Competition in the Real Estate Brokerage Industry: A Critical Review*

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The past decade has witnessed remarkable technology innovations and a proliferation of new business models in the real estate sector. However, much of the potential of these innovations has yet to be realized, and most real estate brokerage firms command a persistently high price (commission fees) for services rendered that seems to vary little with the associated cost. This paper identifies structural hurdles that have limited change, including the current commission payment arrangement whereby the seller pays commissions to both the listing agent and the buying agent, high concentration in local markets, the threat of retaliation, and consumer biases. We then describe the negative welfare consequences of high commissions, discuss policy recommendations that could enhance competition in commissions, and conclude with a brief discussion of the implications of recent innovations in this industry.

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1 Introduction

We live in a world with head-spinning changes powered by dazzling technological innovations. In the real estate brokerage industry, the past decade has witnessed a proliferation of innovative business models. These range from instant buying programs that make selling properties 'as simple as clicking a button' to initiatives that streamline housing purchase with renovation and furniture upgrades, from virtual tours that enable housing purchase sight unseen to machine learning algorithms that accurately predict buyer preferences, and from digital closing to blockchain technology that greatly simplifies title and asset transfer. The options available seem endless.

Despite these remarkable technological advances that can lower the cost of matching buyers with houses, the brokerage industry commands a persistently high price for a service rendered that varies little with the associated cost. For example, to sell a house in New York State in 2019, the median household spends half of its annual income on commissions, transfer taxes, and other closing fees, with the lion's share going to commission payments to real estate agents.

In this paper, we identify structural hurdles embedded in this industry that have constrained change, including the current commission payment arrangement whereby the seller pays commissions to both the listing agent and the buying agent, high concentration in local markets, the threat of retaliation, and consumer biases. We then discuss the negative welfare consequences of high commissions, propose policy recommendations that could enhance competition in commissions, and conclude with a brief discussion of the implications of recent innovations in this industry.

2 Lack of Competition and Elevated Commission Fees

At first glance, the residential brokerage industry, with its low entry barriers and many participants, appears competitive. Indeed, relative to the volume of home sales activity, the number of real estate agents has increased significantly over the past several decades. According to the National Association of REALTORS®, the national trade association of real estate agents (hereafter NAR), its membership increased steadily from 760,000 in 2000 to 1,359,000 in 2018.[1] By comparison, the sales of existing homes increased only slightly from 5.11 million in 2000 to 5.34 million in 2018. At the same time, the sales of new single-family homes declined from 877,000 in 2000 to 617,000 in 2018.[2] The competition among agents for prospective sellers and buyers is more intense today than it was two decades ago.

Yet other features of the industry suggest it is not competitive. The most important signal is the fact that prices commanded for services rendered have remained stubbornly high: commission fees have outpaced inflation for most years over the past several decades, do not reflect the cost of doing business, and to a large extent are invariant to the quality and experience of agents. Unlike many other industries

[1] https://www.nar.realtor/membership/historic-report. Last accessed July 2019.

[2] For used home sales, see 100 https://fred.stlouisfed.org/series/EXHOSLUSM495S. For new home sales, see https://fred.stlouisfed.org/series/HSN1F.

that have seen their commission levels plummet as a result of internet-enabled new technologies (Levitt and Syverson, 2008b), inflation-adjusted commission fees in this industry have been steadily increasing. In addition, the entry and expansion of firms that adopt innovative business models and charge low fees has been rather limited.

Below, we present findings from our prior research that support the latter view (Barwick et al., 2017). Our primary dataset consists of 650,000 listings from the Multiple Listing Service Property Information Network that covers eastern Massachusetts between 1998 and 2011. For each listed property, we observe the listing details (the listing date and price, the listing office, and the agent), a rich set of property characteristics, and transaction details of sales (the sale price, date, the purchasing office and agent). We construct proxies of brokerage and agent quality for close to 9,000 brokerages and 35,000 agents. Critically, we observe the commission rate offered to the buyer's agent, which allows us to understand how it influences the performance of housing transactions. We also have aggregate information on commission fees to the buying agents in the city of Boston from 2011 to 2018, and we utilize other auxiliary datasets that we describe below.

In eastern Massachusetts, the typical commission rate is 5 percent. As is the case with the rest of the country, sellers are responsible for paying commission fees to the listing agent and the agent who brings a buyer. The split is usually equal, with 2.5 percent going to both the listing agent and the buyer's agent. These norms can be traced back to the first Code of Ethics adopted by the National Association of Real Estate Exchanges (the predecessor to NAR) in 1913, which states that "an agent should always exact the regular real estate commission prescribed by the board or exchange of which he is a member." Furthermore, the Code indicates that the eighth duty of members is to "... always be ready and willing to divide the regular commission *equally* with any member of the Association who can produce a buyer for any client."[3]

2.1 Uniform Commission Fees

A core principle in economics is that prices should reflect the marginal costs of production in competitive markets. If prices are above marginal costs, positive economic profits will encourage the entry of firms, which then drives prices close to the marginal cost. In our setting, the cost to intermediate a property depends on the type of housing, the agent's effort costs, and general market conditions. One puzzling feature of the residential brokerage industry is that the commission rate is relatively uniform despite significant heterogeneity in the housing stock, the quality of agents, and major changes in how consumers search for properties.[4] This section first discusses trends over time and then turns to the cross-section analysis.

Across Time Figure 1 shows that the average commission rate offered to buying agents has remained

[3]Emphasis added by authors.
[4]Barwick provided consulting service on related issues prior to composing this paper.

roughly constant over the past two decades. The sample includes all properties listed on the Multiple Listing Service (hereafter MLS) in the city of Boston, where the typical commission fee is 5% of the sale price, split between the buying agent and the selling agent. The average buying commission was 2.45 percent in 2000, declined to a minimum of 2.31 in 2005, rose to 2.45 in 2008, and fell slightly to 2.31 in 2018. The median rate has been 2.5 percent each year.[5]

Uniform commission rates over the past two decades also stand in contrast to the substantial entry and exit of agents across the housing cycle. In our primary dataset for eastern Massachusetts, the annual number of listings was 40,000 in early 2000 and increased steadily to 65,000 in 2006 before declining to 40,000 by 2011. The entry and exit of agents and firms appeared to follow the housing cycle. The number of offices nearly doubled from 1,700 in 1998 to 3,200 in 2011, with newly established offices accounting for four-fifths of the sample near the end of our sample period. It is puzzling that the entry and exit of agents did not lead to significant changes in the commission rate.

Across Space The limited change over time corroborates findings from our primary dataset, which indicates that ninety percent of listings have a buying commission of 2 or 2.5 percent. Specifically, the most commonly observed rates are 2.5 percent (59% of listings), 2 percent (31% of listings), 3 percent (5% of listings), and 2.25 percent (3% of listings). This is consistent with the norm in our setting, where the 5 percent commission fee paid by sellers is split equally between the buying agent and the selling agent.

The uniformity in commission rates is striking in light of the heterogeneity in the housing stock and agent quality. Table 1 examines the relationship between commission rates and market, property, and agent attributes. Column 1 shows that listings in markets that are concentrated tend to have high commission rates. We calculate the CR4 ratio in each market year by aggregating the market share (listings and purchases) of the top four brokerages. This suggests that markets where the top firms are dominant tend to exhibit less competition and higher fees.

By contrast, columns 2 to 5 show that the commission rate does not vary with proxies associated with the costs of intermediation, including the ease of selling a property and agent experience. Column 2 shows that listings that are observably easier to sell are not associated with lower commission rates. We first predicted ease-of-sale using listing attributes (such as, the number of bedrooms, the size of the house, indicators for single-family homes, and condominiums) and market controls (including market and year fixed effects and the inventory-to-sold ratio in each market and each year). We then correlated the commission rate with the predicted ease-of-sale, controlling for the same listing and market attributes.

If commission rates reflect the effort it takes to sell a house, then properties that are easy to sell should be associated with a lower commission rate. But the evidence suggests the opposite. The positive correlation suggests that listings that are easier to sell are associated with a weakly higher commission rate. Column 3 shows a similar result even when we add property fixed effects, which compares the same

[5]We thank Sonia Gilbukh and Paul Goldsmith-Pinkham for generously sharing with us the average commission rate of buying agents in Boston from 2011 to 2018.

property sold in hot versus cold markets.

In addition, commission rates do not vary much with the experience of the agent. Indeed, there is a lot of variation in a critical factor in transaction outcomes: agent experience (Gilbukh and Goldsmith-Pinkham, 2019). The average agent in our data has four years of experience (defined relative to the year the agent obtained her license) with a wide range (the 25th percentile is zero and the 75th percentile is seven years). Experience, as measured by the number of transactions (listings and purchases) is also very heterogeneous, with the average agent having 2.6 transactions per year, the median agent only has one, and the standard deviation is five.

Columns 3 and 4 demonstrate a weak positive relationship between agent experience and commission rates. The estimates imply that a one standard deviation increase in experience increases the commission rate by 0.004 percentage points.[6] If experience is measured by the cumulative number of past transactions, then an increase in agent experience is actually associated with lower commission rates, although the effect is small and insignificant (-0.0004). Together, these elasticities imply that agents who have substantial differences in experience appear to be compensated with very similar commission rates.

2.2 Commission Fees High Relative to Industry Trends and Other Countries

Industry trends We live in a digital age characterized by an explosion of internet-powered innovations. Real estate property websites now proliferate. Virtual tours, past transaction histories, monthly mortgage payments, property attributes, as well as detailed information on property taxes, local schools, and other amenities are now at household's fingertips. Machine learning tools combined with a wealth of data on consumers' web browsing behavior have created algorithms that match buyers and houses more efficiently than a typical agent.

These recent innovations have transformed the way buyers search for housing. Compared to 43% of buyers who used the internet in 2003, 89% of them start with the internet search before contacting a buying agent today. In 2018, 88% of buyers identified online websites as their most useful information source (NAR, 2018). Moreover, the share of buyers who learned about the home they eventually purchased through the internet increased sharply from 2% in 1997 to 43% in 2015. In contrast, the share who first found their home through a real estate agent declined from 50% in 1997 to 33% in 2015 (NAR 2006, 2015).

While social institutions often adapt after major technological advances, these transformative changes that have greatly enhanced consumers' housing searches have yet to translate into significant reductions in commission rates, nor has there been an expansion in the methods of intermediation. For example, the share of sales that are for-sale-by-owner (FSBO) remained low at 7% in 2018 and declined from 13% in 2001. Similarly, the share of buyers who purchased directly from sellers in 2018 was 6% (relative to 15% in 2001). Commission rates, too, have risen: as a result of housing price increases, commission fees are much higher today relative to the pre-internet age. For example, the average commissions earned by the

[6] It is calculated as 0.001 * 4 years.

buying agent in the Boston area was $6370 in 2000 and $14500 in 2018.[7]

In addition to their high levels, an important aspect of commission fees that has not received adequate attention is the type of contract terms that specify conditions under which commissions are paid. There are three general types of contracts: the exclusive right to sell, where the listing agent gets compensated as long as the property sells, regardless of who brings the buyer; the exclusive agency, where the seller retains the right not to pay the listing agent if the seller finds the buyer independently of the listing broker; and open listing, where the seller could work with multiple agents and compensate the one who brings a buyer and completes the transaction. In our sample of 650,000 listings, 96% offer the listing agent the exclusive right to sell (the most favorable contract type), while the remainder offer exclusive agency rights. Almost no sellers use open listings. While we cannot distinguish whether this is driven by firm decisions not to offer alternative contract designs or by consumers who prefer the exclusive right to sell over other types of contracts, the fact that commissions are high and the listing contract terms are most favorable to agents is perhaps not coincidental.

Comparison with Other Countries Globally, the commission rates in the U.S. appear to be at the high-end of the spectrum. According to surveys of commission rates in 32 countries undertaken in 2002 and 2015 (Delcoure and Miller, 2002; The Wall Street Journal, 2016), the United States ranked the third highest in 2002 (with a typical rate of 6%) and 2015 (with a slightly lower rate of 5.5%). The typical commission rate paid by the seller is less than 2% in the United Kingdom, Ireland, Netherlands, Singapore, Sweden, Norway, and Hong Kong. In Sweden, sellers used to pay 5% in 2002, but this had declined to 1.5% in 2015.

The U.S. model of the role of buying agents differs from that of other countries in two important respects. First, in many countries, buyers commonly purchase properties without agent representation. In the U.S., the presence of agent representation for both buyers and sellers enhances the importance of cooperation between agents to complete a transaction and makes this industry more vulnerable to retaliation. For example, listings by discount brokers can suffer worse sales outcomes if other agents boycott discounted listings. Hatfield et al. (2019) show that in such settings, price collusion can be sustained even among many market participants because firms can refuse to cooperate with any firm that deviates from the collusive price. As we have seen in other trading markets, this can give rise to mechanisms that sustain tacit collusive behavior (Christie and Schultz, 1994).

Second, in other countries, even if a buying agent is involved, the buyer typically pays his or her agent. This arrangement makes it easier for buyers to negotiate the fee for the service provided. In the U.S., the buyer does not observe the fee paid to the buying agent until the closing.[8] Indeed, the buyer im-

[7] The median sale price for Boston was $260,000 in 2000 and $627,000 in 2018 (Zillow, 2019). The average buying commission rate was 2.45% in 2000 and 2.31% in 2018. The real commission fees in 2018 dollars (inflation adjusted) were $9400 in 2000 and $14500 in 2018– a 54% increase after adjusting for inflation.

[8] At the closing, buyers and sellers are required to sign hundreds of pages of documents, including the HUD settlement statement that details commissions paid to the listing agent as well as the buying agent if there is one. It is impractical to read these documents carefully at the closing. Anecdotal evidence suggests that buyers do not know commissions paid to their

plicitly shoulders commission fees to the listing and buying agents and has little opportunity to negotiate fees to the buying agent. Perhaps not surprisingly, the commission payment does not reflect the quality and costs of the buying agent, as shown above.

Comparison with Other Industries It is also informative to compare commission fees in the real estate brokerage industry to those in other industries. Between the mid-1970s and 2000, the average transaction costs for stocks declined from 1.2% to below 0.2% (Jones, 2002). Mutual fund industry, for example, commanded in the early 2000s an average 1% commission rate that by 2018 had been reduced by half, thanks to competition from low-fee index funds. Interestingly, 91-94% of the rate reduction between 2017 and 2018 was driven by consumers (investors) who switched to low fee index funds; the remainder came from fee reductions in existing funds (Duvall, 2019).

Across the range of goods and services that consumers purchase, the real estate brokerage service has seen one of the highest price increases. According to data from BLS and Case-Shiller Home Price Index, commission fees have outpaced the rise in inflation in all but five years of history. Over the past twenty years, the average national housing price doubled, while inflation increased only fifty percent.

2.3 Industry Concentration

The brokerage industry may appear to be competitive with thousands of brokerage firms and more than a million agents nationwide. However, aggregate statistics may appear misleading because an agent in Chicago is not a substitute for an agent in Boston. More specifically, one potential drawback of the CR4 measure — the combined market share of the top four firms, a standard measure of concentration — is that it critically depends on how markets are defined. In our sample, when we treat eastern Massachusetts as one market, the CR4 ratio is five percent. However, it is not likely that consumers are searching across thousands of listings that span the entire region. When we separately examine the region's 87 local markets,[9] we find that the average CR4 ratio is 42 percent, or eight times higher. Expensive markets tend to be more concentrated, and the CR4 is higher for listings (40 percent) than for purchases (32 percent). Despite its steady decline, the CR4 remains high today. The average CR4 across the markets was 54 percent in 1998, falling to 35 percent in 2011– a trend consistent with the remarkable persistence of firms in the ranking.

Not only are the top four brokerage firms prominent in local markets; the top agents are critical to completing a sale. In our dataset of more than 35,000 agents, a small selected group of elite agents plays a particularly significant role in the transaction history. We rank agents by their average annual number of transactions throughout our sample period and create an indicator for agents in the top decile (*Top-10*).

buying agent, even though buyers are required to sign the HUD form.

[9]These 87 markets largely represent towns in eastern Massachusetts, with some exceptions as follows: Our sample covers 85 towns and cities surrounding Boston. We combine 12 small cities with their closest neighbor. Given the size of Boston, we split it into 15 markets using ZillowâĂŹs definition of neighborhoods and a variable in the MLS (*area*) that identifies neighborhoods within cities. The conclusions remain when we define markets in other ways.

Notably, these Top-10 agents are part of 81 percent of completed transactions. If top agents are randomly matched to each other, the likelihood that a transaction will include at least one top agent is only 19 percent.[10] Furthermore, 31 percent of transactions involve a top agent on both sides relative to a random benchmark of one percent. Together, these patterns indicate that to thrive in this industry, obtaining the co-operation of these dominant offices and agents could be vital. As we show below, the threat of withdrawing co-operation (retaliation) can punish rivals who undercut, thereby helping to sustain high commission fees.

3 Contributing Factors

Having described several distinctive features of the industry that suggest a lack of competition, we focus in this section on the potential barriers in the market and empirical evidence of anti-competitive conduct. We first describe how steering behavior can contribute to high commissions. Next, we discuss the potential threat of retaliation against firms that use non-traditional practices. Finally, we investigate other barriers that limit competition.

3.1 Steering

In Barwick et al. (2017), we empirically assess how cooperation between agents helps to sustain a rigid commission structure, despite low entry barriers and a seemingly competitive marketplace that has many agents. In particular, we demonstrate that the threat of steering plays a significant role. Regulators have raised concerns that "(s)teering ... may make price competition a potentially unsuccessful competitive strategy, and it is our belief that this is the most important factor explaining the general uniformity of commission rates" (FTC, 1983, p. 12).

The negative consequences of steering arise because the seller's listing agent is required to specify commissions paid to the buying agent when he or she uploads the property information (attributes, listing price, showing instructions, etc.) to the Multiple Listing Service, a local database often maintained by real estate brokers that contains all properties represented by agents. When searching for listings for their buyers, buying agents observe property attributes as well as the commission offered (buyers do not see the commission fee). All else being equal, the buyer's agent has an incentive to prioritize properties that offer higher commissions. Therefore, listings that offer lower commissions may suffer poor sales performances. Knowing this, sellers are less likely to choose to offer low commission rates. In this way, the threat of steering offsets the competitive force of free entry, limiting the growth of discount brokerages that offer low commission rates.

To quantify the impact that steering has on sales outcomes, we utilize our rich dataset to compare observably identical properties that offer low versus high commission rates. We define a *low commission*

[10] This is calculated as 1 minus the likelihood that a transaction includes a non-top agent on the listing and buying sides, or $1 - 0.9 \times 0.9$.

rate listing as one with a buying commission rate strictly below 2.5 percent and a *high commission rate* listing one with a rate at or above 2.5 percent.

In Table 2, our main table shows that low commission listings suffer worse sales outcomes. We report results for three outcomes, including the probability of sale (Panel A), the number of days it takes to sell (Panel B), and the sale price (Panel C). Our conclusions survive a rich set of variables that control for observed and unobserved property quality. Column 1 accounts for market conditions using market-by-year fixed effects and month fixed effects. Columns 2 to 6 progressively add property controls, property fixed effects, an index of the seller's urgency to sell, and office and agent controls. Our most saturated specification (column 6) compares the same property listed at high versus low commissions, controlling for different market conditions, changes in property attributes (upgrades), and observed agent quality and office quality.

Across the columns and the three panels, we consistently find that lower commission listings are less likely to sell and take longer to sell. We find no effect on the sale price, conditional on our rich controls. Our findings survive a battery of robustness tests, including comparisons of high versus low commission listings by the same agent or the same seller, as well as other transaction outcomes.

The effect sizes we find are economically significant. Two out of three listings are sold; among the sold listings, one in three listings sells within a month. Low commission listings are 5% less likely than high commission listings to sell and stay on the market for twenty more days. Not selling a property the first time is also costly, and selling during the off-peak season (winter time and during the school year) could lead to a much longer time on the market. As shown in Figure 2, there is a long right tail in the days on market for sold listings. Low commission properties are five percentage points less likely to sell within 30 days and are five percentage points more likely to stay on the market for six months or longer. This is a significant risk given that only 15% of listings remain on the market for more than six months.

Moreover, we find that properties more susceptible to the threat of steering suffer worse consequences. For example, sale outcomes are best for listings that offer more than 2.5 percent, compared to those that offer exactly 2.5 percent, while those that offer less than 2.5 percent have the worst outcomes. In addition, sale outcomes are worse for low commission listings in neighborhoods that have a larger fraction of high commission listings, listings by entrants, and listings by offices that used lower commission rate policies in the past.

We reinforce our findings using a battery of robustness checks. In particular, one concern is that poor performance may reflect less effort on the part of the listing agent rather than steering by the buying agent. We first show that our results are similar for new properties, which rely less on the listing agent's effort. Our findings are also similar if we compare listings by the same agent. To proxy for the incentive of listing agents to exert effort, we construct 'pairs' of properties listed by the same agent in the same year to listing commission revenues within a $500 bin but that offer *different* commission rates to the buying agent. Since these properties have the same payoff for the listing agent, they should induce the same level of effort from the listing agent, but they might attract a different number of buyers given the difference in buying commission rates. We continue to find poorer outcomes for properties that pay low commission

rates to the buying agents. Finally, we address the concern that low commission listings may take longer to sell because they tend to be listed by patient sellers who are willing to trade off a slower sale for a lower commission fee. We assess this by comparing listings by the same seller, and by constructing an index to proxy for seller patience. Our conclusions remain the same across these demanding robustness checks.

What do our findings mean for sellers? They suggest that the average seller who chooses to offer a low commission rate saves $4790 in commission fees (which is 1% of the average sale price of $479,000 in 2011 dollars) but faces a higher risk of staying on the market for more than six months. At the 5.3% annual user cost of owning a property (Himmelberg et al., 2005), the six-month carrying cost for a $479,000 property would amount to $12,700, or 20% of the median annual household income of Massachusetts residents in 2010.

Our calculations suggest that sellers face a significant trade-off between the cost savings from offering a low commission and the risk of a protracted sales process. Sellers may choose high commission rates if they are risk-averse or cash-constrained and rely on the sales proceeds from their existing home for the down-payment of their next house. The economic trade-offs we uncover are consistent with the literature, which suggests that sellers may favor a quick sale. Genesove and Mayer (1997) report that sellers whose loan-to-value ratios are below 100% forgo a 4% gain in sale price in exchange for selling 70 days earlier, which is equivalent to trading off 1% in sale price against 18 days. Similarly, Hendel et al. (2009) find that FSBO sellers save $1625 (about 0.8% of the sale price) and their properties take 16 days longer to sell. Notably, our findings that low commission rates suffer worse sales outcomes also echo Levitt and Syverson (2008b), who find worse performance for listings by flat-fee or limited service agencies, as well as Hendel et al. (2009), who focus on For-Sale-by-Owner (FSBO) transactions. Han and Strange (2015) offer an excellent review of other related research on the residential brokerage industry.

In summary, our results illustrate that when a seller and her listing agency have to rely on a high commission rate to induce cooperation from the buying agency, a low commission strategy is less attractive. The estimates speak to why offices that charge lower commission rates are less likely to be successful. In addition, the adverse sales outcomes associated with low commissions provide a lens to interpret sellers' reluctance to adopt such a strategy, which, in turn, reinforces the existing commission structure.

3.2 Limited Cooperation

The uniformly high commission fees suggest barriers to entry, exclusionary conduct, or both. As discussed in Section 2.2, a successful property transaction requires the cooperation of both the listing and the buying agents. As a result, refusal to cooperate could serve as a punishment, limit the expansion of firms that engage in price cuts, and sustain high prices (Hatfield et al., 2019). In this section, we examine the purchasing patterns of dominant brokerage offices, which account for the lion's share of listings in local markets.[11] Specifically, we ask whether dominant offices that have greater market power are less

[11] We use the word 'purchase' to refer to properties that offices intermediate on behalf of their buyers.

likely to purchase listings that offer low commission rates. We estimate the following equation:

$$ln(FrcBL25_{lmt}) = \delta ln(Share_{lm,t-1}) + X_{lm,t-1}\beta + \mu_{mt} + \varepsilon_{lmt}, \quad (1)$$

where the dependent variable is the log of the fraction of office l's purchases that have low commission rates in market m and year t. The key regressor $ln(Share_{lm,t-1})$ is log of office l's market share in market m and year $t-1$, which we use as a proxy for market dominance. An office's market share is its commission revenue from all of its sold listings in a market and year divided by the aggregate listing commission revenue in the same market and year. To mitigate potential confounding factors, we exclude buying commission revenues in the calculation of market share because an office's buying commissions in the previous year are likely to be correlated with the dependent variable. Office attributes $X_{lm,t-1}$ are lagged one year and include office performance, agent composition, and age of the firm. All regressions control for market by year fixed effects μ_{mt}. To reduce measurement errors, we focus on active offices that have an average annual number of listings above 5 and limit analysis to top offices that account for 95% of all listings. Standard errors are clustered at the office level.

Dominant offices are less likely to purchase low commission rate listings (Table 3, Panel A). The first specification with market by year fixed effects (column 1) suggests that doubling an office's market share reduces the fraction of low commission listings it purchases by 14%. This is almost a third of the sample average of 44%– a significant effect considering the wide variation in market shares in our sample. For example, the average market share for offices affiliated with the top six dominant chains is 2.8 times larger than that for non top-chain offices.

A confounding factor that can lead to an adverse effect is that buyers of high commission listings prefer to work with high-quality offices or high-quality agents. Even if dominant offices do not retaliate against low commission firms, there may be a spurious negative relationship through this omitted variable. To address this concern, we add office controls (lagged a year) to proxy for the past performance and agent composition of an office. These controls include the fraction of listings sold, average days on market for sold listings, the fraction of agents who are the top ten percent highest-performing agents, an entrant dummy, an interaction with the age of the firm, and a dummy for offices located in our cities. In column 2, we show that the effect remains after these controls for office quality are added.

Next, we address concerns that δ may be biased downwards if dominant offices tend to represent wealthy buyers who prefer properties listed at high commission rates. Column 3 controls for differences in offices' portfolios, including the average square footage, the average number of bedrooms and bathrooms, the average listing price, etc. These averages are calculated using office l's listings in market m and year $t-1$.[12] The coefficient remains the same at -0.14.

In column 4, we add chain fixed effects to capture brand preferences and the possibility that firms associated with some chains may prefer high commission listings independent of their size. Given that

[12]We exclude office l's purchases when we calculate these attributes to mitigate endogeneity concerns, although including them leads to almost identical estimates.

more than 90% of listings by Coldwell Banker and Hammond have high commission rates, it is not surprising that their coefficients are sizeable (-0.34 and -0.57, respectively), indicating a strong preference for high commission listings. After controlling for fixed brand preferences, the estimate for δ is slightly weaker at -0.10 but is still significant.

In the last column, we address concerns that the negative effect might be driven by office-level policies that are correlated with market shares and purchase patterns. After adding office fixed effects, the magnitude is smaller (-0.04) but still significant. Market shares vary widely in our sample. The average market share for offices unaffiliated with the top six chains is 6%, while the share for offices affiliated with the top six chains is 17%. At our most conservative estimate of an elasticity of 4% (column 5), a threefold increase in an office's market share would translate to a noticeable reduction in its fraction of purchases that go to low commission rate properties.

How does a dominant office's diminished propensity to purchase low commission properties relate to our main findings above? Our back-of-the-envelope calculation suggests that the reduced purchase propensity from the six dominant chains could lead to a two p.p. reduction in the sale probability. This accounts for 40% of the negative consequence of low commission policies. While these calculations suffer from various caveats, they suggest a potentially important channel through which dominant offices could sustain the current commission structure.

Our findings are robust across different samples, different market share metrics, and different dependent variables. In particular, some listings are purchased by buying agents in the same office as the listing agents or are intermediated by the same agent (dual-agency). We refer to both cases as in-house transactions (Han and Hong, 2016). If in-house sales are more common in large offices that have a big inventory of properties and more selections, and if large offices tend to charge higher commission rates, then the coefficient δ will be biased downwards by this network effect. We repeat our analysis excluding in-house transactions and find similar results.

We repeat the same exercise for agents in Panel B. Across all specifications, we consistently find that dominant agents are indeed less likely to purchase low commission rate listings. The estimated elasticity in column 1 (Panel B) suggests that doubling an agent's market share reduces the fraction of low commission listings it purchases by 12%. Similar to our findings for firms, the negative estimate survives controlling for chain fixed effects (-0.13 in column 4) and also when we add more than 10,000 agent fixed effects to control for fixed agent attributes. The magnitude is smaller (-0.02) in this demanding specification, but it is still significant.

Table 4 estimates a version of equation (1), except here the analysis is at the agent-year level and the dependent variable is now the percent of purchases from online or discount brokers. We define online or discount brokers who use the name of the brokerage firm (e.g., ZipRealty, The Entry Only Listing Service) or whether a majority of the firm's listings is entry-only (the agent's primary responsibility is to enter the data into the MLS). The three columns in Table 4 are analogous to the first three columns in Table 3. The key regressor is whether an agent in our setting works for the six dominant chains in our setting: Coldwell Banker, Century 21, Remax, Hammond, Prudential, and GMAC. These chains

account for 67% of the listings in our sample. Again, we see a consistent pattern of negative coefficients, suggesting that the agents in the top chains are less likely to purchase listings by discount firms. The effect size (0.8 percentage point) is large relative to the dependent variable mean (1.5%).

These patterns for discount brokers corroborate findings in Levitt and Syverson (2008b). Using data from three real estate markets (Cook County, Santa Cruz County, and Sacramento) from 2004 to 2006, they document that, relative to houses listed by full-commission agents, those sold by flat-fee agents took substantially longer to sell. For example, in Cook County and Sacramento, homes represented by flat-fee agents were approximately ten percentage points less likely to sell than those that used full-commission agents. In addition, flat-fee homes that sold in Cook County stayed on the market more than a month longer than those represented by a full-service agent. For Sacramento, the effect was smaller (9 days) and it was insignificant for Santa Cruz. Levitt and Syverson (2008b) did not find an effect on the sale price.

Together, the patterns described above present barriers to entry consistent with the importance of cooperation from rival agents. It is difficult for discount brokers to charge sellers low commissions or offer buyers rebates if they cannot obtain the cooperation of other brokers to complete sales. Indeed, entrants that try to compete by offering low commission rates do not tend to succeed, as shown in Figure 3. First, we define 'successful brokerage firms' as those whose listing revenues are ranked in the top quartile among all offices in the same market. Second, we classify entrants into a low commission rate group (solid line) and a high commission rate group (dashed line) based on their observed commission rates during the first three years. An entrant belongs to the low (high) commission rate group if its fraction of low commission listings in the first three years is in the top (bottom) quartile among all entrants in the same market.

Figure 3 shows that both groups start small with a similar probability of being in the top quartile (less than 3%), but the gap widens over time. By the end of our sample period, entrants with high initial commission rates are 17% more likely be in the top quartile than entrants whose initial commission rate is low. This pattern remains the same under alternative definitions of success and if we control for differences between high- and low-commission firms to address the concern that low-commission firms might offer lower quality service.

3.3 Consumer Biases

A large body of empirical research demonstrates that consumers exhibit significant biases and cognitive limitations when they make financial decisions (Campbell et al., 2011). A housing purchase is often the most crucial and emotional transaction made by a household, but most of them lack expertise in this area. It does not help that housing transactions happen very infrequently and learning, if it exists, is slow (Akerlof and Shiller, 2015). All of these demonstrate an under-recognized market power held by incumbent firms.

In housing, researchers have consistently found a striking pattern of sellers who appear to sell "too

soon". The implied discount rates appear irrationally large, suggesting that sellers could gain significantly by being a bit more patient. For example, Levitt and Syverson (2008a) find estimates that imply that consumers could have obtained a 3.7% higher price if they had waited an additional 9.5 days, indicating an annual discount rate of 140%. More recent estimates suggest that sellers on average are willing to give up 1% of the sale price to sell 16 to 20 days faster. These estimates imply annualized discount rates that exceed 20%, and are suggestive of highly impatient or risk-averse sellers.

Several factors can contribute to this pattern. First, sellers can be particularly averse to taking too long to sell, perhaps because they have children and need to move before school begins or because they fear being in the market for a prolonged period. Second, sellers, including those who are buying a home at the same time, can be liquidity constrained and, thus, cannot finance multiple mortgages concurrently (Genesove and Mayer, 1997). Third, the price expectations of sellers may not be entirely rational, as indicated by research that has uncovered patterns that reflect loss aversion (Genesove and Mayer, 2001) and reference-point dependence (Pope et al., 2015).

Moreover, there are concerns that commission rates are not salient to buyers, even though they implicitly pay for the commission fees through a higher purchase price. If salience is an issue, buyers who are not aware of the fee may appear to be inelastic or unable to bargain. Many buyers are also told that the buying agent's service is free, which further limits their incentive to bargain. Existing research has shown that the statutory incidence (who is responsible for payment) matters (Chetty et al., 2009). In a telling demonstration of this, Busse et al. (2006) find that offering a $1000 cash rebate to car buyers rather than dealers matters: when car buyers receive the rebate, consumers get 70 to 90 percent of the benefit; when dealers receive the rebate, the consumer benefit is only 30 to 40 percent of the surplus amount. Given that in our setting the statutory incidence is on the seller, the buyer is often unaware of the fees and may not ask for a rebate. Nevertheless, as we discuss below, there is evidence from other settings in the housing literature that when buyers are aware of transactions costs, prices will adjust so that the ultimate economic incidence no longer depends on who pays (Best and Kleven, 2018). This suggests that increasing the salience of fees or rebates and promoting awareness will be useful.

Finally, consumers do not seem to search for agents; instead, they agree to settings chosen by the service provider, and they generally favor the status quo, which makes it difficult for entrants to attract consumers. Notably, while they search intensely for properties – the average buyer in 2018 searched for 10 weeks and looked at a median of ten properties – they rarely search for brokerage services. In 2018, 68% of buyers interviewed only one agent during their house search and 41% used an agent who was referred by a friend, neighbor, or relative; 75% of sellers contacted only one agent. Why do consumers not search? Maybe they believe that all agents charge the same price and that commissions are non-negotiable, and, thus, there is little benefit to searching. Some of them regard this as an emotional process and are hesitant to bargain (Akerlof and Shiller, 2015).

4 Welfare Consequence of High Commissions

What are the welfare implications of the negative consequences of high commissions? Below, we first document that commissions are high relative to households' savings in housing equity, then we discuss social losses from reduced household mobility, and we conclude with the distortions associated with the excess entry of real estate agents and firms.

Commission fees constitute a large share of transactions costs for home sellers. According to ATTOM data solutions, the average home sellers achieved a gain of $57,500 from selling their homes in the first quarter of 2019, after owning their homes for 8.05 years. The average commission that they pay for selling the property is around $13,000 to $15,000, or about a quarter of their savings from owning real estate. This number masks the fact that a significant fraction of home sellers have close to zero gains, especially in metropolitan areas where the median housing price is still below the pre-recession peak (ATTOM, 2019).

In the United States, the three largest financial resources of the elderly are Social Security, home equity, and the value of employer-provided pension or retirement savings account balances. Gustman et al. (2010) report that Social Security accounts for 40 percent of the wealth of households approaching retirement, housing accounts for 22 percent, and pensions/retirement savings plans account for 20 percent. Given that savings for the median American household are merely $11,700, the transaction costs that are attributable to commission fees could translate to a significant reduction of household savings.[13]

Research has shown that transaction costs in housing can induce significant lock-in effects that limit household mobility. Ferreira et al. (2010) estimate that every $1,000 of additional mortgage or property tax costs reduces household mobility by 10%-16% (or 1 to 2 percentage points relative to a baseline two-year mobility rate of 11.4%). In California, as a result of Proposition 13, 54-year old homeowners who face a larger property tax burden if they move have a 25% lower moving rate than otherwise comparable 55-year-olds (Ferreira, 2010). Additionally, Hilber and Lyytikainen (2017) show that a two percentage point increase in the housing transaction tax rate in the United Kingdom reduces the annual rate of mobility by 2.6 percentage points, representing a 37 percent decrease in mobility.

More generally, this lock-in effect can distort households away from their optimal housing consumption and location choice. Kopczuk and Munroe (2015) find evidence of "missing transactions" associated with housing transaction taxes. In New York City, the one percent tax for housing transactions above one million dollars led to 2,800 fewer sales out of 380,000 transactions in the sample period. They argue that these are surplus-generating transactions that would have occurred had the transaction tax not been in effect.

Due to the complementarity between housing and durable expenditures, increases in mobility and housing transactions can have multiplier effects on the rest of the economy, through spending on home-related durables, home maintenance, and home improvement, which are complementary to the purchase of the new house (Benmelech et al., 2017).

[13]The average American household saves $175,510 (Gustman et al., 2010).

The second component of social losses relates to the excess entry of agents and a misallocation of talent. The number of real estate transactions during the 2010s has been moderately higher than the number during the 1990s, but the number of agents and firms nearly doubled. Putting aside technology progress that has made it easier for households to obtain information about properties (and that, hence, drives down the cost of transaction), this trend implies that the labor productivity of this industry has deteriorated dramatically. In the U.K., commission fees are a fraction of those in the U.S., yet more than one million housing transactions occur each year and there are only 50,000 agents. In contrast, in the U.S., six million housing transactions occur annually under the guidance of 1.3 million agents. In other words, the U.S. has around six times more housing transactions than the U.K., but more than 26 times more agents. There is no evidence that quality of service is much lower in the U.K.; indeed, average sales performance metrics such as days on market and probability of sale appear similar in both countries.

As the literature (Hsieh and Moretti, 2003; Barwick and Pathak, 2015) has shown forcefully, the key contributing factor of this reduction in labor productivity and lost production and social welfare in the U.S. is high commissions bundled with low entry barriers. As housing transactions become more lucrative, the real estate brokerage industry attracts more agents who compete for the same amount of property transactions. The outcome? A reduction in labor productivity and a loss of social welfare because some of these individuals could have engaged in the production of goods and services in other sectors that are valuable to society and increase GDP. If agent productivity has remained the same as it was 20 years ago, we would have a surplus of nearly one million individuals for production in other sectors, a non-trivial number relative to the total employment in the U.S. Moreover, excess entry is often associated with a prevalence of inexperienced agents, especially following house price booms. Inexperienced agents take longer to sell properties, which can have aggregate impacts on housing cycles (Gilbukh and Goldsmith-Pinkham, 2019).

Paralleling concerns about the excess entry of traditional agents charging uniform commission rates, policymakers have highlighted the lack of entry and expansion of discount firms charging low fees. This is consistent with our discussion of Figure 3 and can present social losses if it leads to fewer product choices for consumers, unrealized potential paths of innovation, and reduced quality of service per dollar spent (Morton et al., 2019).

5 Policy Discussion

5.1 Policy Interventions: Untying Commissions and Encouraging Rebates

Untying Commissions Given that the compensation of buying agents by sellers leads to steering and inflated commission fees, a natural policy intervention would be to let the seller and buyer pay independently for the professional services that each obtains (untying commissions), which is the norm in all other consumer service industries. The buyer can and should shop for appropriate services from the buying agent and, in return, is financially liable for the service rendered.

This intervention would have several benefits. The most direct benefit would be to largely eliminate the threat of steering and the conflict of interest that results from it. Second, and more importantly, it would allow buyers to shop for the level of service that suits their needs and bargain for its price. The existing payment arrangement prevents buyers from doing this because the commission paid to a buyer's agent is determined by the seller (and his listing agent) and is not seen by the buyer. It is difficult to negotiate on a commission that is not observed. Moreover, while the buying commission is ultimately funded through the cost of buying a house and is partially shared by the buyer (the other part is paid by the seller), it is often advertised by agents as a free service. Buyers cannot negotiate for a lower price if the price is already zero.[14] Instead, a buyer who pays for the service of the buying agent directly can negotiate the price, reward agents for the quality of their service, and shop for less-than-full services if he chooses to do so. In exchange, the buyer bears the financial burden of the service that he requests.

Allowing buyers the option to shop around sharpens their price sensitivity and exerts pressure for firms to compete on prices. A crucial ingredient of 'market forces' that ensures the proper functioning of a market is buyers' uncompromised ability to observe fees collected by the service provider, negotiate prices, use high commissions to reward quality, and vote with their feet if they desire. This ingredient is greatly hampered when buyers do not observe the commissions that realtors collect and/or are misled by the free commission advertisement. Buyers are more price sensitive when they have to pay for the service than when they believe the service is free. Price sensitive consumers will impose downward price pressure on brokerage firms and agents, which will help maintain a healthy competitive environment: it will promote price competition, encourage the market entrance of innovative low-cost firms, and incentivize existing firms to provide better service.

Another advantage of making buyers pay for the service is to discourage the over-consumption that occurs when the service is labeled as 'free.' Economists have long lamented the peril of goods offered for 'free.' For example, over-pollution arises, especially in developing countries, because polluting is free; highly subsidized health services in Europe lead to long queues outside the doctor's office. Ironically, real estate agents also suffer from the over-consumption of their service. They complain about the difficulty of screening uncommitted buyers who take up time touring houses they do not intend to buy. The presence of uncommitted buyers who respond to 'free' service claims reduces the overall quality of the buyer pool and decreases the efficiency of the matching process. It also prolongs the average amount of time an agent spends on each successful transaction and inflates the costs of service.

Third, greater competition in commissions will lower transaction costs, which will alleviate the negative consequences on social welfare discussed at length in Section 4. Consumers are more likely to purchase homes that match their needs and buy and sell more often. Increases in mobility and housing transactions can generate significant multiplier effects on the aggregate economy through spending that is complementary to the purchase of homes (Benmelech et al., 2017). Households also will be able to keep a bigger portion of their financial savings, elevating the miserably low savings rate in this country.

Critics of having buyers directly pay for the buying agent point out that buyers are often financially

[14]Negative prices are possible in theory but are rarely used in consumer goods and service industries.

constrained. If low-income households had to pay for the buying agent's service, these critics claim, many would not be able to afford it, and this would lead to 'disastrous' consequences for households and the industry. Since commission fees represent large upfront payments that cannot be financed by debt, imposing greater upfront costs on buyers could reinforce downpayment requirements.[15]

Although well intentioned, this argument is not economically sound. Owning a house comes with a host of financial responsibilities, and not everyone should participate in this market activity. Prospective buyers should stay as renters until they accumulate adequate cash reserves. If access to a good or service is essential to a society's well-being and/or creates positive externalities, public policies, rather than market forces, are the appropriate vehicles to address equity concerns and help make essential goods accessible to low-income groups.[16] In fact, making a desirable good free *creates* detrimental consequences because it encourages wasteful consumption– in this case, more consumption of housing and agent services than is socially optimal.

Encourage Rebates Others argue that buyers should not be allowed to pay because firms and agents would object to fundamental changes in the decades-long industry practice of sellers paying all commissions. Indeed, this could be a challenge. Given the potential for resistance from industry participants, could less-radical solutions promote competition on commissions?

One option is to let buyers observe buying commissions and encourage rebates. Rebates have been commonly used in other industries, especially among sellers of consumer goods, where purchasers mail in a coupon and a receipt to receive a check rebate. For rebates to generate price competition, the sellers who would continue to pay for commissions need to allow buyers to observe those commissions. Buyers cannot request a rebate from an agent if they are unaware that they must pay him, either directly or indirectly. Once buyers observe commissions and understand that this constitutes a significant part of the transaction costs of buying a property and that they have the right to request rebates from brokers, they are more likely to engage in such a discussion. The number of firms that offer rebates is small but growing, although their service is mostly limited to major metropolitan areas, and rebates are either fully or partially banned in ten of the fifty states in the U.S.[17]

Will these suggestions fix the high commission problem in the U.S.? This outcome is far from guaranteed, and there are many frictions in addition to the ones discussed here. Yet evidence from other countries offers some cause for optimism. In the U.K., a country that shares many similarities to the U.S., but where sellers and buyers pay for their own brokerage service, price competition is much more common. As of 2018, 20% of buyers used a fixed-fee commission arrangement instead of the percentage fees. In response to the entry and expansion of discount firms, the average commission decreased from 1.8% in 2011 to 1.2% in 2018.

[15] See https://www.inman.com/2019/07/26/nar-commission-lawsuits-could-be-disastrous-for-both-bu Last accessed July 2019.

[16] High homeownership is argued to generate positive externalities (Campbell et al., 2011). Public policies, such as home mortgage subsidies or first home-buyer credits, are the appropriate channel to promote homeownership.

[17] Here is an incomplete list of firms that offer rebates: Redfin.com, glasshousere.com for the D.C. area, Trelora.com for Denver, Yoreevo.com for New York City, and ShopProp.com.

Would housing price adjust if the sellers stopped paying for buyer's commissions? While we do not have data that speaks to this directly, evidence from the U.K. suggests that housing prices can and do adjust quickly. Using administrative data on all property transactions in the U.K. from 2004 to 2012, Best and Kleven (2018) show that housing prices in the U.K. responded almost instantaneously to changes in the Stamp Duty Land Tax code. When there is a discontinuous jump (notch) in tax liability for properties priced above £250,000, a significant fraction of properties is sold at or just below £250,000 (bunching). When the notch disappears, so does the bunching. "The price adjustment is very fast, with a new steady state emerging in about three to four months for unanticipated changes and almost immediately for anticipated changes. The remarkable sharpness of these dynamic findings suggests that agents in the housing market are less affected by optimization frictions (inattention, inertia, etc.) than, for example, agents in the labour market" (Best and Kleven, 2018).

Besley et al. (2014) exploit the U.K.'s 2008-09 Stamp Duty holiday, when properties priced below £175,000 were exempted from the 1% Stamp Duty tax. The authors calibrate that about 60% of the surplus generated by the tax holiday accrued to buyers. If experiences in the U.K. offer any guidance, we should expect housing price to go down about 2-3% when half of the financial burden of commissions is shifted to the buyer.

5.2 Other Important Considerations

To increase the chance that commission fees will induce more competition, four other important factors need to be considered in coordination with the policy interventions discussed above.

First, regardless of whether buyers pay for the commission directly or request a rebate from a broker, firms' ability to compete on commissions through discounts, rebates, or other innovative business models will be severely compromised if they face retaliation and boycott from other (especially dominant) firms and agents. This threat is not unique to the real estate brokerage industry, although the problem is exacerbated by the fact that the existing business model in the U.S. requires agent co-operation to finalize a transaction (the listing agent needs co-operation from the buying agent and vice versa). Empirical research suggests that this is not a mere theoretical possibility. Instead it is a real phenomenon that could stall competition in this industry (Levitt and Syverson, 2008b). Our analysis in Section 3.2 also confirms that dominant brokerage firms are less likely to cooperate with firms that use non-traditional business models. Our view is that all firms should face a level playing field and no exclusionary conduct as they contest the market. Regulation may be required to prevent some incumbents from erecting improper barriers to rivals.

Second, a key ingredient to promoting competition in commissions is allowing consumers to shop. As mentioned in Section 3.3, although they search intensely for properties, consumers rarely search for brokerage services. There are many barriers to searching. In a potentially crucial barrier, information about the price and quality of agents until recently was difficult to obtain, in stark contrast to the ubiquity of information on housing. Promoting price transparency will make it easier for consumers to shop.

Although in other industries measuring agent quality is challenging, in real estate there is an easy solution. The Multiple Listing Service database records the past transaction history of all agents individually as well as all agents collectively in a brokerage firm. This history includes attributes of properties sold or bought, transaction price, probability of sale, and days on market, all of which are concrete benchmarks of quality. In recent years, Zillow.com has provided for agents who choose to advertise with the firm their number of transactions in the past twelve months and in the 'Premier Agent' section consumer reviews and agent's average ratings. More can be done to help consumers search for agents. Barwick and Pathak (2015) and Gilbukh and Goldsmith-Pinkham (2019) suggest that consumers would greatly benefit from information about agent quality that would facilitate comparisons of and searches for agents.

Research on a closely related industry – mortgage loan applications – offers potentially relevant lessons. Bhutta et al. (2019) show that contacting more than one loan officer leads to lower interest payments and better loan terms. Alexandrov and Koulayev (2018) argue that "if 20% of consumers had obtained one extra quote on mortgage loans, consumers would save $4 billion dollars a year, the lion's share (about 90%) coming from the indirect/equilibrium effect of firms lowering prices in response to more shopping by consumers." This result is particularly important. Consumers do not have to engage in searches. The mere *threat* of searching will pressure firms to lower prices.

Third, the public finance literature (Finkelstein, 2009; Chetty et al., 2009) has shown that salience and transparency greatly enhance consumers' awareness and price sensitivity. Disclosure needs to be salient and easy to understand. Commission information should be presented to consumers in a manner that is transparent and easy to grasp. A 6% commission in a small font buried in a lengthy document might be easy to miss; a $15,000 price tag in bold font at the beginning of the listing contract is more informative. The buyer should be given the commissions that his agent obtains from different properties, and he or she should not be advised that the service is free.[18] Finally, before signing a contract with the agent, the buyer should be told explicitly that he or she can and should negotiate the commission fees and the level of service.

Similarly, the behavioral economics literature has consistently documented the importance of framing, bench-marking, and cognitive biases (Kahneman and Tversky, 1979; Thaler and Sunstein, 2008). Consumers are much more likely to take commission fees seriously if commissions (in the range of $15,000 for an average home in 2018) are presented together and contrasted with the average capital gains for a home seller ($57,000 in 2018). Standardization and a centralized database (for agent quality, etc.) could reduce search costs. Equally important is information about terms and conditions (the scope of service provided) and measures of quality, in addition to price. Finally, continuing efforts to educate consumers about their behavioral biases – for example, a 'fact sheet' about the brokerage service industry that is similar to those consumers receive when they apply for mortgage loans – would also help to reduce consumer biases.

Last but not least, policymakers should seek to allow, and indeed encourage, innovations in technol-

[18] Northwest MLS, which covers Seattle and much of the state of Washington, started publicly displaying buying commissions on Oct 1st, 2019. Policymakers should watch the effect of this change on consumer searches and industry responses.

ogy and business models.

6 Digital Platforms in the Real Estate Industry

Recently the real estate brokerage industry has received renewed interest from both regulatory agencies and the private sector. In June 2018, the Department of Justice and the Federal Trade Commission jointly hosted a public workshop on the competitiveness of the real estate industry.[19] In the spring of 2019, two separate class-action lawsuits were filed against NAR and leading brokerage firms regarding their rules for commission compensation. In the meantime, global venture capital investment in the real estate technology sector jumped from $1.8 billion in 2015 to $11.2 billion in 2018 (Source: CRETech). Together with eye-boggling investment from incumbents, the large amount of financial support is fueling exciting changes powered by modern techniques that are transforming this industry.

In this section, we discuss how issues raised in Sections 2 to 5 provide a lens to understand the implications of these events. Given the importance of data that plays a central role in these recent changes, we first analyze MLS and the repository of housing data, then we describe how they relate to digital platforms in the real estate sector.

Policymakers are concerned that the frictions in the traditional setting discussed above may limit innovation in digital platforms. Some debate whether digital platforms will mitigate or exacerbate these frictions, and to what extent lessons learned from the traditional market structure are relevant to the digital context (Morton et al., 2019). Consumers' ability to freely search for property information at low costs without any constraint or compromise is a pre-requisite for a competitive and efficient market. Our view is that some consumers will be able to use these websites and other low-cost solutions to substitute for services traditionally provided by buying brokers, and they will find cheaper solutions. At the same time, anecdotal evidence suggests that digital platforms raise prices once they achieve a significant market share. For example, Lianjia, a traditional brokerage with a rapidly growing digital arm, just announced that it would raise its fees in Beijing, where it enjoys a large market share. Finally, we describe a few recent innovations and identify how our discussion above provides a lens to understand the implications for market structure and consumer welfare.

6.1 MLS as Platforms

The internet has become the buyer's de facto broker (Inmans 2018). A proliferation of websites in recent years has made real-estate information (number of houses on the market, estimated property values, past sale prices, and detailed property attributes), all previously held in the realm of professionals, readily available to consumers.

This proliferation of websites has benefited from a couple of factors. The first is a well-developed information structure called the Multiple Listing Service, which is a platform shared among real estate

[19] https://www.ftc.gov/news-events/events-calendar/2018/04/whats-new-residential-real-estate-b

brokers that distributes information about properties for sale. By the early 2000s when, e-commerce took off, about 700 MLSs covered all cities in the U.S., most of which were owned by NAR. When a seller signs a listing agreement with a listing agent, the agent takes photos of the property, uploads property attributes to the centralized local MLS platform, provides instructions, and shows commissions promised to any buying agent. Agents agree to share the listing information with all MLS members. The information is then disseminated to buyers and the public through buying brokers and various websites. The MLS, the essential repository of listing information, is arguably the most valuable asset in this industry. Access to MLS listings is regarded as a 'must-have' by realtors, most of whom pay a membership fee to access their local MLS and in some cases several local MLSs.

The second factor is a pro-competitive business environment that has allowed all brokers to have access to MLS listing information. In 2003, NAR adopted a policy that "allowed brokers to opt out of having their listings displayed on the virtual office websites (VOW) of other brokers, prohibited VOWs from referring consumers to other real estate professionals for a fee, and prohibited VOWs from displaying an advertisement for one broker on a page displaying the listing of another broker."(Johnson 2018) This was challenged by DOJ, which viewed these policies as anticompetitive and allowed traditional brokers to discriminate against rival brokers on the basis of their business model. NAR and DOJ reached a settlement agreement effective between 2008 and 2018 that "prohibits all REALTOR® associations and association-owned MLSs from impeding a broker's ability to operate a "VOW" (Johnson 2018).

Since then, NAR has adopted policies that allow property information (such as listings with a pending sales agreement and historical sales data) to be displayed on MLS participants' internet data exchange sites. Real estate portals, such as Zillow.com, Yahoo! Homes.com, and Realtor.com, also have benefited from being able to synchronize properties listed on regional MLSs. As a result, consumers can easily browse millions of properties on websites that provide accurate and timely information. The gains in consumer surplus, although difficult to quantify, are probably substantial, given that these websites have attracted hundreds of millions of visitors each month.[20] Through a series of impressive innovations, websites like Zillow.com and Redfin.com have combined property information with interactive maps, school ratings, estimated mortgage payments, and virtual tours, which has dramatically simplified the search process. Not surprisingly, in 2018, 88% of consumers preferred to start their property searches online before contacting an agent, even though both approaches are free (NAR 2018).

6.2 Economics of Digital Platforms for Residential Brokerage

While not at the center of the recent debate about whether and how to regulate platform-based companies and the digital economy (see the Furman Report, the Stigler Report, and the Vestager Report), such discussion is clearly relevant to the real estate brokerage industry, whose most valuable asset is undeniably the body of listing information in the MLS system and other digital platforms.

[20] According to Statista.com https://www.statista.com/statistics/381468/most-popular-real-estate-websites-by-monthly-visits-usa/, the six most popular real estate websites attracted 108 million visitors in January 2019.

Like information on weather and stock markets, listing information shares a non-rival property. One buyer consumes the information but this does not prevent other buyers from consuming it at the same time. Consequently, it is in the seller's best interest to disseminate the information as widely as possible. Although there is no consensus about who owns the information, whether sellers or their brokers do so, society is best served when houses are matched with buyers who have the highest willingness to pay at the lowest cost possible. Any restraint that limits dissemination is unlikely to be pro-competitive.

A signature feature of the digital platform-based economy is that the massive returns to scale production of information goods and services often requires a sizable fixed cost and little variable cost. In other words, when an additional user is served, costs do not go up proportionately. Once a listing agent or a seller enters into MLS information of the listed property, such information can be distributed to millions of consumers at zero cost. In addition, machine learning tools yield better insights when trained on larger datasets. Firms with access to data from millions of consumers will be able to predict much better than smaller firms the type of houses that a particular buyer is seeking or the market price of a property, and they can raise the quality of their services in ways that smaller firms cannot. This could further enhance the market power of big firms.

The greater scale benefits will have to be weighed against the potential barriers imposed by large incumbents. Platforms generally derive revenues from providing complementary services to users on their platforms. Of course, large incumbents could limit innovation in the industry by strategies such as tying, wherein the firm ties complementary services to its platform, at the expense of competitors that provide similar services.

In several empirical papers that could be relevant to the real estate brokerage industry, researchers examine the market power of aggregators. Kim and Luca (2019) examine the implications of Google's decision to tie its new reviews product to its search engine. Google's exclusion of downstream competitors reduced the share of Yelp's traffic from Google relative to traffic from Bing and Yahoo (which do not exclude other companies' reviews). Also, Google reviews expanded faster than Yelp and TripAdvisor during the period in which Google banned these (and other) reviews providers. Notably, they find that users prefer the version that does not eliminate competitor reviews. Elsewhere, Athey et al. (2017) examine the shutdown of Google News in Spain in 2014, which led to a decline in the country's overall news consumption. Readers can replace some but not all of the types of news that they previously read. They read less breaking news, less hard news, and less news that is not well covered on their favorite news publishers.

6.3 New Innovations

The real estate brokerage industry is at the brink of exciting changes. As the industry adopts modern techniques powered by digital platforms, we see around us a long list of head-spinning changes. Here are just a few examples.

- One stop service

Housing transactions are complicated and take a painfully long time because many parties are involved. Companies now offer streamlined one-stop services that greatly simplify the procedures households need to go through, from inspections to obtaining title insurances, lawyers, mortgage applications, and the final closing. Some also provide 'post-sale' services that help consumers with move-in, renovation, and appliance purchases.

- Flat-Fee, discount, fee-for-service, and rebates

  While these companies have always existed, we are now seeing an increasing number of firms that offer non-traditional service models tailored to consumers' needs. Buyers and sellers can choose a la carte or a range of bundled services that include MLS listings with professionally written descriptions, staging, buyer funds verification and background checks, property showings, and negotiation support.

- i-buy programs

  As discussed in Section 3.1, some sellers, who appear to be overly risk-averse and perhaps impatient, seem willing to pay to sell their house quickly and with less uncertainty. Whether this reflects consumer biases or credit constraints, firms are responding to this demand for liquidity and certainty by offering instant cash purchasing (no staging, renovation, or marketing required) for a discount and the flexibility of seller-desired closing dates.

- Virtual tours

  High-resolution and interactive 3-D virtual tours make it possible for buyers to purchase real estate without visiting it physically. Some software allows consumers to view the natural light at different times of the day and even during different times of the year. [21] A significant advantage of these virtual software and automation techniques is that technological progress is quickly reducing their cost and making it easier to scale up the size of the operation. These innovations also allows realtors to expand their geographical territory and serve customers in different cities. Thus, the real estate brokerage industry could become national or potentially global.

- Blockchain technology

  The decentralized blockchain technology could automate the process of transferring real estate titles and financial assets, remove human interactions, and significantly reduce the cost of real estate transactions.

It might take years for researchers and policymakers to fully grasp the impact of these new phenomena on the industry and households. Just as the Internet and mobile and social technology have disrupted other traditional industries and allowed consumers to reap the benefit of technology advances, so, we

[21] According to a survey conducted by Redfin (https://www.redfin.com/blog/sight-unseen-in-2017/), 53% of successful buyer survey correspondents in Los Angeles made an offer without seeing the house in 2017.

hope, digital changes in the real estate brokerage industry may someday help consumers in the U.S. buy and sell properties at a fraction of the cost they pay today.

7 Conclusions

As a financial service industry with over $100 billions of commission revenues that serves five to six million new and used-home sales annually, the real estate brokerage industry has recently attracted well-deserved attention from both private investors and public agencies. One of the most exciting trends in this industry is the entrance and expansion of tech companies that have the potential to improve efficiency significantly.

Thus, this is a propitious moment to reflect on frictions that have existed in this industry and experiment with market design and changes that could improve market efficiency, not only through importing design features from other countries, but also by considering innovations that firms are bringing to markets. Research on the efficiency of the real estate brokerage industry offers researchers an exciting opportunity to contribute to society's well-being.

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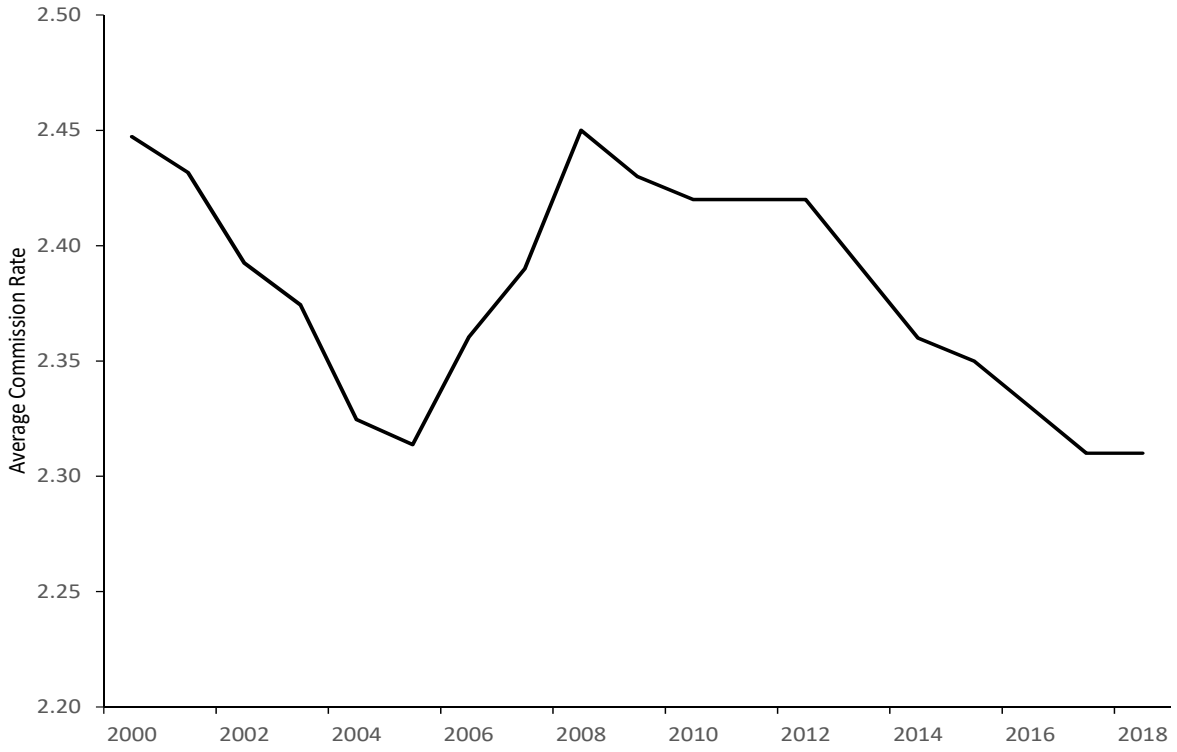
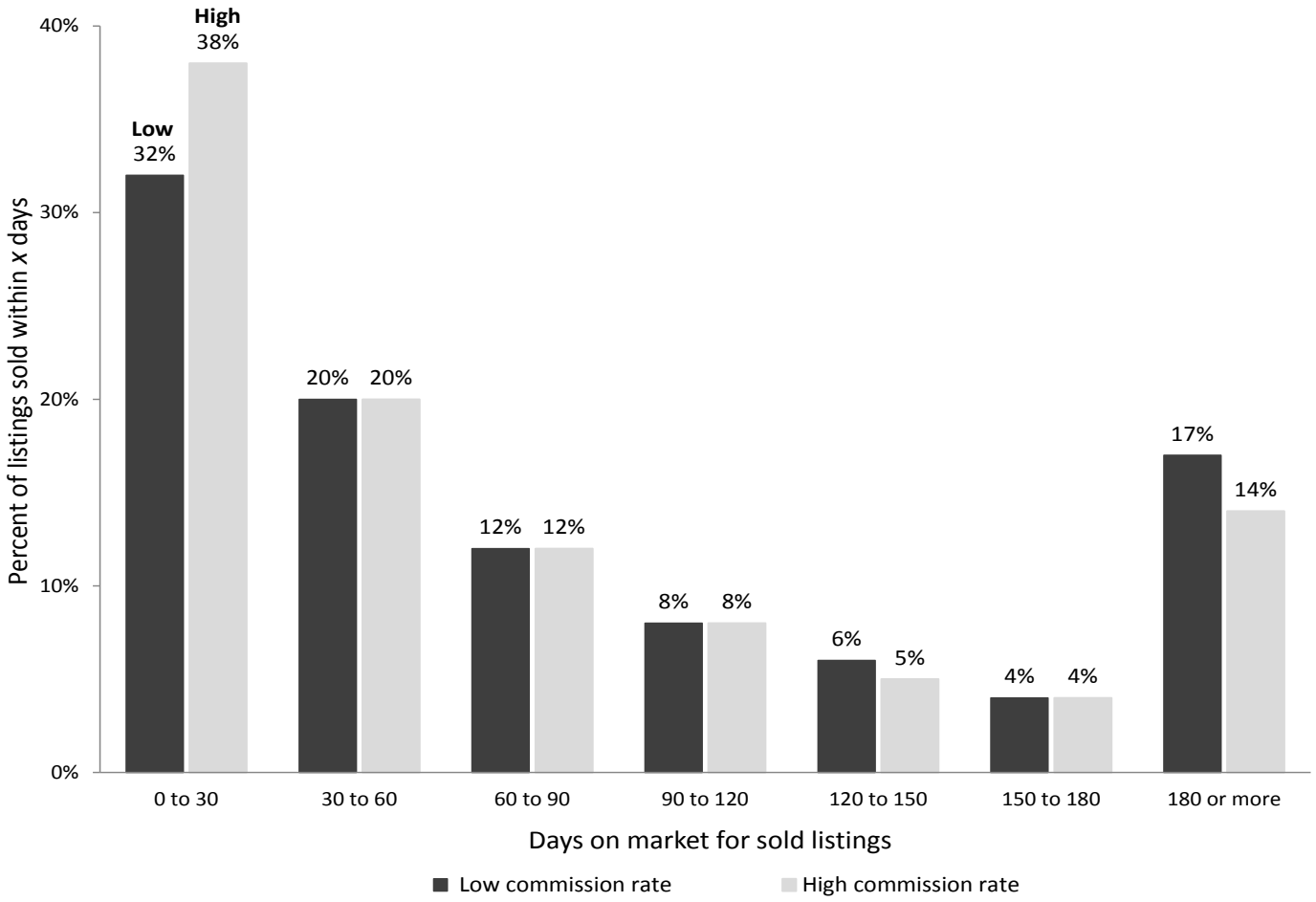
Tables

Figure 1: Commission rates over time



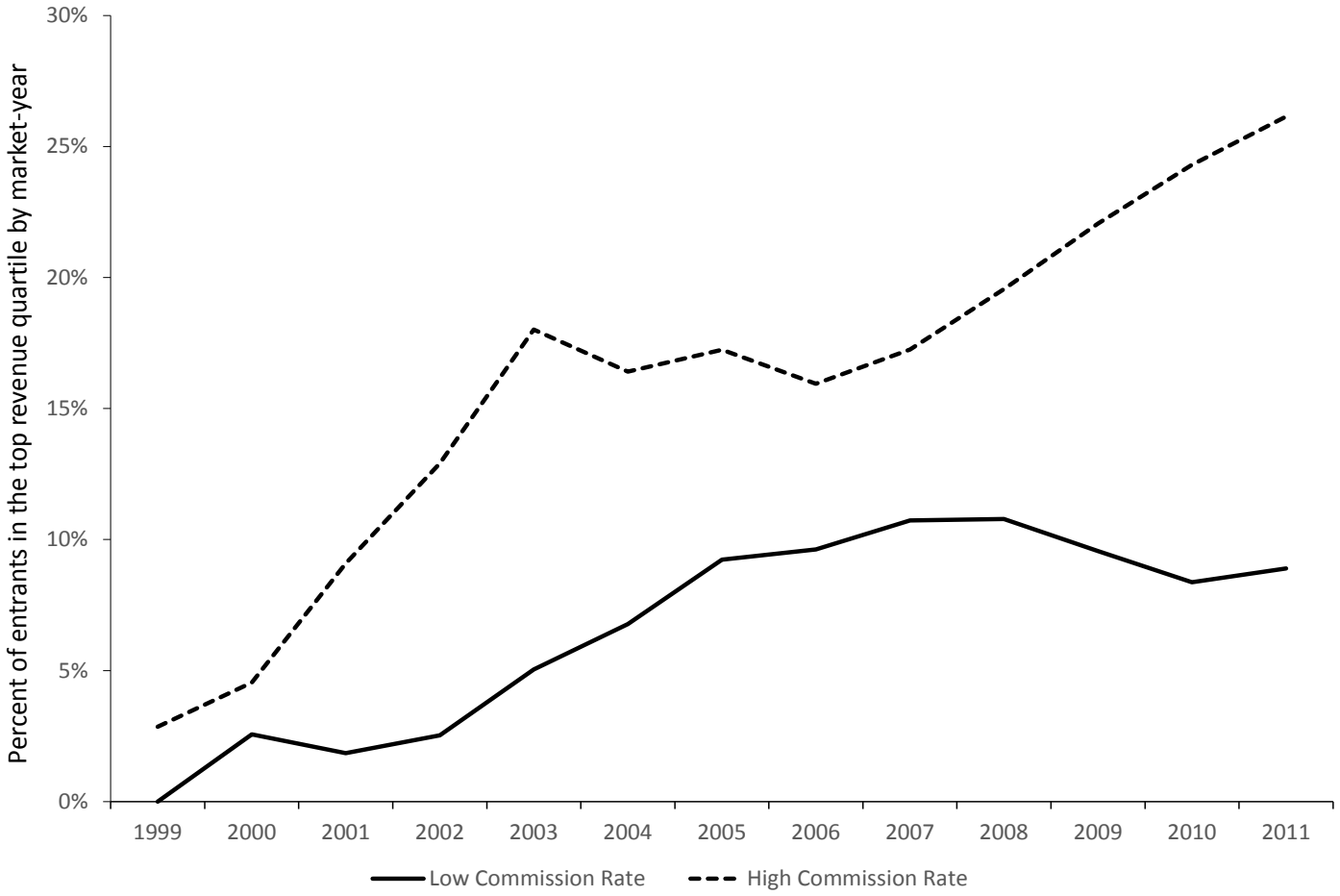
Notes: This figure reports the yearly average buying agent commission for all MLS listings in the city of Boston.

Figure 2: Cumulative days on market for sold listings (initially high versus initially low commission rate)



Notes: The dark (light) grey bars correspond to properties that initially list at low (high) commission rates. Each bar represents the percent of listings sold within a 30-day bin, except the last pair of bars to the right that indicates the percent of listings sold in 180 days or more. Reproduced from Barwick et al. (2017)

Figure 3: Growth paths for high and low commission entrants



Notes: Entrants are firms that first appear in our sample in 1999 or later. We classify entrants into the *high commission rate* group and *low commission rate* group using their commission rates in the first three years. Entrant i is in the *high commission rate* group (or *low commission rate* group) if its fraction of high commission listings in the first three years is in the top 25% (bottom 25%) among all entrants in the same market. An entrant's top-revenue-quartile status is defined using its listing commission revenue in a market and year against all offices in the same market-year. Reproduced from Barwick et al. (2017)

Table 1: Relationship between commission rate and market, property, and agent Attributes

Dependent variable:	**Commission rate**				
	(1)	(2)	(3)	(4)	(5)
CR4	0.25***				
	(0.07)				
Predicted sale probability		0.10	-0.05		
		(0.09)	(0.14)		
Agent experience (years)				0.001***	0.001**
				(0.0003)	(0.0004)
Agent experience (sales volume)					-0.0004
					(0.001)
N	653475	653475	344832	344832	344832
R-squared.	0.08	0.25	0.59	0.59	0.59
Property controls	Y	Y	Y	Y	Y
Market controls	N	Y	Y	Y	Y
Market, Year FE	N	Y	Y	Y	Y
Property FE	N	N	Y	Y	Y

* p<0.1, ** p<0.05, *** p<0.01

Notes: This table reports OLS regressions at the listing level with the buying agent commission rate as the dependant variable. Column 1 controls for property characteristics (number of bedrooms, number of bathrooms, etc.). Column 2 adds controls for market conditions over time (inventory-to-sale ratio and an aggregate price index) as well as market, year, and month fixed effects. Column 3 adds property fixed effects and restricts the sample for listings that occur more than once. The main regressors are concentration ratio at the market-year level (column 1), the predicted sale probability (predicted using the controls in columns 2 and 3, respectively), agent experience measured in years (column 4), and the log of cumulative past transaction volume (column 5). Standard errors are clustered at the market level (columns 1 and 2) and at the property level thereafter.

Table 2: Effect of a low commission rate

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Probability of sale					
Low commission listings	-0.09***	-0.07***	-0.09***	-0.06***	-0.05***	-0.05***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
N	653475	653475	344832	344832	344832	344832
R-squared	0.08	0.10	0.46	0.51	0.51	0.51
	Panel B: Ln(Days on market)					
Low commission listings	0.13***	0.11***	0.14***	0.12***	0.12***	0.12***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
N	419116	419116	136624	136624	136624	136624
R-squared	0.11	0.14	0.56	0.56	0.57	0.57
	Panel C: Ln(Sale price)					
Low commission listings	0.06***	0.01***	0.03***	-0.0006	0.0003	0.0003
	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
N	421329	421329	137085	137085	137085	137085
R-squared	0.45	0.86	0.97	0.99	0.99	0.99
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Market-year FE, month FE	Y	Y	Y	Y	Y	Y
Property controls	N	Y	Y	Y	Y	Y
Property FE	N	N	Y	Y	Y	Y
Seller patience	N	N	N	Y	Y	Y
Office controls	N	N	N	N	Y	Y
Agent controls	N	N	N	N	N	Y

* p<0.1, ** p<0.05, *** p<0.01

Notes: Panel A reports OLS regressions at the listing level for the effect of low commission rate (a dummy that is 1 for commission rate below 2.5%) on the probability of sale (a dummy that is 1 if the listing is sold). The full estimation sample for columns 1 and 2 includes 653,475 listings. Column 1 has 1228 market by year and month fixed effects. Column 2 adds 148 property controls. Column 3 adds 133,902 property fixed effects and restricts the sample to properties with repeat listings only. For seller patience (column 4), we first estimate a hedonic regression of *ln(List price)* on the full set of controls in column 6 (except the low commission rate dummy). We index sellers by the ratio of their observed list price to the predicted list price and create dummies for each decile of this ratio. These dummies constitute our seller patience controls. Columns 5 and 6 add controls for office and agent quality. Standard errors are clustered by market by year (columns 1-2) and by property (columns 3 to 6). Panel B repeats the analysis for log of days on market and restricts the estimation sample to sold properties (columns 1-2) and properties with repeat sales (columns 3 to 6, where we include 62,841 property fixed effects). We lose 2,207 sales with 0 days on market and 6 with negative days on market after taking logs. Panel C estimates the effect on sales prices. Reproduced from Barwick et al. (2017).

Table 3: Propensity of dominant offices and agents to purchase low commission listings

Dependent variable:	**Ln(Fraction of purchases with low commission rate)**				
	(1)	(2)	(3)	(4)	(5)
	Panel A: Dominant offices				
ln(Shares), lagged 1 year	-0.14***	-0.14***	-0.14***	-0.10***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N	10352	10352	10352	10352	10352
R-squared	0.65	0.66	0.66	0.69	0.81
	Panel B: Dominant agents				
ln(Shares), lagged 1 year	-0.12***	-0.13***	-0.13***	-0.13***	-0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N	33,317	32,946	32,844	32,844	32,844
R-squared	0.43	0.44	0.44	0.47	0.72
Market-year FE	Y	Y	Y	Y	Y
Office/Agent controls	N	Y	Y	Y	Y
Portfolio controls	N	N	Y	Y	Y
Chain FE	N	N	N	Y	Y
Office/Agent FE	N	N	N	N	Y

* p<0.1, ** p<0.05, *** p<0.01

Notes: Panel A reports OLS regressions at the office-year level for the relationship between an office's lagged market share and the fraction of its purchases that are low commission rate listings. The dependent variable is ln(Fraction of purchases in an office-year that have low commission rates). The main regressor is the log of the one-year lagged market share of an office, defined using its listing commission revenues in a year. Each office is assigned to one primary market in each year. The sample includes all offices with five or more average annual number of listings. Office controls (lagged a year) include the fraction of listings that are sold, average days on market for sold listings, fraction of agents who are the top ten percent highest performing agents, an entrant dummy (1 if the office appears in 1999 or later), age of the firm interacted with the entrant dummy, and 1 if the office location is in our list of cities. Portfolio controls (lagged a year) include the fraction of listings that are condominiums, the fraction that are single family, average square footage, number of bedrooms, number of bathrooms, listing price, age of the property, averaged among an office's listings in a year. There are 171 chain fixed effects. The last column controls for 1852 office fixed effects. Standard errors are clustered at the office level. Panel B repeats the analysis at the agent-year level. Each agent is assigned to one primary market in each year. The sample includes all active agents (whose average annual number of listings is above the median). Agent controls (lagged a year) include the fraction of listings that are sold, an entrant dummy (1 if the agent appears in 1999 or later), experience of the agent interacted with the entrant dummy. The last column controls for 10,300 agent fixed effects. Panel A is reproduced from Barwick et al. (2017).

Table 4: Propensity of top chains to purchase listings by discount brokers

Dependent variable:	**Percent of purchases from discount firms**		
	(1)	(2)	(3)
Top Chains	-0.81***	-0.76***	-0.76***
	(0.14)	(0.13)	(0.13)
N	49671	49671	49671
R-squared	0.03	0.03	0.03
Market-year FE	Y	Y	Y
Agent controls	N	Y	Y
Portfolio controls	N	N	Y

* p<0.1, ** p<0.05, *** p<0.01

Notes: This table repeats the agent-year analysis in the first three columns of the preceding table (Panel B), except the main regressor is an indicator for agent-years associated with the top six chains (Coldwell Banker, Century 21, Remax, Hammond, Prudential, and GMAC). The dependant variable is the percent of purchases by the agent in a year that is listed by online or discount brokers, defined by the name of the brokerage firm (e.g. Ziprealty, The Entry Only Listing Service) or whether a majority of the firm's listings is entry-only (the agent's primary responsibility is to enter the data into the MLS).