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

Panle Jia Barwick† Maisy Wong‡

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The past decade has witnessed remarkable technological 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 fee) for services rendered that seems to vary little with the associated cost. This paper identifies structural hurdles that have limited competition, 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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†Department of Economics, Cornell University and NBER. Email: panle.barwick@cornell.edu.

‡University of Pennsylvania and NBER. Email: maisy@wharton.upenn.edu. Wong acknowledges financial support from the Research Sponsors Program of the Zell/Lurie Real Estate Center at Wharton.

1 Introduction

We live in a world with remarkable technological innovations. In the real estate brokerage industry, the past decade has witnessed a proliferation of new 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 and facilitate housing transactions, the real estate brokerage industry in the United States still commands a persistently high price for services rendered. For example, to sell a house in New York State in 2018, the median household spends more than 40% 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 (Bureau, 2018; John Cropley, 2019; Prevu, 2019). Across the country, national average commission fees over the past couple of decades have doubled and outpaced inflation in most years. Commission rates have remained uniformly high relative to other countries and industries, and appear largely invariant to factors that affect the cost of housing transactions. All of these patterns are puzzling given the industry's significant technological changes in the meantime.

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 and propose policy recommendations that could enhance competition in the brokerage industry. We conclude with a brief discussion of recent trends and innovations in this industry, including opportunities and challenges associated with digital platforms, and point to lessons learned from the existing literature and avenues for future research.

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 (NAR, 2019a). By comparison, the sales of new and existing homes remained similar: 5.99 million units in 2000 and 5.96 million units in 2018.[1]

[1] For used home sales, see (NAR, 2019b). For new home sales, see (U.S. Census Bureau and U.S. Department of Housing and Urban Development, 2019).

The competition among agents for prospective sellers and buyers is much 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 that prices commanded for services rendered have remained stubbornly high, relative to other countries and also relative to other service industries that have seen their commission levels plummet as a result of internet-enabled new technologies (Levitt and Syverson, 2008b). We present descriptive patterns showing that inflation-adjusted commission fees in the residential brokerage industry in the United States have been steadily increasing. Commission fees do not appear to reflect the cost of doing business or the quality and experience of agents. Local market concentration as measured by the market share of the top four largest firms is high. In addition, the entry and expansion of firms that adopt innovative business models and charge low fees have been rather limited.

The primary dataset for statistics reported in this section 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 quality proxies for all of the 9,000 brokerages and 35,000 agents observed in the sample. Critically, we observe commission rates that listed properties offer to buying agents, which allows us to examine how these commissions influence the transaction outcome of listings. To extend our original analysis to more recent years, we have obtained aggregate information on commission fees to the buying agents in the city of Boston from 2011 to 2018 and utilize other auxiliary datasets that we describe below.

In eastern Massachusetts, as is the case with the rest of the country, sellers are responsible for paying commission fees to both the listing agent and the agent who brings a buyer. The typical commission rate is 5 percent, which is usually evenly split between the listing agent and the buying 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 a member 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."[2]

2.1 Uniform Commission Fees

Across Time Figure 1 shows that the average commission rate offered to buying agents has remained roughly constant over the past two decades. The underlying sample includes all properties listed on the Multiple Listing Service (hereafter MLS) in the city of Boston. The average buying commission was 2.45 percent in 2000, declined to 2.31 in 2005, rose to 2.45 in 2008, and fell to 2.31 in 2018. The median

[2]Emphasis added by authors.

rate has been 2.5 percent every year throughout this period.[3]

Given that commission rates have remained relatively stable, total commission fees have risen as a result of housing price appreciation. For example, the average commissions paid to a buying agent in the Boston area was $6,370 in 2000 (or $9,400 in 2018 dollars) and $14,500 in 2018, which constitutes a 54% increase after adjusting for inflation.[4]

Uniform commission rates and rising commission fees over the past couple of decades stand in contrast to the substantial entry and exit of firms across the housing cycle. In our primary dataset for eastern Massachusetts, the number of active brokerage 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. Surprisingly, the significant entry and exit of firms over the housing cycle lead to no appreciable changes in the commission rate.

Across Space The limited change over time corroborates with a lack of variation geographically. Findings from our primary dataset indicate that ninety percent of listings pay 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 observed in Massachusetts, where the 5 percent commission fee paid by sellers is usually split equally between the buying agent and the selling agent.

These patterns are not unique to Massachusetts. Schnare and Kulick (2009) document that the average commission rate for buying agents remained mostly between 2.5 percent and 3 percent from 2000 to 2006 in Baltimore, Chicago, Dallas-Forth Worth, Kansas City, Miami-Fort Lauderdale, Orange County, and Washington D.C. Similarly, Hsieh and Moretti (2003b) show that more than 90% of listings have a total commission rate (paid to the listing agent and the buying agent) above 5 percent, using a nationally representative sample in 1980.

2.2 Commission Fees High Relative to Other Countries and Industries

Comparison with Other Countries The commission rates in the U.S. appear to be at the high-end of the commission spectrum globally. According to surveys of 32 countries undertaken in 2002 and 2015 (Delcoure and Miller, 2002; The Wall Street Journal, 2016), the United States ranked the third highest in both 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. Interestingly, the commission rate in Sweden fell from 5% in 2002 to only 1.5% in 2015, though there is limited causal evidence underlying this trend.

The role of buying agents in the United States differs from that in other countries. In many countries,

[3] 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.

[4] The median sale price for Boston was $260,000 in 2000 and $627,000 in 2018 (Zillow, 2019). The average commission rate paid to a buying agent was 2.45% in 2000 and 2.31% in 2018.

including Australia, Canada, and Denmark, buyers commonly purchase properties without agent representation. Even if a buying agent is involved, the buyer typically pays his agent's service directly, as in the United Kingdom, China, Japan, and Italy.

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). These fees continue to decline in the 2000s. The mutual fund industry, for example, commanded in the early 2000s an average 1% commission rate that had been reduced by half by 2018, thanks to competition from low-fee index funds. Interestingly, between 2017 and 2018, 91-94% of the rate reduction was driven by investors switching 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 steepest price increases. According to data from the Bureau of Labor Statistics and Case-Shiller Home Price Index, national average commission fees have largely outpaced inflation.[5] Over the past twenty years, the average commission fees doubled, while inflation increased by only fifty percent.

2.3 Commissions do not Reflect Costs

A core principle in economics is that prices reflect the marginal costs of production in competitive markets. If prices are substantially higher than marginal costs, positive economic profits encourage the entry of firms, which would intensify competition and drive prices close to the marginal cost. In our setting, the cost to intermediate a property depends on the type of housing, the costs for agents to exert effort, 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 market conditions.[6]

To analyze how commission rates vary with the costs and effort required to sell a property, we examine how it correlates with proxies of costs and agent quality. We first predict ease-of-sale using a logit regression with property 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 price index and inventory-to-sold ratio in each market and year). We then correlate the commission rate with the predicted ease-of-sale, controlling for property and market attributes. If commission rates reflect the cost it takes to sell a house, then properties that are easier to sell should be associated with a lower commission rate. The positive correlation between commission rates and ease-of-sale in Column 1 of Table 1 suggests the opposite. In Column 2 where we add property fixed effects and compare the same property sold in hot versus cold markets, the coefficient turns negative but remains insignificant.

[5]The calculation here assumes a constant commission rate.
[6]Barwick provided consulting service on related issues prior to composing this paper.

Agent experience is a critical factor for transaction outcomes. There is a lot of variation in agent experience (Gilbukh and Goldsmith-Pinkham, 2019). In our data, the average agent has four years of experience as defined relative to the year when an agent obtained his license, with a wide inter-quartile range where the 25th percentile is zero and the 75th percentile is seven years. Experience, as measured by the number of transactions per year (listings and purchases) is also very heterogeneous, with the average agent having 2.6 transactions per year, the median agent having only one, and a standard deviation of five transactions.

Columns 3 and 4 demonstrate a very weak relationship between agent experience and commission rates.[7] While these patterns are descriptive correlations that are likely driven by sorting among agents and do not have a causal interpretation, they are nonetheless informative. The estimates imply that a one standard deviation increase in years of experience is associated with a modest 0.004 percentage point increase in the commission rate.[8] If experience is measured by the cumulative number of past transactions, then an increase in agent experience is associated with lower commission rates, although the effect is small and insignificant (-0.0004). Results using other measures of experience (e.g., the cumulative number of past transactions) are similar. Together, these estimates imply that agents who have substantial experience appear to be compensated with similar commission rates as those with little experience.

2.4 Industry Concentration

While commission fees bear little resemblance to the underlying costs of housing transactions, they appear to be correlated with market concentration. A standard measure of concentration is the combined market share of the top four firms (CR4). Nationally, the CR4 ratio is 4 percent, consistent with the fact that there are thousands of brokerage firms in the U.S.[9] Similarly, when we treat eastern Massachusetts as one market, the CR4 ratio is five percent. However, these aggregate concentration ratios are misleading because consumers are unlikely to search across all listings that span the entire region. When we separately examine eastern Massachusetts's eighty-seven local markets,[10] the average CR4 ratio is 42 percent, eight times higher than the regional average. As a result of the significant entry of brokerage firms, the average CR4 fell from 54 percent in 1998 to 35 percent in 2011, though still high compared to other retail or service industries in the U.S. The correlation between CR4 and average commission at the market-year level is 0.17, suggesting that concentrated markets tend to exhibit higher commission fees.

Not only are the top brokerage firms prominent in local markets as indicated by the high CR4 ratios,

[7] The patterns are similar if we measure experience using accumulated past transactions instead of annual transactions.

[8] The standard deviation of experience is 4 years.

[9] The national CR4 ratio is based on the 2018 aggregate commission revenues for Realogy, Re/Max, Keller Williams, and eXp. All other CR4 ratios discussed in this section are based on the number of transactions.

[10] The 87 markets in our sample largely represent towns in eastern Massachusetts, except that the smallest towns are grouped with neighboring ones and the metropolitan area of Boston is split into twelve markets using Zillow's neighborhood definition. For details of the market definition, see Barwick et al. (2017). The CR4 ratio remains high when we don't group markets or split Boston.

the top agents are also critical to completing a sale. We rank agents by their average annual number of transactions and focus on agents in the top decile. Notably, these top 10 percent of agents are part of 81 percent of completed transactions. If agents are randomly matched to each other, the likelihood that a transaction will include at least one top agent is only 19 percent.[11] Furthermore, 31 percent of transactions involve a top agent on both sides of the transaction relative to a random benchmark of one percent. 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 potential barriers in the market and the 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 consumer biases and other barriers that limit competition.

3.1 Steering

In Barwick et al. (2017), we empirically assess how cooperation between agents helps to sustain high commission fees, despite low entry barriers and a seemingly competitive marketplace that has many agents. In particular, we provide evidence that substantiates regulators' 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).

When a listing agent uploads property information to MLS on behalf of a seller, he is required to specify the commission split that is offered to any buying agent who produces a buyer. While buying agents observe commissions offered on MLS, such information is hidden from potential buyers or non real-estate professionals (a feature we return to in the discussion below). All else being equal, buyers' agents have an incentive to prioritize properties that offer high commissions and steer buyers away from low-commission listings. As a result, listings that offer low commissions would suffer from poor sales performances. Knowing this, sellers are less likely to offer low commission rates. In this way, the threat of steering offsets the competitive force of price competition, limiting the growth of discount brokerages that offer low commission rates.

To document the existence of steering and quantify its impact on sales outcomes, we utilize our rich dataset to compare observably identical properties that offer low versus high commission rates. We define

[11] This is calculated as 1 minus the likelihood that a transaction does not include a top agent on either the listing or the buying side: $1 - 0.9 \times 0.9$.

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

Table 2 shows that low commission listings indeed suffer worse sales outcomes. We examine three aspects of the transaction outcome, including the probability of sale (Panel A), the number of days it takes to sell (Panel B), and the sale price (Panel C). 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, we consistently find that low commission listings are less likely to sell and take longer to sell. The effect on the sale price is close to zero and insignificant, once we control for property fixed effects and seller patience.

The effect sizes documented in Table 2 are economically significant. On average, 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 to sell than high commission listings and stay on the market for twenty more days. Not selling a property the first time is costly, and selling during the off-peak season (wintertime or in the middle of a school year) could lead to a protracted time on the market. As shown in Figure 2, the days on market for sold listings has a long right tail. Low commission properties are five percentage points less likely to sell within 30 days and five percentage points more likely to stay on the market for six months or longer. This is a significant increase in risks 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 newly entered offices, and listings by offices that used low commission rate policies in the past.

One might be concerned that poor transaction outcomes may reflect a low 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, where the listing agent's effort is not as crucial. Our findings are also similar if we compare listings by the same agent. To directly control for the incentive of listing agents to exert effort, we construct 'pairs' of properties that are listed by the same agent in the same year with similar listing commission revenues but offer *different* commission rates to the buying agent.[12] Since these properties deliver the same amount of payoff for the listing agent, they should induce the same level of effort but might attract a different number of buyers given the difference in buying commission rates. We continue to find poor 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 could be listed

[12]The difference in listing commission revenue within a pair is capped at $500.

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.

Our findings 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. What is the cost of taking six months or longer to sell a property? Assuming that the annual user cost of owning a property is 5.3% (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 2011.

Our calculations suggest that sellers face a significant trade-off between 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 if they are 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 evidence in the literature that sellers are willing to give up higher prices in favor of quick sales and exhibit high annualized discount rates. Genesove and Mayer (1997) report that sellers whose loan-to-value ratios are at 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. 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 his 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, as documented in Section 3.2 below. 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 Dominant Firms and Discount Listings

The uniformly high commission fees suggest barriers to entry, exclusionary conduct, or both. As discussed in Section 2.2, a successful 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.[13] Specifically, we ask whether dominant offices that have greater market power are less likely

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

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 based on its commission revenue from all of its sold listings in a 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 at least five listings per year 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 (Coldwell Banker, Century 21, Remax, Hammond, Prudential, and GMAC) is 2.8 times larger than that for non top-chain offices.

A potential confounding factor is that buyers of high commission listings might prefer to work with high-quality offices and that high-quality offices are also large. Even if dominant offices do not retaliate against low commission listings, there may be a spurious negative relationship through this omitted quality 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 and its interaction with the age of the firm, and a dummy for offices located inside the boundary of markets (towns) we study. Column 2 illustrates that the negative effect remains after these controls for office quality are added.

Next, we address concerns that δ may be biased if dominant offices tend to represent wealthy buyers who prefer properties listed at high commission rates. Column 3 controls for differences in offices' property attributes that proxy for buyers' wealth, 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 $t-1$.[14] 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 as-

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

sociated with chains may prefer high commission listings independent of their size. Given that more than 90% of listings by Coldwell Banker and Hammond have high commission rates, it is not surprising that their fixed effect 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 by 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 (12%) 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 percentage point (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 sustain the current commission structure.

Our findings that dominant firms are less likely to purchase properties offering low commission rates are robust across different samples, different market share metrics, and different measures of the propensity to purchase low commission listings. For example, some listings are intermediated by the same agent (dual-agency) or purchased by buying agents in the same office as the listing agents. 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 if large offices tend to charge higher commission rates, then the coefficient δ will be biased downwards by this network effect. Excluding in-house transactions delivers similar results.

We replicate the analysis for agents in Panel B. Across all specifications, we consistently find that dominant agents are also less likely to purchase low commission rate listings. The estimated elasticity in Column 1 of Panel B suggests that doubling an agent's market share reduces the fraction of low commission listings he purchases by 12%. Similar to our findings for firms, the negative estimate survives chain fixed effects (-0.13 in Column 4) and agent fixed effects (Column 5). The magnitude is smaller (-0.02) in this demanding specification, but still significant.

Table 4 estimates a version of equation (1), except that the dependent variable is the percent of purchases from online or discount brokers and the analysis is at the agent-year level. We define online or discount brokers using 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 where the listing agent's primary responsibility is to enter the property information into the MLS system. The three columns in Table 4 are analogous to the first three columns of Panel B in Table 3. The key regressor is whether an agent works for the

six dominant chains. These chains account for 53% of the purchases 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) 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 were sold in Cook County stayed on the market for 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.

The patterns described above present evidence on entry barriers that reflect 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 to be in the top quartile than entrants whose initial commission rate is low. This pattern remains the same under alternative definitions of success, or if we control for observable differences in performance (fraction of listings that are sold, etc.) and agent composition to address the concern that low-commission firms might offer lower quality service.

As more than 90% of buyers and sellers still rely on agent representation (NAR, 2018), co-operation between the buying and selling agents remains crucial to complete a transaction and makes this industry more vulnerable to retaliation. Hatfield et al. (2019) show that in such settings, price collusion can be sustained even with many market participants because firms can refuse to cooperate with any rival 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).

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). Housing purchases are often the most crucial and emotional transactions made by households, 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).

As mentioned in Section 3.1, the housing literature has 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 more patient. For example, Levitt and Syverson (2008a) find 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 driven by the need to move before the school year begins or the fear of being stuck in the market for a prolonged period. Second, sellers, especially those buying a home at the same time, can be liquidity constrained and cannot finance multiple mortgages concurrently (Genesove and Mayer, 1997). Third, the price expectations of some sellers may be irrational, 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 hidden to buyers, even though they implicitly pay for the commission fees through a higher purchase price.[15,16] 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 vs. dealers produces drastically different outcomes: when car buyers receive the rebate, consumers get 70 to 90 percent of the benefit. When dealers receive the payment, consumers only get 30 to 40 percent of the rebate amount. In our setting, the statutory incidence is on sellers and buyers are often unaware of the part of commission fees that they shoulder implicitly. As we discuss below in Section 4, there is evidence from existing housing literature that when buyers are aware of the transaction costs, prices will adjust so that the ultimate economic incidence might no longer depend on who pays (Best and Kleven, 2018). This suggests that increasing the salience of fees and rebates and promoting consumer awareness could

[15] Before the closing of the property transaction, buyers do not observe commission rates, neither do sellers for properties not their own. At the closing for a given property, the buyer and seller are required to sign hundreds of pages of documents, including the Closing Disclosure that are formerly the HUD-I settlement forms, which 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 buying agent, even though buyers are required to sign the Closing Disclosure.

[16] A recent survey of home sellers found that nearly 45% didn't know that their commission fee included the buying agent fee (O'Shaughnessy, 2019). In general, home buyers and sellers exhibit a limited understanding of the commission structure (Brobeck, 2019).

be socially beneficial. Finally, while consumers search intensively for properties – the average buyer in 2018 searched for ten weeks and looked at a median of ten properties – they rarely search for brokerage services (NAR, 2018). For example, 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. Three quarters of sellers contacted only one agent. Why do not consumers search? Some believe that all agents charge the same price and that commissions are non-negotiable. Thus, there is little benefit to search. Others regard this as an emotional process and are hesitant to search and bargain (Akerlof and Shiller, 2015).

3.4 Other Contributing Factors

Lastly, an important feature that has not received adequate attention is the type of contract terms that specify conditions under which commissions are paid. There are three main types of contracts: the exclusive right to sell, where the listing agent gets compensated as long as the property sells, regardless of who finds 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. Historically, the exclusive right to sell (or sole agency), the contract type that is most favorable to agents, was also emphasized in item five of the 1913 Code of Ethics: "Obtain sole agency, in writing, if it is property worthy of a special effort to sell." Among our sample of 650,000 listings, 96% offer the listing agent the exclusive right to sell, while the remainder offer exclusive agency rights. Almost no sellers use open listings. While we cannot distinguish whether this is because firms don't offer alternative contract designs or sellers 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.

4 Welfare Consequence of High Commissions

What are the welfare implications of high commissions? Below, we first document that commissions are high relative to households' savings in housing equity, then discuss social losses from reduced household mobility as a consequence of high commissions, and conclude with the welfare distortions associated with the excessive entry of real estate agents and firms in pursuit of above normal rents brought by high commissions.

Commission fees constitute a large share of the transaction costs paid by home sellers. According to ATTOM data solutions, the average home sellers achieved a capital gain of $57,500 from selling their homes in the first quarter of 2019, after owning homes for 8.05 years. The average commission that they incur for selling properties 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 U.S., the three largest financial resources of the elderly are Social Security, home equity, and employer-provided pension or retirement savings. 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 and retirement savings 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.[17]

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 taxes 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 "mansion tax" for housing transactions above one million dollars led to 2,800 fewer sales out of 380,000 transactions in their 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, reductions in mobility and housing transactions can have multiplier effects on the rest of the economy, through spending on home-related durables, home maintenance and improvement, which are complementary to the purchase of a new house (Benmelech et al., 2017).

The second component of social losses relates to the excess entry of agents and firms and a misallocation of talent and resources. The number of real estate transactions during the 2010s has been moderately higher than that 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 on properties (and has driven down the cost of transaction), this trend implies that the labor productivity of this industry has deteriorated dramatically. In the U.K. where commission fees are a fraction of those in the U.S., there are more than one million housing transactions each year with 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 requires twenty-six times more agents. There is no evidence that the quality of service is much lower in the U.K.; indeed, average sales performance metrics such as days on market and the probability of sale appear similar in

[17] The average American household saves $175,510 (Gustman et al., 2010). The gap between the median and average savings reflects inequality in the wealth distribution.

both countries.

As the literature (Hsieh and Moretti, 2003a; Barwick and Pathak, 2015) has shown forcefully, the key contributing factor of this low labor productivity 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 number of property transactions. The outcome? A reduction in labor productivity and a loss of social welfare because some of these individuals and firms could have engaged in the production of goods and services in other sectors that is valuable to society and increases GDP. If agent productivity had 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).

5 Policy Discussion

5.1 Policy Interventions: Untying Commissions and Encouraging Rebates

Untying Commissions Given that sellers compensating buying agents 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 party obtains (untying commissions), which is the norm in other consumer service industries.

This intervention has several benefits. The most direct benefit would be to mitigate the threat of steering and the resulting conflict of interest. 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 seller's listing agent) and is not observed by the buyer. It is difficult to negotiate on a commission that is unobserved. 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.[18]

A crucial ingredient of 'market forces' that ensures the proper functioning of a market is buyers' uncompromised ability to observe prices collected by the service provider, negotiate fees when necessary, use high commissions to reward quality, shop for less-than-full services if needed, and vote with their feet if they desire. This market force is greatly hampered when buyers do not observe the commissions that agents collect and/or are misled by the free-commission advertisement. In contrast, when buyers observe commissions and have to pay for the service they desire, they would be more price sensitive. Price sensitive consumers impose downward price pressure on brokerage firms and agents, which helps maintain a healthy competitive environment: it promotes price competition, encourages the market entrance of

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

innovative low-cost firms, and incentivizes existing firms to provide better service. Greater competition in commissions lowers transaction costs, which in turn alleviates the negative consequences on social welfare discussed at length in Section 4.

Another advantage of making buyers pay for the service is to discourage over-consumption that occurs when something is labeled as 'free.' Economists have long lamented the peril of goods offered for 'free': severe pollution arises 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 as a result of 'free' services 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.

Critics of having buyers pay directly for the buying agent point out that buyers are often financially 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 mortgage loans, imposing greater upfront costs on buyers could exacerbate credit constraints.[19]

Although well-intended, 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.[20] 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 Some people argue that having buyers pay commissions constitutes fundamental changes to the decades-long industry practice of sellers paying all commissions and would meet fierce resistance from industry participants. Are there less-radical solutions to 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 consumer goods sectors, where purchasers mail in a coupon and a receipt to receive a check rebate. For rebates to generate price competition, buyers need to observe commissions and understand that commissions constitute a significant part of the transaction costs of buying a property and that they have the right to request rebates from brokers. The number of

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

[20] 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.

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 states in the U.S.[21]

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. In response to the entry and expansion of discount firms, the average commission decreased from 1.8% in 2011 to 1.2% in 2018. As of 2018, 20% of U.K. buyers used a fixed-fee commission arrangement instead of the percentage fees (TheAdvisory, 2019).

Would housing prices adjust if the sellers stop paying for buyers' commissions? While we do not have data that speak 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 authors conclude that "(T)he 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." Another study by Besley et al. (2014) exploits 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 prices to decrease by about 2 to 3% when half of the financial burden of commissions is shifted to the buyer.

5.2 Other Important Considerations

To induce more competition in commission fees, 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 retaliation is not a mere theoretical possibility; instead, it is a real phenomenon

[21] 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.

that could stall competition in this industry (Levitt and Syverson, 2008b). The analysis in Section 3.2 suggests 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 incumbents from erecting improper barriers to rivals.

Second, a key ingredient in promoting competition in commissions is encouraging consumers to shop. As mentioned in Section 3.3, although they search intensely for properties, consumers rarely search for brokerage services. One crucial barrier to searching is that information on the price and quality of agents is difficult to obtain, in stark contrast to the ubiquitous information on housing. Promoting transparency of commission fees will make it easier for consumers to shop for low-fee agents. As for quality, although it is challenging to measure quality in other industries, there is an easy solution in the real estate brokerage industry through the MLS database, which records the past transaction history of all individual agents 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 agent quality. Barwick and Pathak (2015) and Gilbukh and Goldsmith-Pinkham (2019) suggest that consumers would greatly benefit from information on 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." In addition, consumers do not have to engage in more 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 sellers and buyers 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. Buyers should not be advised that the buying agent's service is free.[22] Finally, before signing a contract with the agent, it would be useful to inform a buyer that he has the option to negotiate the commission fees and the level of service.

Similarly, the behavioral economics literature has consistently documented the importance of framing and cognitive biases (Kahneman and Tversky, 1979; Thaler and Sunstein, 2008). Consumers are much more likely to take commission fees seriously if commissions are contrasted with the capital gains for a home seller (averaging $15,000 vs. $57,000 in 2018). Standardization and a centralized database

[22]Northwest MLS, which covers Seattle and much of the state of Washington, started publicly displaying buying commissions on Oct 1st, 2019. Evaluating the effect of this change on consumer searches and industry responses would be very valuable.

on all agents could reduce search costs and facilitate comparison across agents. Equally important is information about contract terms and conditions, the scope of service provided and measures of quality, in addition to the 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 that consumers receive when they apply for mortgage loans – would also help.

Last but not least, policymakers should seek to allow, and indeed encourage, innovations in technology 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. For example, global venture capital investment in the real estate technology sector jumped from $1.8 billion in 2015 to $11.2 billion in 2018 (CREtech, 2019). Together with significant investment from incumbents, the large amount of financial support is fueling exciting changes powered by modern techniques that are transforming this industry.

The emergence of internet-powered innovations has transformed the way buyers search for housing. Compared to 43% of buyers who used the internet in 2003, 89% of them start with an 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 fraction of households who first found their home through a real estate agent declined from 50% in 1997 to 33% in 2015 (NAR 2006, 2015).

While technological advances often give rise to changes in social institutions, there have been relatively limited changes in commission rates as shown in Section 2.1 or innovations in how properties are intermediated despite significant changes in the way consumers search for housing. 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 (NAR, 2018).

In this section, we discuss how issues raised in Sections 2 to 5 provide a lens to conceptualize the competitive effects associated with internet innovations and the emergence of digital platforms in real estate. We first analyze MLS as a repository of housing data and a platform, then describe how they inform the debate on digital platforms in the real estate sector.

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), which was 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 brokers that distributes information on 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. Agents agree to share their own listing information with all MLS members by uploading it to the MLS system, which 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 agents, most of whom pay a membership fee to access their local MLS.

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 these 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.[23] Through a series of 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 (Furman et al., 2019), the Stigler Report (Morton et al.,

[23] According to ebizmba.com (eBizMBA, 2019), the six most popular real estate websites attracted 108 million visitors in January 2019.

2019), and the Vestager Report (Cremer et al., 2019)), 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. A central theme of the policy reports is the debate around the potential benefits and challenges brought by digital platforms. On the benefit side, digital platforms exhibit massive economies of scale and scope due to low marginal costs and the non-rivalry of data. This can dramatically reduce search costs and lead to faster and better matches between buyers and sellers. However, there are also concerns that digital platforms can leverage their scale advantages to limit entry and competition, which can augment the frictions discussed in Section 3. We highlight a few lessons learned from the reports that are relevant for real estate platforms and point to future avenues for research as there are limited empirical studies in this area.

First, it is important to promote entry and competition. Innovation and competition associated with the entry of firms with new technology and business models represent major sources of social welfare gains over time. Barriers to entry can present social losses associated with fewer product choices for consumers, unrealized potential paths of innovation, reduced quality of service per dollar spent, or inflated prices. Existing platforms could inhibit entry or raise entry barriers, given their scale and low marginal costs once they are established (Morton et al., 2019).

Second, authorities should ensure that data are portable across platforms and consumers have access to databases on housing information that is as complete, accurate, and updated as possible. Like information on weather and stock markets, listing information shares a non-rival property. One buyer consuming such information 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 on who owns the listing information, whether sellers or their brokers, our society is best served when listing data are widely disseminated and houses are matched with buyers who have the highest willingness to pay.

Third, due to the massive returns to scale and scope on digital platforms, there are concerns that dominant firms may use bundling to extend their market power from their core business to complementary businesses.[24] Platforms generally derive revenues from providing complementary services to users on their platforms. For example, a housing search platform can raise revenue from services that facilitate housing transactions, including mortgage financing, moving, and post-purchase services like installing appliances and renovations. Bundling by large incumbents has the potential to limit competition. In a different context, Kim and Luca (2019) examine the implications of Google's decision to tie its user reviews 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 excluded these (and other) review providers. Notably, they find that users prefer the version of Google that does not eliminate competitor reviews. Besides bundling, there are also concerns that digital platforms raise prices once they achieve a significant market share. For example, Lianjia, a traditional

[24]We thank Dmitry Shkipin for helpful discussions.

brokerage with a rapidly growing digital arm, just announced that it would raise its fees in Beijing, where it commands a large market share.

Finally, the low cost of information gathering allows digital platforms a greater ability to exploit consumer biases. In addition, consumers have a tendency to single-home and rely on one platform only, which further enhances the market power of digital platforms, especially the dominant ones.

7 Conclusions

As an industry with well over $100 billion of commission revenues that serves 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 entry 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, all of which offers exciting opportunities for future research.

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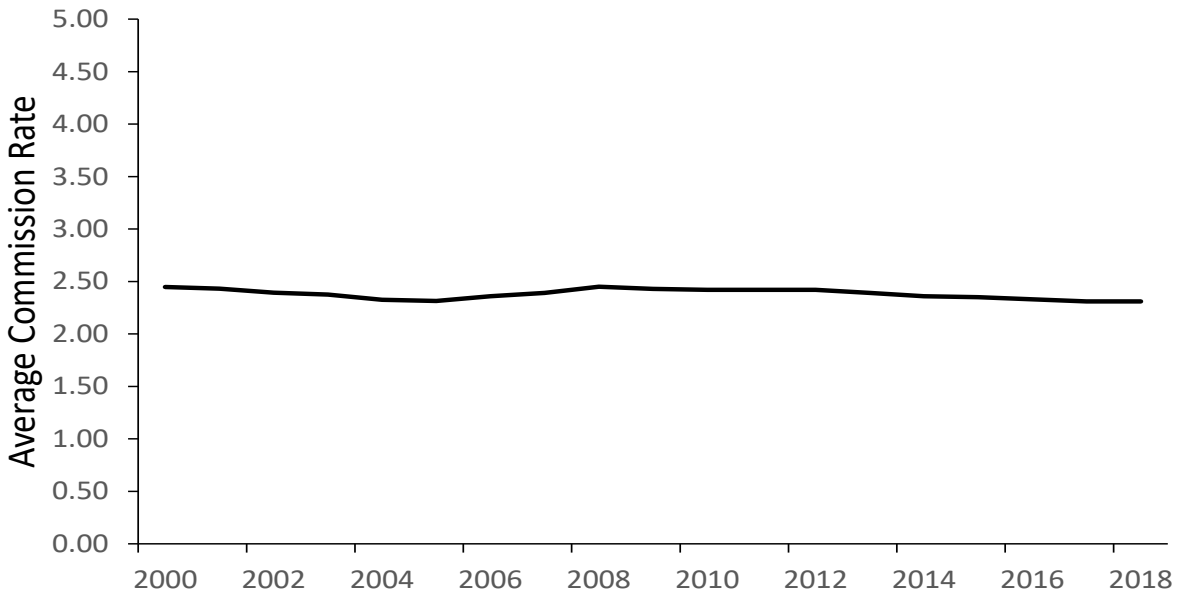
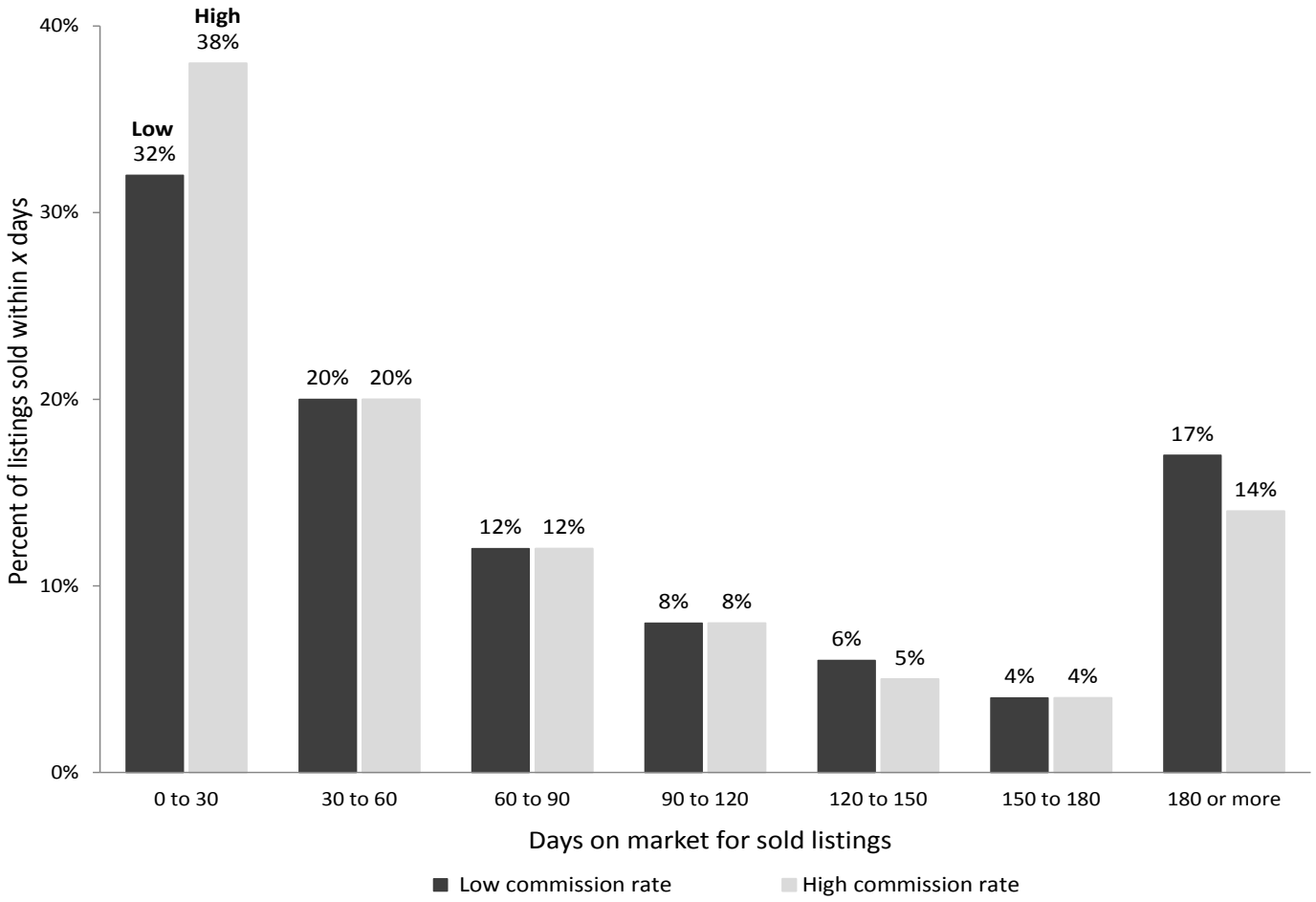
Tables

Figure 1: Commission rates over time



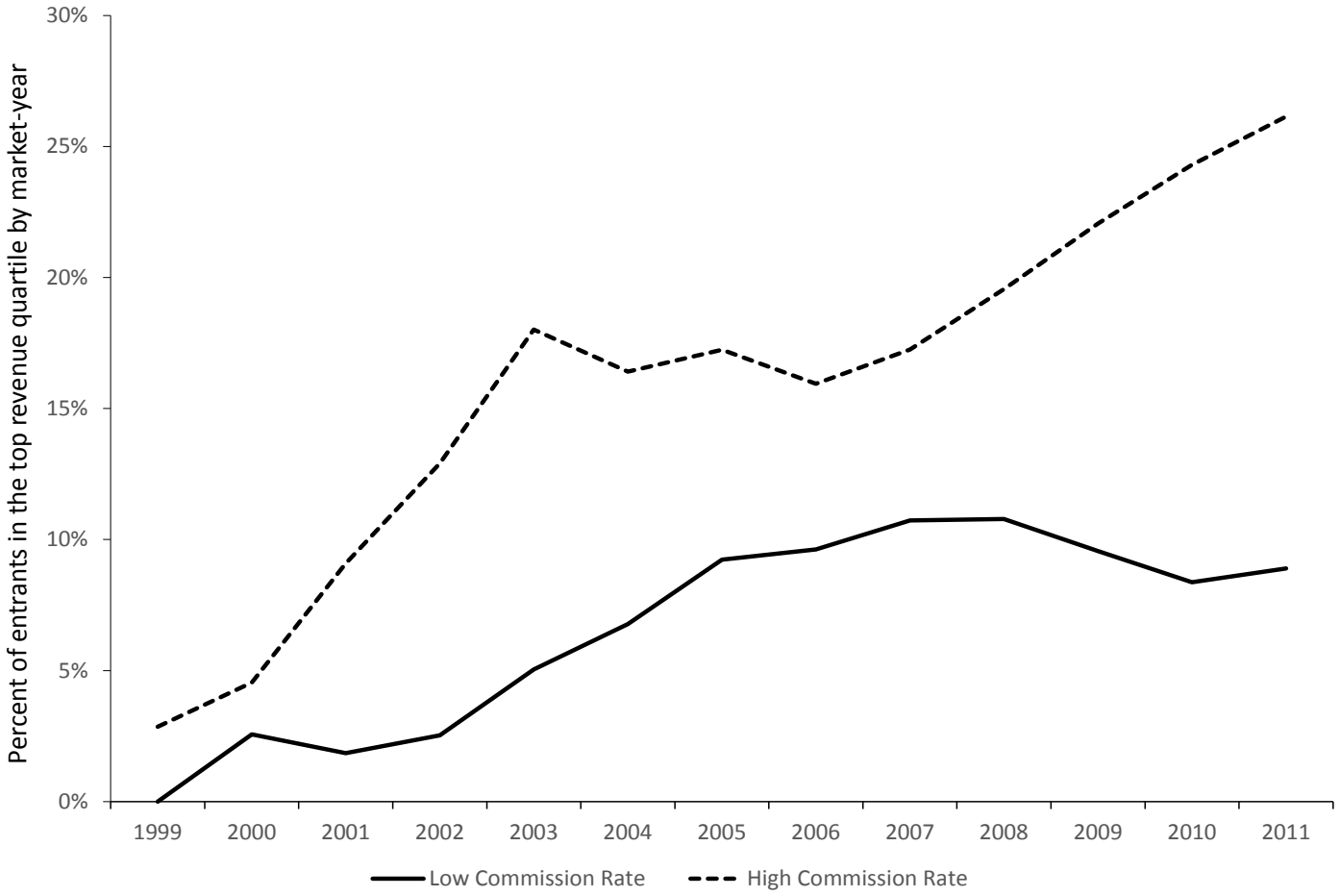
Notes: This figure reports the yearly average buying agent commission for all MLS listings in the city of Boston.

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)
Predicted sale probability	0.02	-0.01		
	(0.02)	(0.03)		
Agent experience (years)			0.001***	0.001**
			(0.0003)	(0.0004)
Agent experience (sales volume)				-0.0004
				(0.001)
CR4				
N	653475	344832	344832	344832
R-squared.	0.25	0.59	0.59	0.59
Property controls	Y	Y	Y	Y
Market controls	Y	Y	Y	Y
Market, Year FE	Y	Y	Y	Y
Property FE	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.), market conditions over time (inventory-to-sale ratio and an aggregate price index), and market, year, and month fixed effects. The key regressor is the predicted sale probability (predicted using a logit model with the same controls). Column 2 adds property fixed effects and restricts the sample to listings that occur more than once. In columns 3 and 4, respectively, we consider how agent experience influences commission rates, where experience is measured in years (column 3) and the log of cumulative past transaction volume (column 4). Standard errors are clustered at the market level (column 1) and at the property level otherwise. See Barwick et al. (2017) for more details about the controls.

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).