415	2,053		

This table compares the summary statistics of the control group to those of the treatment group balanced through propensity score matching. The treatment group consists loans that are in deals with an a liated trustee while the control group consists loans that are in deals with a trustee at arm's length. Panel A reports the balanced samples from matching within loans a ected by the LaSalle acquisition while Panel B reports the same statistics but for loans a ected by the Wachovia acquisition.

Table 3.11. Propensity Score Matching and Ex-post regressions

	(1) LaSalle	(2) Wachovia
Same	13.628***	14.484***
	(3.646)	(2.059)
Co-dealing	14.914***	4.789**
	(3.038)	(1.985)
Debt Service Coverage Ratio	-1.193*	-3.111***
	(0.669)	(0.710)
Loan-to-Value	0.041	0.002
	(0.029)	(0.020)
Log Loan Balance	2.092***	1.357***
	(0.297)	(0.225)
Log Remaining Term	1.227***	1.814***
	(0.334)	(0.318)
Spread	0.827	-0.874
	(0.674)	(0.966)
Full Amortization	1.473	8.972
	(7.857)	(7.342)
Interest Only	-0.588	-0.561
	(1.164)	(0.981)
Yield Maintenance	0.261	1.027
	(1.005)	(1.607)
Log Lock-out Months	0.228	0.406
	(0.536)	(0.757)
Cross-collateralized	-0.649	-0.482
	(2.007)	(2.024)
Vintage	-0.257**	-0.301*
	(0.129)	(0.153)
Vintage Squared	0.001	0.002
	(0.001)	(0.001)
Log Pool Balance	2.312**	-0.020
	(1.138)	(0.680)
Multiple Properties	2.595	4.159**
	(1.906)	(1.650)
Industrial	1.653	0.427
	(1.177)	(1.104)
O□ce	0.952	2.569***
	(0.797)	(0.935)
Retail	0.650	2.307**
	(0.702)	(0.928)
Other	1.991	2.498
	(1.645)	(1.952)
Observations	3,360	2,468
R-squared	0.255	0.352
State FE	Yes	Yes
Origination Year FE	Yes	Yes
Transfer Year-Month FE	Yes	Yes
Deal FE	Yes	Yes

This table reports OLS estimate using balanced samples from propensity score matches. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.12. Cox Hazard Model for Suspending Advances

	(1) 12 Months	(2) 24 Months	(3) 36 Months	(4) 48 Months
Same	-0.145***	-0.125***	-0.153***	-0.163***
	(0.039)	(0.029)	(0.026)	(0.025)
Co-dealing	-0.161***	-0.085***	-0.082***	-0.084***
	(0.043)	(0.030)	(0.027)	(0.026)
Debt Service Coverage Ratio	0.188***	0.145***	0.116***	0.095***
	(0.024)	(0.019)	(0.018)	(0.017)
Loan-to-Value	0.001	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Log Loan Balance	-0.232***	-0.223***	-0.211***	-0.210***
	(0.009)	(0.008)	(0.008)	(0.008)
Log Remaining Term	-0.227***	-0.153***	-0.136***	-0.128***
	(0.012)	(0.010)	(0.009)	(0.009)
Spread	-0.109***	-0.063***	-0.045***	-0.038***
	(0.022)	(0.017)	(0.016)	(0.015)
Full Amortization	0.419***	0.291***	0.242***	0.255***
	(0.072)	(0.056)	(0.052)	(0.050)
Interest Only	0.283***	0.200***	0.146***	0.124***
	(0.050)	(0.038)	(0.034)	(0.033)
Yield Maintenance	0.124***	0.057*	0.056**	0.042
	(0.038)	(0.030)	(0.027)	(0.026)
Log Lock-out Months	0.041***	0.034***	0.029***	0.026***
	(0.013)	(0.010)	(0.009)	(0.009)
Cross-collateralized	0.031	-0.075*	-0.106***	-0.099***
	(0.055)	(0.042)	(0.039)	(0.037)
Vintage	0.010***	0.007***	0.006***	0.005**
	(0.003)	(0.002)	(0.002)	(0.002)
Vintage Squared	-0.000**	-0.000**	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Log Pool Balance	-0.164***	-0.140***	-0.125***	-0.105***
	(0.011)	(0.008)	(0.006)	(0.006)
Multiple Properties	-0.068	-0.097*	-0.135***	-0.128***
	(0.070)	(0.052)	(0.046)	(0.043)
Industrial	-0.037	-0.068*	-0.065**	-0.049
	(0.045)	(0.035)	(0.032)	(0.031)
O□ce	-0.098***	-0.117***	-0.126***	-0.111***
	(0.035)	(0.027)	(0.024)	(0.023)
Other	-0.137*	-0.194***	-0.180***	-0.167***
	(0.071)	(0.053)	(0.047)	(0.045)
Retail	-0.111***	-0.134***	-0.141***	-0.123***
	(0.032)	(0.024)	(0.022)	(0.021)
Observations	17,384	17,384	17,384	17,384
State FE	Yes	Yes	Yes	Yes
Origination Year FE	Yes	Yes	Yes	Yes
Transfer Year-Month FE	Yes	Yes	Yes	Yes

This table reports the coe□cients for a Cox proportional hazard model by censorship window. The hazard denotes the likelihood that the mortgage servicer suspends the advancement of payments for delinquent loans within $h \in \{12, 24, 36, 48\}$ months. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.13. OLS for Duration of Advances by Coordination Difficulty

	(1)	(2)
Same	5.873***	5.890***
	(0.839)	(0.910)
Co-dealing	1.410**	1.379**
	(0.666)	(0.665)
Multiple Master Servicers	-0.220	
	(0.965)	
Multiple Trustees	-0.272	
	(0.719)	
New Trustee		0.114
		(0.869)
New Master Servicer		0.147
		(0.572)
Debt Service Coverage Ratio	-1.256***	-1.254***
	(0.218)	(0.218)
Loan-to-Value	0.013	0.013
	(0.008)	(0.008)
Log Loan Balance	1.401***	1.401***
	(0.081)	(0.081)
Log Remaining Term	1.336***	1.333***
	(0.124)	(0.125)
Spread	0.094	0.094
	(0.226)	(0.226)
Full Amortization	-3.190***	-3.196***
	(0.771)	(0.777)
Interest Only	-0.910*	-0.914*
	(0.516)	(0.519)
(Continued)		

This table reports OLS estimates using proxy variables for coordination deficiencies. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Multiple mortgage servicers (or trustees) equals one when multiples mortgage servicers (or trustees) administer the loans in the pool, and zero otherwise. New mortgage servicer (or trustee) is an indicator for whether the mortgage servicer (or trustee) is different from the institution assigned at securitization. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.13. OLS for Duration of Advances by Coordination Difficulty (Cont'd)

	(1)	(2)
Yield Maintenance	0.214	0.214
	(0.474)	(0.472)
Log Lock-out Months	0.150	0.151
	(0.188)	(0.187)
Cross-collateralized	1.039	1.041
	(0.885)	(0.885)
Vintage	-0.201***	-0.201***
	(0.043)	(0.043)
Vintage Squared	0.001***	0.001***
	(0.000)	(0.000)
Log Pool Balance	1.335***	1.334***
	(0.059)	(0.059)
Multiple Properties	3.062***	3.064***
	(0.769)	(0.768)
Industrial	0.642	0.638
	(0.407)	(0.407)
Office	1.641***	1.639***
	(0.323)	(0.324)
Retail	1.642***	1.641***
	(0.301)	(0.300)
Other	2.580***	2.577***
	(0.653)	(0.653)
Observations	17,384	17,384
R-squared	0.269	0.269
State FE	Yes	Yes
Origination Year FE	Yes	Yes
Transfer Year-Month FE	Yes	Yes
Deal FE	Yes	Yes

This table reports OLS estimates using proxy variables for coordination deficiencies. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Multiple mortgage servicers (or trustees) equals one when multiples mortgage servicers (or trustees) administer the loans in the pool, and zero otherwise. New mortgage servicer (or trustee) is an indicator for whether the mortgage servicer (or trustee) is different from the institution assigned at securitization. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.14. OLS Regressions for Duration of Advances by Workload

	(1)	(2)
Same	7.752***	13.855***
	(0.947)	(1.962)
Co-dealing	1.813***	9.458***
	(0.671)	(2.774)
Master Servicer's Workload	-0.006***	-0.002
	(0.002)	(0.002)
Trustee's Workload	-0.005*	-0.000
	(0.003)	(0.003)
Same Mortgage Servicer's Workload		-0.007*
		(0.004)
Same Trustee's Workload		-0.010**
		(0.005)
Co-dealing Mortgage Servicer's Workload		-0.003
		(0.003)
Co-dealing Trustee's Workload		-0.017***
		(0.006)
Debt Service Coverage Ratio	-1.279***	-1.287***
	(0.217)	(0.219)
Loan-to-Value	0.013	0.013
	(0.008)	(0.008)
Log Loan Balance	1.402***	1.405***
	(0.081)	(0.081)
Log Remaining Term	1.330***	1.325***
	(0.125)	(0.124)
Spread	0.081	0.091
	(0.227)	(0.226)
Full Amortization	-3.185***	-3.180***
	(0.779)	(0.778)
Interest Only	-0.950*	-0.965*
	(0.516)	(0.516)

(Continued)

This table reports OLS estimates. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Same equals one when the mortgage servicer is also the trustee. Co-dealing equals one when the mortgage servicer is co-dealing with the trustee. Mortgage servicer's workload is the number of pools that the mortgage servicer administers at the time of the loan's delinquency date. Trustee's workload is the number of pools that the trustee administers at the time of the loan's delinquency date. Financial intermediary fixed e□ects include dummy variables for special servicers, mortgage servicers and trustees currently managing the pool. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.14. OLS Regressions for Duration of Advances by Workload (Continued)

	(1)	(2)
Yield Maintenance	0.231	0.251
	(0.475)	(0.476)
Log Lock-out Months	0.151	0.168
	(0.188)	(0.187)
Cross-collateralized	1.061	1.014
	(0.887)	(0.887)
Vintage	-0.200***	-0.200***
	(0.043)	(0.043)
Vintage Squared	0.001***	0.001***
	(0.000)	(0.000)
Log Pool Balance	1.332***	1.338***
	(0.060)	(0.059)
Multiple Properties	3.054***	3.055***
	(0.769)	(0.767)
Industrial	0.655	0.663
	(0.406)	(0.405)
O□ce	1.648***	1.674***
	(0.323)	(0.323)
Other	2.575***	2.539***
	(0.654)	(0.651)
Retail	1.660***	1.674***
	(0.301)	(0.301)
Observations	17,384	17,384
R-squared	0.271	0.272
State FE	Yes	Yes
Origination Year FE	Yes	Yes
Transfer Year-Month FE	Yes	Yes
Deal FE	Yes	Yes

This table reports OLS estimates. The dependent variable is the Duration of Advances – the number of months before the mortgage servicer suspends advances on missing payments. Same equals one when the mortgage servicer is also the trustee. Co-dealing equals one when the mortgage servicer is co-dealing with the trustee. Mortgage servicer's workload is the number of pools that the mortgage servicer administers at the time of the loan's delinquency date. Trustee's workload is the number of pools that the trustee administers at the time of the loan's delinquency date. Financial intermediary fixed e□ects include dummy variables for special servicers, mortgage servicers and trustees currently managing the pool. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.15. OLS Regressions for Loss Rate

	(1)	(2)	(3)	(4)	(5)
				Post-Matching	
	All	LaSalle	Wachovia	LaSalle	Wachovia
Same	0.039*	-0.007	0.118***	-0.009	0.283***
	(0.021)	(0.041)	(0.029)	(0.063)	(0.044)
Co-dealing	0.072***	0.099***	0.094***	0.279***	0.062*
	(0.013)	(0.019)	(0.024)	(0.073)	(0.034)
Debt Service Coverage Ratio	-0.064***	-0.055***	-0.062***	-0.069***	-0.088***
	(0.006)	(0.008)	(0.011)	(0.017)	(0.018)
Loan-to-Value	0.001***	0.001***	0.001	0.002***	0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Log Loan Balance	-0.007***	-0.006**	-0.013***	-0.030***	-0.013**
	(0.002)	(0.003)	(0.004)	(0.007)	(0.006)
Log Remaining Term	0.038***	0.044***	0.036***	0.045***	0.036***
	(0.003)	(0.004)	(0.005)	(0.007)	(0.007)
Spread	0.014**	0.012	0.012	0.020	0.031**
	(0.006)	(0.008)	(0.009)	(0.015)	(0.015)
Full Amortization	-0.060**	-0.042	-0.111**	-0.056	-0.025
	(0.025)	(0.037)	(0.053)	(0.166)	(0.146)
Interest Only	-0.092***	-0.105***	-0.102***	-0.104***	-0.084***
	(0.012)	(0.016)	(0.018)	(0.022)	(0.024)
Yield Maintenance	0.005	-0.003	0.009	0.011	0.018
	(0.011)	(0.015)	(0.024)	(0.028)	(0.026)
Log Lock-out Months	0.003	-0.006	-0.000	0.004	0.006
	(0.005)	(0.007)	(0.009)	(0.013)	(0.011)
Cross-collateralized	-0.074***	-0.074***	-0.066**	-0.128***	-0.060
	(0.015)	(0.023)	(0.030)	(0.049)	(0.039)
Vintage	-0.001*	-0.001	-0.007***	0.000	-0.006**
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Vintage Squared	0.000	0.000	0.000***	-0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log Pool Balance	0.015**	0.009	0.025**	0.107***	0.027*
	(0.007)	(0.011)	(0.012)	(0.034)	(0.015)
Multiple Properties	-0.006	0.001	0.010	0.050	0.021
	(0.015)	(0.021)	(0.029)	(0.036)	(0.032)
Industrial	0.015	0.030*	0.002	0.016	-0.012
	(0.010)	(0.016)	(0.023)	(0.026)	(0.030)
O□ce	0.073***	0.065***	0.064***	0.064***	0.052**
	(0.008)	(0.012)	(0.016)	(0.020)	(0.021)
Retail	0.041***	0.038***	0.029**	0.044**	0.026
	(0.007)	(0.012)	(0.014)	(0.019)	(0.017)
Other	0.025*	0.001	0.025	0.007	-0.022
	(0.014)	(0.023)	(0.031)	(0.039)	(0.038)
Observations	17,193	7,499	4,843	3,360	2,468
R-squared	0.267	0.301	0.283	0.286	0.340
State Year	Yes	Yes	Yes	Yes	Yes
Origination Year	Yes	Yes	Yes	Yes	Yes
Transfer Year-Month FE	Yes	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes	Yes

This table reports OLS estimates using loans with liquidation losses. The dependent variable is the loss rate, which is the liquidation losses divided by the outstanding balance a month before liquidation. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.16. OLS Regressions for Loss Rate by U.S. Census Region

	(1) Northeast	(2) Midwest	(3) South	(4) West
Same	0.073	0.125**	0.056**	0.009
	(0.073)	(0.053)	(0.028)	(0.041)
Co-dealing	0.140***	0.109***	0.056***	0.054**
	(0.043)	(0.033)	(0.019)	(0.027)
Debt Service Coverage Ratio	-0.035*	-0.097***	-0.069***	-0.035***
	(0.019)	(0.018)	(0.009)	(0.013)
Loan-to-Value	0.001	0.000	0.001**	0.001**
	(0.001)	(0.001)	(0.000)	(0.001)
Log Loan Balance	-0.016**	-0.007	-0.005*	-0.012**
	(0.007)	(0.007)	(0.003)	(0.005)
Log Remaining Term	0.024**	0.050***	0.038***	0.031***
	(0.011)	(0.010)	(0.004)	(0.006)
Spread	-0.007	0.026	0.012	0.008
	(0.020)	(0.018)	(0.008)	(0.016)
Full Amortization	0.029	-0.093	-0.078**	-0.021
	(0.087)	(0.083)	(0.036)	(0.053)
Interest Only	-0.086***	-0.101***	-0.096***	-0.077***
	(0.033)	(0.033)	(0.017)	(0.022)
Yield Maintenance	0.030	-0.055	-0.006	0.019
	(0.040)	(0.034)	(0.016)	(0.024)
Log Lock-out Months	-0.003	-0.013	0.004	0.003
	(0.016)	(0.013)	(0.008)	(0.010)
Cross-collateralized	-0.011	-0.059	-0.085***	-0.078**
	(0.058)	(0.037)	(0.026)	(0.034)
Vintage	-0.002	0.001	-0.002	-0.001
	(0.003)	(0.003)	(0.001)	(0.002)
Vintage Squared	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Log Pool Balance	0.020	0.043**	0.021**	-0.021
	(0.025)	(0.019)	(0.010)	(0.015)
Multiple Properties	0.053	0.013	-0.035	0.031
	(0.040)	(0.035)	(0.025)	(0.046)
Industrial	0.062*	0.023	-0.005	0.023
	(0.034)	(0.032)	(0.017)	(0.022)
O□ce	0.134***	0.104***	0.047***	0.097***
	(0.026)	(0.023)	(0.012)	(0.019)
Retail	0.071***	0.061***	0.020*	0.087***
	(0.027)	(0.020)	(0.010)	(0.018)
Other	0.074*	0.021	0.071**	0.003
	(0.042)	(0.042)	(0.028)	(0.030)
Observations	2,166	3,266	7,411	3,455
R-squared	0.475	0.420	0.315	0.411
State FE	Yes	Yes	Yes	Yes
Origination Year FE	Yes	Yes	Yes	Yes
Transfer Year-Month FE	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes

This table reports OLS estimates using loans with liquidation losses. The dependent variable is the loss rate, which is the liquidation losses divided by the outstanding balance a month before liquidation. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.17. CMBS Bond Tranches by Credit Rating Scores

Credit Risk	Moody's	Standard & Poor's	Fitch's	Score	Frequency
Highest grade	Aaa	AAA	AAA	1	5,765
	Aa1	AA+	AA+	2	222
High grade	Aa2	AA	AA	3	673
	Aa3	AA-	AA-	4	580
	A1	A+	A+	5	181
Upper medium grade	A2	A	A	6	630
	A3	A-	A-	7	782
	Baa1	BBB+	BBB+	8	426
Medium grade	Baa2	BBB	BBB	9	606
	Baa3	BBB-	BBB-	10	870
	Ba1	BB+	BB+	11	449
Lower medium grade	Ba2	BB	BB	12	633
	Ba3	BB-	BB-	13	556
	B1	B+	B+	14	408
Low grade	B2	B	B	15	586
	B3	B-	B-	16	550
	Caa1	CCC	CCC+	17	5
	Caa2	C	CCC	18	37
Unrated	.	.	.	19	3,400

This table displays the ratings score of the credit ratings by Moody's S&P's and Fitch following Cheng and Neamtiu (2009). This table also reports the unique frequency count of bond tranches that correspond to private conduit CMBS deals in the Trepp dataset.

Table 3.18. Characteristics of CMBS Bond Tranches by Credit Rating Scores

		Coupon		Balance (in $mil.)	
Rating Score	Observations	Mean	SD	Mean	SD
1	394,945	3.86	2.23	455.65	634.59
2	15,011	5.38	1.16	67.69	180.96
3	63,459	5.83	0.99	41.14	23.92
4	43,114	5.20	1.04	27.06	30.36
5	14,937	5.64	0.81	26.19	31.78
6	65,562	5.92	1.02	35.62	27.32
7	60,714	5.70	1.17	26.46	33.91
8	45,704	5.79	0.68	21.16	13.78
9	64,069	6.26	0.96	25.58	24.83
10	71,149	6.24	1.23	22.40	18.84
11	49,543	5.52	0.81	15.60	21.91
12	62,007	5.61	1.08	15.12	16.47
13	49,221	5.39	1.11	11.86	28.76
14	41,740	5.46	0.78	7.32	9.70
15	54,517	5.56	1.04	10.08	11.40
16	47,180	5.53	0.95	6.97	7.92
Unrated	168,076	5.32	2.55	64.39	226.16

This table provides summary statistics on the coupon and outstanding balance of the bond tranches by rating score.

Table 3.19. Fixed E□ects Panel of Monthly Bond Returns

VARIABLES			VARIABLES (CONTINUED)		
Same	Max Rating of		Co-deal	Max Rating of	
	1	0.008		1	-0.305***
		(0.106)			(0.061)
	2	0.831***		2	-0.461***
		(0.258)			(0.105)
	3	0.701***		3	-0.245***
		(0.109)			(0.076)
	4	0.699***		4	-0.353***
		(0.122)			(0.089)
	5	0.924***		5	-0.098
		(0.213)			(0.129)
	6	0.793***		6	-0.090
		(0.110)			(0.081)
	7	0.677***		7	0.078
		(0.138)			(0.098)
	8	0.676***		8	0.239**
		(0.151)			(0.115)
	9	0.702***		9	0.538***
		(0.129)			(0.121)
	10	0.611***		10	0.774***
		(0.143)			(0.151)
	11	0.586***		11	0.866***
		(0.167)			(0.162)
	12	0.440**		12	0.795***
		(0.186)			(0.171)
	13	0.249		13	0.913***
		(0.239)			(0.185)
	14	0.015		14	0.727***
		(0.219)			(0.186)
	15	-0.389		15	0.536**
		(0.270)			(0.221)
	16	-1.162***		16	0.096
		(0.323)			(0.230)
	unrated	-1.762***		unrated	-0.541**
		(0.379)			(0.210)
				(Continued)	

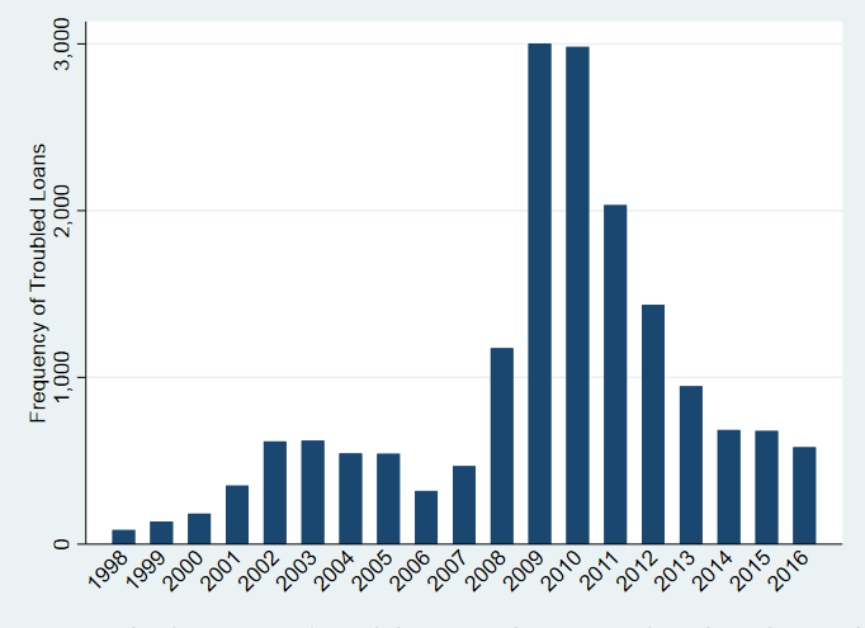
This table reports OLS estimates using a monthly panel on bond tranche returns. The dependent variable is the monthly return to the bond tranche, measured as a percent. Each reported coe□cient corresponds to the interaction of the a□liation dummy (Same/Co-dealing) and the max rating of the tranche. Baseline controls include: deal characteristics along with fixed e□ects for the month-year and bond-deal tranche. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3.19. Fixed E□ects Panel of Monthly Bond Returns (Continued)

VARIABLES (Continued)	
Log Outstanding Balance	0.149**
	(0.070)
Current Loan Count	0.002
	(0.001)
Gross Weighted Average Coupon Rate	0.046
	(0.138)
Weighted Average Debt Service Coverage Ratio	0.000
	(0.000)
Weighted Average Loan-to-Value	0.002*
	(0.001)
Share of Loans with Yield Maintenance	0.014***
	(0.002)
Share of Loans in Lock-out Period	0.017***
	(0.001)
Count of Loans with Prepayment Penalty	0.007
	(0.010)
Top Share of Collateral Located in Single State	-0.002
	(0.005)
Top Loan Amount Share	0.015***
	(0.005)
Warehouse Share	-0.226
	(0.172)
Industrial Share	-0.014**
	(0.007)
O□ce Share	-0.002
	(0.003)
Multifamily Share	-0.004
	(0.004)
Other Property Type Share	-0.005
	(0.003)
Observations	1,210,053
Number of Bond Tranches	15,019
R-squared	0.016
Deal Controls	Yes
Bond Tranche FE	Yes
Year-Month FE	Yes

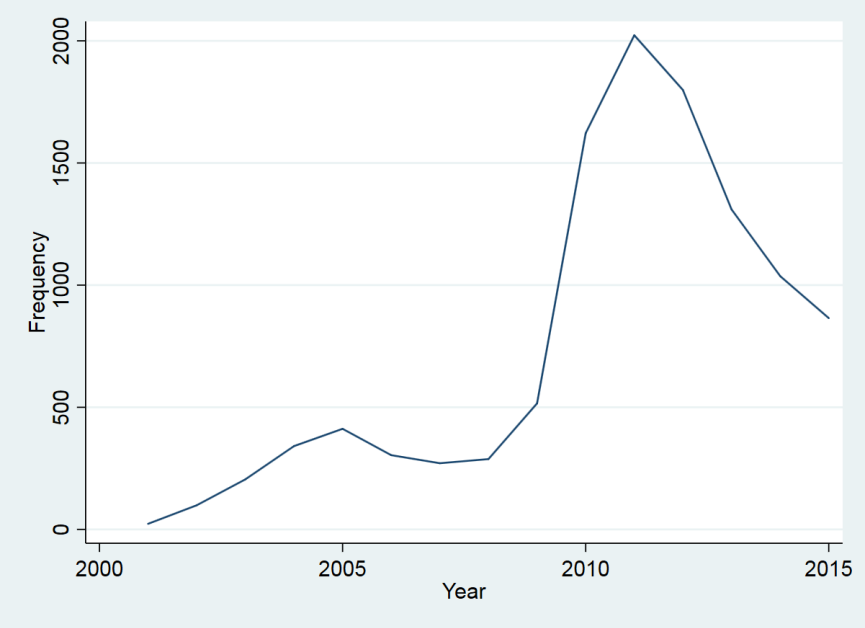
This table reports OLS estimates using a monthly panel on bond tranche returns. The dependent variable is the monthly return to the bond tranche, measured as a percent. Robust standard errors clustered by CMBS deal are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Figure 3.1. Troubled Conduit CMBS Loans



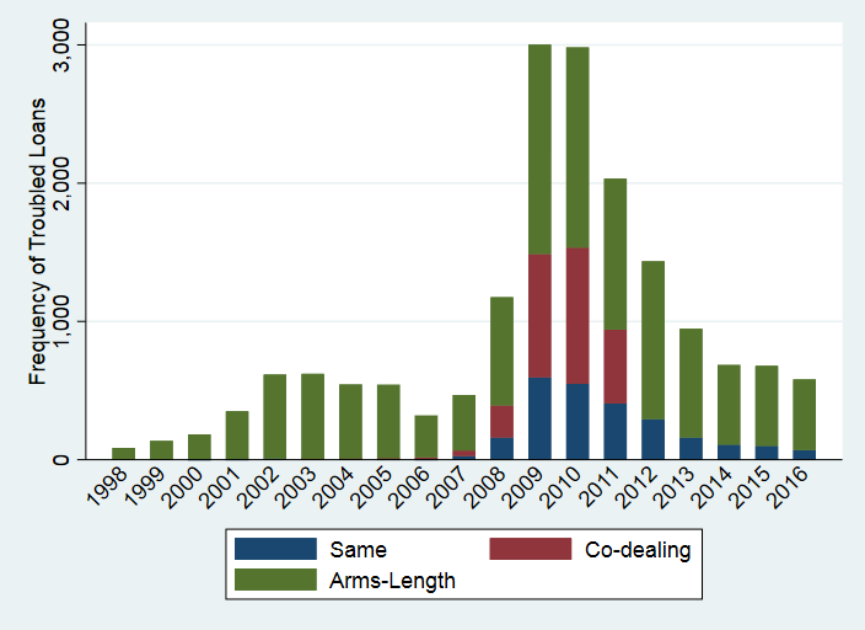
This figure presents the frequency of conduit CMBS loans transferred to the special servicer for missing at least 60 days of debt service payments by year. The data derive from Trepp.

Figure 3.2. Conduit CMBS Loans Liquidated with Losses



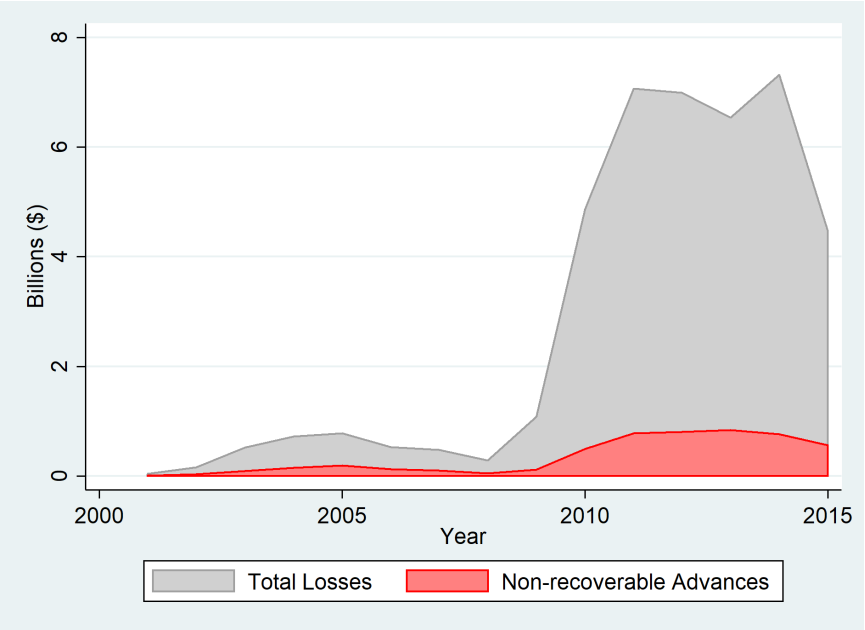
This figure presents the frequency of conduit CMBS loans liquidated with losses by year. The data derive from Trepp.

Figure 3.3. Troubled Conduit CMBS Loans by A□liation Type



This figure presents by servicer-trustee a□liation type the frequency of conduit CMBS loans transferred to the special servicer for missing at least 60 days of debt service payments by year. Same stands for loans that have a single form operating as the mortgage servicer and trustee. Co-dealing stands for loans that have co-dealing mortgage servicers and trustees. Arm's length stands for loans that have a trustee that is at arm's length of the mortgage servicer. The data derive from Trepp.

Figure 3.4. Conduit CMBS Liquidation Losses and Non-Recoverable Advances



This figure plots the annual liquidation losses and the non-recoverable advances. The losses and non-recoverable advances are reported in $billions. The figure uses liquidated commercial loans that underlay conduit CMBS observable in the Trepp data.

Chapter 4
Servicing Behavior and the Risk Retention of Securitized Residential Mortgages[1]

4.1 Introduction

Following the recent recession in 2007, mortgage servicers responsible for handling securitized loans received attention from both economists and regulators. While economists debated on whether distancing mortgage servicers from default losses through securitization reduced the servicers' incentive to minimize losses (Adelino, Gerardi and Willen, 2009; Piskorski, Seru and Vig, 2010; Agarwal et al., 2011), policymakers made regulatory changes to the securtization market with the passage of the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA). A resulting regulation is that mortgage servicers sponsoring residential mortgage backed securities (RMBS) deals must, under certain circumstances, hold on to at least 5 percent of the credit risk.[2] While prior studies show that risk retention can motivate banks to securitize high quality (i.e., safe) loans (e.g., Demiroglu and James, 2012), there is little empirical research on how varying degrees of credit exposure affects servicing behavior.

This paper examines how credit exposure from affiliation with bondholders affects the behavior of mortgage servicers towards securitized delinquent loans. In

[1] This chapter was inspired by conversations with Walter D'Lima.

[2] For full details on the risk retention rules, see Section 24 CFR Part 267, available at https://www.gpo.gov/fdsys/pkg/FR-2014-12-24/pdf/2014-29256.pdf.

principle, if a borrower becomes seriously delinquent on loan payments, usually by missing three or more monthly payments, the servicer has the responsibility to carryout the loss mitigation strategy on behalf of bondholders. The servicer may choose to foreclose on the delinquent loan. The servicer, however, may instead use a less costly non-foreclosure alternative such as loan modification, deed-in-lieu of foreclosure or residential short sale.[3] In exchange, the servicer receives compensation in the form of an interest-like servicing fee stripped from the collateral pool payments on interest. A benefit of this setup is that while multiple investors hold an interest to the collateral pool, a bank with an informational or technological advantages provides expert loan servicing, similar to Diamond's (1984) delegated monitoring model.

Critics of the securitization market, however, point out that banks infrequently choose non-foreclose avenues for securitized loans. For example, Piskorski, Seru and Vig (2010) find that mortgage servicers foreclose on homes that they hold in portfolio about 13 to 32 percent less often than securitized loans. Agarwal et al. (2011) find that portfolio loans are about 26 to 36 percent more likely to be renegotiated than observably similar securitized mortgages in distressed. Together, these studies suggest that servicers seek non-foreclosure alternatives for loans to which they hold credit exposure more often.

Credit exposure theoretically could motivate mortgage servicers to administer securitized loans as if held in portfolio. DeMarzo and Sannikov (2006) show that the principal (i.e., bondholder) can motivate the agent (i.e., servicer) to exert optimal effort in managing the underlying project by promising the agent a payoff that depends on the residual value of the project at termination.[4] However, the effectiveness of credit exposure is unclear. There are existing mechanisms other than credit exposure designed to motivate optimal behavior by the agents. First, servicing contracts can prescribe penalties to motivate optimal behavior. Piskorski and Westerfield (2016) show that random audits on the agent can motivate optimal

[3] Ambrose and Capone Jr (1996), Wang, Young and Zhou (2002), Pennington-Cross (2006), and Clauretie and Daneshvary (2011) point out that foreclosure is a costly process that reduces property values relative to other alternatives. Foreclosures for example take up administrative costs in processing the repossession and sale of the loan's collateral. Furthermore, the process can result in property damage if the property, for example, is left vacant and uncared in the interim.

[4] This theory builds o the literature on agency problems beginning with Alchian and Demsetz (1972) who argue that positioning the intermediary as the residual claimant will motivate the intermediary to optimally monitor the borrowers of the underlying assets.

behavior when using the proper frequency and penalty combination. Second, the bondholders can use a delegated monitor such as a trustee to oversee the servicers.[5] Hence, the impact of credit exposure on servicer behavior is unclear ex ante.

To identify the effect of credit exposure on servicing behavior, I take advantage of acquisitions in the retail and investment banking sectors that led to affiliations between the servicers and bondholders. This occurs when a bank acquires an investment firm that happens to hold securities that the bank is servicing or vice versa. For example, at the start of the Great Recession, Bank of America in a corporate takeover took control of Solomon Brothers Asset Management who held securities that Bank of America was servicing. As a result, Bank of America was incidentally exposed to the loans Bank of America was servicing—an outcome unanticipated at the issuance of related RMBS.

Using data from BlackBox on subprime private RMBS loans, I compare the outcomes of delinquent loans serviced by a bank with an affiliated bondholder to those serviced by a bank without an affiliated bondholder. I find that affiliation motivates a mortgage servicer to increase the liquidation rate of delinquent loans. But I also find that it motivates the servicer to seek non-foreclosure avenues more often. Affiliation seems to allow the servicing bank to develop a sensitivity to the cash flows from the loans she is servicing and thus capitalize potential losses into foreclosure decisions. The empirical strategy features a multinomial logit model on the competing risks of foreclosure versus non-foreclosure workout alternatives. The foreclosure and non-foreclosure outcomes are measured within a 12-month performance window starting from each loan's 60-days delinquency date; but the results hold using alternative performance windows.

The endogeneity concern is that affiliation perhaps correlates with the underlying quality of the RMBS deals' collateral pool. To mitigate this endogeneity concern, the baseline model includes controls for the loan quality such as the borrower's

[5] Tirole (1986), for example, shows that a supervisor can motivate the agent to perform optimally by buying from the supervisor his information set; This is assuming that the agent and the supervisor cannot collude against the principal. If collusion is possible, the same e□ort and profit can be achieved by making the supervisor a partner (or giving him credit exposure). Moreover, as Ashcraft, Gooriah and Kermani (2014) and Stanton and Wallace (2018) point out, credit rating agencies provide high rating on the bonds the sponsoring banks issue through the SPV that give investors confidence about the underlying assets. The idea follows Ramakrishnan and Thakor (1984) who argue that with an information disadvantage for when a firm is issuing public shares, the public can heir a third-party to provide information about the quality of the firm.

credit score, loan type, and income documentation at origination. Moreover, I employ two robustness checks. First, I obtained a balanced treatment and control sample from propensity score matches and fit the baseline model using this sample. The propensity score approach mimics random assignment of loans to RMBS deals with or without a servicer-bondholder affiliation. Second, I employ a two-step selection model in which the first step models the likelihood of default and the second step estimates the likelihood of liquidation while correcting for selection in a holdout sample. In both robustness checks, the results on the marginal effect of affiliation remain virtually unchanged.

To understand how bondholders respond to affiliations, I examine RMBS bond holdings reported in Thompson Reuters' eMAXX dataset. The bond holdings data contain information on various types of bonds held by institutional investors like insurance firms and mutual funds. I find that institutional bondholders do not reduce their holdings in the affected RMBS bonds relative to their total holdings when an affiliation exists between the mortgage servicer and another senior investor with related bond holdings. I also find that the institutional bondholders do not reduce their own holdings when they are affiliated to the mortgage servicer. The results provide no evidence that the bondholders respond negatively to servicer-investor affiliations.

This paper relates to the research on affiliations in the securitization market. Demiroglu and James (2012) examine how affiliation between the loan originator and RMBS sponsor affect the loan quality. Ambrose, Sanders and Yavas (2016) test whether affiliations among the servicers within deals is efficient when working with delinquent commercial loans. Conklin et al. (2018) analyze how affiliations between the originators of residential mortgages and the servicers can create information advantages when modifying delinquent loans. Lopez (2018) studies how affiliations between the servicers and trustee can create monitoring conflicts and skew the servicer's behavior. This paper contributes to the literature in securitization by exploring the impact of servicer-investor affiliations on the ex post securitization efforts of mortgage servicers. My paper also relates to the work on quantifying the impact of risk retention on servicer behavior. Pagès (2013) theorizes that risk retention can motivate deal sponsors to securitize high quality loans but a 5 percent mandate will have varying levels of effectiveness across different deals. Guo and Wu (2014) admonish that mandatory risk retention could reduce the information

flow from deal sponsors to investors and exacerbate the adverse selection challenges in securitization. Furfine (2018) finds that risk retention increases the quality of securitized mortgages but at the expense of higher borrowing costs. Agarwal et al. (2018) also investigate the effect of risk retention on securitized commercial mortgages of multifamily structures. My paper shows that holding an affiliation with senior bondholders influences servicer behavior. The results suggest that credit exposure form part of the tool set that complements oversight of the financial intermediaries administering securitized mortgages.

The rest of the paper proceeds as follows. In Section 4.2, I discuss the available RMBS data and explain how I flag affiliations between the servicers and investors. I then provide an empirical analysis in Section 4.3. In Section 4.5, I examine how bondholders respond to affiliations. In Section 4.6, I conclude and discuss policy implications.

4.2 Data

I use data from BlackBox (BBx) and the Thomas Reuters eMAXX database on bond holdings. BlackBox provides loan performance records on over seven million non-agency RMBS loans. The loan records include time varying information about the loans such as the delinquency status and liquidation avenue (if applicable). They also supply descriptions of standard underwriting criteria (e.g., Loan-to-value ratio, borrower's credit score) and the financial institutions serving as mortgage servicers. Meanwhile, eMAXX provides quarterly senior bond holdings on mortgage securities by insurance companies, mutual funds, and other institutional investors. I focus on first-lien mortgages for purchase, refinance, or cash-out refinance that were originated on or after 2000 and became 60-days or more delinquent in debt service payments within two years of securitization. I exclude loans with a missing credit (FICO) score, loan-to-value (LTV) ratio, or loan balance fields. I also focus on loans that merge with the eMAXX database at the loans' delinquency date. This results in a sample of over 978,501 mortgages that became delinquent between the first quarter of 2005 and the fourth quarter of 2008. The sample contains up to four years of performance records for each loan in the sample following its delinquency date.

4.2.1 Flagging A□liations

The BBx and eMAXX datasets allow me to observe and flag affiliations. To do so, I begin by identifying all the institutional investors in the eMAXX dataset with RMBS holdings.[6] There are over 500 firms with in-sample RMBS holdings. About 44 percent of the firms are insurance companies, 34 percent are investment managers, 11 percent are banks, and 4 percent are mutual funds. The remainder include governments, hedge funds, and pension funds. Next, I identify the mortgage servicers in the BBx sample, and determine whether each servicer is a subsidiary or a parent firm of each investor.[7] Finally, I flag RMBS deals on a quarterly basis in which at least one bondholder is affiliated to the mortgage servicer. Tables 4.1 and 4.2 in the Appendix summarize the affiliations for pre- and post-2007, respectively. The post-2007 affiliations formed following merger activity during the Great Recession.

Table 4.3 tabulates the sample of delinquent loans by servicer and whether there is an affiliate at the time of the loan's 60-days delinquency date. As Table 4.3 shows, there are 978,501 delinquent loans of which 36,666 have an affiliate. The largest servicer is Ocwen, representing 16.8 percent of all delinquent loans in the sample; but none of the loans that Ocwen services appear to have an affiliated bondholder. The second largest servicer is Countrywide Home Loans, which Bank of America bought in July 2008. Countrywide (or Bank of America doing business as Countrywide) was servicing 9,115 loans with an affiliate and 155,191 without an affiliate. Using its own name, Bank of America was servicing 5,602 out of 28,758 loans for an affiliate bondholder. The third largest servicer is Wells Fargo, accounting for nearly 12 percent of the sample. Wells Fargo likewise was servicing both loans with (8,804) and without (110,567) an affiliate. Other major banks servicing loans with and without an affiliate include Aurora Loan Services, Litton Loan Servicing, Saxon Mortgage Servicing, EMC Mortgage, JP Morgan Chase, EMC Mortgage, Select Portfolio Servicing, and Washington Mutual among others.

Figure 4.1 displays the frequency of loans with affiliations by the loans' delinquency year. The figure indicates that relatively few loans held a servicer-investor

[6] I use a crosswalk from Bloomberg to merge the BBx and eMAXX datasets.

[7] There are over 90 mortgage servicers in the sample; I use online resources (i.e., company websites, press releases, prospectuses and so on) to evaluate whether an a□liation exists between an investor and mortgage servicer.

affiliation among loans that became delinquent in 2005. Affiliations, however, took off in the following years—affecting up to 23,738 loans in 2008 when several mergers and acquisitions formed. Figure 4.2 reports the average ownership share by the loans delinquency date, given affiliation. That is, the aggregate par amount of the loan's RMBS held by the servicier's affiliates divided by the outstanding balance of the RMBS deal at the time of the loan's delinquency. The ownership share is an informal proxy for the interest that the affiliates hold over the loan's RMBS deal performance. Intuitively, a larger share further motivates the affiliates and thus servicer to avoid losses. The figure suggest that the average affiliation ownership share ranges from 1.6 percent to 3.4 percent. In 2005, the affiliation ownership share of the deal was about 3.4 percent, but dropped in 2006 and 2007 before picking up again in 2008 at about 2.7 percent.

4.2.2 Loan-Level Summary Statistics

Table 4.4 reports summary statistics on the sample of loans by whether the servicer has an affiliated bondholder. Panel A provides the mean and standard deviation for each standard underwriting variable defined at the loan's origination date while Panel B (which is examined in the next section) provides the foreclosure and short sale (or non-foreclosure) rates. Among the loans in which the lenders are unaffiliated to the servicer, the borrower of the average loan in the sample has a credit score of 632, a LTV of 86.2 percent, an initial balance of about $163,000, and an interest rate of about 8 percent. Among the loans in which the servicer retains credit risk through an affiliation, the borrower of the average loan has a credit score of 664, a LTV of 87.5, an initial balance of about $163,000, and an interest rate of 7.6 percent.

The third column reports the differences between these statistics and the t-statistic from a standard mean difference t-test. All differences are statistically significant at the 1 percent significance level, but the differences provide little economic meaning. Table 4.5 provides further summary statistics (including t-statistics for the mean differences) for other variables in the analysis. Table 4.5 reveals that both subsamples (affiliated and unaffiliated) feature notable differences in the other loan characteristics such as loan purpose, loan type, property use, and income documentation. Since variation in the standard underwriting criteria exist,

a multivariate approach will be necessary to examine the marginal differences in the propensity of a mortgage servicer to foreclose or not on delinquent loans.

4.3 Empirical Analysis

This section presents the empirical analysis on the effect of affiliation on servicer behavior with respect to delinquent loans. In particular, I observe for each loan that becomes 60-days delinquent whether the servicer liquidates the loan through foreclosure or a non-foreclosure alternative within 12, 24, 36, or 48 months of default.[8] This section begins with a descriptive analysis of the foreclosure rates and then presents the baseline regression model and the results. Overall, this section shows that affiliation influences the mortgage servicer to seek non-foreclosure alternatives more often than otherwise.

4.3.1 Methodology

To evaluate how affiliation influences the mortgage servicer's behavior towards a delinquent loan, I use a competing risk model that incorporates a hazard function for each potential post-default event.[9] The hazard function I use specifies the risk that a loan experiences a certain event during the next infinitesimally small period, given the loan's survival time. Specifically, the hazard function for event j, conditional on the loan's survival up to time t, is

$$h_j(t) = b_j(t)\exp(X_t\beta_j + \text{Affiliation}\lambda_y) \tag{4.1}$$

where $b_j(t)$ stands for the baseline hazard rate for event j, X_t stands for a matrix of time-varying loan characteristics, and Affiliation is the dummy variable for whether the mortgage servicer is affiliated to at least one of the loan's RMBS bondholders. Hence, a change in the mortgage servicer's affiliation status represents a proportional change in the hazard of event j.

In the competing risk model, there are three events that may occur. First, a delinquent loan continues to survive without being liquidated ($j = 1$). Survival

[8] By focusing on the liquidation type instead of when the servicer initiates foreclosure, I bypass concerns that servicers engage in dual loss mitigation strategies simultaneously.

[9] The competing risk model is a common model used to evaluate the outcomes of mortgages; see Ambrose and Sanders (2003), for an example.

occurs when the borrower becomes current on loan payments, the borrower prepays the loan, or the mortgage servicer delays the liquidation of the loan. Second, a delinquent loan is liquidated through the foreclosure ($j = 2$) process. And third, the loan is liquidated through a non-foreclosure ($j = 3$) process. A non-foreclosure liquidation may include a residential short sale where the owner is allowed to sell the property of an amount below the outstanding balance, or a deed-in-lieu of foreclosure where the owner remits the property's deed to the lender in exchange for a full or partial pardon of the outstanding debt. The conditional probability of event $y \in \{j\}$ is

$$Pr(y|t, X_t, \text{Affiliation}; \beta_y, \lambda_y) = \frac{h_y(t)}{\sum_{j=1}^{3} h_j(t)}. \tag{4.2}$$

The numerator is the hazard function of event y while the denominator is the cumulative hazard of the three possible events. To estimate the parameters β_y and λ_y, I use a multinomial logit model with the survival outcome as the base. X_t stands for a matrix of controls.

The model's controls X_t are defined at the date of the loan's 60-days delinquency date and account for standard underwriter criteria found in prior literature on securitization frictions (e.g., Adelino, Gerardi and Willen, 2009; Piskorski, Seru and Vig, 2010; Agarwal et al., 2011). These controls are summarized and displayed in Table 4.5. Specifically, the controls include the loan's natural log of the balance outstanding, natural log of the term, contract rate, interest rate type dummies (i.e., fixed, adjustable-rate mortgage, or hybrid), loan type dummies (i.e., refinance, cash-out refinance, or purchase), and dummy variables for whether the loan has a prepayment penalty, or primary mortgage insurance. The controls also include property attributes including a categorical variable for the property use (i.e., primary, investment, or other) and another categorical variable for the property type (i.e., single family, condominium, or other).

Additionally, the controls include several variables that account for variation in the riskiness of the loans. First, the controls include a set of dummy variables for the borrower's FICO credit score at origination, and the LTV ratio. Mayer, Pence and Sherlund (2009) point out that breaking out the credit score and LTV into buckets allows the model to account for the non-linear impact of these variables on post-default outcomes. Second, the controls also include indicators for the income

documentation type that was obtained when originating the loan (i.e., high, low or no income documentation).[10] Prior studies show that loans with low or no income documentation tend to be riskier and subsequently under-perform relative to loans with high-income documentation (e.g., Keys, Seru and Vig, 2012). Finally, to account for changes in the economic or regulatory environment that could also affect loan quality, the controls include year and property location (state) fixed effects.

4.3.2 Descriptive Results

As a benchmark, Panel B of Table 4.4 reports the foreclosure and non-foreclosure liquidation rates by performance window. There are four performance windows that start at the time of the loan's 60-day delinquency date: the 6-month window, the 12-month window, the 24-month window, and the 48-month window. The foreclosure rows report the share of loans foreclosed and liquidated within the specified performance window. The non-foreclosure rows report the share of loans liquidated through a non-foreclosure avenue (other than prepayment) within the specified performance window. The remainder is the share of loans that survive; that is, become current on mortgage payments or remain delinquent.

As Panel B of Table 4.4 shows, 1 percent of the delinquent loans are liquidated through foreclosure within six months of securitization and another 1 percent are liquidated through a non-foreclosure avenue whether or not the servicer is affiliated to the bondholders. The 12-month performance window reports differences among the foreclosure and non-foreclosure liquidation rates. The 12-month performance window reveals that the foreclosure liquidation rate is 11 percent and 8 percent with and without affiliation, respectively. Meanwhile, the non-foreclosure rate is 2 percent and 1 percent with and without affiliation, respectively.

These statistics suggest that affiliation correlates with higher levels of liquidation. However, they also suggest that affiliation motivates the mortgage servicer to seek non-foreclosure alternatives. For every non-foreclosure liquidation within 12 months of default, there are eight (or .08/.01) foreclosure liquidations in the absence of

[10] High income documentation refers to the situation in which the mortgage underwriter required the borrower to provide at least two-years of income tax reports, pay-stubs, and other relevant documents to prove the borrower's creditworthiness. Low or no income documentation refers to the situation in which the mortgage underwriter required fewer or no documents to prove he borrower's creditworthiness.

affiliation. With affiliation, however, there are about five (or .11/.02) foreclosure liquidations for every non-foreclosure liquidation. The larger performance windows reveal similar statistics.

4.3.3 Baseline Results

Table 4.6 reports the point estimates of equation 4.2 using a multinomial logit model. I fit three specifications: A, B, and C. Specification A uses no controls other than the affiliation dummy variable. The purpose is to observe the baseline correlation between affiliation and the foreclosure and non-foreclosure liquidation outcomes. Specification B adds the baseline controls, and Specification C adds fixed effects for the loan's default year and property's location. All three specifications use robust standard errors clustered by the property's location. The odd columns of Table 4.6 report the coefficient estimates of affiliation on the relative risk of foreclosure while the even columns report them for the relative risk of non-foreclosure. The base for each specification is surviving during a 12-month performance window.

Specification A in Table 4.6 suggests that affiliation correlates significantly with foreclosure decisions while Specifications B and C refine the marginal effects of affiliation. The coefficient estimates for affiliation in all three specifications are statistically significant at the conventional levels. As reported by Specification A in columns (1) and (2), affiliation marginally affects the chances of foreclosure and non-foreclosure relative to survival by .42 and .70 units at the 1 percent significance level, respectively. Upon obtaining the odd ratios by calculating exponent of the coefficients, the results suggests that the marginal increase in the relative risk of non-foreclosure over foreclosure that can be attributed to affiliation is $1.33 = (2.02/1.52)$. In other words, an affiliation between the mortgage servicer and investor(s) increases the chance of non-foreclosure by 33 percent relative to foreclosure. Specifications B and C produce smaller coefficients for affiliation but tell the same story. For instance, the coefficient estimates from Specification C in columns (5) and (6) suggest that the relative risk of foreclosure does not change; but the relative risk increases by 40 percent for a non-foreclosure liquidation,[11] implying that the chance of non-foreclosure relative to foreclosure due to affiliation increases by about 40 percent as well.

[11] These figures are calculated as $\exp\{\beta\} - 1$ using the point estimates in columns (5) and (6).

To ensure that the 12-month performance window is not influencing the results, I examine the results using alternative performance windows. While still using a multinomial logit model, I estimate equation 4.2 but specify the dependent variable on the basis of the 6-month, 24-month or 48-month performance window. Table 4.7 reports the results. Overall, the effect of affiliation in each performance window is positive and statistically significant at the 1 percent level for the non-foreclosure liquidation outcome while insignificant for the foreclosure liquidation outcome. Furthermore, the marginal impact of affiliation on the non-foreclosure outcome is larger than that of the foreclosure outcome. These results are therefore supportive of the earlier findings.

4.4 Robustness Checks

The prior section presents results that suggest that the mortgage servicer's behavior varies when exposed to the mortgages she services through an affiliation with the bondholders. The results hold using a rich set of controls and fixed effects. They also hold using alternative performance windows. However, there may be other confounding factors that could influence the results. Although the affiliation proxy obtains identification from unperceived acquisitions ex-post securitization, and thus should not be biased by unobservable factors, I relax this assumption and investigate alternative specifications of the baseline multinomial logit model. Specifically, I use propensity score matching, account for servicer heterogeneity using a probit model, and consider the impact of sample selection bias.

4.4.1 Propensity Score Matching

An endogeneity concern is that bias may arise from the non-random assignment of loans to servicers with or without affiliated bondholders. For example, if affiliations develop more often among loans that are performing well and more likely to cure or qualify for non-foreclosure alternatives, it is possible that the point-estimates on affiliation is biased. To reduce this endogeneity concern, I employ propensity score matching. Rosenbaum and Rubin (1985) argue that propensity score matching mimics random sampling and provides a non-linear alternative. The goal is to find for every loan being serviced by a servicer with an affiliated bondholder an

observably similar loan being serviced by the same servicer but without an affiliated bondholder. The matching will ensure the comparison of loans have the same size, cost, and risk among other characteristics.

To match the loans, I first obtain the propensity scores from fitting the following model on the probability of Affiliation for loan i using a Probit regression:

$$Pr(\text{Affiliation}_i = 1 | Z_{it}, \eta_t) = \quad (Z_{it}\gamma + \epsilon_i) \tag{4.3}$$

where stands for the cumulative density function, Z_{it} stands for a matrix of time-varying characteristics (defined at default date t), γ stands for a vector of coefficients, and ϵ_i stands for an error term.[12] Specifically, the matrix Z_{it} includes the same covariates in the baseline regression (i.e., Specification C of Table 4.6) but excludes the Affiliation dummy.

I next find for each affiliated loan a comparable unaffiliated loan that has the closest propensity score that falls within a caliper of 0.02, and allow matching with replacement. The process yields 69,321 observations. Using the balanced sample, I re-run the baseline multinomial logit model. Table 4.8 reports the results. The results are supportive of the earlier findings.

4.4.2 Servicer Heterogeneity

I consider whether differences among the servicers administering the underlying loans affect the results. Agarwal et al. (2011) point out that the available resources to handle large levels of delinquent loans vary from one servicer to the next. If servicers with substantial resources are more capable of considering non-foreclosure alternatives, and are simultaneously more likely to hold an affiliation with a bondholder, then omission of a control for the servicer's resources could bias the affiliation coefficient positively. Thus, to reduce this omitted variable bias concern, I add to the baseline regression model a set of fixed effects to identify the mortgage servicer administering the loan. However, since there are over 90 mortgage servicers in the sample, the computation difficulty increases when adding servicer fixed effects to the baseline multinomial logit model. To bypass this challenge, I change the functional form of the baseline regression model to a probit model.

Table 4.10 reports the marginal effects of affiliation (at the mean) on the

[12] To implement the matching procedure, I use the PSMATCH2 command in STATA.

likelihood of a foreclosure or non-foreclosure liquidation outcome. The odd columns use an indicator for whether the loan is liquidated through foreclosure within 12 months while the even columns use an indicator for whether the loan is liquidated through a non-foreclosure avenue within 12 months. Moreover, columns (1) and (2) do not include servicer fixed effects while columns (3) and (4) include them. The results suggest that affiliation increases the chances of non-foreclosure but not foreclosure, per se. Specifically, column (1) reveals that affiliation does not affect the marginal likelihood of foreclosure. However, column (2) reveals that affiliation increases the chances of non-foreclosure by 20 basis points, which is statistically significant at the 1 percent level.

Adding the servicer fixed effects to the probit regressions does not substantially affect the marginal estimate of affiliation on the foreclosure likelihood. The marginal impact of affiliation on the non-foreclosure likelihood, however, slightly changes to 10 basis points but remains statistically significant at the 1 percent level. Nevertheless, the results in column (4) imply that affiliation increases the relative chances of a non-foreclosure liquidation for a delinquent loan. The results are therefore robust to servicer heterogeneity.

4.4.3 Likelihood of Default

Up until this point, the analysis has focused on loans that became 60 days delinquent. In this subsection, I apply a split-sample approach as an alternative method to account for the possibility of bias from non-random assignment. The full sample of loans comprise 5.17 million loans of which about 1.1 million became delinquent within 2 years of securitization.[13] Among these loans, 59,521 had affiliated bondholders, representing about 1.15 percent of the full sample.

Using half of the full sample, chosen at random, I first predict the likelihood that a loan becomes delinquent within two years of securitization. Specifically, I estimate the following linear probability model using OLS

$$\text{Default}_i = \delta \text{Affiliation}_t + X_{it}\gamma + e_i \tag{4.4}$$

[13] These figures exclude loans that have missing data and did not merge with the Thompson Reuter's eMAXX dataset. There are a few more loans than in the previous tables since there are more observations that have non-missing fields at the date of securitization rather than at the date of delinquency.

where Affiliation$_t$ is defined at the date of securitization t, X_{it} stands for the control variables (as in Table 4.6, Specification C) but defined at the date of securitization, and e_i stands for the error term.

I then re-fit the baseline multinomial logit regression model using the holdout sample and include the predicted likelihood of default. Table 4.9 reports the results. Column (1) reports the OLS point estimates of equation 4.4. They suggest that affiliation at securitization does not correlate significantly with the likelihood of default. Columns (2) and (3) report the point estimates for the multinomial logit regression model using the holdout sample and include the predicted default likelihood as an additional regressor. The results suggest that the likelihood of a pre-foreclosure outcome is higher than that of foreclosure on loans with affiliated bondholders. As a benchmark, columns (4) and (5) repeat the baseline regression model using the hold out sample but excludes the predicted default likelihood. Overall, the results support the earlier findings that affiliation appears to motivate mortgage servicers to avoid foreclosure liquidations.

4.5 Do Investors Respond to A□liations?

In this section, I examine how investment firms with related RMBS bond holdings respond to affiliations. To do so, I turn to the eMAXX dataset on bond holdings. Specifically, I use a panel dataset of firm holdings in specific bond tranches over time. That is, for each firm, I observe quarterly time series of senior bond holdings from 2005 to 2008. I merge to this data the Black Box data on private, non-agency RMBS deals. The dataset amounts to 98,269 panel observations (without missing data fields), representing 2,223 RMBS deals, 8,945 RMBS bond tranches, and 519 firms.

I then run the following panel regression

$$H_{ibt} = \delta_1 \text{Affiliation1}_{bt} + \delta_2 \text{Affiliation2}_{bt} + X_{bt}\beta + \tau_t + \kappa_{ib} + \varepsilon \qquad (4.5)$$

where the dependent variable of interest H_{ibt} is the firm i's total RMBS holdings (or par amount) in bond tranche b as a percentage of the firm's total bond holdings at time t. A firm's medium RMBS holdings in a RMBS bond tranche is \$76,490,290 (or 14.7 percent of the medium firm's total bond holdings). Intuitively, if bondholders

anticipate that an affiliation is unfavorable, bondholders can minimize their exposure by selling their RMBS holdings in the affected RMBS deal and/or purchase non-RMBS bonds. Alternatively, if bondholders anticipate that an affiliation is favorable, bondholders may not have an incentive to minimize their exposure or reduce their holdings. Using similar reasoning, bondholders can respond by adjusting their RMBS holdings when an affiliation is held by a co-investor instead of themselves.

Hence, the independent variables of interest are "Affiliation1" and "Affiliation2". First, "Affiliation1" is an indicator variable that equals one when firm i is affiliated to the mortgage servicer of the loans underlying the RMBS bond tranche b; it equals zero otherwise. Second, "Affiliation2" is an indicator variable that equals one when another firm $j \neq i$ with related RMBS holdings is affiliated to the mortgage servicer of the loans underlying the RMBS bond tranche b; it equals zero otherwise. Since a firm's holdings for a particular RMBS bond tranche may change from one quarter to the next, the dummy variables of interest vary over time.

The control variables in equation 4.5 include time-varying RMBS deal attributes X_{bt}, fixed effects for the quarter-year τ_t of the observed holdings, and fixed effects for the firm-RMBS tranche holdings κ_{ib}. The quarter-year fixed effect account for contemporaneous changes in the economic environment that may impact the holding decisions of investment firms. The firm-RMBS tranche holdings fixed effects account for attributes that are firm specific, RMBS deal specific, or RMBS tranche specific. Finally, the matrix X_{bt} accounts for time-varying attributes specific to the RMBS deal related to the RMBS bond tranche. Specifically, this includes the time since securitization in quarters, the natural logarithm of the RMBS deal's outstanding balance, and the natural logarithm of the RMBS deal's cumulative losses.

The identification assumption of this model is that once controlling for firm, RMBS deal, RMBS bond tranche, and economic characteristics, treatment assignment of "Affiliation1" and "Affiliation2" is random. Table 4.11 reports the regression results. Column (1) holds the estimates using only the independent variables of interest and a rich set of fixed effects. Column (2) adds the time-varying RMBS deal attributes. Both columns reveal similar results: an affiliation to the mortgage servicer does not impact a firm's RMBS holdings at a statistically significant level. Likewise, an affiliation between a co-investor and the servicer does not impact a firm's RMBS bond tranche holdings at a statistically significant level. These results

suggest that firms do not respond negatively to affiliations.

4.6 Conclusion

This paper examines the impact of an affiliation between the mortgage servicer and investor on the servicer's behavior towards delinquent loans. I find that when a servicer becomes affiliated to an RMBS investor following merger activity, the mortgage servicer seeks non-foreclosure alternatives more often for delinquent loans. Specifically, the relative chance of a delinquent loan going through non-foreclosure relative to foreclosure increases by about 33 percent. The results suggest that mortgage servicers behave differently when they have exposure to the collateral they are servicing relative to when they hold no credit risk. Hence, the results have policy implications about how risk retention could influence the management of securitized delinquent loans by the servicer. This paper opens up further questions on what other mechanisms can align incentives between servicers and investors in the securitization market; such questions warrant future research.

Table 4.1. A□liated Bondholders by Mortgage Servicer between 2005 and 2007

Bank of America
BANC AMERICA CAPITAL MANAGEMENT CHARLOTTE
BANC AMERICA CAPITAL MANAGEMENT LOS ANGELES
BANK AMERICA PORTFOLIO
COLUMBIA MANAGEMENT ADVISERS
COLUMBIA MANAGEMENT ADVISERS CHICAGO
COLUMBIA MANAGEMENT ADVISERS PORTLAND
MARSICO CAPITAL MANAGEMENT
US TRUST TRUST
Countrywide
COUNTRYWIDE CAPITAL MARKETS
LEGG MASON ASSET MANAGEMENT JAPANLTD
LEGG MASON PARTNERS FUND ADVISER NEW YORK
SALOMON BROTHERS ASSET MANAGEMENT UNITED STATES
SMITH BARNEY ASSET MANAGEMENT
EMC Mortgage
BARROW HANLEY MEWHINNEY STRAUSS INC
BEAR STEARNS ASSET MANAGEMENT
Wells Fargo
WELLS FARGO BANK PRIVATE CLIENT SERVICES PORTLAND
WELLS FARGO BANK PRIVATE CLIENT SERVICES SALT LAKE
WELLS FARGO FINANCIAL
Aurora Bank
LEHMAN BROTHERS ASSET MANAGEMENT LLC
NEUBERGER BERMAN INVESTMENT MANAGEMENT
LaSalle Bank
ABN AMRO ASSET MANAGEMENT
SCOTIA CAPITAL PORTFOLIO MANAGEMENT
Wilshire Credit Corp
BLACKROCK NEW JERSEY

Table 4.1. A□liated Bondholders by Mortgage Servicer between 2005 and 2007 (continued)

JP Morgan Chase
AMERICAN CENTURY GLOBAL INVESTMENT MANAGEMENT
AMERICAN CENTURY INVESTMENTS KANSAS CITY
AMERICAN CENTURY INVESTMENTS MOUNTAIN VIEW
BANC ONE INVESTMENT ADVISERS WISCONSIN
JPMORGAN ASSET MANAGEMENT COLUMBUS
JPMORGAN CHASE BANK PORTFOLIO
JPMORGAN HIGH YIELD PARTNERS
MORGAN J P FLEMING ASSET MANAGEMENT
Goldman Sachs (dba: Litton Loan Services and Avelo Mortgage)
GOLDMAN SACHS ASSET MANAGEMENT GSAM TOKYO
GOLDMAN SACHS ASSET MANAGEMENT GSAM UNITED STATESA
Credit Suisse (dba: Homeq Servicing Corp and Select Portfolio Servicing)
BARCLAYS GLOBAL INVESTORS SAN FRANCISCO
CREDIT SUISSE ASSET MANAGEMENT AMERICAS NEW YORK
CREDIT SUISSE ASSET MANAGEMENT LTD
Saxon Mortgage Services
MORGAN STANLEY INVESTMENT ADVISERS INC
MORGAN STANLEY INVESTMENT MANAGEMENT
MORGAN STANLEY INVESTMENT MANAGEMENT MONEY MARKETS
MORGAN STANLEY INVESTMENT MGMT WEST CONSHOHOCKEN
VANKAMPEN ASSET MANAGEMENT HOUSTON
VANKAMPEN INVESTMENTS
National City Bank
NATIONAL CITY INVESTMENT MANAGEMENT
NATIONAL CITY BANK PORTFOLIO CLEVELAND
CITI Bank/Ameriquest
CITIBANK PORTFOLIO
CITIGROUP INSURANCE INVESTMENTS
Aegis Mortgage
AEGIS ASSET MANAGEMENT
AEGIS SECURITY INSURANCE

Table 4.2. A□liated Bondholders by Mortgage Servicer in 2008

Bank of America (a)
BANC AMERICA CAPITAL MANAGEMENT CHARLOTTE
BANC AMERICA CAPITAL MANAGEMENT LOS ANGELES
BANK AMERICA PORTFOLIO
COLUMBIA MANAGEMENT ADVISORS
COLUMBIA MANAGEMENT ADVISORS CHICAGO
COLUMBIA MANAGEMENT ADVISORS PORTLAND
MARSICO CAPITAL MANAGEMENT
US TRUST TRUST
COUNTRYWIDE CAPITAL MARKETS
LEGG MASON ASSET MANAGEMENT JAPANLTD
LEGG MASON PARTNERS FUND ADVISOR NEW YORK
SALOMON BROTHERS ASSET MANAGEMENT UNITED STATES
SMITH BARNEY ASSET MANAGEMENT
ABN AMRO ASSET MANAGEMENT
SCOTIA CAPITAL PORTFOLIO MANAGEMENT
BLACKROCK NEW JERSEY (only for Wilshire Credit Corp)
JP Morgan Chase (b)
BARROW HANLEY MEWHINNEY STRAUSS INC
BEAR STEARNS ASSET MANAGEMENT
AMERICAN CENTURY GLOBAL INVESTMENT MANAGEMENT
AMERICAN CENTURY INVESTMENTS KANSAS CITY
AMERICAN CENTURY INVESTMENTS MOUNTAIN VIEW
BANC ONE INVESTMENT ADVISORS WISCONSIN
JPMORGAN ASSET MANAGEMENT COLUMBUS
JPMORGAN CHASE BANK PORTFOLIO
JPMORGAN HIGH YIELD PARTNERS
MORGAN J P FLEMING ASSET MANAGEMENT
Wells Fargo (c)
WELLS FARGO BANK PRIVATE CLIENT SERVICES PORTLAND
WELLS FARGO BANK PRIVATE CLIENT SERVICES SALT LAKE
WELLS FARGO FINANCIAL
EVERGREEN INSTITUTIONAL ASSET MANAGEMENT CHARLOTTE
EVERGREEN INSTITUTIONAL ASSET MANAGEMENT PHILADELPHIA
EVERGREEN INSTITUTIONAL ASSET MGMT JACKSONVILLE
EVERGREEN INVESTMENT MANAGEMENT LLC
GOLDEN WEST FINANCIAL
SOUTHTRUST BANK TRUST
TATTERSALL ADVISORY GROUP

Table 4.2. A□liated Bondholders by Mortgage Servicer in 2008 (continued)

Credit Suisse (dba: Homeq Servicing Corp and Select Portfolio Servicing)
BARCLAYS GLOBAL INVESTORS SAN FRANCISCO
CREDIT SUISSE ASSET MANAGEMENT AMERICAS NEW YORK
CREDIT SUISSE ASSET MANAGEMENT LTD
Saxon Mortgage Services
MORGAN STANLEY INVESTMENT ADVISORS INC
MORGAN STANLEY INVESTMENT MANAGEMENT
MORGAN STANLEY INVESTMENT MANAGEMENT MONEY MARKETS
MORGAN STANLEY INVESTMENT MGMT WEST CONSHOHOCKEN
VANKAMPEN ASSET MANAGEMENT HOUSTON
VANKAMPEN INVESTMENTS
CITI Bank/Ameriquest
CITIBANK PORTFOLIO
CITIGROUP INSURANCE INVESTMENTS
Aegis Mortgage
AEGIS ASSET MANAGEMENT
AEGIS SECURITY INSURANCE

Table 4.3. Top Servicers by Loan Count

ID	Servicer	Una□liated	A□liated	Total
1	Ocwen	164,507	0	164,507
2	Countrywide	155,191	9,115	164,306
3	Wells Fargo	110,567	8,804	119,371
4	Residential Funding	72,646	0	72,646
5	Aurora Loan Services	53,867	2,853	56,720
6	Nationstar Mortgage	46,208	0	46,208
7	IndyMac	32,595	0	32,595
8	Litton Loan Servicing	31,541	458	31,999
9	Bank of America	23,156	5,602	28,758
10	JP Morgan Chase	26,791	1,319	28,110
11	EMC Mortgage	21,263	6,343	27,606
12	American Home Mortgage	21,841	0	21,841
13	Select Portfolio Servicing	19,884	835	20,719
14	Saxon Mortgage Servicing	15,616	407	16,023
15	Washington Mutual	14,882	922	15,804
16	Carrington Mortgage	13,053	0	13,053
17	Homeq Servicing Corp.	12,681	0	12,681
18	Wilshire Credit Corp.	7,961	0	7,961
19	GMAC	6,900	0	6,900
20	Option One	6,701	0	6,701
21	CitiMortgage	6,402	3	6,405
22	Homeward Residential	5,816	0	5,816
23	Home Loan Services	5,486	0	5,486
24	Bayview Loan Servicing	4,615	0	4,615
25-92	Others	61,665	5	61,670
	Total	941,835	36,666	978,501

This table displays the number of 60-days+ delinquent loans in the sample by servicer assigned at securitization and the servicer's a□liation status. Una□liated means that the servicer is not a□liated to any of the loan's investors at delinquency. A□liated means that the servicer is a□liated to one or more of the loan's investors at delinquency. (a) The servicer was acquired by Bank of America in 2008. (b) The servicer was acquired by J.P. Morgan Chase.

Table 4.4. Summary of Delinquent RMBS Loans

Variable	Unaffiliated	Affiliated	Difference
Panel A: Summary Statistics			
FICO Score	631.6	664.3	-32.7
	(65.20)	(64.17)	[-94.18]
Combined LTV	86.2	87.5	-1.3
	(13.39)	(11.74)	[-17.15]
Log Loan Balance	12.2	12.5	-0.3
	(0.71)	(0.69)	[-72.97]
Interest Rate	8.1	7.6	0.4
	(1.30)	(1.13)	[61.85]
Log Loan Term	5.89	5.91	-0.02
	(0.11)	(0.11)	[-30.37]
Panel B: Liquidation Rates			
Foreclosure (6 months)	0.01	0.01	0.00
Short Sale (6 months)	0.01	0.01	-0.01
Foreclosure (12 months)	0.08	0.11	-0.03
Short Sale (12 months)	0.01	0.02	-0.01
Foreclosure (24 months)	0.30	0.37	-0.07
Short Sale (24 months)	0.02	0.03	-0.01
Foreclosure (48 months)	0.31	0.38	-0.07
Short Sale (48 months)	0.01	0.02	-0.01
Observations	941,835	36,666	

Panel A reports the mean values of standard underwriter criteria for the sample of 60-day delinquent RMBS loans. Standard deviations are reported in parentheses. Panel B reports the foreclosure and non-foreclosure rate of 60-day delinquent loans. Unaffiliated means that the servicer is not affiliated to any of the loan's investors at delinquency. Affiliated means that the servicer is affiliated to one or more of the loan's investors at delinquency.

Table 4.5. Summary and t-statistics of Delinquent RMBS Loans for Additional Variables

Variable	Una□liated	A□liated	Di□erence
Interest Type: Fixed	0.22	0.18	0.04
	(0.41)	(0.38)	[17.46]
Interest Type: ARM	0.78	0.82	-0.04
	(0.41)	(0.38)	[-17.48]
Loan Purpose: Purchase	0.48	0.49	-0.01
	(0.50)	(0.50)	[-2.81]
Loan Purpose: Refinance Loan Type	0.14	0.16	-0.02
	(0.35)	(0.37)	[-12.49]
Loan Purpose: Cash Refinance Loan Type	0.38	0.35	0.03
	(0.48)	(0.48)	[11.91]
ARM Type: Hybrid Arm	0.17	0.28	-0.11
	(0.37)	(0.45)	[-56.04]
ARM Type: Option	0.09	0.37	-0.28
	(0.28)	(0.48)	[-181.64]
Prepayment Penalty	0.63	0.66	-0.04
	(0.48)	(0.47)	[-13.96]
Primary Mortgage Insurance	0.05	0.10	-0.04
	(0.23)	(0.30)	[-35.91]
Property Use: Primary Home	0.88	0.79	0.08
	(0.33)	(0.40)	[45.96]
Property Use: Investment Home	0.12	0.15	-0.04
	(0.32)	(0.36)	[-19.98]
Property Use: Other Home Type	0.01	0.05	-0.05
	(0.08)	(0.22)	[-102.83]
Income Documentation: Full	0.40	0.22	0.19
	(0.49)	(0.41)	[71.53]
Income Documentation: Low	0.52	0.72	-0.20
	(0.50)	(0.45)	[-75.87]
Income Documentation: Unknown	0.07	0.06	0.02
	(0.26)	(0.24)	[10.95]
Property Type: Single Family Home	0.78	0.73	0.05
	(0.42)	(0.45)	[24.15]
Property Type: Condominium	0.08	0.10	-0.02
	(0.27)	(0.30)	[-16.80]
Property Type: Planned Community	0.13	0.17	-0.04
	(0.33)	(0.37)	[-22.42]
Property Type: Other	0.02	0.01	0.01
	(0.13)	(0.09)	[14.76]
Observations	941,835	36,666	

This table reports the mean values of the variables in this study for the sample of 60-day delinquent RMBS loans. Standard deviations are reported in parentheses. This table also reports the mean di□erences in the last column and the corresponding t-statistics in brackets.

Table 4.6. Baseline Multinomial Logit

	(1)	(2)	(3)	(4)	(5)	(6)
	Specification A		Specification B		Specification C	
	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure
A□liation	0.419***	0.704***	0.172***	0.545***	-0.006	0.337***
	(0.050)	(0.156)	(0.057)	(0.114)	(0.036)	(0.121)
FICO below 550			-1.388***	-0.140	-1.130***	-0.002
			(0.077)	(0.118)	(0.051)	(0.083)
FICO between 550 and 560			-0.630***	-0.307***	-0.502***	-0.229***
			(0.025)	(0.064)	(0.023)	(0.047)
FICO at or above 750			0.273***	0.560***	0.237***	0.537***
			(0.036)	(0.096)	(0.030)	(0.086)
LTV below 70			-0.994***	0.224**	-0.934***	0.231**
			(0.048)	(0.097)	(0.058)	(0.097)
LTV between 70 and 80			-0.273***	-0.049	-0.259***	-0.042
			(0.025)	(0.054)	(0.016)	(0.056)
LTV between 90 and 100			-0.180***	0.098**	-0.056***	0.117**
			(0.029)	(0.045)	(0.016)	(0.047)
LTV between 100 and 110			0.002	0.570***	0.167***	0.594***
			(0.061)	(0.060)	(0.036)	(0.066)
LTV above 110			-0.393	-1.629**	-0.535*	-1.662**
			(0.280)	(0.768)	(0.288)	(0.760)
Balance			0.166	0.013	0.031	-0.067
			(0.121)	(0.079)	(0.036)	(0.086)
Log Loan Term			-0.429***	-0.218***	-0.347***	-0.332***
			(0.080)	(0.074)	(0.074)	(0.060)
Contract Rate			0.090***	0.029	0.095***	0.043*
			(0.014)	(0.032)	(0.008)	(0.023)
Interest Type: Fixed			-0.227***	0.029	-0.245***	0.022
			(0.066)	(0.040)	(0.031)	(0.042)
Interest Type: Unknown			-1.053*	1.759***	-1.515***	1.473**
			(0.544)	(0.603)	(0.583)	(0.625)
Loan Type: Refinance			0.041	0.360***	-0.014	0.298***
			(0.084)	(0.050)	(0.036)	(0.042)
Loan Type: Cash Refinance			-0.226***	0.258***	-0.244***	0.193**
			(0.058)	(0.072)	(0.042)	(0.076)
ARM Type: Hybrid Arm			-0.150***	0.490***	-0.253***	0.475***
			(0.042)	(0.092)	(0.023)	(0.094)
ARM Type: Option			-0.022	0.460***	-0.148***	0.394***
			(0.052)	(0.046)	(0.022)	(0.040)

(Continued)

Table 4.6. Baseline Multinomial Logit (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Specification A		Specification B		Specification C	
	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure
Prepayment Penalty			0.144	0.067	-0.076**	0.032
			(0.119)	(0.062)	(0.033)	(0.031)
Primary Mortgage Insurance			-0.745***	-1.149***	-0.721***	-1.143***
			(0.078)	(0.077)	(0.049)	(0.076)
Property Use: Investment			0.251***	0.156	0.314***	0.172
			(0.097)	(0.144)	(0.067)	(0.137)
Property Use: Other			-0.497***	-0.802***	-0.378**	-0.759***
			(0.162)	(0.199)	(0.156)	(0.198)
Income Documentation: Full			-0.004	0.310***	-0.026	0.308***
			(0.044)	(0.031)	(0.041)	(0.031)
Income Documentation: Unknown			-0.416***	-0.198**	-0.276***	-0.154
			(0.106)	(0.082)	(0.068)	(0.099)
Property Type: Condominium			-0.072	0.134	0.052	0.147
			(0.202)	(0.177)	(0.074)	(0.160)
Property Type: Planned			0.381**	0.244***	0.194***	0.319***
			(0.191)	(0.051)	(0.038)	(0.034)
Property Type: Other			-0.868***	-0.810***	-0.615***	-0.815***
			(0.109)	(0.153)	(0.095)	(0.142)
Observations	978,501	978,501	978,195	978,195	978,195	978,195
Default Year FE	No	No	No	No	Yes	Yes
State FE	No	No	No	No	Yes	Yes
Pseudo R^2	0.001	0.001	0.06	0.06	0.122	0.122

This table reports Multinomal Logit estimates. The dependent variable is a categorical variable that has three outcomes: foreclosure, non-foreclosure, or survived. “Foreclose” is when the loan is liquidated through foreclosure within 12 months of delinquency. “Non-Foreclosure” is when the loan is liquidated through a non-foreclosure method (i.e., short sale, deed-in-lieu of foreclosure) within 12 months of delinquency. “Survived” is the base and stands for when the loan cures or is not liquidated within 12 months of delinquency. “A□liation” is an indicator variable that equals one when the mortgage servicer is a□liated to an investors holding related RMBS bonds, and zero otherwise. Robust standard errors clustered by the property’s state are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 4.7. Multinomial Logit with Alternative Windows

	(1)	(2)	(3)	(4)	(5)	(6)
	6-month		24-month		48-month	
	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure
A□liation	0.045	0.342***	-0.010	0.326***	-0.024	0.311**
	(0.055)	(0.132)	(0.065)	(0.122)	(0.061)	(0.121)
FICO below 550	-1.111***	-0.011	-0.981***	-0.169*	-1.014***	-0.912***
	(0.100)	(0.079)	(0.036)	(0.091)	(0.035)	(0.069)
FICO between 550 and 650	-0.495***	-0.216***	-0.475***	-0.295***	-0.488***	-0.555***
	(0.056)	(0.047)	(0.019)	(0.054)	(0.021)	(0.040)
FICO at or above 750	0.295***	0.594***	0.149***	0.526***	0.166***	0.589***
	(0.062)	(0.072)	(0.032)	(0.068)	(0.031)	(0.044)
LTV below 70	-0.687***	0.314***	-1.129***	0.003	-1.162***	-0.956***
	(0.091)	(0.096)	(0.115)	(0.143)	(0.118)	(0.176)
LTV between 70 and 80	-0.269***	0.024	-0.329***	-0.123*	-0.349***	-0.326***
	(0.049)	(0.065)	(0.033)	(0.069)	(0.033)	(0.053)
LTV between 90 and 100	0.008	0.115**	-0.049***	0.096**	-0.009	0.109***
	(0.035)	(0.046)	(0.018)	(0.042)	(0.019)	(0.032)
LTV between 100 and 110	0.410***	0.578***	0.043	0.545***	0.168***	0.546***
	(0.068)	(0.070)	(0.026)	(0.064)	(0.024)	(0.049)
LTV above 110	-16.857***	-1.699	-0.196	-0.960**	-0.259**	-0.586
	(0.276)	(1.045)	(0.128)	(0.430)	(0.130)	(0.412)
Balance	0.068	-0.031	-0.011	-0.155*	-0.003	-0.143
	(0.114)	(0.065)	(0.049)	(0.092)	(0.050)	(0.141)
Log Loan Term	-0.266**	-0.157*	-0.642***	-0.536***	-0.633***	-0.640***
	(0.134)	(0.090)	(0.123)	(0.070)	(0.127)	(0.125)
Contract Rate	0.104***	0.066***	0.084***	0.055**	0.081***	0.065*
	(0.025)	(0.015)	(0.009)	(0.027)	(0.008)	(0.036)
Interest Type: Fixed	-0.156***	0.074*	-0.313***	-0.082	-0.323***	-0.331***
	(0.052)	(0.042)	(0.049)	(0.057)	(0.049)	(0.060)
Interest Type: Unknown	-18.347***	1.868*	-1.608***	0.490	-1.676***	0.394
	(0.565)	(1.127)	(0.440)	(0.774)	(0.457)	(0.981)
Loan Type: Refinance	0.176***	0.289***	-0.112***	0.263***	-0.022	0.365***
	(0.065)	(0.048)	(0.029)	(0.043)	(0.028)	(0.057)
Loan Type: Cash Refinance	-0.125*	0.317***	-0.260***	0.086	-0.285***	-0.101
	(0.069)	(0.057)	(0.030)	(0.076)	(0.029)	(0.071)
ARM Type: Hybrid Arm	-0.454***	0.588***	-0.229***	0.370***	-0.276***	-0.370***
	(0.048)	(0.090)	(0.031)	(0.092)	(0.030)	(0.090)
ARM Type: Option	-0.300***	0.452***	-0.145***	0.416***	-0.161***	0.321***
	(0.078)	(0.051)	(0.041)	(0.044)	(0.039)	(0.031)

(Continued)

Table 4.7. Multinomial Logit with Alternative Windows

	(1)	(2)	(3)	(4)	(5)	(6)
	6-month		24-month		48-month	
	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure
Prepayment Penalty	-0.033	0.040	-0.100***	0.015	-0.111***	-0.076**
	(0.047)	(0.042)	(0.032)	(0.028)	(0.032)	(0.039)
Primary Mortgage Insurance	-1.125***	-1.309***	-0.139***	-0.882***	-0.207***	-0.965***
	(0.152)	(0.113)	(0.050)	(0.085)	(0.051)	(0.080)
Property Use: Investment	0.333***	0.087	0.477***	0.260*	0.491***	0.357***
	(0.102)	(0.127)	(0.054)	(0.141)	(0.057)	(0.138)
Property Use: Other	-0.714*	-1.417***	-0.153*	-0.315*	-0.133	0.117
	(0.371)	(0.463)	(0.090)	(0.166)	(0.082)	(0.184)
Income Documentation: Full	0.010	0.372***	-0.147***	0.258***	-0.149***	0.168***
	(0.041)	(0.049)	(0.025)	(0.026)	(0.024)	(0.037)
Income Documentation: Unknown	0.146	-0.051	-0.849***	-0.486***	-0.882***	-0.334***
	(0.093)	(0.096)	(0.058)	(0.090)	(0.057)	(0.099)
Property Type: Condominium	0.152	0.230	0.068	0.122	0.075	0.215
	(0.137)	(0.154)	(0.053)	(0.156)	(0.053)	(0.187)
Property Type: Planned	0.169***	0.346***	0.098**	0.303***	0.099**	0.353***
	(0.060)	(0.042)	(0.049)	(0.035)	(0.049)	(0.049)
Property Type: Other	-0.096	-0.983***	-0.370***	-0.660***	-0.342***	-0.471***
	(0.116)	(0.168)	(0.074)	(0.117)	(0.072)	(0.159)
Observations	978,195	978,195	978,195	978,195	978,195	978,195
Default Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.058	0.058	0.143	0.143	0.150	0.150

This table reports Multinomal Logit estimates. The dependent variable is a categorical variable that has three outcomes: foreclosure, non-foreclosure, or survived. “Foreclose” is when the loan is liquidated through foreclosure within 6, 24, or 48 months of delinquency. “Non-Foreclosure” is when the loan is liquidated through a non-foreclosure method (i.e., short sale, deed-in-lieu of foreclosure) within 6, 24, or 48 months of delinquency. “Survived” is the base and stands for when the loan cures or is not liquidated within 6, 24, or 48 months of delinquency. “A□liation” is an indicator variable that equals one when the mortgage servicer is a□liated to an investors holding related RMBS bonds, and zero otherwise. Robust standard errors clustered by the property’s state are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 4.8. Multinomial Logit Ex Post Propensity Score Matching

	(1) Foreclose	(2) Non-Foreclose
A□liation	0.024	0.325***
	(0.045)	(0.088)
FICO below 550	-1.195***	0.471***
	(0.127)	(0.138)
FICO between 550 and 650	-0.550***	-0.263*
	(0.041)	(0.158)
FICO above 750	0.315***	0.582***
	(0.047)	(0.119)
LTV below 70	-0.880***	-0.001
	(0.075)	(0.175)
LTV between 70 and 80	-0.208***	-0.137***
	(0.031)	(0.045)
LTV between 90 and 100	-0.140**	-0.197*
	(0.056)	(0.104)
LTV between 100 and 110	0.024	0.385
	(0.094)	(0.260)
LTV above 110	-16.376***	-16.146***
	(0.581)	(0.613)
Log Loan Balance	0.008	0.179**
	(0.047)	(0.080)
Log Loan Term	-0.411***	-0.379*
	(0.128)	(0.220)
Contract Rate	0.103***	-0.022
	(0.033)	(0.036)
Interest Type: Fixed	-0.353***	-0.475***
	(0.054)	(0.130)
Loan Type: Refinance	0.065**	0.186**
	(0.031)	(0.074)
Loan Type: Cash Refinance	-0.219***	-0.028
	(0.041)	(0.179)
ARM Type: Hybrid Arm	-0.431***	-0.074
	(0.029)	(0.102)
ARM Type: Option	-0.178***	0.591***
	(0.051)	(0.087)

(Continued)

Table 4.8. Multinomial Logit Ex Post Propensity Score Matching (Continued)

	(1) Foreclose	(2) Non-Foreclose
Prepayment Penalty	-0.159***	-0.028
	(0.035)	(0.075)
Primary Mortgage Insurance	-0.601***	-0.974***
	(0.057)	(0.160)
Property Use: Investment	0.290***	-0.256**
	(0.083)	(0.130)
Property Use: Other	-0.481***	-0.931***
	(0.165)	(0.252)
Income Documentation: Full	-0.020	0.456***
	(0.062)	(0.086)
Income Documentation: Unknown	-0.183***	-0.364
	(0.060)	(0.232)
Property Type: Condominium	0.045	0.243
	(0.078)	(0.171)
Property Type: Planned	0.171***	0.345***
	(0.024)	(0.045)
Property Type: Other	-0.012	-1.792**
	(0.143)	(0.900)
Observations	69,321	69,321
Default Year FE	Yes	Yes
State FE	Yes	Yes
Pseudo R^2	0.113	0.113

This table reports Multinomal Logit estimates using a balanced sample obtained from propensity score matching. The dependent variable is a categorical variable that has three outcomes: foreclosure, non-foreclosure, or survived. "Foreclose" is when the loan is liquidated through foreclosure within 12 months of delinquency. "Non-Foreclosure" is when the loan is liquidated through a non-foreclosure method (i.e., short sale, deed-in-lieu of foreclosure) within 12 months of delinquency. "Survived" is the base and stands for when the loan cures or is not liquidated within 12 months of delinquency. "A□liation" is an indicator variable that equals one when the mortgage servicer is a□liated to an investors holding related RMBS bonds, and zero otherwise. Robust standard errors clustered by the property's state are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 4.9. Split Sample

	(1)	(2)	(3)	(4)	(5)
	OLS	Multinomial Logit		Multinomial Logit	
	1[Default]	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure
A□liation	0.003	0.010	0.285**	0.007	0.281**
	(0.003)	(0.026)	(0.141)	(0.024)	(0.142)
Delinquency Hat		-0.258	0.682**		
		(0.168)	(0.346)		
FICO below 550	0.207***	-1.066***	-0.520***	-1.129***	-0.359***
	(0.008)	(0.050)	(0.159)	(0.048)	(0.116)
FICO between 550 and 650	0.115***	-0.457***	-0.481***	-0.493***	-0.398***
	(0.004)	(0.022)	(0.074)	(0.021)	(0.068)
FICO at or above 750	-0.080***	0.216***	0.714***	0.238***	0.659***
	(0.003)	(0.027)	(0.062)	(0.025)	(0.069)
LTV below 70	-0.102***	-0.933***	-0.144	-0.916***	-0.212
	(0.014)	(0.078)	(0.173)	(0.066)	(0.146)
LTV between 70 and 80	-0.047***	-0.284***	-0.104	-0.272***	-0.141**
	(0.009)	(0.018)	(0.078)	(0.016)	(0.066)
LTV between 90 and 100	0.004**	-0.046***	0.116**	-0.049***	0.122**
	(0.002)	(0.017)	(0.054)	(0.019)	(0.055)
LTV between 100 and 110	-0.003	0.166***	0.581***	0.160***	0.581***
	(0.005)	(0.047)	(0.082)	(0.049)	(0.083)
LTV above 110	0.116***	-0.576**	-16.649***	-0.617**	-16.950***
	(0.014)	(0.283)	(0.322)	(0.284)	(0.340)
Log Loan Balance	0.010***	0.061*	-0.005	0.041	-0.003
	(0.001)	(0.037)	(0.110)	(0.038)	(0.105)
Log Loan Term	0.029*	-0.336***	-0.207	-0.344***	-0.235
	(0.017)	(0.079)	(0.160)	(0.083)	(0.159)
Contract Rate	0.031***	0.101***	0.061***	0.095***	0.078***
	(0.002)	(0.011)	(0.021)	(0.010)	(0.027)
Interest Type: Fixed	-0.077***	-0.260***	-0.036	-0.243***	-0.085*
	(0.006)	(0.033)	(0.053)	(0.029)	(0.048)
Interest Type: Unknown	-0.054	-1.640***	2.506***	-1.684***	2.226***
	(0.040)	(0.521)	(0.780)	(0.530)	(0.836)
Loan Type: Refinance	-0.018***	-0.016	0.396***	-0.012	0.385***
	(0.005)	(0.039)	(0.050)	(0.039)	(0.050)
Loan Type: Cash Refinance	-0.027***	-0.241***	0.140	-0.231***	0.122
	(0.003)	(0.043)	(0.087)	(0.043)	(0.083)
ARM Type: Hybrid Arm	-0.034***	-0.246***	0.142*	-0.241***	0.130*
	(0.004)	(0.023)	(0.079)	(0.024)	(0.076)
ARM Type: Option	-0.036***	-0.161***	0.391***	-0.145***	0.366***
	(0.005)	(0.029)	(0.044)	(0.030)	(0.043)

(Continued)

Table 4.9. Split Sample (Continued)

	(1)	(2)	(3)	(4)	(5)
	OLS	Multinomial Logit		Multinomial Logit	
	1[Default]	Foreclosure	Non-Foreclosure	Foreclosure	Non-Foreclosure
Prepayment Penalty	0.042***	-0.082**	-0.052	-0.089**	-0.023
	(0.007)	(0.036)	(0.043)	(0.037)	(0.043)
Primary Mortgage Insurance	-0.008***	-0.772***	-1.397***	-0.778***	-1.392***
	(0.003)	(0.041)	(0.099)	(0.041)	(0.100)
Property Use: Investment	-0.000	0.328***	0.257*	0.323***	0.262*
	(0.006)	(0.071)	(0.140)	(0.071)	(0.142)
Property Use: Other	0.049***	-0.423***	-0.552**	-0.429***	-0.456*
	(0.007)	(0.125)	(0.225)	(0.130)	(0.249)
Income Documentation: Full	-0.044***	-0.028	0.311***	-0.017	0.273***
	(0.002)	(0.044)	(0.056)	(0.046)	(0.061)
Income Documentation: Unknown	-0.113***	-0.259***	0.130	-0.238***	0.061
	(0.005)	(0.079)	(0.120)	(0.074)	(0.107)
Property Type: Condominium	-0.028***	0.036	0.231	0.042	0.211
	(0.004)	(0.077)	(0.205)	(0.079)	(0.210)
Property Type: Planned	-0.004	0.184***	0.361***	0.187***	0.355***
	(0.005)	(0.043)	(0.054)	(0.043)	(0.055)
Property Type: Other	-0.014***	-0.639***	-0.623***	-0.629***	-0.650***
	(0.004)	(0.079)	(0.181)	(0.079)	(0.181)
Observations	2,492,344	483,869	483,869	488,983	488,983
R^2	0.161				
Pseudo R^2		0.129	0.129	0.128	0.128
Default Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

Column (1) reports the OLS coe□cient estimates using Delinquency as the dependent variables. Delinquency is a dummy variable that takes the value of one if the loan becomes 60 days delinquent on mortgage payments within two years of securitization; it is zero otherwise. Column (1) uses half of all the observations available in the BlackBox dataset. Columns (2) through (4) report the Multinomal Logit estimates loans that became 60 days delinquent in the hold out sample. The dependent variable is a categorical variable that has three outcomes: foreclosure, non-foreclosure, or survived. "Foreclose" is when the loan is liquidated through foreclosure within 12 months of delinquency. "Non-Foreclosure" is when the loan is liquidated through a non-foreclosure method (i.e., short sale, deed-in-lieu of foreclosure) within 12 months of delinquency. "Survived" is the base and stands for when the loan cures or is not liquidated within 12 months of delinquency. "A□liation" is an indicator variable that equals one when the mortgage servicer is a□liated to an investors holding related RMBS bonds, and zero otherwise. "Delinquent Hat" is the predicted likelihood of 60-days delinquency obtain from using the coe□cient estimates in column (1). Robust standard errors clustered by the property's state are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 4.10. Servicer Heterogeneity

	(1) Foreclosure	(2) Non-Foreclosure	(3) Foreclosure	(4) Non-Foreclosure
A□liation	-0.000	0.002**	-0.002	0.001***
	(0.002)	(0.001)	(0.002)	(0.000)
FICO below 550	-0.053***	-0.002***	-0.042***	-0.001**
	(0.003)	(0.001)	(0.002)	(0.000)
FICO between 550 and 650	-0.026***	-0.002***	-0.020***	-0.001***
	(0.001)	(0.000)	(0.001)	(0.000)
FICO at or above 750	0.013***	0.004***	0.011***	0.003***
	(0.001)	(0.000)	(0.001)	(0.000)
LTV below 70	-0.045***	-0.001	-0.039***	-0.001*
	(0.003)	(0.001)	(0.002)	(0.000)
LTV between 70 80	-0.014***	-0.001***	-0.011***	-0.000***
	(0.001)	(0.000)	(0.001)	(0.000)
LTV between 90 and 100	-0.003***	0.001***	-0.003***	0.000***
	(0.001)	(0.000)	(0.001)	(0.000)
LTV between 100 and 110	0.008***	0.004***	0.003**	0.002***
	(0.002)	(0.000)	(0.001)	(0.000)
LTV above 110	-0.025*	-0.007*	-0.007	-0.003
	(0.013)	(0.004)	(0.011)	(0.003)
Log Loan Balance	0.001	-0.000	0.001	-0.000
	(0.002)	(0.001)	(0.001)	(0.000)
Log Loan Term	-0.019***	-0.002***	-0.011***	-0.001*
	(0.004)	(0.001)	(0.002)	(0.001)
Contract Rate	0.005***	0.000***	0.004***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Interest Type: Fixed	-0.012***	-0.001**	-0.010***	-0.001***
	(0.002)	(0.000)	(0.001)	(0.000)
Interest Type: Unknown	-0.086***	0.013**	-0.067**	0.007**
	(0.026)	(0.005)	(0.027)	(0.004)
Loan Type: Refinance	-0.001	0.002***	-0.001	0.001***
	(0.002)	(0.000)	(0.001)	(0.000)
Loan Type: Cash Refinance	-0.012***	0.001**	-0.008***	0.001***
	(0.002)	(0.000)	(0.002)	(0.000)
ARM Type: Hybrid Arm	-0.013***	0.002***	-0.009***	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)
ARM Type: Option	-0.008***	0.002***	0.000	0.001***
	(0.001)	(0.000)	(0.002)	(0.000)

(Continued)

Robust standard errors clustered by the property's state are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 4.10. Servicer Heterogeneity (Continued)

	(1) Foreclosure	(2) Non-Foreclosure	(3) Foreclosure	(4) Non-Foreclosure
Prepayment	-0.004*	-0.000	-0.002	-0.001***
	(0.002)	(0.000)	(0.002)	(0.000)
Primary Mortgage Insurance	-0.035***	-0.008***	-0.032***	-0.004***
	(0.002)	(0.001)	(0.002)	(0.000)
Property Use: Investment	0.016***	0.001	0.011***	0.001
	(0.004)	(0.001)	(0.003)	(0.001)
Property Use: Other	-0.017**	-0.003**	0.008	-0.000
	(0.008)	(0.001)	(0.005)	(0.001)
Income Documentation: Full	-0.002	0.002***	-0.002	0.001***
	(0.002)	(0.000)	(0.001)	(0.000)
Income Documentation: Unknown	-0.013***	0.001	-0.010***	0.001**
	(0.003)	(0.001)	(0.003)	(0.000)
Property Type: Condominium	0.002	0.001	0.002	0.001
	(0.004)	(0.001)	(0.003)	(0.001)
Property Type: Planned	0.010***	0.002***	0.009***	0.001***
	(0.002)	(0.000)	(0.002)	(0.000)
Property Type: Other	-0.027***	-0.004***	-0.025***	-0.003***
	(0.004)	(0.001)	(0.003)	(0.001)
Observations	975,709	974,186	975,042	971,850
Default Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Servicer FE	No	No	Yes	Yes

This table reports the marginal effects of Probit estimates. The dependent variable is specified in the column headers. "Foreclose" equals one if the loan is liquidated through foreclosure within 12 months of delinquency, and zero otherwise. "Non-Foreclosure" equals one if the loan is liquidated through a non-foreclosure method (i.e., short sale, deed-in-lieu of foreclosure) within 12 months of delinquency, and zero otherwise. "Affiliation" is an indicator variable that equals one when the mortgage servicer is affiliated to an investors holding related RMBS bonds, and zero otherwise. Robust standard errors clustered by the property's state are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

Table 4.11. Firm-Bond Tranche Holdings Panel Regression

	(1) Holdings	(2) Holdings
A□liated to Servicer	0.058	0.056
	(0.053)	(0.055)
Co-Investor A□liated to Servicer	0.000	-0.002
	(0.008)	(0.008)
Time Since Securitization		-0.027***
		(0.005)
Log RMBS Balance		-0.043
		(0.030)
Log RMBS Cumulative Losses		-0.001
		(0.001)
Constant	0.809***	1.597**
	(0.046)	(0.627)
Observations	98,269	90,332
R^2	0.056	0.055
Number of Firm-CUSIP IDs	32,427	29,756
Quarter-Year FE	Yes	Yes
Firm-CUSIP FE	Yes	Yes

This table reports panel regression estimates. The dependent variable is the investment firm's total holdings in a specific RMBS senior tranche as a percentage of the firm's total (RMBS and non-RMBS) bond holdings. The variable "A□liated to Servicer" is an indicator that equals one if the investment firms is a□liated to the mortgage servicer of the loans underlying the firm's RMBS holdings, and zero otherwise. The variable "Co-Investor A□liated to Servicer" is an indicator that equals one if the a co-investment firms is a□liated to the mortgage servicer of the loans underlying the firm's RMBS holdings, and zero otherwise. "Time Since Securitization" is the number of quarter between the RMBS bond holdings and deal securitization date. "Log RMBS Balance" is the natural log of the outstanding balance on the related RMBS deal. "Log RMBS Cumulative Losses" is the natural log of the cumulative losses on the related RMBS deal. Robust standard errors clustered by investment firm are in parentheses. The stars ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

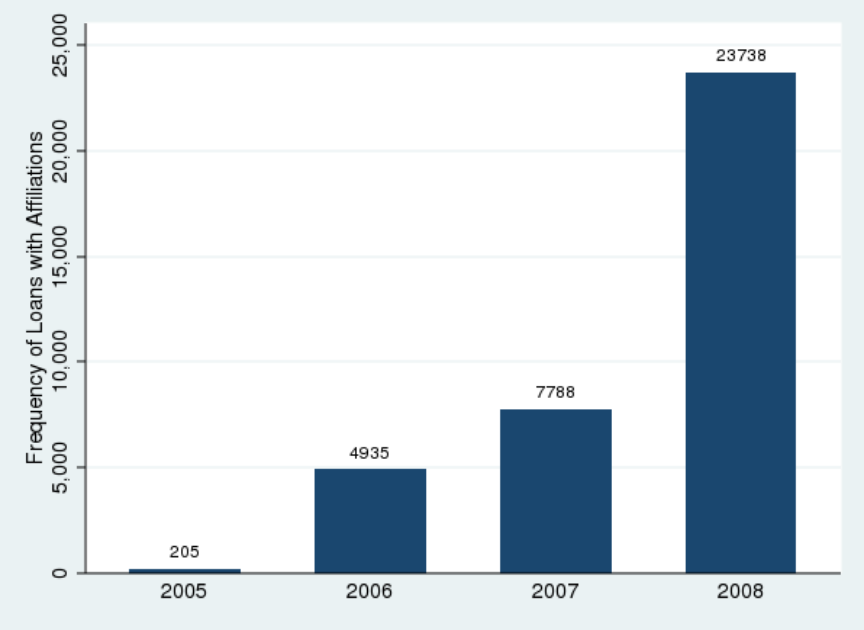


Figure 4.1. Frequency of A□liations by Delinquency Year

This figure reports the frequency of loans in RMBS deals where at least one bondholder is related to the servicer.

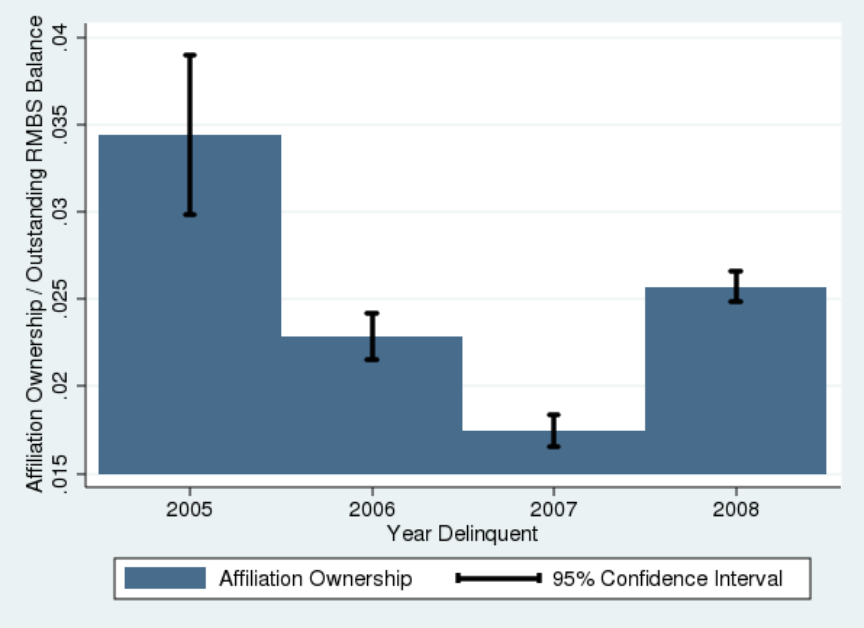


Figure 4.2. Average A□liation Ownership Share

This figure reports the average a□liation ownership share of holdings by the loan's delinquency year. The a□liation ownership share is measured as the total par amount of the loan's RMBS deal held by a□liates divided by the total outstanding RMBS balance at the time of the loan's delinquency.

Appendix
Excerpts from the Pooling and Servicing Agreement: Bank of America Commercial Mortgage Series 2005-3

This appendix provides excerpts from the pooling and servicing agreement (PSA) for the Bank of America Commercial Mortgage Series 2005-3 CMBS deal. The document is representative of CMBS deals that were affected by the LaSalle acquisition. Section 3.11(a) describes the compensation scheme for the mortgage servicer, referred to technically as the master servicer. This passage reveals that a mortgage servicer has an incentive to prolong the life of a delinquent loan: the monthly servicing fee accrues on a mortgage, even if delinquent, until its liquidation date. Section 4.03 explains the mortgage servicer's duty to advance missing payments and the consequences for failure to comply. Section 7.01 outlines a subset of events that constitute a default by the mortgage servicer or another agent of the trust. These default events imply a duty by the mortgage servicer to offer, albeit in limited quantities, advances on underperforming loans. Finally, Section 8.01 outlines the trustee's fiduciary duties to administer and oversee the CMBS deal to protect bondholders from default events.

Note that the following passages have been abbreviated from their original lengths to improve readability. The full passages can be found in the full pooling and servicing agreement, available online through platforms such as the Bloomberg

Terminal or Trepp (www.trepp.com). The deal name is Bank of America Commercial Mortgage Series 2005-3 CMBS deal, and the corresponding internal Trepp ID is boa053.

Section 3.11: Servicing Compensation (page 157-158)

(a) As compensation for its activities hereunder, the Master Servicer shall be entitled to receive the Master Servicing Fee with respect to each Loan (including each Specially Serviced Loan) and each related REO [real estate owned] Loan. As to each such Loan and REO Loan..., the Master Servicing Fee shall accrue at the related Master Servicing Fee Rate on the same principal amount... The Master Servicing Fee with respect to any Loan or REO Loan shall cease to accrue if a Liquidation Event occurs in respect thereof. Master Servicing Fees earned with respect to any such Loan or REO Loan shall be payable monthly from payments of interest on such Loan or REO Revenues allocable as interest on such REO Loan, as the case may be. The Master Servicer shall be entitled to recover unpaid Master Servicing Fees in respect of any Loan or REO Loan out of the portion of any related Insurance Proceeds, Condemnation Proceeds or Liquidation Proceeds allocable as interest on such Loan or REO Loan, as the case may be.

Section 4.03: Principal and Interest (P&I) Advances (page 237-239)

(a) ...the Master Servicer shall in the case of all Mortgage Loans... either (i) deposit into the Distribution Account from its own funds an amount equal to the aggregate amount of P&I Advances, if any, to be made in respect of the related Distribution Date, (ii) apply amounts held in the Certificate Account for future distribution to Certificateholders in subsequent months in discharge of any such obligation to make P&I Advances, or (iii) make P&I Advances in the form of any combination of (i) and (ii) aggregating the total amount of P&I... [If] the Trustee does not receive the full amount of such P&I Advances by the close of business..., then (i) unless the Trustee or the Fiscal Agent determines that such Advance would be a Nonrecoverable P&I Advance if made, the Trustee or the Fiscal Agent shall make... the portion of such P&I Advances that was required to be, but was not, made by the Master Servicer... and (ii) such failure shall constitute an Event of Default on the part of the Master Servicer.

(b) The aggregate amount of P&I Advances to be made in respect of the Loans... and any REO Loans for any Distribution Date shall equal, subject to subsection (c) below, the aggregate of all Monthly Payments... net of related Master Servicing Fees payable hereunder, that were due or deemed due... and that were not paid by or on behalf of the related Mortgagors...

(c) ...no P&I Advance shall be required to be made hereunder if such P&I Advance would, if made, constitute a Nonrecoverable P&I Advance. In addition, with respect to the Mortgage Loans other than Mortgage Loans included in a Whole Loan, Nonrecoverable P&I Advances shall be reimbursable... The determination by the Master Servicer... that any proposed P&I Advance, if made, would constitute a Nonrecoverable P&I Advance, shall be evidenced by an O□cer's Certificate..., together with... a copy of an Appraisal of the related Mortgaged Property or REO Property... [and] any other information that the Master Servicer or the Special Servicer may have obtained that supports such determination.

Section 7.01: Events of Default (page 262-265)

(a) "Event of Default", wherever used herein, unless the context otherwise requires, means any one of the following events:

(i) any failure by the Master Servicer (A) to deposit into the Certificate Account or a Whole Loan Custodial Account any amount required to be so deposited...; or

(ii) any failure by the Special Servicer to deposit into, or to remit to the Master Servicer for deposit into, the Certificate Account or a Whole Loan Custodial Account or the applicable REO Account any amount required to be so deposited or remitted...

(iii) any failure by the Master Servicer to remit to the Trustee for deposit into the Distribution Account, on any Master Servicer Remittance Date, the full amount of P&I Advances required to be made....

(iv) any failure by the Master Servicer to timely make any Servicing Advance required to be made by it pursuant to this Agreement, which failure continues unremedied for a period of three Business Days following the date on which notice shall have been given to the Master Servicer by the Trustee...

(v) any failure by the Special Servicer to timely direct the Master Servicer to make any Servicing Advance (including any Emergency Advance) required to be made by the Master Servicer at its direction pursuant to this Agreement...

(vi) any failure on the part of the Master Servicer or the Special Servicer duly to observe or perform in any material respect any other of the covenants or agreements thereof contained in this Agreement...

(vii) any failure on the part of the REMIC Administrator duly to observe or perform in any material respect any of the covenants or agreements thereof contained in this Agreement...

(viii) any breach on the part of the Master Servicer, the Special Servicer or the REMIC Administrator of any representation or warranty thereof contained in this Agreement that materially and adversely a□ects the interests of any Class of Certificateholders...

Section 7.01: Events of Default (page 262-265)

b) If any Event of Default with respect to the Master Servicer or the Special Servicer... shall occur and be continuing, then, and in each and every such case, so long as the Event of Default shall not have been remedied, the Depositor or the Trustee may, and... at the written direction of the Holders of Certificates entitled to at least 51% of the Voting Rights..., the Trustee shall, terminate, by notice in writing to the Defaulting Party..., all of the rights and obligations... of the Defaulting Party under this Agreement...

Section 8.01: Duties of Trustee (page 270-272)

(a) The Trustee, prior to the occurrence of an Event of Default hereunder and after the curing or waiver of all such Events of Default and defaults that may have occurred, undertakes to perform such duties and only such duties as are specifically set forth in this Agreement; provided that it is herein acknowledged and agreed that the Trustee is at all times acting in a fiduciary capacity with respect to the Certificateholders. If an Event of Default hereunder occurs and is continuing, the Trustee shall exercise such of the rights and powers vested in it by this Agreement and applicable law, and use the same degree of care and skill in their exercise as a prudent man or the Trustee would exercise or use under the circumstances in the conduct of his or its own a□airs (whichever standard would be higher). Any permissive right of the Trustee contained in this Agreement shall not be construed as a duty.

(b) The Trustee, upon receipt of all resolutions, certificates, statements, opinions, reports, documents, orders or other instruments furnished to the Trustee that are specifically required to be furnished pursuant to any provision of this Agreement..., shall examine them to determine whether they conform in form to the requirements of this Agreement. If any such instrument is found not to so conform to the requirements of this Agreement in a material manner, the Trustee shall take such action as it deems appropriate to have the instrument corrected. The Trustee shall not be responsible for, but may assume and rely upon, the accuracy and content of any resolution, certificate, statement, opinion, report, document, order or other instrument furnished by the Depositor, the Master Servicer, the Special Servicer or the REMIC Administrator and accepted by the Trustee in good faith, pursuant to this Agreement.

(c) No provision of this Agreement shall be construed to relieve the Trustee from liability for its own negligent action, its own negligent failure to act or its own willful misconduct;

(d) The Trustee hereby indemnifies and holds the Trust harmless for all losses, liabilities and damages incurred by the Trust by virtue of the Trustee's negligence or fraud

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Education

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Ph.D., Business Administration, Real Estate Finance (May 2019)
University of Nevada, Las Vegas
M.A., Economics (December 2012)
B.A., Economics, Minor in Political Science (December 2010)

Publications and Working Papers

"The Role of Auctions in University Intellectual Property Transactions," with Daniel R. Cahoy and Anthony M. Kwasnica, *Duquesne Law Review*, 2016, Vol. 54, No. 1, pp. 53-80.
"Preferential Treatment in Financial Contracts: Does Borrower and Broker Race Affect Mortgage Prices?" with Brent W. Ambrose and James N. Conklin
"Essays on Brokers, Financial Intermediaries, and Securitized Mortgages"

Teaching Experience

Department of Risk Management, Smeal College of Business, PSU
Contemporary Issues in Real Estate Markets, Fall 2016 & 2017 (Instructor)
Real Estate and Capital Markets, Spring 2016 & 2018 (Teaching Assistant)
Quantitative Analysis for Business, Spring 2017 (Teaching Assistant)
Real Estate Fundamentals, Fall 2015 (Teaching Assistant)
Department of Economics, Lee Business School, UNLV
Statistical Analysis, MBA, Spring 2012 (Faculty Assistant)
Principles of Microeconomics, Fall 2011 (Faculty Assistant)

Professional Experience

University of Nevada, Las Vegas (Las Vegas, NV)
Data Analyst, Lied Institute for Real Estate Studies, Jul. 2012 - Aug. 2014
U.S. Department of Interior, Bureau of Land Management (Las Vegas, NV)
Realty Technician (STEP, GS-4), Pahrump Office, Jun. - Aug. 2011, Jun. 2012
Las Colinas Realty, LLC (Las Vegas, NV)
Real Estate Agent/Broker-Salesperson (BS.0143144), Jul. 2009 - Jul. 2012

Select Awards and Honors

Smeal Small Research Grant: Fall 2018
The Jeanne and Charles Rider Graduate Fellowship: Fall 2018 - Spring 2019
Bunton-Waller Graduate Award Program: Fall 2014 - Spring 2016
Governor Guinn Millennium Scholarship: Fall 2007 - Spring 2010