

What Problem Do Intermediaries Solve?

Evidence From Real Estate Markets*

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Abstract

We study intermediation in the housing market. Using data from an online platform used by real estate agents to generate leads, we identify exogenous intermediary attention arising from the quasi-randomized ordering of potential listings. Greater intermediary attention leads to an increased probability of listing with an agent and selling quickly, and a higher transaction price. The listing and transaction probabilities of neighboring properties decrease in intermediary attention. These results provide causal evidence supporting search theories of intermediation, contrast sharply with endogenous correlations, and indicate that agents in this market serve mainly to facilitate search rather than to reduce information asymmetries.

KEYWORDS: Search, intermediation, real estate.

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1 Introduction

Intermediation is ubiquitous in the real economy, by some accounts representing an estimated 25% of U.S. economic activity ([Spulber, 1996](#)). There are two leading theories of intermediation: search and information. Search theories argue that intermediaries exist primarily to reduce search frictions that hinder exchanges between potential counterparties in markets for real and financial assets, particularly in decentralized markets for heterogeneous goods. Information theories argue that intermediaries reduce information asymmetries between buyers and sellers and thereby promote trade. Distinguishing these theories empirically and assessing the causal effects of intermediation has proven challenging. This is because intermediation rarely occurs randomly. Trades more likely to be facilitated through an intermediary often feature assets or counterparties that differ along observable or unobservable quality dimensions (as in [Hortaçsu and Syverson \(2004\)](#)), making it difficult to disentangle the effects of intermediary-reduced costs from other aspects of the transaction.

In this paper we provide causal estimates of the effects of intermediation on volume and price in a setting in which we can measure quasi-random variation in intermediary activity. Using data from an online platform that generates leads for U.S. residential real estate agents, we observe a variable that describes the exogenous level of attention each property receives from a broad set of agents operating in the area. Properties that are given more attention are more likely to be listed by an agent and are listed by more distant and wide-ranging agents. We show that increased intermediary attention leads to a greater likelihood of a quick sale, a higher sales price, and fewer listings and sales for immediately proximate properties.

We emphasize three main points in our analysis. First, our causal estimates support the main intuition of search models that feature intermediation such as [Rubinstein and Wolinsky \(1987\)](#), [Duffie, Gârleanu, and Pedersen \(2005\)](#) and [Duffie, Gârleanu, and Pedersen \(2007\)](#), namely that

intermediaries reduce search frictions.¹ We show that an online platform can increase intermediary attention paid to a property by calling it to the attention of a broader set of agents and that the effects of that heightened attention for volume and pricing generally confirm the predictions of search models. Second, our estimates of the impacts of intermediary attention differ in a number of respects from those generated from endogenous correlations between whether a property is listed publicly with an agent and various outcome variables, suggesting that empirical estimates of endogenous search relationships should be treated with significant caution. Third, in contrasting the predictions of search models with those of competing information theories of intermediation (such as [Li \(1998\)](#) or [Glode and Opp \(2016\)](#)), we show that the implications of search theories of intermediation are more strongly supported in the data, specifically with respect to our spillover findings.

Search and matching explanations of housing market outcomes have taken on a recent prominence, with studies emphasizing heterogeneous search across buyers ([Gargano, Giacoletti, and Jarnećić, 2020](#)) and intra-ethnic group matching ([Agarwal, Choi, He, and Sing, 2019](#)). From a financing perspective, search considerations also offer a natural rationale for the positive impact of local branch presence on residential mortgage originations ([Benetton, 2021](#)) and for dispersion in mortgage rates ([Bhutta, Fuster, and Hizmo, 2020](#)). In commercial real estate as well, search models have been advanced to explain inefficient allocation of assets in bankruptcy ([Bernstein, Colonnelli, and Iverson, 2019](#)), price dynamics ([Sagi, 2021](#)), and counterparty matching ([Badarınza, Ramadorai, and Shimizu, 2021](#)). We complement this research by providing causal evidence that the key function of intermediaries in the housing market is to help resolve search frictions.

The online platform that provides our data gathers for-sale-by-owner (FSBO) and for-rent-

¹Reduced-form estimates of intermediaries' causal role in alleviating search frictions have been difficult to obtain. [Gavazza \(2016\)](#) and [Salz \(2022\)](#) use structural models to evaluate the welfare effects of intermediaries in the market for used aircraft and the New York City waste market, respectively. [Hendel, Nevo, and Ortalo-Magné \(2009\)](#) compare the relative performance of a real-estate listing service with homes listed for sale by owner.

by-owner (FRBO) listings from various online sources. FSBO and FRBO listings generally do not appear on platforms primarily reserved for listings acquired by intermediary agents. The collected leads are cleaned, culled for relevant information, and displayed on the online platform. Agents who subscribe to the platform contact the provided leads with the objective of securing the listing.

The platform's data-gathering procedure takes place multiple times throughout the day for each data source, leading to the creation of different upload batches. The display order of the leads within each batch is determined by a lead identification number that is generated by the software in an automated way and executed without reference to lead quality. As a result, the list order of displayed properties on a computer screen is exogenous to property and seller characteristics. We confirm the randomization of lead display order by documenting that there is no meaningful correlation between lead sort rank within a batch and property characteristics such as square feet, number of bedrooms or number of bathrooms.

Our experimental design is based on the argument that affiliated agents who subscribe to the platform devote greater attention to higher-displayed leads than to leads displayed near the bottom. We find evidence in support of this claim: an interquartile increase in lead ranking (i.e., an increase in rank from the third to the first quartile) increases the probability that an agent affiliated with the online platform secures the property listing by 0.6%, which is 3% of the mean. Might it be the case that higher lead rankings are simply correlated with an unobserved variable associated with a higher probability of a listing? Such a relationship would not be consistent with the online platform's quasi-random method of generating lead ordering or with the lack of correlation between the rank order and various observed property characteristics. As an additional test, however, we consider whether higher-ranked properties are also more likely to be listed by agents who do not subscribe to the service, as one would expect to observe if sort order

proxies for an unobserved proclivity to be listed. We find, by contrast, that unaffiliated agents are less likely to list higher-ranked properties. This is inconsistent with the argument that lead order measures a general propensity to be listed. The findings suggest that higher-ranked listings receive more attention only from affiliated agents and that, given the attempts of affiliated agents to acquire the listings, unaffiliated agents are less likely to do so. Further, we show that highly-ranked leads are significantly more likely to be listed with an agent within 3 days of the creation of the lead, which is an indication that it is these leads' appearance on the online platform that allows affiliated agents to secure the listings.

We find that the technology platform appears to reduce search costs for agents themselves. Agents affiliated with the platform acquire listings of properties that are geographically further from their prior listings. Moreover, agents who secure listings through the platform demonstrate larger geographic dispersion in their listings in general. These results indicate that the platform reduces the search costs associated with agents attempting to expand the geographic scope of their services. We also find that affiliated agents are more likely to serve as buyer's agents (as opposed to listing agents) for properties with more prominent leads, showing that lead ordering promotes intermediation through multiple mechanisms.

Search and information theories make similar predictions about the effects of intermediation on price and volume. In search models, heightened attention from intermediaries increases the meeting and matching rates between buyers and sellers, ultimately speeding up transaction times and yielding higher prices (Duffie, Gârleanu, and Pedersen, 2005). In information theories intermediaries reduce information asymmetries, thereby promoting trade and minimizing lemon discounts (Milgrom and Stokey, 1982; Myers and Majluf, 1984; Glode and Opp, 2016).

We test these predictions and examine the impact of intermediation on volume by first analyzing the endogenous correlation between an agent-listed property and quick sale outcomes

(sold within 60 days) or a sale within a year. We find that relative to non-agent-listed properties, properties listed with an agent are less likely to have a quick sale but are significantly more likely to be sold within a year. These endogenous correlations could be interpreted to show that agents require some time to access their networks and market a property but that they are very effective in the medium term. We find, by contrast, that an exogenous increase in intermediary attention increases the probability of a quick sale but has no impact on sale within a year. An interquartile increase in lead ordering increases the probability of a quick sale by 0.2%, which is 3% of the mean. This finding of quicker transactions in the presence of intermediaries comports with the implications of both search and information theories. These causal results indicate that agents' networks and efforts are helpful in negotiating quick transactions but that over the course of a year, properties that owners wish to sell will be sold irrespective of the involvement of an agent. The endogenous relationships in our data, which likely reflect selection in the types of buyers who hire agents, thus offer precisely misleading conclusions.

In a price analysis we find that properties receiving greater intermediary attention transact at higher values. This confirms the shared prediction of both search and information theories. This result stands in contrast to [Hendel, Nevo, and Ortalo-Magné \(2009\)](#) who find no pricing differences in houses sold through an agent based real-estate listing service relative to FSBO.² Given the multiple mechanisms by which intermediary attention affects the presence and type of agents, we cannot draw conclusions about whether the pure price benefits of hiring an agent are equal to the costs; our data also do not contain precise measures of agent fees.

The findings described thus far linking intermediary attention to quick sales and higher prices are consistent with the predictions of search models, but they may also be reconciled with an

²Though our pricing results differ from [Hendel, Nevo, and Ortalo-Magné \(2009\)](#), our quick sale results are similar. [Hendel, Nevo, and Ortalo-Magné \(2009\)](#) find that houses listed on an agent-based platform are more likely to sell quickly relative to homes sold FSBO.

information-based account of the role of agents. In order to distinguish between search and information theories, we consider the spillover impact of intermediary attention on the leads in the online platform to neighboring residences. For these tests we analyze the full set of nearby properties drawn from the Zillow database. We study local listing intensity, which we define as the ratio of other-property listings within a quarter-mile of the focal property to other-property listings within 2 miles.

Search theories predict that increased intermediary attention will divert buyers to the focal property, discourage rival listings and thereby *decrease* the local listing intensity of other neighborhood properties. Information theories highlight the role of intermediaries in producing information about the local market (both for buyers and sellers), which should encourage listings of neighboring properties and therefore *increase* the local listing intensity. Similarly, in rational information herding models (Banerjee, 1992; Bikhchandani, Hirshleifer, and Welch, 1992), the listing of a focal property may induce neighbors to list their properties.

Endogenous correlations show that the listing of a property with an agent is associated with a higher subsequent local listing intensity, suggesting that listings are positively correlated, but this may be driven by unobserved variables such as localized demand shocks. Our causal analysis, however, shows that higher intermediary attention leads to a lower subsequent local listing intensity. The focal property listing appears to capture the attention of prospective local buyers and to discourage other local listings. This is evidence in favor of the search theory description of the housing market.

Search and information theories also offer contrasting predictions for the effect of intermediary attention on neighboring transactions. In a search setting, agent attention on the focal property resulting in a quick sale removes a potential buyer from the pool and reduces the sale probability for neighboring properties. In information models, the availability of price data from

the sale of the focal property should diminish local information asymmetries and promote the sale of neighboring houses.

We find clear evidence that heightened intermediary attention decreases the local transaction intensity. An interquartile increase in listing rank decreases the 365-day local transaction intensity by 0.03%, which is 0.50% of the mean. This finding supports the prediction of search theories and does not conform to the information theory hypothesis. This result is also consistent with [Piazzesi, Schneider, and Stroebel \(2020\)](#), who show that housing search is often segmented to narrowly-defined geographic areas. The decline in neighboring transactions we observe indicates that natural buyers search within a constricted housing segment. Our findings indicate that intermediaries in the U.S. housing market serve mainly to facilitate search matches rather than acting to reduce information asymmetries.³

Given the multi-pronged impact of intermediary attention on the probability of hiring a listing agent, the type of listing agent hired, and the likelihood of buyer's agent involvement, we cannot quantify the causal effect of any single one of these mechanisms on housing outcomes. We therefore undertake a simple calibration exercise to assess, under reasonable conjectures, the relative magnitudes of each of the channels. We find that under plausible assumptions the main driver of our results is that the online platform expands the set of agents who may list a property, thereby allowing owners to select higher-quality and better-matched agents. The increased likelihood of the provision of standard agent services, by contrast, does not appear to explain much of the overall impact of intermediary attention that we find.

Our results do not rule out the existence of asymmetric information in intermediated real estate markets. Indeed, [Garmaise and Moskowitz \(2004\)](#), [Levitt and Syverson \(2008\)](#), and [Kurlat](#)

³While our contribution is to produce causal empirical estimates of intermediation, a large empirical literature evaluates search frictions in real and credit markets. Relevant papers include [Hortaçsu and Syverson \(2004\)](#), [De los Santos, Hortaçsu, and Wildenbeest \(2012\)](#), [Alexandrov and Koulayev \(2018\)](#), [Allen, Clark, and Houde \(2019\)](#) and [Agarwal, Grigsby, Hortaçsu, Matvos, Seru, and Yao \(2020\)](#).

and Stroebe (2015) demonstrate that valuable private information about neighborhood or property characteristics can influence equilibrium outcomes in real estate markets. These papers demonstrate the existence of asymmetric information but do not pursue the question we pose in this paper, namely, whether intermediaries primarily serve to reduce asymmetric information or search frictions. We show that for the large and important market of U.S. residential housing, agents mainly facilitate search rather than reduce information asymmetries. This is consistent with recent work that argues the information advantage of housing agents may not be as large as previously thought (Liu, Nowak, and Smith, 2020).

The relative importance of intermediary search and information functions is likely to differ across markets. The method we develop in this paper of distinguishing these two roles through an analysis of the effect of exogenous intermediary activity on nearby or similar assets can be applied in other settings. Such inquiries could assist in improving our understanding of the pervasiveness and broad influence of intermediaries throughout the economy.

2 Data

We obtain data on residential properties that are listed as for-sale-by-owner (FSBO) and for-rent-by-owner (FRBO) from an online platform that collects leads from various classified advertisement websites and displays them to their customers—local residential real estate agents. These data contain a small number of hedonic features (bedrooms, bathrooms, square footage, two-car garage indicator) as well as very precise geographic information (street address supplemented with latitude and longitude). Additionally, the online platform has supplemented information about these leads with detailed information regarding the eventual listings of these leads with agents as well as with the neighborhood listing activity of the surrounding area. The online

platform provided leads that were collected between 1/3/2016 and 7/31/2018.

We obtain property-level data from the Zillow Transaction and Assessment Dataset (ZTRAX). ZTRAX is, to the best of our knowledge, the largest national real estate database, with information on more than 374 million detailed public records across 2,750 U.S. counties. Data includes transaction prices (where available) and transaction dates. It also includes detailed assessor data including property characteristics, geographic information, and valuations on over 200 million parcels in over 3,100 counties. These data have been used by [Aiello, Bernstein, Kargar, Lewis, and Schwert \(2021\)](#), among others.

Our final dataset includes 654,991 FSBO and FRBO leads from the online platform that contained valid address matches into the ZTRAX county assessor’s data. Table 1 reports descriptive statistics for the merged dataset. Our final sample consists of 41% FRBO leads. The leads have a median of 3 bedrooms, 2 bathrooms, and 1,700 square feet. Thirty-three percent of these leads ultimately hired an agent to list their property, with 20% using an agent affiliated with the online platform and 13% using an agent that is not. The median number of days until the property was listed publicly with an agent was 77. As shown in the bottom portion of Table 1, *Proximate Agent Listings*, the properties in our data are quite similar in size to agent listings close in time and space to our FSBO and FRBO leads (i.e., properties listed by agents within one year and a quarter-mile of the lead). Figure 1 demonstrates the geographic scope of the matched lead sample with a county-level map.

3 Empirical Methodology

We study the effects of increased intermediary attention on a property in order to understand how agents influence the housing market. We explore outcomes such as whether the property

was listed with an agent, the probability and speed of a sale and the transacted price. We also consider spillover effects on neighboring properties.

Agent interest in a property is obviously endogenous; certain types of properties and sellers are likely more drawn to agents, and these properties and sellers almost certainly have important unobserved characteristics. We seek to assess the causal impact of heightened agent interest by making use of quasi-randomized sorting of displayed properties on an online platform used by agents to seek leads.

The online platform offers affiliated agents access to proprietary lists of FSBO and FRBO properties. These leads are collected daily from various sources by automated programs that run in parallel and collect FSBO/FRBO advertisements in multiple batches per source per state per day. The online platform describes the parallel collecting processes as chaotic and completed without reference to the quality of the leads. The properties are assigned lead numbers in the order they enter the online platform’s system. The platform displays listings from a given day in an order determined by the lead number: properties with larger lead numbers appear higher on the page viewed by affiliated agents.⁴ We view the variation in lead ordering arising from this process as quasi-random, and we show in tests that the ordering is unrelated to observable characteristics of the leads. See Figure 2 for an example of the user interface experienced by real estate agents affiliated with the online platform.

We hypothesize that leads displayed higher in the platform are more likely to garner the attention of affiliated agents (Fedyk (2020)) and that the strength of this effect will likely diminish as the lead number declines and listings are placed towards the bottom of the page. For all leads within a state on a given day, we therefore rank the lead numbers (i.e., the highest ranked lead is

⁴Our measure of rank is the order of the lead number within the batch the lead was collected in. Because multiple batches are likely displayed contiguously on a screen to real estate agents, salience thresholds (such as discontinuities around leads displayed per results screen) are not easily measured within batch.

rank = 1) and define

$$\begin{aligned} & \text{Intermediary Attention}_{i,t} \\ &= -\log(\text{rank of lead number of property } i \text{ created on day } t) / \log(3) \end{aligned} \tag{1}$$

The scaling of the log of the rank by $\log(3)$ enables us to describe an interquartile increase in rank (i.e., an increase in rank from the third to the first quartile) as an increase of one unit in intermediary attention, which facilitates the interpretation of our results.

We investigate the impact of increased intermediary attention on transaction outcomes for property i with a lead created on day t by estimating the regression

$$\begin{aligned} & \text{Property outcome}_{i,t} \\ &= \alpha + \beta * \text{Intermediary Attention}_{i,t} + \gamma * \text{controls}_{i,t} + \lambda_{\text{batch}(i,t)} + \delta_{(\text{county}(i), \text{month}(t))} + \epsilon_{i,t}, \end{aligned} \tag{2}$$

where $\lambda_{\text{batch}(i,t)}$ is a fixed effect for the specific batch (with multiple batches per day at the FSBO/FRBO by state by data source level) that includes the lead for this property, $\delta_{(\text{county}(i), \text{month}(t))}$ is a county-month fixed effect and $\epsilon_{i,t}$ is an error term. We cluster standard errors jointly at the level of the county and lead creation week. We also consider spillover effects of intermediary attention by examining outcomes such as future transactions and listings for other properties within a quarter mile of the focal property.

4 Results

4.1 Covariate Balance

We view the variation in lead ordering arising from the batching process as quasi-random. We investigate this description by regressing various property characteristics on intermediary attention and the controls described in equation (2). We show in Table 2 that the number of bedrooms, the number of bathrooms, the log of property square footage and an indicator for a two-car garage are all insignificantly related to intermediary attention. These results offer evidence in support of the argument that our measure of intermediary attention is not driven by underlying property characteristics.

4.2 The Hiring of Listing Agents

Intermediary attention describes the prominence of a listing on the online platform. Do listings placed higher on the screen indeed garner greater interest from agents and lead to an increased probability that an agent is hired by the seller as the listing agent for the property? Only agents affiliated with the technology platform view these listings, so we should expect increased hiring of affiliated agents. We examine this issue by regressing an indicator for whether an affiliated agent is hired as a listing agent by the property owner subsequent to the lead creation on increased intermediary attention and the controls outlined in equation (2). We find a significant positive impact of increased intermediary attention on affiliated listing agent hiring (coefficient=0.00597 and t -stat=4.23), as displayed in the first column of Table 3. An interquartile increase in listing rank (i.e., a move from the third quartile to the first quartile of listings, which is equivalent to a one-unit increase in intermediary attention) thus results in a 0.60% higher probability of hiring an affiliated listing agent, which is 3.0% of the mean.

From the perspective of search theory, an increase in intermediary attention increases the probability of an encounter between an agent and the property owner. An increase in the probability of such an encounter is predicted to increase the probability of agent retention (Duffie, Gârleanu, and Pedersen (2005) and Gavazza (2016)), and that is precisely what we find.

A more prominent listing on the online platform should not increase the probability that a listing is secured by a unaffiliated agent. In fact, a property owner who might have eventually hired an unaffiliated agent is less likely to do so if he is approached by many affiliated agents who are all seeking his listing. Consistent with that intuition, we show in the second column of Table 3 that increased intermediary attention has a negative (coefficient=-0.002 and t -stat=-1.95) effect on the hiring of an unaffiliated listing agent.

This result may also be interpreted as an additional placebo test for the exogenous nature of intermediation attention. If intermediation attention is acting as a proxy for some unobservable property characteristic associated with a higher listing probability (despite its lack of correlation with observed characteristics, as shown in Table 2), then it should be associated with a higher probability of hiring unaffiliated listing agents as well as affiliated listing agents. We find, however, that it is only associated with a greater likelihood of affiliated listing agent retention- there is, in fact, a negative effect on the retention of unaffiliated agents, which indicates that intermediary attention is not correlated with an unobservable variable associated with generally higher agent hiring.

Overall, due to the strong impact on affiliated agent hiring, we find that the probability that any listing agent is retained increases in intermediary attention (coefficient=0.0038 and t -stat=2.34), as described in the third column of Table 3. Further supporting the argument that it is the online platform that is the mechanism driving agent hiring, we show that the probability of a listing agent being hired within 5 days of the lead's being posted is increasing in intermediary

attention (coefficient=.0023 and t -stat=3.49), as outlined in the fourth column of Table 3. Even within three days of the lead post date, we find that properties with higher intermediary attention are more likely to retain a listing agent (coefficient=0.0021 and t -stat=3.95). This result is shown in the fifth column of Table 3. An interquartile increase in listing rank results in a 0.21% increase in the probability of an agent’s being retained within 3 days of the lead being posted, which is 14.4% of the mean. This marked effect for higher-ranked leads specifically within 3 days of the posting is evidence that lead ordering has a meaningful impact in generating listings for affiliated agents.

4.3 Attracting New Types of Listing Agents

The results in Table 3 show that the prominent display of a lead on the online platform increases the probability that an affiliated listing agent secures the focal property listing. In order to better understand how this mechanism operates, we examine how the characteristics of the retained agent change when a lead is given a higher placing. Specifically, for each listing agent we calculate the geographical centroid of her prior listings. We regress the log of the distance between this centroid and the focal property on intermediary attention and the standard controls. We find that higher intermediary attention leads to the retention of agents whose previous listings are more distant from the property (coefficient=0.0391 and t -stat=2.96), as displayed in the first column of Table 4. An interquartile increase in the rank of a listing results in the hiring of an agent whose previous listings were approximately 3.9% more distant from the property. In other words, the online platform allows non-local agents to access leads that were likely previously inaccessible to her. The platform broadens the listing market to include more distant agents.

We define an agent’s listing dispersion to be the standard deviation of the distance of her previous listings from the agent’s listing centroid; this is a measure of an agent’s geographic scope.

We regress the log of the retained agent's dispersion on intermediary attention and the controls. An increase in intermediary attention brings about the hiring of more geographically dispersed listing agents (coefficient=0.0415 and t -stat=3.56). The platform therefore generates listings for agents who are both more distant and who range over wider areas. These are agents who may have less personal visibility into potential local leads, and the platform enhances the search capability of these agents. We further find marginal evidence that increased intermediary attention engenders the hiring of listing agents who have had more past listings (coefficient=0.0247 and t -stat=1.81).

4.4 Buyers' Agents

The agents we analyze in Sections 4.2 and 4.3 are listing agents hired by sellers to market their properties. A higher lead ordering on the online platform, however, may also have an impact on buyers' agents who assist prospective purchasers in finding a home. In particular, affiliated agents may take note of properties with prominent lead orderings as potential purchase opportunities for their buyers and may be more likely to direct their clients to these properties.

Information on buyers' agents is provided in our data, but it is somewhat more sparse than for listing agents. We can identify the listing agent associated with 33% of leads, but the buyer's agent is reported for only 16.4% of leads. Partly this reflects the fact that every listing involves a listing agent while only consummated transactions involve a buyer's agent, but it may also be a result of incomplete reporting. If buyer's agent reporting is correlated in some way with lead ordering that may generate misleading conclusions. We explore this concern by regressing an indicator for any reported buyer's agent on intermediary attention and the standard controls and we find, as reported in the first column of Table 5, an insignificant effect (coefficient=-0.00017 and t -statistic=-0.14). There is no apparent bias in the reporting of buyer's agent identity that is

linked to lead ordering.

We assess whether affiliated agents are more likely to serve as buyers' agents on properties with high lead orderings by regressing an indicator for an affiliated buyer's agent on intermediary attention and the controls. We find that an increase in intermediary attention increases the probability of an affiliated buyer's agent by 0.13% (t -statistic=1.73), which is 2.5% of the mean. This result is detailed in the second column of Table 5. When conditioning on the reporting of any buyer's agent, we find that intermediary attention increases the probability that the buyer's agent is affiliated (coefficient=0.011 and t -statistic=2.22), as displayed in the third column of Table 5. Higher-ranked leads are more likely to subsequently involve affiliated buyers' agents.

4.5 Causal Effects of Intermediary Attention

Tables 3, 4 and 5 establish that an increase intermediary attention has three distinct causal effects on a property: it heightens the probability of affiliated listing agent retention, it attracts the interest of more distant and geographically dispersed listing agents, and it improves the likelihood that an affiliated buyer's agent will be involved in the sale transaction. Intermediary attention thus both increases the probability of intermediation and changes the types of agents who participate in the listing.

In the analysis that follows, we relate intermediary attention to subsequent outcomes for focal properties. Given the multi-pronged effects of intermediary attention, we cannot isolate the impact of any single channel.⁵ Our main focus is on assessing the causal effects of agent interest on focal properties, and our empirical estimates reflect all three mechanisms jointly.

We approach our inquiry from the perspective of two different frameworks: search theory

⁵A 2SLS regression approach, for example, would improperly attribute the full causal impact of intermediary attention to the one selected endogenous explanatory variable while ignoring the potential influence of the other mechanisms.

and information theory. Intermediaries play an important role in each of these theories. In search theory, intermediaries reduce the frictions impeding trade and facilitate the matching of sellers and buyers. In information theory, intermediaries act to mitigate information asymmetries. We discuss below in the context of our empirical analyses the predictions of these models for the impact of intermediation on transaction volume, sales prices and spillovers to nearby properties. While some of the predictions overlap, the theories do have contrasting implications that we use to assess which framework offers a more compelling description of the role played by agents in the U.S. housing market.

4.6 Does Intermediary Attention Generate Quick Sales?

We begin by considering whether heightened agent interest leads to quicker sales. One of the key features of intermediaries that is emphasized in the search theory literature is their ability to facilitate quicker transactions. In information models intermediaries reduce the informational disadvantage suffered by potential buyers; this can encourage them to make purchases (Milgrom and Stokey, 1982). We make use of the exogenous variation in intermediary attention to examine whether greater agent interest does, in fact, generate quick property transactions, as suggested by both theories.

We define a property sale within 60 days of the lead creation date to be a quick sale. As a starting point we regress an indicator for a quick sale on a dummy for whether a listing agent was hired and the standard controls. The agent hiring dummy is obviously endogenous: various unobservable seller and property characteristics are almost certainly correlated with the agent retention decision. Nonetheless, partial correlations in the data may be informative. In addition to the standard controls we include the ratio of historical transactions to listings within one-quarter of a mile in the previous 90 days (winsorized at the 1%- and 99%-levels) as a measure of how

active the market is. We find that property owners who hire a listing agent are substantially less likely to quickly sell their properties (coefficient=-0.0335 and t -stat=-10.19), as displayed in the first column of Table 6. By contrast, however, property owners who hire an agent are significantly more likely to sell their property within a year (coefficient=0.119 and t -stat=20.68), as shown in the second column of Table 6.

These endogenous patterns in the data suggest a preliminary reasonable narrative for the effectiveness of agents in facilitating sales: listing agents are initially slow to close transactions as it takes time for them to access their networks and meet potential new buyers, but in the medium-term hiring an agent meaningfully improves the probability of a sale. We show below that this preliminary interpretation of the endogenous correlations in the data is actually incorrect and misleading.

We contrast the endogenous findings with an analysis based on exogenous changes in intermediary attention. We regress an indicator for a quick sale on intermediary attention and the previous controls, and we find, as described in the third column of Table 6, that increased intermediary attention increases the probability of a quick sale (coefficient=0.00198 and t -stat=2.15). An interquartile increase in listing rank increases the probability of a quick sale by 0.20%, which is 3.0% of the mean. By contrast, we show in the fourth column of Table 6 that an increase in intermediary attention has an insignificant effect (coefficient=0.000385 and t -stat=0.24) on the probability of a sale within one year.

Our exogenous measure of intermediary attention thus yields results that contrast notably with those from the endogenous correlations. An increase in intermediary attention generates quick sales but has no differential impact on sales in the medium term. Presumably potential local buyers who were already in the market can be more quickly directed to the focal property after an increase in agent attention. We do not find, however, that agent attention brings a broader

set of buyers to the property over the course of a year. Sellers who wish to sell within a year can apparently do so even without heightened intermediary interest. This result is similar in spirit to [Gavazza \(2016\)](#) who shows that in the market for used business aircraft, intermediaries facilitate transactions (and thus earn transaction fees) that may have occurred absent intermediation.

The endogenous findings likely arise from significant selection in which owners choose to hire a listing agent. The results are consistent with the argument that serious sellers often first try to sell their property on their own and only turn to agents after some time if they have been unsuccessful. The hiring of an agent is therefore negatively correlated with a quick sale, because these sellers only hire agents when they cannot execute a quick sale without an intermediary. Agent retention, however, is positively correlated with a sale within a year because serious sellers who cannot sell quickly seek out agents in the medium-term and sell their properties. While these patterns are interesting, they do not provide evidence on the causal effects of an increase in agent interest in a property. The misleading preliminary endogenous narrative supplied above incorrectly interprets the data. Our measure of intermediary attention shows that the direct impact of heightened agent interest is to increase quick sales, but it has no effect on sales within a year.

These effects of intermediation are consistent with the shared predictions of search and information theories. A search theory view of these results is that agents hasten the meeting of interested buyers with sellers, resulting in quicker sales. Over a long period of time, however, buyers may encounter sellers on their own, even without the assistance of an agent.

From an information theory perspective, agents supply data to market participants about the local neighborhood and perhaps about the focal property itself. These data reassure buyers and allow them to make quick offers without forcing them to gather the necessary information themselves. In the absence of an agent, though, buyers may undertake the time-consuming effort

to acquire information, and with this information in hand they can initiate purchases.

In the fifth column of Table 6 we display the result from regressing an indicator for ever selling the property on intermediary attention and find an insignificant result (coefficient=0.00234 and t -stat=1.47); this is consistent with the null effect on selling within one year.

We find some evidence that an increase in intermediary attention leads to a higher probability of a sale after two years (coefficient=0.00166 and t -stat=1.94), as described in the sixth column of Table 6. A listing agent retained shortly after the lead creation is perhaps unlikely to keep the listing for two years, so this result may reflect the results in Table 5 that we described above: affiliated buyers' agents may keep the property in mind when attempting to find houses for future clients.

4.7 Intermediary Attention and Prices

The findings in Table 6 show that higher agent interest generates quick sales. In this section we analyze the impact of intermediary attention on the transaction price. In theories of search, intermediaries promote better matches between sellers and buyers which results in higher transaction prices. For example, in [Duffie, Gârleanu, and Pedersen \(2005\)](#) intermediaries can facilitate the sale of an asset to a buyer with a higher valuation. By reducing search frictions in this way, intermediaries help sellers garner better pricing. A similar intuition emerges in the model of [Vayanos and Weill \(2008\)](#), who show that assets with more buyers and short-sellers sell at a premium due to diminished search frictions. In information models, intermediaries can certify asset qualities and reduce information discounts, which increases prices. Thus both models predict that intermediation should lead to higher prices.

For every transacted property in the Zillow database, we regress the log of the sales price on fixed effects at the level of zip-year-month-number of beds-square foot buckets, where the square

foot buckets have a size of 100 square feet. This provides a price residual for a property relative to a set of quite similar properties. We assign to each lead from the platform database that was eventually sold the winsorized price residual (at the 1% and 99% levels) from the Zillow model.

We provide a descriptive sense of the data by regressing this price residual on an indicator for whether the property was listed with an agent; we include the standard controls and a control for the average historical price residual for all properties sold within a quarter mile in the 90 days before the lead creation date, where this average residual is winsorized at the 1% and 99% levels. We find that properties listed with an agent have price residuals that are 2.64% higher (t -statistic=6.38), as shown in the first column of Table 7. This endogenous correlation could indicate that agents reap higher prices for their clients or it may reflect some unobserved difference between property owners who do or who do not retain agents.

We analyze the causal impact of heightened agent interest on pricing by regressing the focal property price residual on intermediary attention, the average historical price residual and the standard controls. We find that increased intermediary attention results in a higher price residual (coefficient=0.00645 and t -stat=1.88, as displayed in the second column of Table 7. An interquartile increase in the rank of a listing generates a 0.65% higher price. When agents are more interested in a property, it sells for a higher price. This result is consistent with the prediction of both search and information theories.

4.8 Listing Spillovers

Consider a focal property that receives increased intermediary attention. We have shown that such properties are more likely to be listed and sold quickly. How should neighboring property owners respond in making decisions about whether to list their own properties?

Search theories predict that increased intermediary attention on a focal property will reduce

the frequency of neighboring property listings: the focal property captures the attention of potential buyers and therefore discourages rival listings. In essence, properties compete for the interest of prospective local buyers, and greater intermediary attention on the focal property reduces the notice that will be paid to neighboring properties. This is particularly true if, as we show in Table 4, the increase in intermediary attention attracts active listing agents who range over a broad geographical scope.

From an information perspective, by contrast, greater intermediary attention on the focal property resulting in a higher probability of a focal property listing has distinct information effects on buyers and sellers, both of which should lead to more neighborhood listings. From the standpoint of buyers, agents reduce information asymmetries about the neighborhood, and the listing itself provides useful price information to potential purchasers of nearby properties. From the perspective of sellers, they receive information about the state of the market from the listing, and they may learn more about the listing agent herself. In a rational information herding setting (Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992)), a choice by the focal property owner to list may induce neighbors to also list, as the neighbors interpret the focal property listing as a signal about increasing demand for the area.

We evaluate the empirical evidence on the competing hypotheses of search and information theories. Our tests to this point have focused on the impact of intermediary attention on the leads in the online platform. We now shift attention to the full set of properties in the Zillow database. We make use of variation in intermediation attention to the online platform leads to study potential search and information spillovers to the broad set of properties in the wide-ranging Zillow data. It is important in these tests to control for shifting neighborhood conditions, so we use as our measure of local listing intensity the ratio of other listings within a quarter mile of the focal property to other listings within 2 miles of the focal property. This variable, which

excludes the focal property listing, describes the frequency of listings very close to the property while controlling for neighborhood effects.

We begin by considering endogenous patterns of correlations between a listing of the focal property and the local listing intensity of neighboring properties. In this analysis we include controls for the historical listing intensity and for the historical transaction intensity, where the latter is defined as the ratio of neighboring property sales within a quarter of a mile to neighboring property sales within two miles. Specifically, we regress the local listing intensity on an indicator for a focal property agent listing, fixed effects for historical listing and transaction intensities in the previous 90 days (rounded to the nearest hundredth) and the previous controls. We show in the first column of Panel A of Table 8 that when the focal property is listed with an agent, this is followed by an increase in the local listing intensity (coefficient=0.0011 and t -stat=3.69) over days 0 to 30 after the lead creation date. A similar pattern is seen across time horizons out to 1 year. The results displayed in Panel A of Table 8 provide convincing evidence that listings tend to increase in concert within neighborhoods, which appears to support the prediction of information theory. The endogenous nature of listing choices, however, makes it difficult to know if the listing of the focal property actually drives neighboring listings.

We evaluate whether a given listing has a causal impact on other local listings by regressing the subsequent local listing intensity on intermediary attention and the controls. We find, as shown in the first column of Panel B of Table 8, that an increase in intermediary attention reduces (coefficient=-0.0006 and t -stat=-3.03) local listings relative to those in the broader neighborhood over days 0 to 60. An interquartile increase in listing rank decreases the local listing intensity by 0.06%, which is 1.1% of the mean. This negative effect of intermediary attention on local listing intensity is concentrated within the first 90 days following lead creation.

These clear negative impacts stand in direct contrast to the endogenous positive correlations

documented in Panel A. Taken together, these findings indicate that unobserved local shocks lead to many listings occurring at the same time in a neighborhood, but the causal impact of greater intermediary attention on a given focal property is to reduce neighboring listings. These results offer evidence in favor of the prediction of search theory and are not consistent with the pattern suggested by information theory.

4.9 Transaction Spillovers

Search and information theories also yield divergent predictions for the effects of heightened intermediary attention on subsequent transaction volume in properties that neighbor the focal property. From a search theory perspective, a prominent listing on the online platform leading to a quick sale of the focal property serves to remove a potential local buyer of area properties from the pool. In effect, greater agent interest in the focal property captures a local buyer and thereby reduces sale probabilities of neighboring properties.

If, by contrast, agents mainly serve to reduce information asymmetries by creating and disseminating knowledge about an area, then greater agent interest in the focal property should minimize information issues for neighboring properties as well. The price at which a quick sale transacts will be useful data for potential buyers. Information theories therefore predict that heightened intermediary attention in the focal property should increase neighboring transactions.

We consider these different hypotheses of search and information theories by calculating for each focal property the local transaction intensity which is defined as the ratio of other properties sold within a quarter-mile to other properties sold within two miles. This measure excludes the focal property, and we calculate it over various horizons following the lead creation date. In these tests, as for the neighbor listing analysis above, we consider the spillover impact of intermediary

attention on the full set of Zillow database properties.

We begin by considering the endogenous correlation between the local transaction intensity and a quick sale (i.e., a dummy for whether a focal property was sold within 60 days of the lead creation date). We regress the local transaction intensity on a quick sale indicator, fixed effects for historical transactions and listing intensities in the previous 90 days (rounded to the nearest hundredth) and the standard controls. As shown in Panel A of Table 9, the coefficient on quick sale is positive and significant over all horizons ranging from 0 to 30 days to 0 to 365 days. This indicates that transactions are geographically clustered; a quick sale of the focal property is associated with sales of other nearby properties. This may be driven by information effects or by other factors such as shifts in highly localized housing demand or in area amenities.

A quick sale of a property may depend on various unobserved variables, so these positive coefficients do not offer a straightforward interpretation. We seek to understand the causal effect of heightened agent interest by regressing local transaction intensity on our quasi-random measure of intermediary attention and the previously described controls. As we show in the first two columns of Panel B of Table 9, intermediary attention has an insignificant effect on neighboring transactions in the 30 and 60 days after the lead creation. This is perhaps unsurprising as a focal property quick sale will likely require some lead time to have an impact on neighboring properties. Moreover, intermediary attention first decreases local listing intensity at a 60-day horizon (as displayed in Table 8), and one would expect to observe an effect on listings before transactions.

At longer horizons we find a negative and significant effect of intermediary attention on neighboring property sales: there is a meaningful negative impact at horizons of 180, 270 and 365 days. In the eighth column of Panel B of Table 9, we show that at a 365-day horizon an interquartile increase in listing rank decreases the local transaction intensity by 0.00028 (t -stat=-

2.78), which is 0.50% of the mean. The pattern of negative coefficients on intermediary attention that we observe is consistent with the prediction of search theory models: more pronounced agent interest in a property has a negative effect on subsequent neighboring sales, as potential buyers are diverted from other area properties to the focal property. Greater intermediary interest in the focal property does not appear to reduce information asymmetries which would have created an energetic market for other local houses, as suggested by information theories. Intermediaries instead mainly serve to facilitate transactions for the focal property and to draw buyer attention to it.

Our negative transaction spillover results are consistent with theories of segmented search. We establish that a certain subset of potential buyers is interested in purchasing properties within a given narrow geographical area. If buyers did not segment themselves in this way, then we would not observe negative spillovers to nearby properties; the buyers redirected to the focal property would arrive from all over the city and this would not have a particularly negative effect on transactions in closely adjacent properties. A negative spillover to local properties is therefore evidence in favor of search theories generally and supports the importance of segmented search in particular ([Piazzesi, Schneider, and Stroebel \(2020\)](#)). We document negative spillovers on transaction intensities, which complements work finding that owner characteristics can lead to negative price spillover effects ([Giacoletti and Parsons, 2021](#)).

4.10 Heterogeneity of Effects

The previous analysis establishes that an exogenous increase in intermediary attention leads to an increased probability of retaining an affiliated listing agent, the entry of more distant listing agents into the market, a greater likelihood of the involvement of an affiliated buyer's agent, quicker sales, higher sales prices and fewer neighboring listings and transactions. In this section,

in order to further elucidate the underlying mechanism, we consider whether more prominent lead placement in the online platform has a heterogeneous impact on properties with varying characteristics.

Our main heterogeneity hypothesis is that greater intermediary attention should matter more for properties that have, *ex ante*, a relatively low probability of being serviced by an agent. For properties that were likely to be listed with an agent in any event, a prominent lead placement should matter less. The counter hypothesis is that increased agent interest will only matter for properties with a high initial propensity to be listed. Perhaps owners who are resistant to listing are unlikely to be swayed by the calls of multiple prospective listing agents.

As a first approach, we consider the fraction of historical transactions within a quarter-mile of the focal property over the past 90 days that were listed with an agent. Under the main heterogeneity hypothesis, increased intermediary attention should be less effective in areas in which most transactions are regularly listed with an agent. We regress an indicator for whether the owner retained an affiliated agent on intermediary attention, the fraction of historical transacted properties listed with an agent, the interaction between these two variables and the standard controls. We find, as displayed in the first column of Table 10, that the interaction is negative (coefficient=-0.008 and t -stat=-3.61): increased intermediary attention does indeed have less of an impact in neighborhoods in which agents are already very active. This is evidence in support of the main heterogeneity hypothesis.

Agents are more likely to be retained to market large properties. In an unreported regression of an indicator for hiring an agent on the log of property square feet, lead creation month-county fixed effects and batch fixed effects, we find that the coefficient on log of square feet is highly positive and significant (coefficient=0.10 and t -stat=15.91). An analogous regression replacing log of square feet with number of bedrooms yields a positive and significant coefficient on number of

bedrooms (coefficient=0.03, t -stat=13.87). These results suggest that owners of larger properties typically hire agents so that an increase in intermediary attention is less likely to affect the agent retention decision. In the second and third columns of Table 10, we describe results confirming this intuition. The interaction between intermediary attention and log square feet is negative (coefficient=-0.012 and t -stat=-5.00), as is the interaction between intermediary attention and the number of bedrooms (coefficient=-0.0034 and t -stat=-3.67).

The results described in Table 10 offer uniform support to the main heterogeneity hypothesis that intermediary attention is most important for properties that are naturally less likely to be listed by agents. Increased agent interest in these properties can encourage owners who had perhaps not been thinking of pursuing a formal listing to retain an intermediary.

4.11 Robustness and Magnitude Calibration

4.11.1 Robustness

In Table A.1 in the Appendix, we show that our main results are largely driven by the differential effects of top-quartile and non-top-quartile leads. Agent attention appears to be mainly focused on properties that are ranked in the top quartile. Table A.2 in the Appendix displays the results for the second through fourth quartiles. The effect is broadly monotonic across the quartiles, and the strongest effects are clearly found for top quartile properties.

In Table A.3 we show results interacting intermediary attention with indicators for vacant land and one-bedroom houses. We do not find that the interactions are significant: the effects of intermediary attention do not appear to vary significantly with the property type.

4.11.2 Magnitude Calibration

As described in Section 4.5, the multi-faceted impact of intermediary attention does not allow us to conduct a 2SLS analysis. Specifically, the results in Tables 3, 4 and 5 describe three distinct mechanisms by which intermediary attention affects properties: it heightens the probability of listing agent retention, it attracts the interest of more distant and geographically dispersed listing agents, and it improves the likelihood that an affiliated buyer's agent will be involved in the sale transaction. We therefore cannot isolate the causal effect of any given channel. Using a basic model relating property outcomes to the three mechanisms and making assumptions about parameter values lying in reasonable ranges, however, we can use a calibration to provide a general assessment of the relative importance of the magnitudes.

In the Appendix we provide details on the simple model we use. It reflects the effects of hiring a listing agent, the maximal distance from a property for which an agent will consider seeking the listing and whether a buyer's agent is interested in bringing her client to the property. This basic model ignores potential cross-effects of the three mechanisms, and it also rules out other mechanisms such as the effects of increasing the interest of more experienced agents. This approach can therefore only provide general guidance on the relative importance of the three mechanisms.

We use the estimated results from Tables 3, 4 and 5 to calculate the effect of an increase in intermediary attention on each of these mechanisms. For each of the main outcome variables in the paper, we then decompose the estimated effect of intermediary attention into the impacts of the three mechanisms. This requires some subjective assumptions. For example, the sample frequency of quick sales is 7%, and we assume that the maximum plausible impact of hiring a listing agent would be to double this number. We similarly assume that the maximal effect of attracting a listing agent is to increase the probability of a quick sale by 7%. Under these

generous assumptions, we then calibrate the impact on quick sales of increasing the radius of potential agents so that we match the total impact of intermediary attention estimated in the third column of Table 6. We then calculate the fraction of the overall impact of intermediary attention that arises due to each of the three mechanisms. As outlined in the third column of Panel A of Table A.4, we find that even assuming quite large effects on quick sales of hiring a listing agent and attracting a buyer’s agent, the largest impact (47.5% of the total) comes from increasing the radius of prospective agents. Under this calibration, a 10% increase in the radius of prospective agents (i.e., a 21% increase in the catchment area of agents) would result in approximately a 0.23 percentage point increase in the probability of a quick sale. Given these assumptions, 13.3% of the total effect of intermediary attention arises from hiring a listing agent and 39.2% of the overall impact derives from attracting a buyer’s agent.

We show in Table A.4 that under reasonable assumptions the largest effect for all our main outcome variables appears to arise from the mechanism by which increased intermediary attention leads to a broader pool of potential listing agents. This has two implications. First, it suggests that agent heterogeneity is meaningful. Gaining access to higher-quality (or better-matched) listing agents can have a substantial impact on transaction speeds and prices. Second, the relatively small fraction of the overall effect that we attribute to simply hiring a listing agent indicates that the provision of standard agent services (e.g., managing paperwork or granting access to a group of agents who only cooperate with other agents), appears not to drive our results. That is not to say that the calibration results show that hiring an agent has a small influence on property outcomes; indeed, in some of the specifications we presume that its impact is quite large. It does demonstrate, however, that the intermediary attention we study affects price and volume largely through increasing the set of interested agents rather than by increasing the probability that any listing agent is retained.

5 Conclusion

We study the role of intermediation in the U.S. residential housing market by exploiting exogenous variation in the attention paid by agents to listings on an online platform. We show that properties quasi-randomly displayed higher on the screen receive greater intermediary attention: they are more likely to be listed by agents affiliated with the platform even though they do not differ in their observable qualities. Higher-ranked properties are listed by more distant agents who range over broader geographical areas. We find that increased intermediary attention leads to a higher probability of a quick sale of a property within 60 days and a higher transaction price. Heightened intermediary attention reduces the listing and transaction intensities of neighboring properties. These latter results provide causal evidence in favor of search theories of intermediation and indicate that agents in this market serve mainly to facilitate search rather than to reduce information asymmetries.

Online platforms are often thought to promote disintermediation, but our findings show that intermediary-oriented platforms can act as a powerful mechanism to encourage greater use of agents. The focused market attention and personal networks of intermediaries are thus likely to remain critical for facilitating transactions even in environments in which technology acts to reduce overall search frictions.

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Table 1
Summary Statistics

This table presents summary statistics for our sample of leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. The bottom portion, relating to Proximate Agent Listings, reports property characteristic summary data for the properties listed by agents that occurred within 1-year and a quarter-mile of a lead on the online platform, that themselves did not appear as leads on the online platform.

Variable	Obs.	Mean	Std. Dev.	Q5	Q25	Q50	Q75	Q95
FRBO	654,991	0.41	0.49					
# Bedrooms	621,204	3.04	0.82	2	3	3	4	4
# Bathrooms	617,742	2.34	0.73	1	2	2	3	3
Sq Ft	605,822	1,861	867	800	1,200	1,700	2,300	3,600
Two-Car Garage	157,997	0.81	0.39					
Lead Create Date	654,991	5/9/2017	279 Days	3/4/2016	8/24/2016	5/16/2017	1/18/2018	6/28/2018
Rank of Lead Number	654,991	18.02	23.49	2	5	11	22	61
Batch Size	654,991	35.53	37.02	6	14	24	43	106
Intermediary Attention	654,991	-2.11	1.00	-3.74	-2.81	-2.18	-1.46	-0.63
Hired Agent	654,991	0.33	0.47					
Hired Affiliated Agent	654,991	0.20	0.40					
Hired Unaffiliated Agent	654,991	0.13	0.33					
Days Until Agent Hiring	221,178	251.22	333.02	4	23	77	387	1,008
Ever Sold	654,991	0.55	0.50					
Sold Within One Year	654,991	0.41	0.49					
Quick Sale	654,991	0.07	0.26					
Sales Price (\$ '000s)	252,895	295.47	261.43	60	155	239	360	695
Sales Price Residual	82,407	0.09	0.42	-0.44	-0.07	0.06	0.25	0.75
<i>Proximate Agent Listings</i>								
# Bedrooms	2,014,886	3.05	0.98	2	2	3	4	5
# Bathrooms	1,982,319	2.17	0.78	1	2	2	2.5	3.5
Sq Ft	2,429,241	1,815.30	892.13	838	1,202	1,603	2,190	3,551

Table 2
No Relationship Between Lead Order and Observables

This table presents estimates from regressions where the dependent variables are various observable characteristics associated with the focal lead. Columns (1)-(4) utilize the number of bedrooms, the number of bathrooms, the log of the square footage of the structure, and an indicator for whether the property includes a two-car garage, respectively. The explanatory variable of interest utilized throughout is a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. The samples are further restricted to observations with valid, non-missing, values for the covariate utilized as the dependent variable in the particular regression reported. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Number Of Bedrooms	Number Of Bathrooms	Log Square Feet	Two-Car Garage
	(1)	(2)	(3)	(4)
Intermediary Attention	-0.000385 (-0.13)	-0.00268 (-0.97)	0.00285 (1.55)	0.00193 (0.64)
Lead Creation Month by County FE	Yes	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes	Yes
Number of observations	615,482	611,773	596,093	106,403
Adj. R ²	0.129	0.200	0.157	0.055
Dependent Variable Average	3.04	2.13	5.13	0.81

Table 3
Lead Order Drives Hiring of Affiliated Agents

This table presents estimates from regressions where the dependent variables are various outcome measures associated with whether agents were hired to list the focal lead. Columns (1)-(3) utilize an indicator for whether the lead was ever listed with an agent that is affiliated with the online platform, an indicator for whether the lead was ever listed with an agent that is not affiliated with the online platform, and an indicator for whether the lead was ever listed with an agent irrespective of their association with the online platform, respectively. Columns (4) and (5) utilize indicators constructed similarly to that used in column (3), but focusing on whether the agent was hired to list the lead within 5 days and 3 days, respectively, of the lead appearing on the online platform. The explanatory variable of interest utilized throughout is a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Hired Affiliated Agent (1)	Hired Unaffiliated Agent (2)	Hired Agent (3)	Hired Agent, Within 5 Days (4)	Hired Agent, Within 3 Days (5)
Intermediary Attention	0.00597*** (4.23)	-0.00221* (-1.95)	0.00376** (2.34)	0.00232*** (3.49)	0.00213*** (3.95)
Lead Creation Month by County FE	Yes	Yes	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes	Yes	Yes
Number of observations	654,991	654,991	654,991	654,991	654,991
Adj. R ²	0.172	0.143	0.213	0.013	0.007
Dependent Variable Average	0.20	0.13	0.33	0.023	0.015

Table 4
Attracting New Types of Agents

This table presents estimates from regressions where the dependent variables are various outcome measures associated with the characteristics of the agents that were ultimately hired to list the focal lead. Columns (1) and (2) utilize the log distance of the focal property lead listed with a real estate agent to the geographic centroid of that agent's listings and the log standard deviation of the distances of that agent's listings from their geographic centroid, respectively. Column (3) utilizes the log of the total number of listings for the listing agent. The explanatory variable of interest utilized throughout is a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. The samples are further restricted to leads that were ultimately listed with an agent, and where there was only a single agent associated with that listing. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Log Distance From Hired Agent Center (1)	Log Hired Agent Listing Dispersion (2)	Log Hired Agent Listing Count (3)
Intermediary Attention	0.0391*** (2.96)	0.0415*** (3.56)	0.0247* (1.81)
Lead Creation Month by County FE	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes
Number of observations	136,724	134,382	136,800
Adj. R ²	0.020	0.040	0.025
Dependent Variable Average	2.38	2.74	4.16

Table 5
Buyer's Agents

This table presents estimates from regressions assessing whether affiliated agents are more likely to serve as buyer's agents for properties with more prominent leads, ultimately demonstrating that lead ordering promotes intermediation through multiple mechanisms. As dependent variables, Column (1) utilizes an indicator for whether or not the listing recorded a buyer's agent name at all whereas Columns (2) and (3) utilize an indicator for whether the listing recorded a buyer's agent name that is affiliated with the online platform. These dependent variables are regressed on a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. The sample in Column (3) is restricted to leads from the online platform that where the listing recorded a buyer's agent name. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Listing Records		
	Buyer Agent Name	Affiliated Buyer Agent	
	(1)	(2)	(3)
Intermediary Attention	-0.00017 (-0.14)	0.0013* (1.73)	0.0111** (2.22)
Lead Creation Month by County FE	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes
Listing Records Buyer Agent Name			Yes
Number of observations	654,991	654,991	72,779
Adj. R ²	0.260	0.095	0.111
Dependent Variable Average	0.164	0.052	0.309

Table 6
Intermediary Attention Leads to Quicker Sales

This table presents estimates from regressions where the dependent variables are various outcome measures associated with whether and how quickly the focal lead was sold. Columns (1) and (3) utilize an indicator, *Quick Sale*, of whether the property was sold within 60 days of the lead appearing on the online platform. Columns (2) and (4) utilize an indicator of whether property was sold within a year of the lead appearing on the online platform. Columns (5) and (6) utilize indicators of whether the property was ever sold and whether the property was sold more than two years after the lead appeared on the online platform, respectively. The explanatory variable of interest utilized in columns (1) and (2) is an endogenous indicator for whether the lead was ever listed with an agent. The explanatory variable of interest utilized in columns (3)-(6) is a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. Included throughout as a control is the ratio of historical transactions to historical listings within 1/4-Mile of the focal lead, measured over the 90 days prior to the lead appearing on the online platform and winsorized at the 1% and 99% levels. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. Further sample restrictions occur when the number of historical listings utilized in the denominator of the control variable are zero. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Quick Sale (1)	Sold Within One Year (2)	Quick Sale (3)	Sold Within One Year (4)	Ever Sold (5)	Sold After Two Years (6)
Agent Hired	-0.0335*** (-10.19)	0.119*** (20.68)				
Intermediary Attention			0.00198** (2.25)	0.000385 (0.24)	0.00234 (1.47)	0.00166* (1.94)
Ratio of Historical Transactions to Listings, 1/4-Mile, 90 Days	0.00104*** (3.63)	0.00313*** (4.71)	0.00141*** (4.90)	0.00180*** (2.72)	0.000786 (1.36)	0.0000250 (0.07)
Lead Creation Month by County FE	Yes	Yes	Yes	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	393,380	393,380	393,380	393,380	393,380	393,380
Adj. R ²	0.108	0.323	0.104	0.311	0.282	0.023
Dependent Variable Average	0.07	0.38	0.07	0.38	0.52	0.05

Table 7
Intermediary Attention Leads to Higher Priced Sales

This table presents estimates from regressions where the dependent variable is a regression residual for the focal lead, conditional on sale, from an hedonic model of log sales price, fit over the entire sample of ZTRAX transactions, winsorized at the 1% and 99% levels. The explanatory variable of interest utilized in column (1) is an endogenous indicator for whether the lead was ever listed with an agent. The explanatory variable of interest utilized in column (2) is a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. Included throughout as a control is the average of all log sales price residuals within 1/4-Mile of the focal lead, measured over the 90 days prior to the lead appearing on the online platform and winsorized at the 1% and 99% levels. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. The samples are further restricted to leads that were ultimately sold with a valid sales price populated and that were not dropped from the hedonic model due to singleton fixed effects cells or data availability issues. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Log Sales Price Residual	
	(1)	(2)
Agent Hired	0.0264*** (6.38)	
Intermediary Attention		0.00645* (1.88)
Average Historical Sales Price Residuals, 1/4-Mile, 90 Days, Winsorized	0.179*** (14.61)	0.179*** (14.62)
Lead Creation Month by County FE	Yes	Yes
Lead Batch FE	Yes	Yes
Number of observations	82,407	82,407
Adj. R ²	0.063	0.063
Dependent Variable Average	0.09	0.09

Table 9

Increased Intermediary Attention Diverts Prospects

This table presents estimates from regressions where the dependent variables are measures of the *Local Transaction Intensity* of the area surrounding the focal lead. Specifically, this is the ratio of transactions within a ¼-Mile of the focal lead to those within 2 miles of the focal lead, measured at increasing time intervals from the lead appearing on the online platform. The explanatory variable of interest utilized throughout Panel A is an endogenous indicator for whether the lead was ever listed with an agent. The explanatory variable of interest utilized throughout Panel B is a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Fixed effect cells of size 0.01 for the *Local Listing Intensity* and *Local Transaction Intensity* over the 90 days preceding the lead appearing on the online platform are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

[illegible][illegible]

Table 10
Heterogeneous in Ex-Ante Probability of Hiring an Agent

This table presents estimates from regressions where the dependent variable is an indicator for whether the lead was ever listed with an agent that is affiliated with the online platform. The explanatory variables of interest utilized throughout are a measure of exogenous *Intermediary Attention* derived from a lead's placement on the online platform, a measure of ex-ante increased probability of hiring an agent, and the relevant interaction between the two. Columns (1)-(3) utilize, as respective measures of ex-ante increased probability of hiring an agent, the fraction of historical transactions listed with an agent over the 90 days preceding the lead appearing on the online platform and within $\frac{1}{4}$ -Mile of the focal lead, the log of the square footage of the structure, and the number of bedrooms. The samples are restricted to leads from the online platform that had valid address matches into the ZTRAX Assessment dataset. Fixed effects for the creation month of the lead interacted with the county of the lead as well as for the batch the lead was loaded into the platform in are included throughout. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. Additionally, the average of the dependent variable in the regression sample is reported. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Hired Affiliated Agent		
	(1)	(2)	(3)
Intermediary Attention	0.00814*** (4.46)	0.0634*** (5.29)	0.0139*** (4.57)
Relevant Interaction	-0.00828*** (-3.61)	-0.0116*** (-5.00)	-0.00342*** (-3.67)
Fraction of Historical Transactions Listed with Agent, $\frac{1}{4}$ -Mile, 90 Days	0.0133*** (2.84)		
Log Square Feet		0.0370*** (7.98)	
Number Of Bedrooms			0.0112*** (6.23)
Lead Creation Month by County FE	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes
Number of observations	507,659	596,093	654,991
Adj. R ²	0.182	0.199	0.194
Dependent Variable Average	0.19	0.18	0.18

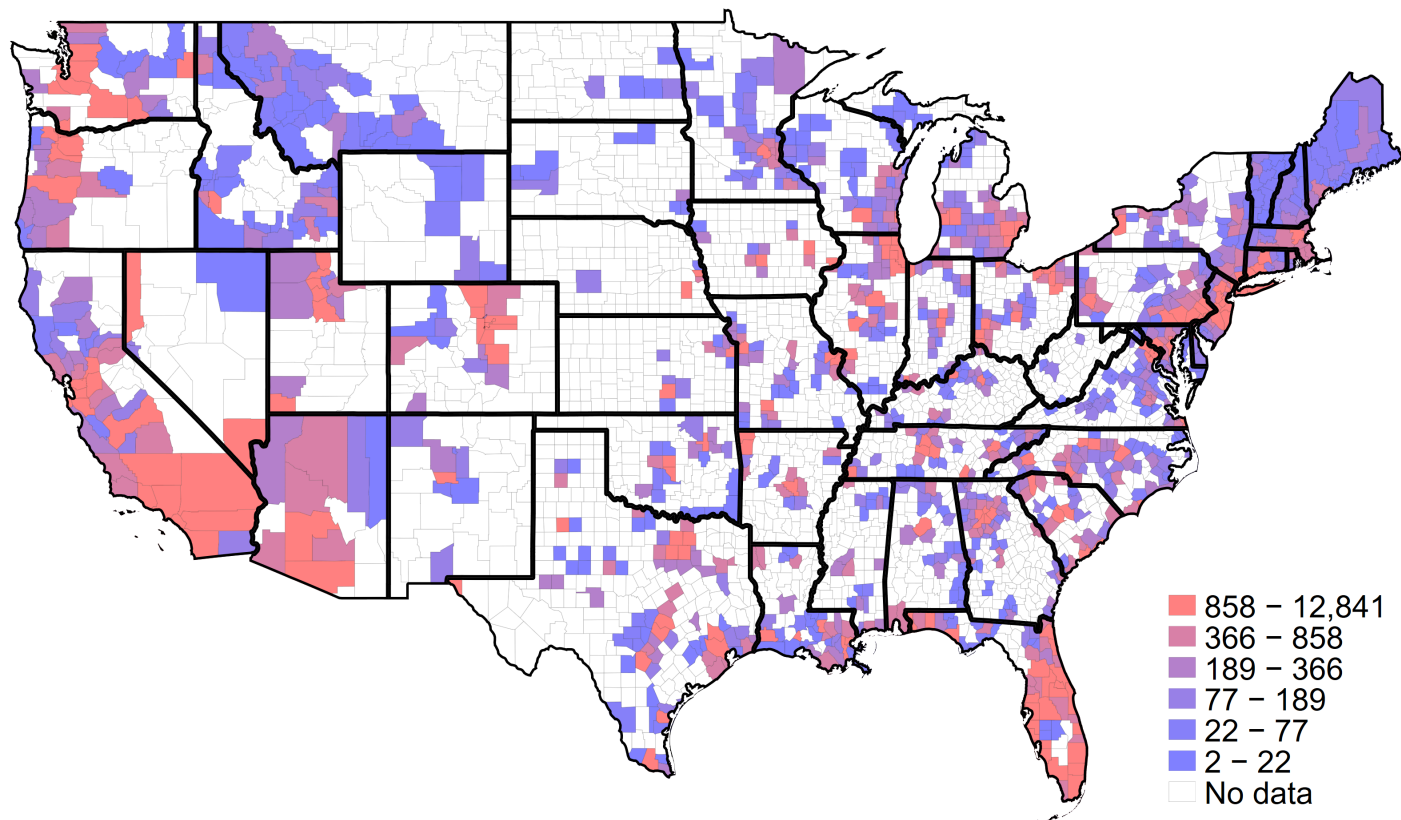


Figure 1. Geographic Scope This figure presents the geographic variation of the 654,991 leads in the baseline regression specifications of Table 3.

Filters 1		263 Leads	Dial	Mail	Other
SAVED FILTERS ALL DATA ALL EXPIRED ALL FSBO ALL FRBO ALL FORECLOSURE MY IMPORTS MY FILTERS FRBO BYU Filter #1 Filter #2 MLT Withdrawn					
MY FOLDERS Hot Leads Investment PropertL.. By City Alpine American Fork Cedar Hills Highland Housing Options					
	Rufus Agicatus 801-832-9510 +1	Contacted HOT LEADS		\$304,900 2,948 sqf Lead: 01/21/16 Listing: 01/21/16	5358 S Gaynel Autumn Cir TAYLORSVILLE, UT 84129
	Andrew West 801-875-9407 +1	New INVESTMENT PROPERTL..		\$15,500 900 sqf Lead: 01/21/16 Listing: 01/21/16	155 S 1200 W OREM, UT 84058
	Winston Adler 801-563-8752 +1	New HOT LEADS		\$464,900 5,043 sqf Lead: 01/20/16 Listing: 01/20/16	251 W. 1100 S. LEHI, UT 84043
	Victoria Burbank 801-756-8686	New		\$220,000 1,590 sqf Lead: 01/20/16 Listing: 01/20/16	422 N 1322 E LEHI, UT 84043
	Jerry Rogers 801-336-4708 +1	New		\$209,000 Lead: 01/20/16 Listing: 01/20/16	405 Deer Ridge Drive Lot #5 SALT LAKE CITY, UT 00000
	Spencer Stauffer 801-584-7781 +1	New		\$875,000 6,967 sqf Lead: 01/20/16 Listing: 01/20/16	12568 N Angels Gate HIGHLAND, UT 84003
	Kylie Woodman 801-785-9925	New		\$289,900 2,653 sqf Lead: 01/20/16 Listing: 01/20/16	7264 S Santa Maria Cir WEST JORDAN, UT 84084
	Steven Olsen 801-756-1387	New		\$126,000 1,070 sqf Lead: 01/20/16 Listing: 01/20/16	876 Greenridge Ave PAYSON, UT 84651
	Joe Ellis 385-895-5455	New		\$132,000 1,160 sqf Lead: 01/20/16 Listing: 01/20/16	California Ave At South State PROVO, UT 00000
	Shannon Blackham	New		\$299,950 2,735 sqf Lead: 01/19/16	1191 E 1025 S SPANISH CANYON, UT 84650

Figure 2. Online Platform Sample User Interface This figure presents a screenshot from training material related to an agent's use of the online platform's user interface. Layout and structure are identical to that experienced by an affiliated agent during our sample period. Actual data displayed is stylized by the online platform to avoid disclosing personally identifying information. Not all fields were provided by the online platform.

Internet Appendix

A.1 Robustness

Table [A.1](#) displays the main tests in the paper in specifications using an indicator for properties that rank in the top quartile of leads for their state on a given day. Table [A.2](#) displays the results for the second through fourth quartiles.

In Table [A.3](#) we show results interacting an indicator for vacant land with intermediary attention. In some information theories agents act in a certifying role, attesting to the quality of the property, but this consideration is clearly muted for vacant land. Under these certification theories, we would expect intermediary attention to have a much smaller impact on outcomes for vacant land than for properties with structures, but Table [A.3](#) shows no meaningful difference between the two classes of properties. These results do not support a certification interpretation of our findings. Under search theories, or under information theories that focus on an agent's role in resolving asymmetries about neighborhood characteristics, there is no obvious distinction between an agent's impact on vacant land or improved properties and, indeed, we find none. As discussed above, the negative spillover effects of intermediary attention on the listing and transaction intensities in the local area offer evidence in favor of search theories over information theories. Table [A.3](#) also shows the interaction of an indicator for 1-bedroom houses with intermediary attention. In this specification as well, the property type does not interact significantly with intermediary attention.

A.2 Magnitude Calibration

Tables 3, 4 and 5 document three distinct mechanisms by which an increase in intermediary attention has causal effects on a property: it heightens the probability of listing agent retention, it attracts the interest of more distant and geographically dispersed listing agents, and it improves the likelihood that an affiliated buyer’s agent will be involved in the sale transaction. In this section we outline a simple calibration approach to assessing the relative magnitudes of these mechanisms.

As described in Section 4.5, the multi-faceted impact of intermediary attention does not allow us to conduct a 2SLS analysis. Using a basic model relating property outcomes to the three mechanisms and making assumptions about parameter values lying in reasonable ranges, however, we can provide a general assessment of the relative importance of the magnitudes. Specifically, we assume that the three mechanisms have the following impact:

$$\text{Property outcome}_{i,t} \tag{A.1}$$

$$= \kappa + \mu_1 * \text{Hire Listing Agent}_{i,t} + \mu_2 * \text{Log(Radius of Prospective Agents)}_{i,t} + \mu_3 * \text{Attract Buyer's Agent}_{i,t},$$

where *Hire Listing Agent* is an indicator for hiring a listing agent, *Log(Radius of Prospective Agents)* describes the maximal distance from a property for which an agent will consider seeking the listing and *Attract Buyer’s Agent* is an indicator for whether a buyer’s agent is interested in bringing her client to the property.

This basic model ignores potential cross-effects of the three mechanisms, and it also rules out other mechanisms. For example, equation (A.1) reflects the second mechanism under which intermediary attention can lead the property to receive interest from more distant agents, but it ignores the related possibilities that the property may receive interest from more dispersed or more experienced agents. This approach can therefore only provide general guidance on the

relative importance of the three mechanisms.

We use the estimated results in the regressions in the tables in the paper to calculate the effect of an increase in intermediary attention on each of these variables. The effect on *Hire Listing Agent* is calculated using the estimate in the third column of Table 3. The effect on *Log(Radius of Prospective Agents)* is calculated from the first column of Table 4. Strictly speaking, this estimate reflects the impact on the average distance of hired listed agents rather than the maximum potential radius of interested agents, but the latter is not observable. The effect on *Attract Buyer's Agent* is calculated via the third column of Table 5. The Buyer Agent field is so often zero that we cannot directly estimate the effect of intermediary attention on the presence of a buyer's agent. We find in column three of Table 5 that an interquartile increase in intermediary attention increases the probability of an affiliated buyer's agent by 1.1 percentage points. We assume it has no effect on non-affiliated buyer's agents and that the overall impact is to increase the probability of a buyer's agent by 1.1 percent.

For each outcome variable, we decompose the estimated effect of intermediary attention into the impacts of the three mechanisms. This requires some subjective assumptions. For example, the sample frequency of quick sales is 7%, and we assume that the maximum plausible impact of hiring a listing agent would be to double this number. That is, we presume that in the quick sale version of equation (A.1), $\mu_1 = 7\%$. We similarly assume that the maximal impact of attracting a buyer's agent is to increase the probability of a quick sale by 7% (i.e., $\mu_3 = 7\%$). Under these generous assumptions, we then use equation (A.1) to calibrate the value of μ_2 that matches the total impact of intermediary attention estimated in the third column of Table 6. As shown in Panel A of Table A.4, this value is $\mu_2 = 2.4\%$. Applying the estimated effects of intermediary attention on each of the three mechanisms as outlined in the previous paragraph, we then calculate the fraction of the overall impact of intermediary attention that arises due to each of the three mechanisms.

As outlined in the third column of Panel A of Table [A.4](#), we find that even assuming quite large effects on quick sales of hiring a listing agent and attracting a buyer’s agent, the largest impact (47.5% of the total) comes from increasing the radius of prospective agents. Specifically, we find in column three of Table [6](#) that an interquartile increase in intermediary attention raises the probability of a quick sale by 0.2 percentage points. The results in Panel A of Table [A.4](#) show that 0.03 percentage points of this effect is due to the increased likelihood of the hiring of a listing agent, 0.09 percentage points of the effect is due to the presence of a broader range of prospective agents and 0.08 percentage points of the effect is due the higher probability that a buyer’s agent will be involved in the transaction. Under this calibration, a 10% increase in the radius of prospective agents (i.e., a 21% increase in the catchment area of agents) would result in approximately a 0.23 percentage point increase in the probability of a quick sale.

Panel B of Table [A.4](#) displays the results from assuming that listing and buyer’s agents have no impact on quick sales. The other panels in the table provide similar ranges of calibrated results for the log sales price residual and the local transaction intensity.

Table A.1
Robustness: Top Quartile Intermediary Attention

This table presents robustness results related to an alternate construction of our measure of *Intermediary Attention* by substituting it for an indicator for whether the focal lead was ranked in the top quartile of the batch in which it was collected in a series of specifications replicating the central results of our paper. Column (1) replicates column (1) of Table 3. Column (2) replicates column (3) of Table 6. Column (3) replicates column (2) of Table 7. Column (4) replicates column (2) of Panel B of Table 8. Column (5) replicates column (8) of Panel B of Table 9. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Hired Affiliated Agent (1)	Quick Sale (2)	Log Sales Price Residual (3)	Local Listing Intensity 0 to 60 Days (4)	Local Transaction Intensity 0 to 365 Days (5)
Top Quartile Relative Rank of Lead Number	0.00627*** (3.61)	0.00428*** (3.06)	0.0108** (2.38)	-0.000868*** (-2.65)	-0.000309* (-1.96)
Ratio of Historical Transactions to Listings, 1/4-Mile, 90 Days		0.00141*** (4.82)			
Average Historical Sales Price Residuals, 1/4-Mile, 90 Days, Winsorized			0.179*** (14.62)		
Lead Creation Month by County FE	Yes	Yes	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes	Yes	Yes
Historical Listing and Transaction Intensity FEs				Yes	Yes
Number of observations	654,991	393,380	82,407	513,936	534,403
Adj. R ²	0.172	0.104	0.063	0.453	0.739

Table A.2

Robustness: Intermediary Attention Quartiles

This table presents robustness results related to an alternate construction of our measure of *Intermediary Attention* by substituting it for quartile (top quartile is the base level) indicators for the focal lead rank relative to the batch in which it was collected in a series of specifications replicating the central results of our paper. Column (1) replicates column (1) of Table 3. Column (2) replicates column (3) of Table 6. Column (3) replicates column (2) of Table 7. Column (4) replicates column (2) of Panel B of Table 8. Column (5) replicates column (8) of Panel B of Table 9. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Hired Affiliated Agent (1)	Quick Sale (2)	Log Sales Price Residual (3)	Local Listing Intensity 0 to 60 Days (4)	Local Transaction Intensity 0 to 365 Days (5)
Second Quartile Relative Rank of Lead Number	-0.00497*** (-2.87)	-0.00394*** (-2.67)	-0.0104** (-2.24)	0.000814** (2.47)	0.000333** (2.01)
Third Quartile Relative Rank of Lead Number	-0.00796*** (-3.49)	-0.00612*** (-3.57)	-0.00615 (-1.04)	0.000948** (2.40)	0.000244 (1.28)
Fourth Quartile Relative Rank of Lead Number	-0.0117*** (-4.72)	-0.00253 (-1.43)	-0.0221*** (-2.95)	0.00106** (2.05)	0.000290 (1.42)
Ratio of Historical Transactions to Listings, 1/4-Mile, 90 Days		0.00141*** (4.85)			
Average Historical Sales Price Residuals, 1/4-Mile, 90 Days, Winsorized			0.179*** (14.61)		
Lead Creation Month by County FE	Yes	Yes	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes	Yes	Yes
Historical Listing and Transaction Intensity FEs				Yes	Yes
Number of observations	654,991	393,380	82,407	513,936	534,403
Adj. R ²	0.172	0.104	0.063	0.452	0.739

Table A.3
Robustness: No Property Type Heterogeneity

This table presents robustness results related to interactions of our measure of *Intermediary Attention* and two measures of property type in a series of specifications replicating the central results of our paper. Columns (1), (3), (5) and (7) are conditioned on FSBO and the interaction is with an indicator for whether the lead was likely to be for vacant land (zero bedrooms, zero bathrooms, and zero square feet reported on the lead platform). For columns (2), (4), (6) and (8) the interaction is with an indicator for whether the lead was listed as being for a property with one bedroom. Columns (1) and (2) replicate column (3) of Table 6. Columns (3) and (4) replicate column (2) of Table 7. Columns (5) and (6) replicate column (2) of Panel B of Table 8. Columns (7) and (8) replicate column (8) of Panel B of Table 9. Reported *t*-statistics in parentheses are heteroskedasticity-robust and clustered at both the county and lead creation week level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Quick Sale		Log Sales Price Residual		Local Listing Intensity 0 to 60 Days		Local Transaction Intensity 0 to 365 Days	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intermediary Attention	0.00387** (2.03)	0.00160* (1.73)	0.00681* (1.67)	0.00586 (1.64)	-0.00122*** (-3.70)	-0.000610*** (-2.80)	-0.000421** (-2.54)	-0.000279*** (-2.69)
Vacant Land Indicator	-0.0515*** (-4.84)		-0.240*** (-4.39)		-0.00116 (-0.61)		-0.00283*** (-2.89)	
Intermediary Attention × Vacant Land Indicator	-0.00219 (-0.52)		0.00917 (0.42)		0.000685 (0.97)		-0.000250 (-0.70)	
One Bedroom Indicator		-0.000807 (-0.24)		-0.125*** (-3.35)		0.00455*** (3.23)		0.00428*** (5.72)
Intermediary Attention × One Bedroom Indicator		0.000150 (0.11)		-0.0141 (-1.04)		0.000409 (0.81)		0.000165 (0.63)
Ratio of Historical Transactions to Listings, 1/4-Mile, 90 Days	0.000739 (0.90)	0.000101 (0.21)						
Average Historical Sales Price Residuals, 1/4-Mile, 90 Days, Winsorized			0.174*** (12.45)	0.178*** (12.78)				
Lead Creation Month by County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lead Batch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Listing and Transaction Intensity FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FSBO Only Sample	Yes		Yes		Yes		Yes	
Number of observations	192,941	368,995	58,895	65,741	282,308	483,190	297,841	502,530
Adj. R ²	0.038	0.106	0.057	0.060	0.364	0.447	0.674	0.734

Table A.4
Magnitude Calibration

This table describes calibration results decomposing the impact of intermediary attention on the specified dependent variables into the effects arising from hiring a listing agent, increasing the radius of prospective listing agents and attracting the interest of a buyer's agent. The direct impacts of intermediary attention on each of these mechanisms are derived from the estimates in Tables 3, 4 and 5, respectively, as described in Section A.2 in the Appendix. The effects of intermediary attention on the dependent variables are derived from Table 6 for Panels A and B, Table 7 for Panels C and D and Table 9 for Panels E and F. Coefficients are determined by either assumption or calibration to match the overall impact of intermediary attention, as described in the second column. The third column displays the fraction of the overall impact attributable to each mechanism under the described coefficients.

Explanatory Variable	Coefficient (1)	Determined By (2)	Fraction of Effect (3)
<i>Panel A: Dep Var Quick Sale</i>			
Hire Listing Agent	7%	Assumed	13.3%
Log(radius of prospective agents)	2.4%	Calibrated	47.5%
Attract buyer's agent	7%	Assumed	39.2%
<i>Panel B: Dep Var Quick Sale</i>			
Hire Listing Agent	0%	Assumed	0%
Log(radius of prospective agents)	5.1%	Calibrated	100%
Attract buyer's agent	0%	Assumed	0%
<i>Panel C: Dep Var Log Sales Price Residual</i>			
Hire Listing Agent	10%	Assumed	5.8%
Log(radius of prospective agents)	12.7%	Calibrated	77.0%
Attract buyer's agent	10%	Assumed	17.2%
<i>Panel D: Dep Var Log Sales Price Residual</i>			
Hire Listing Agent	0%	Assumed	0%
Log(radius of prospective agents)	16.2%	Calibrated	100%
Attract buyer's agent	0%	Assumed	0%
<i>Panel E: Dep Var Local Transaction Intensity 0-365 Days</i>			
Hire Listing Agent	-1%	Assumed	13.4%
Log(radius of prospective agents)	-0.34%	Calibrated	47.1%
Attract buyer's agent	-1%	Assumed	39.5%
<i>Panel F: Dep Var Local Transaction Intensity 0-365 Days</i>			
Hire Listing Agent	0%	Assumed	0%
Log(radius of prospective agents)	-0.72%	Calibrated	100%
Attract buyer's agent	0%	Assumed	0%