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Do real estate agents have information advantages in housing markets? ☆

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ABSTRACT

We use a large housing transaction data set in Singapore to study whether real estate agents use information advantages to buy houses at bargain prices. Agents bought their own houses at prices that are 2.54% lower than comparable houses bought by other buyers. Consistent with information asymmetries, agent buyers have more information advantages in less informative environments, and agent buyers are more likely to buy houses from agent sellers. Agent discounts are from both "cherry picking" and bargaining power, and bargaining power contributes more to the agent discounts. Agents' advantage consists in their information of available houses and previous purchase prices.

1. Introduction

Real estate agents play an important intermediary role in housing markets. They use their local market knowledge to bridge the information gap between potential buyers and sellers. Real estate agents use their information advantage in the housing market to reduce search costs and improve matching between buyers and sellers. Buyers and sellers pay a commission to real estate agents, usually a fraction of the transaction price,[1] for their services in brokering a real estate deal. If real estate agents are merely motivated by commissions, they might be induced to close deals in the shortest possible time, even to the extent of not revealing full information to the parties involved in the transactions. Most real estate agents are reluctant to seek the best attainable prices for their clients because the

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[1] In the US, the commission rates range between 5% and 6%. Prior to September 2008, real estate agents in Singapore charged about a 1% commission from sellers for a transaction in the private housing market. Buyers usually do not have to pay a commission to an agent.

effort needed to obtain those prices is not commensurate with incremental increases in agents' commissions.

Previous studies apply two different strategies to test real estate agents' information advantage. The first strategy compares housing transactions with and without agents. Hendel et al. (2009) find no evidence that houses sold via the multiple listing service (MLS) networks command premiums relative to those sold by owners using the for-sale-by-owner (FSBO) platform. Based on the listing data obtained from Stanford University's Faculty Staff Housing (FSH) office, Bernheim and Meer (2013) find that using full-service brokers reduces sale prices of a typical home by 5.9%–7.7%. The results imply that the local knowledge and expertise provided by real estate agents in the MLS listings are not correlated with higher house selling prices. They argue that broker services should be unbundled from MLS listings. The second strategy compares agents' own housing transactions and clients' housing transactions. Rutherford et al. (2005) show that agents sell their own houses for a premium of approximately 4.5%, whereas Levitt and Syverson (2008) find that houses owned by real estate agents sell for approximately 3.7% more than other houses. The evidence suggests the presence of agents' information advantage in the housing market.

Earlier studies invariably focus on the sell-side activities of real estate agents in the US because tracking properties and sellers is easier than tracking the identities of buyers. In this paper, we use the buy-side activities of real estate agents from a unique set of Singaporean data. This study on the buy side of agents, together with the previous literature on sell side, provide a complete picture of the role of real estate agents in housing markets. Similar to the second strategy, we empirically test whether agents use information advantages to buy their own houses at prices that are lower than the houses they broker for other buyers. We merge a data set consisting of more than 100,000 private housing transactions with a data set of real estate agents (salespersons) registered with the Council of Estate Agencies (CEA). The merged data set allows us to identify houses purchased by agents for their own use (the treatment group) and houses bought by other buyers (the control group). We test whether the prices of agent-own housing purchases are lower than comparable houses purchased by nonagent buyers. Our results show that real estate agents paid approximately 2.54% less for their own houses than did other individuals.[2]

Why do real estate agents pay lower prices when buying their own houses? One explanation is related to information asymmetries in the housing market; real estate agents have information advantages over less-informed nonagent buyers. We show that agent buyers with information advantages in a less informative environment are more likely to obtain bargain prices for their own purchases. Given that uninformed sellers are less willing to trade with agent buyers, we find that agent buyers are more likely to buy houses from agent sellers. These results are consistent with the predictions of information asymmetries in Garmaise and Moskowitz (2004) and Levitt and Syverson (2008). However, we show that agents' flipping strategy and their ability to time the market are unlikely to explain our main results.

If agents have information advantages, what are the possible sources of those advantages? The key innovation in our study is that we explore two strategies to investigate the sources of information advantage: sellers' characteristics and house listing information. In the first strategy, we use the merged data set that includes agent buyers' and agent sellers' characteristics and study the interaction between agent buyers and weak sellers. There are two possible channels through which agents could exploit information advantages. First, agents can use information advantages to cherry pick bargain deals from weak sellers. For example, agents buy houses from distressed sellers who were involved in lawsuits. We use two groups of sellers-individuals and distressed sellers, where the latter represent the weak sellers who are disadvantaged by lawsuit events. However, we find no evidence that agents exploit information advantages to cherry pick weak sellers in housing transactions. Second, agents use information advantages to tilt their bargaining power against weak sellers who face time pressure to sell their houses quickly. We find strong evidence that agent buyers pay lower prices relative to nonagent buyers when buying houses for their own use from these distressed sellers; agents also pay lower prices when buying houses for their own occupation from individuals and institutions, but no price discounts are found for houses bought from investors. The results are consistent with the bargaining power story, implying that agents use information advantages to obtain price discounts when buying houses from weak sellers.

The second empirical strategy is to use the merged data set to analyze the interaction between agent buyers and house listing information. We argue that agent buyers' discounts could come from cherry picking houses with low purchase prices and/or agents' power in bargaining down prices in the purchases. One source of information advantage is the agents' access to a larger choice set of houses for sale in the course of their dealings as agents representing potential sellers; they can then use the listing information, which is not accessible to nonagent buyers, to cherry pick cheaper houses. The second source of information advantage is evidenced in agents' ability to obtain larger discounts relative to nonagent buyers by bargaining down prices from the listing prices. Compared to nonagent buyers, we find that agents choose houses approximately 0.50% lower than the listing price, which is equivalent to approximately 20% of an agent's discount on the transaction prices as in the main results. By contrast, agent buyers bargain the price down by 1.8% more from the listing price, which is approximately 70% of the agents' discount to the prices in the main results. The results are consistent with the fact that agent buyers use information advantages (access to the listing prices) to obtain larger discounts when bargaining in their housing purchases.

[2] In Singapore, it is illegal for buyers and sellers to deliberately underreport sale prices, and the scenario in which agent buyers use their commission to partially offset the transaction price is unlikely to occur. Moreover, underreporting the sale price would not be to the agent buyers' advantage because their bank loans are computed based on the transaction prices. The agent buyers would need to provide more cash for the transactions if price is underreported.

Our paper makes three contributions to the broader literature. Our first contribution is related to the role of intermediaries in the markets. In financial markets, banks, as financial intermediaries, help bridge the information gap between users (borrowers) and suppliers (depositors) of funds in the financial markets. In the stock market, institutional investors routinely make use of brokers to execute their trades (Barbon et al., 2017; Di Maggio et al., 2017). Likewise, in housing markets, appraisals bridge the information gap between buyers and sellers/banks by providing an independent assessment on housing values for the purposes of determining the loan quantum (Agarwal et al., 2015; Agarwal et al, 2019; Agarwal et al., 2017), whereas real estate agents with their local market knowledge reduce search costs by matching sellers' houses to prospective buyers. Conflicts of interest may arise if financial intermediaries exploit their information advantages for private gain at the expense of uninformed clients. For example, banks take advantage of consumers' limited knowledge by selling them high-risk financial products with complex structures (Di Maggio, Kermani, and Korgaonkar, 2015; Agarwal et al., 2017a). In facilitating housing transactions, appraisers sometimes relent to client (usually a bank) pressure by producing appraisal values that are the same or close to the contract price in return for more repeated businesses from the same banks (Agarwal et al., 2017b). We find that agent buyers have a greater information advantage in a less informative environment. We also find evidence of a high propensity of transactions between agent buyers and agent sellers, which implies that sellers prefer to trade with nonagent buyers without information advantages. The results are consistent with the predictions of information asymmetries in Garmaise and Moskowitz (2004) and Levitt and Syverson (2008).

Our second contribution is to provide new empirical evidence to verify the hypothesis that experts use information advantages to cause distortions to housing markets.[3] We show that agents use their information advantages to buy houses at significant discounts from less-informed sellers in the informationally imperfect housing markets. Our results support the findings of Rutherford et al. (2005) and Levitt and Syverson (2008), both of whom use data from sell-side activities to show that agent sellers exploit information advantages to sell their own houses for higher prices than those of comparable houses sold by individual sellers. Combining our evidence from the buy-side activities of housing markets with the sell-side evidence from the early studies, the literature is able to provide a more complete picture of the information advantages of real estate agents in housing markets.

Our third contribution is made possible by the ability to connect multiple data sources, which allows us to identify two sources of information advantages and establish the channels through which information advantages are used by real estate agents. First, based on the listing data of agents, we are able to show that agent buyers with access to a larger choice set of housing listings could cherry pick houses with lower listing prices and then use their information advantages to bargain down the listing prices. Second, with the matched data on sellers' involvement in law events, we find that agent buyers obtain discounts in housing transactions from sellers only after knowing that sellers were declared bankrupt in the court records. We find evidence of bargained prices only in houses purchased from weak (bankrupt) sellers by agent buyers; no such discounts prices are obtained by agent buyers in houses purchased from informed sellers (investors).

2. Real estate brokerage industry in Singapore

Singapore is an island nation with a land area of approximately 716 square kilometers. As of 2013, it has a population size of 5.47 million, which includes 3.34 million citizens and 0.527 million permanent residents. The population is composed of a diverse mix of ethnic groups including 74% Chinese, 13% Malays, 9% Indians, and 3% of other races.[4] Singapore's home ownership rate of more than 90% is one of the highest in the world. Public housing constitutes 81.55% of the total housing stocks, estimated at 1.152 million units (as of 2012). The public housing is built by the government and sold to only Singaporean citizens at concessionary prices. The public market is highly regulated and is not a laisser-faire market. Therefore, we use only the non-landed private housing transactions, where price discovery is closer to the free market operations, in our empirical analyses. Non-landed housing, which includes condominiums and apartments,[5] is the largest segment of the private housing market constituting 12.14% of the total private housing stocks.

In Singapore, the government established a new statutory board-the CEA-under the auspices of the Ministry of National Development (MND) on October 22, 2010, to act an industry watchdog for real estate agents.[6] The mission of the CEA is twofold: (i) to increase the professionalism of the real estate agency industry and (ii) to protect the interests of the consumers. The CEA is empowered by the Estate Agents Act (Chapter 95A) to regulate the practices of licensed agents and salespersons in real estate markets. As of March 31, 2013, there were 1495 real estate agency

[3] A recent study by Allen et al. (2016) uses Miami-Dade County MLS data and finds that agent buyers pay 4% less than prices of comparable houses purchased by individual buyers. The data do not allow the authors to study the mechanism, and they also lack the exogenous shock that we exploit to study the change in the commission fee charged by the agents.

[4] These and the following statistics of Singapore's population and housing market are drawn from the Population Trends 2014, Department of Statistics, Singapore.

[5] Condominiums and apartments are both high-rise and high density residential developments. Condominiums are projects with full facilities and are built on lands with a minimum size of 0.4 hectare. By contrast, apartments are projects with limited facilities built on smaller parcels of land. There are no restrictions on foreign ownership in condominium projects, but foreigners could only purchase apartments that are six stories or higher under the Residential Properties Act.

[6] Prior to the establishment of the CEA, real estate agents were informally regulated by two professional bodies, the Institute of Estate Agents (IEA) and Singapore Accredited Estate Agencies (SAEA), Limited. These two professional bodies did not have statutory power to license agents or bar unethical agents from practicing in Singapore.

firms and 32,982 real estate salespersons (agents) registered with the CEA.[7]

In Singapore, real estate agents charge a seller a commission of approximately 1% to 2% of the sale price for closing a transaction in the private housing market. A buyer is usually not required to pay commission to a seller's agent in a transaction. Buyers are not required to appoint an agent in a transaction. However, in cases in which a buyer has specific requirements on the type and/or the location of a property for an agent, he is required to pay his agent a prenegotiated commission under the brokerage contracts after the agent buyer has fulfilled the requirements. After 2010, the CEA disallowed a dual representation arrangement, that is, an agent is not allowed to concurrently represent both a seller and a buyer in a transaction.

3. Data sources and analyses

3.1. Data sources

We collect five different sources of data for our empirical analyses. The first data set obtained from a proprietary source comprises private (non-landed) housing transactions recorded in the caveats for the period from January 1995 to December 2012. The data set contains information on property attributes, such as property type (condominium or apartment), tenure, unit size, floor level and address, and transaction details, such as sale type (new sale, subsale, or resale),[8] transaction date, transaction price, and buyers' and sellers' profiles, such as names and their unique personal identification numbers.

The second proprietary data source contains demographic information of approximately 70% of Singapore's residents. Based on the unique identification numbers, we match sellers in the transaction data set to the population data set to obtain information on their current home addresses. By comparing the transacted property addresses and the residence addresses of sellers, we sort the sellers into one of the categories, either individuals (owner occupiers) or investors. If a seller is a firm, it will be included in the third category known as "institution." While these three categories of sellers were involved in resale transactions, we also separately identify new houses sold by developers in the primary (precompletion) market.

The third data set covers a full list of licensed real estate salespersons (agents) in the public registry of the CEA as of May 2014. The data set includes information on salesperson's name, the name of the affiliated estate agency/firm, and the register number of the salesperson. We match the names of salespersons to the names of buyers in the transaction data set to identify agent buyers (the treatment group) and nonagent buyers (the control group).[9]

In contrast to the US, the MLS system is not widely used in Singapore. Real estate agents in Singapore source their listings, either open listings or exclusive listings, directly from potential sellers. The agent listings are information exclusive to real estate agents, making those listings a choice set of houses for agents in our tests of information advantages. Real estate agents traditionally use print media, such as newspapers, magazines, and flyers, to advertise and disseminate information on houses for sale. Electronic portals started mushrooming after 2010, with popular portals such as PropertyGuru.com, 99.Co, and SRX. These portals gradually replace printed media as the main channel for housing listings and searches for agents and house buyers. We obtain the fourth data set, which collates the listings data from the major portals in Singapore for the period from 2010 to 2013. The data set contains information on housing address, listing price, size, posting date, and agents posting the listing. We merge the listing data with the resale transaction data from 2010 to 2012 using the house address, the posting date, and the transaction date (see Online Appendix A for detail). We are able to merge approximately 40% of the resale transaction to the listing data in the sample period.

The last data set consists of the records of law events recorded in Singapore's courts for the period from 1995 to 2012. The law event records contain information on registration time, nature of claim, level of courts, and outcomes. Based on the unique personal identification numbers of the plaintiff(s) and defendant(s) in each law event, we merge the law event data set with the property transaction dataset.

3.2. Descriptive statistics

After merging the data on buyers, sellers, and law events into a master transaction data file and sieving out transactions with incomplete or wrong information, our final sample contains a total of 108,534 transactions. Out of the total sample transactions, 5775 (5.32%) are agent buyer transactions (treatment group), and 102,759 (94.68%) are nonagent buyer transactions (control group). Fig. 1 shows the frequency of transactions by year for (A) the full sample and (B) the agent buyer sample for the period from 1995 to 2012. The trends of the two sets of transactions are quite similar, and the highest sale numbers were recorded in 2009.

Fig. 2 plots the kernel density of total house prices for the agent buyers and the nonagent buyers. The red line representing housing prices for nonagent buyers is shifted slightly to the right, which indicates that houses bought by

[7] Under the Estate Agency Act, the terms "estate agent" and "salespersons" have legal interpretations and meanings. The CEA defines estate agents as estate agency businesses (sole proprietors, partnerships, and companies) and salespersons as individuals who perform estate agency work. However, we use real estate agents and salespersons interchangeably to represent individuals who are licensed to conduct real estate brokerage services for buyers/sellers of houses.

[8] There are three sale categories recorded in the transaction data. "New sale" and "subsale" consist of pre-completion units sold in the primary markets. The former includes units marketed and sold by developers in new launches, whereas the latter includes units bought and sold by individual buyers before project completion. "Resale" refers to the sales of completed units in the secondary markets.

[9] There are a small number of cases with similar names in both buyers' and agents' files, and robustness tests are done on these duplicated matched samples to remove possible biases.

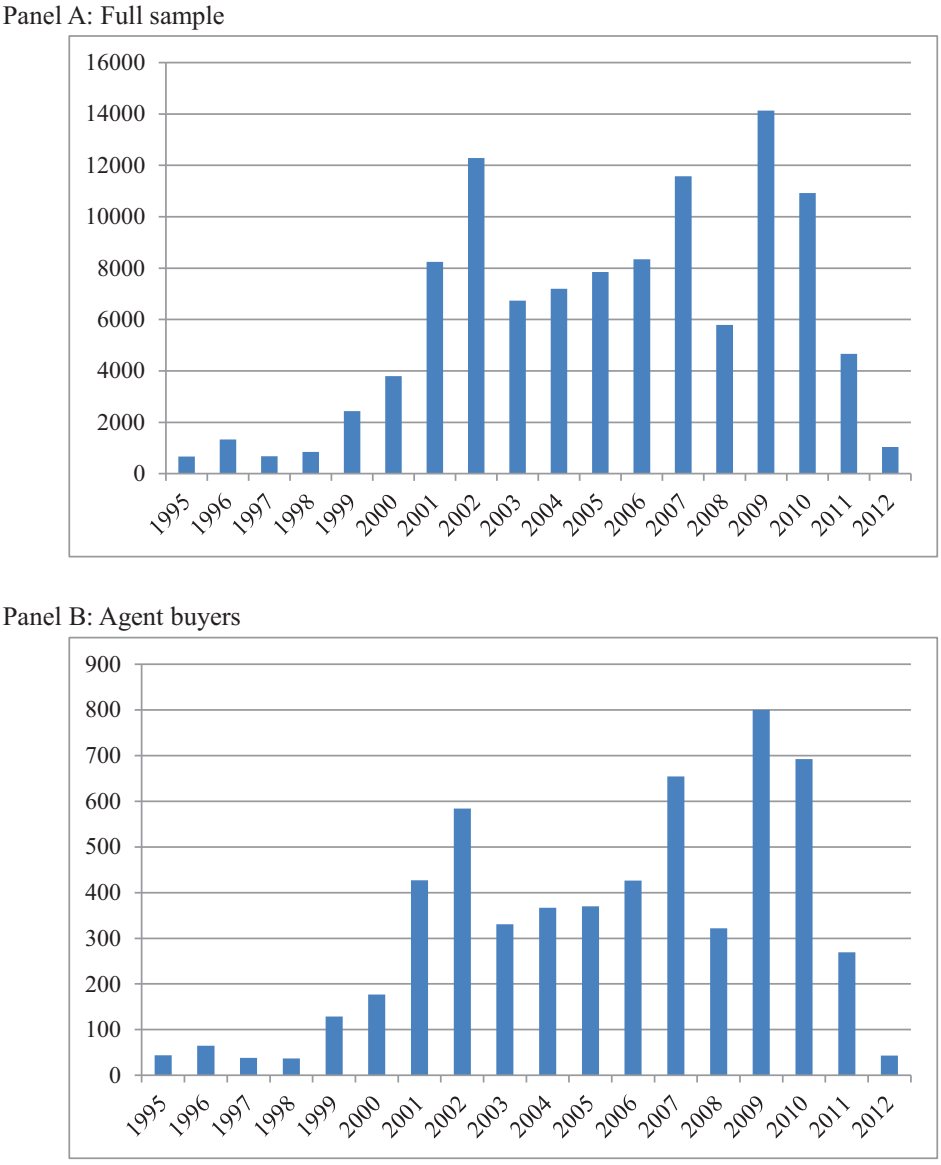


Fig. 1. Transaction frequency over years. The figures show the transaction frequencies by year for the period from 1995 to 2012. Panel A shows the frequency distributions for the full sample, and Panel B shows the distributions for only the agent-buyer sample.

nonagent buyers are more expensive than houses bought by agent buyers.

We estimate the average total monthly house prices for the agent buyers and the nonagent buyers and test the presence of the month effects on agent discounts. Fig. 3, Panel A shows that the average house prices for the agent buyers are lower than the average house prices for the nonagent buyers. The agent buyers pay lower prices than the nonagent buyers for houses bought in all months (unadjusted for housing quality). Panel B shows that the agent buyers' transactions constitute approximately 5% to 5.6% of the total sales across the 12-month period.

Table 1 reports the descriptive statistics of the main variables sorted by the full sample, the agent buyers (treatment sample), and the nonagent buyers (control sample). Panel A reports the statistics for the original sample, and Panel B reports the statistics for the paired samples derived using the propensity score matching (PSM) approach. Panel A shows that the average per square meter (psm) transaction price for the full sample of 108,534 houses is estimated at S$8245.58 psm. The average unit price of S$8127 psm is estimated for the agent buyer sample (5775 houses), which is 1.5% lower than the average unit price of S$8252 psm for the nonagent buyer sample (102,759). The average total house price for the agent buyer sample is also lower than that for the nonagent buyer sample.

We use the PSM technique to create a control group of buyers with matched characteristics, which include hedonic attributes (housing type, floor level, sale type), transaction year, property location, and buyer

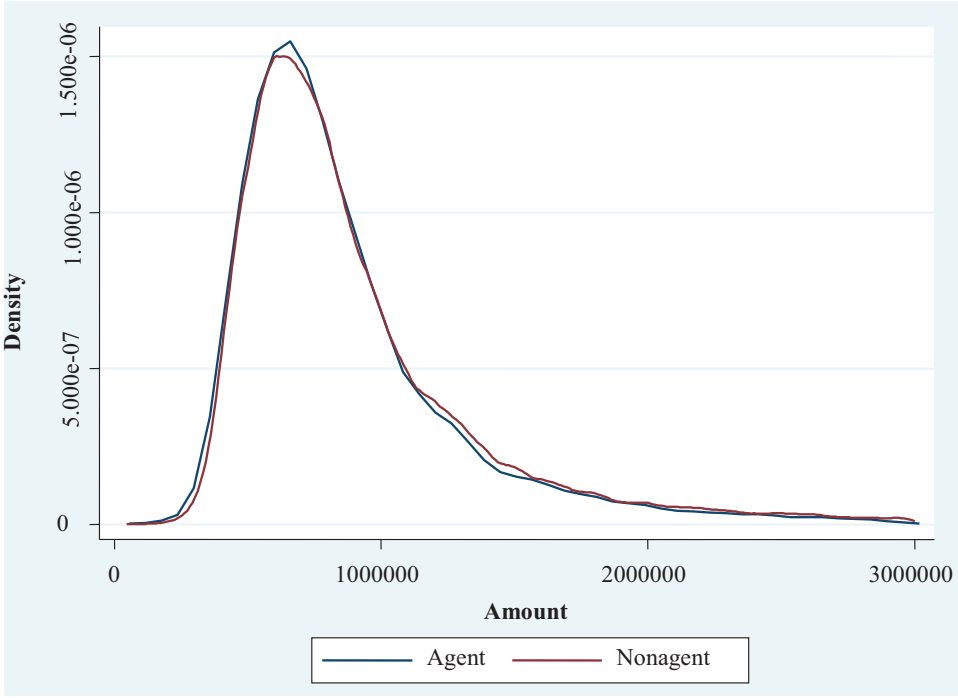


Fig. 2. Kernel density plot of unit price per square meter. This figure shows the kernel density plots of unit price per square meter for agent and nonagent. The *y*-axis indicates the probability of density, and the x-axis indicates the value distribution of the unit price per square meter.

characteristics (race, gender and marital status). Based on the propensity scores of the agent buyers' transactions (the treatment group), we construct a balance sample of the non-agent buyers (the control group) using a one-to-one matching process. As shown by the descriptive statistics of the 5701 matched samples in Panel B of Table 1, except for the transaction prices, the characteristics of the original agent-buyer sample (in term of housing attributes, and demographic characteristics of buyers) match the characteristics of the nonagent control sample generated by the PSM method. The average unit price of the agent buyer group is estimated at S$8123 psm, which was 1.63% lower than the average unit prices of S$8258 psm estimated for the matched nonagent buyer group.

4. Empirical strategy and results

In this section, we present our main empirical results. Section 4.1 presents the main results for agent price discounts. Section 4.2 discusses possible explanations and shows evidence that our main results are consistent with information asymmetries in the housing market; agents have information advantage over less-informed nonagent buyers. After showing agents' information advantages, we investigate sources of information advantage by analyzing the weak sellers and house listing data in Sections 4.3 and 4.4, respectively.

4.1. Do agents buy houses at lower prices?

We test whether price differences exist in houses bought by the agent buyer group (treatment) and the nonagent buyer group (control) controlling for the spatial and the time fixed effects.[10] The model specification is given below:

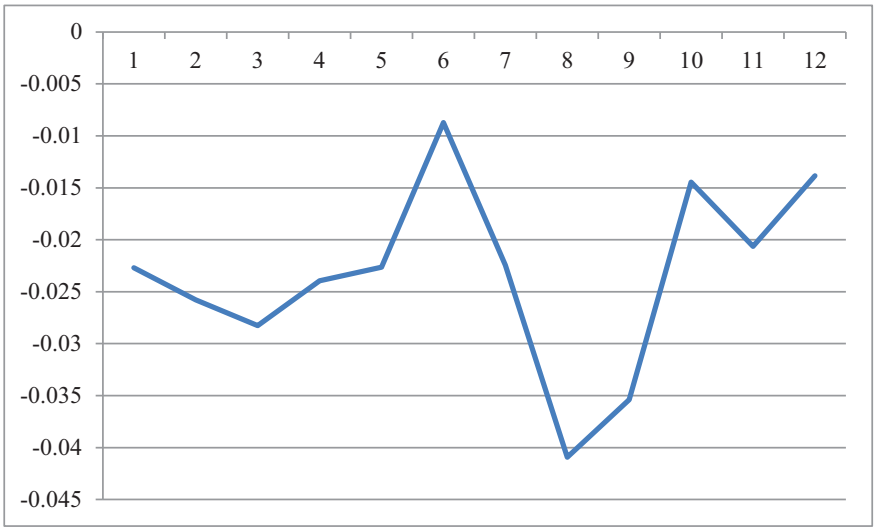
$$\ln\left(\mathrm{P}_{\mathrm{i,d,t}}\right) = \alpha + \beta \times \mathrm{Agent}_{\mathrm{it}} + \gamma \mathbf{X_i} + \mu_{\mathrm{d}} + \varphi_{\mathrm{t}} + \varepsilon_{\mathrm{itd}}, \quad (1)$$

where the dependent variable $\ln(P_{i,d,t})$ is the log-total price (S$) of house i located in a planning region d at time t. $\mathrm{Agent}_{\mathrm{it}}$ is a binary indicator that has a value of one if a buyer is an agent, and zero otherwise, that is, if he/she is a nonagent buyer. $\mathrm{X_i}$ is a vector of regressors on the hedonic attributes of housing, such as housing type, floor level, sale type, and buyer's characteristics-such as race (Chinese, Malay, Indian/others), gender, and marital status. μ_{d} and φ_{t} are the spatial fixed effect and the time fixed effects. α, β, and γ are the estimated regression coefficients, and ε is the residual term of the regression.

Table 2 presents the main results. We estimate the log-price models in Eq. (1) using (a) the full sample (Columns 1, 2, 3, and 4), (b) the subsample of repeated sales (Columns 5 and 6), and the matched sample (Columns 7 and 8). The main results (Columns 1 and 2 of Table 2) show that agents buy their own houses at prices that are 2.54% lower than comparable houses brought by other buyers. The results remain significant after controlling for the socioeconomic characteristics of buyers, and agents pay 2.45% lower for their own houses than comparable houses bought by others. We include the district by year

[10] We also conduct a similar analysis of the seller-side activities of real estate agents as in Levitt and Syverson (2008) and Rutherford et al. (2005), and we have not found that real estate agents obtain higher prices when selling their own houses compared to others' houses.

Panel A: Agent's discount on total price over month



Panel B: Proportion of agent's transaction over months

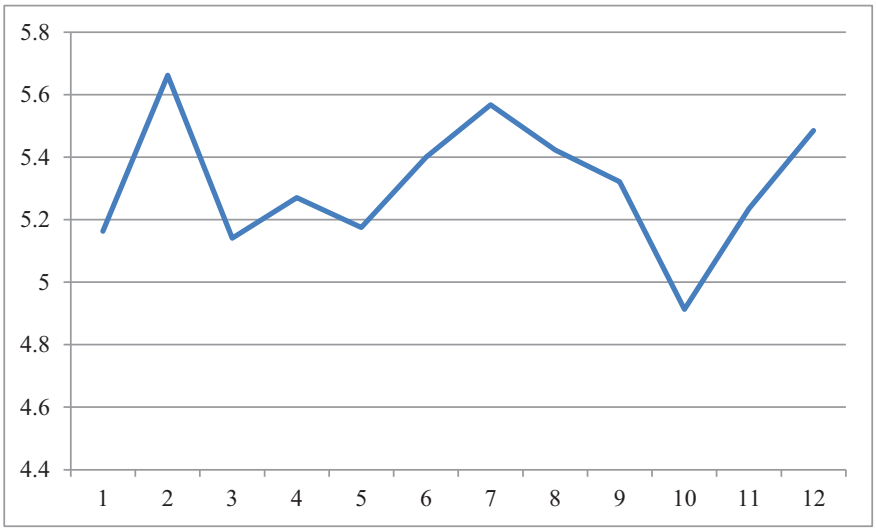


Fig. 3. Agent's transactions by month. This figure shows the agent discount over months and the proportion of agent transactions over months.

fixed effects in Columns 3 and 4 to rule out the concern that agent may selectively time the market and favor particular locations in their purchases, and the results are consistent.

One potential concern is that our data set includes only agents listed on the CEA website as of May 2014. Some nonagent buyers may potentially be misclassified as agent buyers if they become agents after they bought their houses. Similarly, some agent buyers may also be misclassified as nonagent buyers if they quit their agent jobs after they bought their houses. These misclassifications, if they exist, are expected to bias our results toward zero. Thus, the agent discounts are likely to be the lower bound of our estimation.

We conduct further robustness checks on the results. First, we test whether our results are driven by agents' selection on unobserved quality of houses. We use the subsample (b) that includes only 2874 houses that experienced more than one sale, one of which involved agent buyers. We add the house fixed effects to control for unobserved quality of houses. Based on the same rationale of the repeated sale methodology, we compare differences in sale prices while keeping the quality of houses constant by using sample houses that sold twice or more, once to an agent buyer. Despite a smaller sample of repeated sales used in the estimation, the results show that the coefficient on the agent dummy is −1.52% (Columns 5), and the coefficient is −1.48% (Column 6) when the socioeconomic characteristics of buyers are controlled for. The results imply that for repeated transactions-one by an agent buyer and another one by a nonagent buyer-we expect agents to pay a lower price when buying the house

Table 1
Descriptive statistics.
This table presents the aggregate-level summary statistics of our data set before and after propensity score matching. The full sample includes 108,534 property transactions of condominium and apartment in Singapore from 1995 to 2012. Propensity score matching are one-to-one match by setting agent as treatment group based on the property information, transaction year, location of property (district level), and other buyer characteristics. Panel A reports the summary statistics for the full sample, and Panel B reports the summary statistics for propensity score matched sample. "Price" is the unit sale price in Singapore dollars per square meter. "Total amount" is the total transaction amount in Singapore dollars. "Size" is the transacted property size in square meters. "Floor" is the floor level of the property. "Condominium" has a value of one, if a condominium is purchased, and zero otherwise indicates an apartment. "Freehold" has a value of one, if a house has a freehold tenure, and zero otherwise. "Newsale" represents houses sold by developers in the primary market. "Resale" represents houses sold in the secondary market. "Male" has a value of one for a male buyer, and zero otherwise for a female buyer. "Chinese" identifies Chinese buyers, and zero otherwise identifies other races (Malay, India, and others). "Marriage" has a value of one for a married buyer, and zero otherwise. "Age" measures the buyer's age. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	Total	Agent buyer	Nonagent buyer	Diff
Panel A: original sample				
Price (Singapore dollars per square meter)	8245.5800	8127.0000	8252.2400	125.24***
Total amount	970,032.94	904,777.55	973,700.25	68,922.7***
Size (square meters)	120.2209	116.5815	120.4254	3.8439***
Floor	0.7203	0.7108	0.7208	0.0100**
Condominium	0.8869	0.8860	0.8869	0.0009
Freehold	0.4359	0.3952	0.4382	0.0430
Newsale	0.5407	0.5051	0.5427	0.0376
Resale	0.3791	0.4059	0.3776	−0.0283
Male	0.6154	0.5302	0.6202	0.0900***
Chinese	0.9391	0.9635	0.9377	−0.0258***
Marriage	0.5987	0.6536	0.5957	−0.0579***
Age	43.2279	40.3205	43.3915	3.0710***
Total observation	108,534	5775	102,759	
Panel B: propensity score matched sample				
Price (Singapore dollars per square meter)	8190.4800	8122.9900	8257.9700	134.9800*
Total amount	909,842.9	904,422.06	915,263.75	10,841.69
Size (square meters)	115.6771	116.6108	114.7434	−1.8674***
Floor	0.7143	0.7109	0.7176	0.0067
Condominium	0.8935	0.8856	0.9015	0.1590**
Freehold	0.3917	0.3950	0.3884	−0.0066
Newsale	0.5113	0.5052	0.5175	0.0123
Resale	0.4024	0.4066	0.3982	−0.0084
Male	0.5304	0.5306	0.5303	−0.0003
Chinese	0.9634	0.9637	0.9632	−0.0005
Marriage	0.6556	0.6536	0.6576	0.0040
Age	40.3698	40.3577	40.3819	0.0242***
Total observations	11,402	5701	5701	

for their own use compared to buying the same house for clients (other buyers).

In the second robustness test, we test whether our results are influenced by unbalanced samples in the treatment group and the control group. Based on the buyers' loading factors estimated by the PSM technique, we match the housing samples in the treatment group one-on-one onto the control group. We rerun the log-housing price models using the matched samples. The results in Columns 7 and 8 of Table 2 show that agents pay 2.38% lower for houses bought for their own use compared to similar houses bought by other nonagent buyers. The price discount for agents' houses relative to nonagents' houses is still 2.32% after controlling for the buyers' characteristics.

The findings in Table 2 are generally robust and consistent; agents buy their own houses at lower prices than those of comparable houses bought by other buyers. We test the robustness in the process of merging the agent data set and the transaction data set in Online Appendix A.

We analyze the heterogeneous effects by sale type and size of agency companies in Online Appendix B. The results in Table A2 show significant discounts for houses sold to the agent buyers in both the resale and the new sale markets. In the resale market, agent buyers pay 2.56% (Column 1) lower in prices than other buyers for comparable houses, and the price discount is 2.48% (Column 2) after controlling for the buyers' characteristics in the model. However, in the new sale market, the discounts for agent buyers are still significant, but the magnitude is smaller at 2.57% (Column 3) and 2.41% (Column 4) after controlling for the buyers' socioeconomic characteristics. We find that freehold houses are valued 11% to 15% more than other identical leasehold houses, which is consistent with the findings in Giglio et al. (2015).

Does the agent discount change over time? Using the establishment of the CEA in October 2010 as an exogenous shock, we conduct a quasi-experiment to test whether the establishment of the CEA could eliminate agent discounts. The CEA, as the industry watchdog, has the regulatory power to discipline and monitor the behavior of agents as well as to protect buyers from being taken advantage of by agents in the housing markets. The CEA disallows dual representation by an agent to prevent conflicts of interests

Table 2
Information advantages of real estate agents.
This table shows results of OLS regression analysis. The dependent variable is log-total price of houses. "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. The control variables in the model include unit size (sqm), a dummy on condominium, a dummy on high floor that identifies unit located at level nine and above, and a dummy on new sale and a dummy on resale. Models in Column 2, 4, 6, and 8 also control for socioeconomic variations using the buyer characteristics, such as dummies on "Male," "Chinese," and "Marriage." For age, we use a dummy on "Old age" that takes a value of one, if a buyer is 60 year and older, and zero otherwise. The district fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Regression results in Columns 1, 2, 3, and 4 are estimated using the full sample observations. Columns 5 and 6 are estimated using repeated sale samples, i.e., houses sold more than one time during the sample period, and where one of the buyer was an agent. For Columns 5 and 6, housing fixed effects are included. Columns 7 and 8 are estimated based on matched samples generated using the propensity score matching approach. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	All samples				Repeat sale		Matched sample	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Agent	−0.0254***	−0.0245***	−0.0240***	−0.0231***	−0.0152***	−0.0148***	−0.0238***	−0.0232***
	(0.0032)	(0.0032)	(0.0030)	(0.0031)	(0.0049)	(0.0052)	(0.0041)	(0.0041)
Size (square meters)	0.0055***	0.0055***	0.0055***	0.0055***			0.0061***	0.0061***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)			(0.0001)	(0.0001)
Condominium	0.1546***	0.1548***	0.1532***	0.1532***			0.1550***	0.1541***
	(0.0019)	(0.0019)	(0.0019)	(0.0019)			(0.0055)	(0.0055)
High floor	0.0404***	0.0403***	0.0383***	0.0383***			0.0421***	0.0420***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)			(0.0044)	(0.0044)
Freehold	0.1217***	0.1215***	0.1234***	0.1232***			0.1113***	0.1107***
	(0.0018)	(0.0019)	(0.0018)	(0.0018)			(0.0054)	(0.0054)
Newsale	0.0129***	0.0123***	0.0249***	0.0244***	−0.0264***	−0.0272***	0.0057	0.0054
	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0103)	(0.0105)	(0.0079)	(0.0079)
Resale	−0.1785***	−0.1787***	−0.1590***	−0.1593***	−0.0529***	−0.0560***	−0.1733***	−0.1729***
	(0.0029)	(0.0029)	(0.0028)	(0.0029)	(0.0129)	(0.0131)	(0.0081)	(0.0081)
Intercept	13.0899***	13.0755***	12.9117***	12.9031***	14.5393***	14.5600***	13.0082***	12.9805***
	(0.0129)	(0.0133)	(0.1287)	(0.1287)	(0.0991)	(0.1008)	(0.0363)	(0.0380)
Socioeconomic variables	No	Yes	No	Yes	No	Yes	No	Yes
Time fixed effects	Yes	Yes	No	No	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	No	No	Yes	Yes	Yes	Yes
District-year fixed effects	No	No	Yes	Yes	No	No	No	No
House fixed effects	No	No	No	No	Yes	Yes	No	No
Observations	108,534	107,399	108,534	107,399	2874	2831	11,402	11,402
R-squared	0.7743	0.7746	0.7950	0.7952	0.9535	0.9541	0.7732	0.7739

that may arise when an agent concurrently represents a buyer and a seller in a deal. If the CEA is an effective regulator, we should expect discounts in agent buyers' housing purchases to decline, if not fully disappear, after the policy shocks. We run the experiment in the difference-in-differences (diff-in-diff) model below:

$$\ln\left(P_{i,d,t}\right) = \alpha + \beta \times \text{Agent}_{it} + \phi \times (\text{AfterCEA} \times \text{Agent}) + \gamma \mathbf{X_i} + \mu_d + \varphi_t + \varepsilon_{itd}, \quad (2)$$

We include an interaction term, Agent x AfterCEA, where AfterCEA is a time dummy that indicates the post-CEA regime in the above diff-in-diff specification. If the interactive term is positive and significant, we could argue that the new CEA regulatory regime has effectively curtailed the effects of agents' exploitation of information advantages to pay lower prices in their housing purchases.

The results in Table 3 show that agents' information advantages are economically and statistically significant, and the discounts in agent buyers' own housing purchases are estimated at approximately 2.66% (Column 1) and 2.55% (Column 2) relative to the houses bought by other nonagent buyers. The coefficients on the interactive term, Agent × AfterCEA, are positive at 1.73% and 1.60%, respectively, but statistically insignificant in both models. The CEA's effect is large, which is reflected in 70% decreases in agent discounts from the discounts before the CEA's establishment. The large standard error is likely due to the sample limitation because we only have two years of housing data after the CEA's establishment. The agent discounts are estimated at 0.93% (=2.66%−1.73%) and 0.95% (=2.55%−1.6%), respectively, after the CEA's establishment. We could not reject the hypothesis that the agent discount is zero in the post-CEA regime. Despite the sample limitation, the results still show strong treatment effects after the new regulatory regime under the CEA, where decreases in price discounts (information advantages) for agents were observed in the post-CEA period. The results imply that unethical practices by agents, which may include dual representation and information shrouding, could have had been largely curtailed after the CEA regulatory regime. Agents are no longer able to exploit information advantages to buy their own houses at lower prices compared to comparable houses purchased by nonagent buyers.

We test the treatment effects using housing transactions that occur during the period between 2005 and 2012, which is close to the CEA's establishment period in October 2010. The results in Column 3 are robust and consistent with the early results in the full sample. In Columns 4 and 5, we test the impact of CEA using the new sale and the resale data. The results are robust and consistent with the early results in the full sample.

We estimate the average price discounts for houses bought by agent buyers and plot the coefficients of agent

Table 3
Effects of the new regulatory regime.
This table shows results of OLS regression analysis. The dependent variable is log-total price of houses. "AfterCEA" is a time dummy that represents the establishment of Council for Estate Agencies (CEA) on 22 October 2010, and it has a value of one, if a transaction occurs on and after 22 October 2010, and zero otherwise. "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. The control variables in the model include unit size (sqm), a dummy on condominium. Socioeconomic variations are controlled in Columns 2-5 using the buyer characteristics, such as dummies on "Male," "Chinese," and "Marriage." For age, we use a dummy on "Old age" that takes a value of one, if a buyer is 60 year and older, and zero otherwise. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Regression results in Columns 1 and 2 are estimated using the full samples, whereas Columns 3 is estimated using subsamples periods 2005-2012. Column 4 and 5 are estimated using subsamples of new sale and resale. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	Full samples		2005 - 2012	Newsale	Resale
Model	(1)	(2)	(3)	(4)	(5)
Agent	−0.0266***	−0.0255***	−0.0319***	−0.0230***	−0.0264***
	(0.0033)	(0.0033)	(0.0045)	(0.0040)	(0.0055)
Agent × AfterCEA	0.0173	0.0160	0.0203	−0.0431*	0.0145
	(0.0126)	(0.0127)	(0.0137)	(0.0244)	(0.0164)
Size	0.0055***	0.0055***	0.0059***	0.0069***	0.0042***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Condominium	0.1546***	0.1548***	0.1506***	0.0934***	0.2127***
	(0.0019)	(0.0019)	(0.0025)	(0.0024)	(0.0031)
High floor	0.0404***	0.0403***	0.0537***	0.0396***	0.0389***
	(0.0015)	(0.0015)	(0.0021)	(0.0018)	(0.0026)
Freehold	0.1217***	0.1215***	0.0808***	0.1088***	0.1451***
	(0.0019)	(0.0019)	(0.0026)	(0.0024)	(0.0030)
Newsale	0.0129***	0.0122***	0.0413***		
	(0.0028)	(0.0028)	(0.0035)		
Resale	−0.1786***	−0.1787***	−0.1611***		
	(0.0029)	(0.0029)	(0.0036)		
Intercept	13.0893***	13.0750***	13.0068***	12.9963***	13.1183***
	(0.0129)	(0.0133)	(0.0162)	(0.0227)	(0.0181)
Socioeconomic variables	No	Yes	Yes	Yes	Yes
Spatial fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	108,534	107,399	63,580	58,071	40,737
R-squared	0.7743	0.7746	0.7759	0.8148	0.7572

discounts from 2005 to 2012 in a half-year interval in Fig. 4. We find that agent buyers buy houses at discounted prices in 12 out of the 13 half-year periods before the establishment of the CEA; the coefficients are all statistically significant. The only exception is in the second half of 2008, which was the year after the US financial crisis. The agent discounts is estimated at approximately 3% over time, which reflects the common trend before the CEA regime. For the three half-year periods after the establishment of the CEA, the coefficients are close to zero but statistically insignificant. The results indicate that there is a pre-trend before the establishment of the CEA, and the post-CEA trend shows a significant decline in the agent discounts.

We run additional diagnostic tests by using the placebo cutoff dates to mimic the treatment effects of the CEA's establishment. We use different arbitrary treatment years to systematically represent the placebo policy changes between 2004 and 2009. For each of the placebo policy year tests, we keep a balance sample size by keeping the same three-year window both before and after the placebo policy year. We run the tests using the six-year rolling window; for example, in the 2004 placebo year, the samples used in the estimation span from 2001 to 2006. Table A4 shows only the results of the treatment effects (Agent × Placebo cutoff year); the coefficients for other variables are omitted due to the space constraints. We find that except for the year 2005 (Column 2), the coefficients on the interaction terms are negative, though they are insignificant in the four placebo years from 2004 to 2007. However, when we set the placebo cutoff years in 2008 and 2009, which are closer to the actual treatment year in 2010, the coefficients on the Agent × Placebo cutoff year become positive but are still statistically insignificant. The switch in the coefficient signs from negatives in the placebo years from 2004 to 2007 to positives in the placebo years 2008 and 2009 implies that the treatment effects could not be falsified in the placebo controlled tests.

The results show that agents are no longer able to buy houses for their own use at prices that are lower than those paid by other clients following the implementation of regulatory controls in the post-CEA regime. However, we could not rule out one possible confounder associated with the use of online and web-based search and listing services that have gained popularity in Singapore after 2007. Technologies could reduce search costs and diminish information advantages of real estate agents in the housing markets. However, the results in the placebo tests in Column 3,

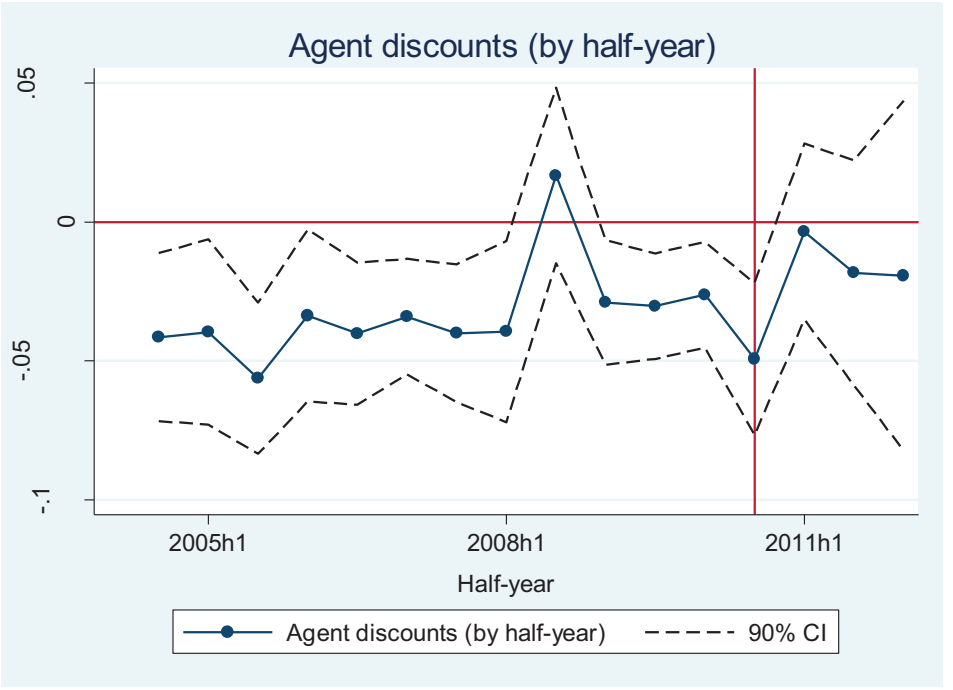


Fig. 4. Agent discount over years. This figure shows the agent discount over time.

Table A4 show that the coefficients on Agent × Placebo cut-off year is negative, and in Column 4, the coefficient is positive and larger than one percentage point. The results suggest that the shock occurred in approximately 2010, rather than in 2007, which means that technological changes are unlikely to explain our results.

4.2. Possible explanations

4.2.1. Information asymmetries

Why do real estate agents pay lower prices when buying their own houses, as shown by the early empirical evidence? Our result is consistent with information asymmetries in the housing market: real estate agents have information advantage over less-informed nonagent buyers. In this section, we provide more evidence to support the predictions of the existing literature regarding information asymmetries.

If agent's price discount is due to information asymmetry, agent buyers should have more information advantage in a less informative environment. There are several ways to identify information asymmetries in the literature. Garmaise and Moskowitz (2004) argue that a high variation in the property tax assessment ratio suggests that the assessment is less informative and information asymmetries are prevalent in a jurisdiction. By contrast, Levitt and Syverson (2008) argue that information asymmetries in an area are correlated with the heterogeneity in house types within a block. However, we cannot directly apply their empirical strategies to test information asymmetries in our context because appraisals for residential houses are not public information, and housing types are rather homogenous in each building in Singapore's non-landed housing markets. Instead, we propose to use the variance in transaction prices in a building to proxy the information asymmetries in Singapore's housing market. In this market, information asymmetries increase with the variance in housing prices. In a building with high price variance, housing information is dispersed and less useful for nonagent buyers. Agent buyers could exploit their information advantages over uninformed buyers to buy houses for their own occupation at discounts in a relatively less informative environment. Thus, we hypothesize that agent discounts are positively correlated with the variance in transaction prices in a building.

In Column 1 of Table 4, we define an environment to be highly heterogeneous and informationally less transparent if the variance in transaction prices is above the median price variance in our sample (Heterogeneity ≥50%). We show that in a transparent market (in buildings with relatively low variance in housing prices), agent buyers obtain a 1.6% discount for their own housing purchases relative to houses purchased by nonagent buyers. However, in a highly heterogeneous environment with high price variance in the buildings, agent buyers obtain larger discounts of 3.1% in their housing purchases relative to nonagents' housing purchases. In Column 2, based on the variance in transaction prices, we divide the information asymmetries of the housing market into three quantiles: High heterogeneity, Median heterogeneity, and Low heterogeneity, and then rerun the models. The results indicate that agent buyers buy houses at 1.3% discounts in the lower third quantile of the building sample by the price variance (heterogeneity). In the upper third quantile of buildings (by the price variance) (High heterogeneity), where prices are more heterogeneous, agent buyers obtain a larger dis-

Table 4
Heterogeneity across real estate agent.
This table shows results of OLS regression analysis. The dependent variable is log-total price of houses. "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. "High heterogeneity (50%)" is a dummy variable that has a value of one if the building in the upper half of our sample in terms of information environment heterogeneity. "High heterogeneity" is a dummy variable that has a value of one if the building in the upper third of our sample in terms of information environment heterogeneity. "Median heterogeneity" is a dummy variable that has a value of one if the building in the middle third of our sample in terms of information environment heterogeneity. "Agent with high performance1" is a dummy variable that has a value of one if agent buyer's performance is above the median performance in our listing sample. "Agent with low performance1" is a dummy variable that has a value of one if agent buyer's performance is below the median performance in our listing sample. "Agent with unknown performance1" is a dummy variable that has a value of one if agent buyer's performance is not shown in our listing data. "Agent with high performance2" is a dummy variable that has a value of one if agent buyer's performance is above the median performance in our transacted sample. "Agent with low performance2" is a dummy variable that has a value of one if agent buyer's performance is below the median performance in our transacted sample. "Agent with unknown performance2" is a dummy variable that has a value of one if agent buyer's performance is not shown in our transacted data. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	All samples			
Model	(1)	(2)	(3)	(4)
Agent	−0.0160***	−0.0134*		
	(0.0049)	(0.0069)		
Agent*High heterogeneity (50%)	−0.0150**			
	(0.0064)			
Agent*High heterogeneity		−0.0271***		
		(0.0086)		
Agent*Median heterogeneity		−0.0025		
		(0.0085)		
Agent with high performance1			−0.0299***	
			(0.0050)	
Agent with low performance1			−0.0199***	
			(0.0050)	
Agent with unknown performance1			−0.0236***	
			(0.0064)	
Agent with high performance2				−0.0304***
				(0.0051)
Agent with low performance2				−0.0194***
				(0.0050)
Agent with unknown performance2				−0.0236***
				(0.0064)
Intercept	13.0751***	13.0650***	13.0758***	13.0754***
	(0.0133)	(0.0132)	(0.0133)	(0.0133)
Socioeconomic variables	Yes	Yes	Yes	Yes
Housing variables	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	107,399	107,399	107,399	107,399
R-squared	0.7749	0.7773	0.7746	0.7746

count of 4.1% for their houses compared to houses bought by nonagent buyers. The results are consistent with the predictions of information asymmetries by Garmaise and Moskowitz (2004) and Levitt and Syverson (2008).

Next, we merge approximately 40% of the resale transaction from 2010 to 2012 to the listing data and create three indicators on agents' performance (Performance1) based on the number of houses he/she represents in the listings over a year: high performance, low performance, and unknown performance. The high performing agent is an agent whose listing performance is above the median listing number in the sample. We then explore the relationships between agent performance and the housing price. In Column 3, we find that the high performing agents enjoy larger discounts of 3.0%, while the low performing agents enjoy significant, but smaller, discounts of 2.0% when they buy their own houses relative to houses bought by nonagent buyers. Similarly, using the number of sales an agent has closed in the transaction data, we calculate the comparable performance indicators, (Performance2) and rerun the log-total housing price models. The results, as shown in Column 4, are consistent with those discussed in Column 3. The results are consistent with the information asymmetry hypothesis, which indicates that

Table 5
Sorting among real estate agent.
This table shows results of OLS regression analysis. The dependent variable is a binary variable has a value of one, if a buyer is an agent. "Agent seller" is a dummy variable that has a value of one, if a seller is also an agent, and zero otherwise. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	All samples	
Model	(1)	(2)
Agent seller	0.0293***	0.0303***
	(0.0058)	(0.0058)
Intercept	0.0669***	0.0721***
	(0.0178)	(0.0187)
Socioeconomic variables	No	Yes
Housing variables	Yes	Yes
Time fixed effects	Yes	Yes
District fixed effects	Yes	Yes
Observations	27,119	23,985
R-squared	0.0042	0.0044

high performing agents with stronger information advantage enjoy significantly larger discounts when they buy their own houses.

Using professional brokers as an indicator of information asymmetries in commercial real estate market, Garmaise and Moskowitz (2004) show that nonagent sellers (nonagent buyers) are unwilling to trade with more informed agent buyers (agent sellers). In equilibrium, market segmentation exists such that agent sellers will only sell their houses to agent buyers. We test this prediction using the binary buyer variable as the dependent variable in the Ordinary Least Square (OLS) regressions, and we summarize these results in Table 5. The coefficients on the agent seller dummy is positive and significant after controlling for socioeconomic factors, housing attributes, time fixed effects, and district fixed effects. The results imply that agent sellers are more likely to sell their houses to agent buyers, which is consistent with the results in Garmaise and Moskowitz (2004).

In summary, we show that agent buyers buy houses at significant discounts because agent buyers have information advantages in a less informative environment, and that high performing agent buyers have a relatively stronger information advantage. We also show that agent buyers are more likely to trade with agent sellers. All the above results are consistent with the predictions of information asymmetries.

4.2.2. Alternative explanations

Agents engaging in flipping activities are likely to buy and sell houses quickly for profits in the market, and the flipping motive offers an alternative explanation to agents' buying a house for their own use. If the flipping story holds, we should expect agents to buy houses at discounted prices and sell them in a short time to realize investment gains. These flipping activities could result in a large volume of selling activities by agents. However, we find no evidence to suggest that flipping is the main story driving our results. First, we find that agents' housing sales (repeat sales) constitute only 8.1% of the housing sales in the market. Second, we show that the establishment of the CEA as the industry watchdog in 2010 reduces the agent discounts (Table 3). If the agent discounts are due to agents' picking and buying low quality houses to flip, we should not observe exogenous shocks associated with the CEA's presence, and the agents' discounts should persist before and after the CEA's establishment. Third, using the home addresses of agents, we sort an agent buyer into the owner occupier group if his/her current home address is the same as the transacted house address; otherwise, the agent buyer is identified as an Investors. We define an Investor dummy with a value of one if an agent is an investor and zero if he/she is an owner occupier; we also include an interactive term (Agent $\times$ Investor) in the log-unit housing price models.

The results as in Table A8 (Online Appendix) show that agent-investors enjoy larger discounts than agent buyers, who buy houses for their own occupation purposes. We find that agent buyers generally pay a 2.5% lower in price for comparable houses compared to other nonagent buyers. However, the coefficients on the interactive term Agent $\times$ Investor are not significant. The results show that agent-investors do not enjoy larger discounts than other agent buyers, who are owner occupiers. We find no evidence to support the flipping as the reason for the price discounts in agent buyers' transactions.

An alternative explanation to the agent discounts is that agents time the market to earn price discounts when buying houses for their own use. The market timing story, if not rejected, implies that agents' transactions are expected to cluster around a specific time of a year during which agents can enjoy large discounts when buying houses. The following evidence suggests that the market timing story may drive the agents' information advantage story in our study. First, we include the year-month fixed effects in Eq. (1) and run the same regression as in Table 2 (Columns 1 and 2). We find that the coefficients are estimated at -0.0255 and -0.0246, respectively, and both are significant at the 1% level. The results are very close to the coefficients reported in Table 2. Second, Fig. 3, Panel B shows that the fractions of agents' housing transactions are distributed within a narrow range of between 5% and 5.6% across 12 months in a year. Bunching of the agent transactions is not evidenced in the data, and the differences in the fraction of agent transactions by month are not significant ($p = 0.71$). We explore the month effects in agent discounts by interacting the agent indicator with various time-related indicators, which include the month of the year, the quarter of the year, the three-month Singapore Interbank Offered Rates (SIBOR), and the housing price index (Table A5).[11]

The agent discounts could be explained by the bundling of sellers' furniture and appliances into a house when the

[11] Three-month SIBOR is usually the index rate for home mortgages in Singapore. We use the price index of non-landed properties from the Urban Redevelopment Authority (URA) as our housing price index.

parties negotiate on the housing sales. Except for a few special cases in which developers sell their "show-flats"[12] in a bundle in new projects, the bundling practice is uncommon in the sales by individual sellers. In Singapore's context, houses are immovables, also legally known as realty or chattels real, which include, other than the land and building structure sitting thereon, fixtures that are annexed to the building and land. Furniture, appliances, and other tangible items (not permanently fixed to land) that are not classified as immovables will not be passed on to buyers unless otherwise agreed upon. In most instances, buyers will take possession of vacant houses without encumbrance upon sales; movables, such as furniture and appliances, are not bundled in most of the housing transactions in Singapore. Thus, it is unlikely that the bundling of movables could explain the agents' price discounts in our results.

4.3. Source of information advantage: evidence from sellers' characteristics

What are the possible mechanisms through which real estate agents could exploit information advantages to gain economic benefits in housing transactions? In this section, we investigate the sources of information advantages through the interactions between agent buyers' and agent sellers' characteristics. There are two possible sources of information advantages: the extensive margin and the intensive margin. On the extensive margin, agents are more likely to use their information advantages to select weak sellers who are financially distressed. This selection channel is supported if real estate agents show a strong preference for buying houses from a selected group of buyers, such as uninformed individuals and/or buyers, who are financially distressed. On the intensive margin, agents might use information advantages to tilt their bargaining power when negotiating against weak sellers. If the bargaining power channel is not rejected, we expect real estate agents to pay lower prices when buying houses from individual sellers, and in contrast, the discounts are smaller when buying houses from more informed sellers. Agents exploit their information advantages to bargain down prices when dealing with buyers in "fire sales."

4.3.1. Extensive margin: agents' selection of weak sellers

To test whether real estate agents use information advantages on the extensive margin to cherry pick weak sellers in the market, we use two types of weak sellers: individual sellers and sellers involved in lawsuits. We test the housing price effects on the group of weak sellers against two other groups of sellers who are investors and institutions. Individual sellers are identified as owner occupiers and live in the houses with the same addresses as the transacted houses. Investor sellers are those whose current home addresses are different from the addresses of transacted houses. Institutional sellers are firms (including developers) that sell houses in the resale markets. We use only transactions in the resale market; developers' sales in the primary market are excluded in the tests.

Compared to investor sellers, individual sellers face pressure to sell their houses quickly before moving into their new houses. Similarly, sellers who are involved in lawsuits are under financial pressure to sell their houses in a shorter time and at fire sale prices. We derive four binary seller dummy variables—k_i=(individuals, investors, institutions and sellers involved in lawsuits)—which have a value of either zero or one, to represent the four groups of sellers and use the seller dummy (k_i) as the dependent variables in the following OLS regression controlling for the district and the time fixed effects:

$$k_i = \alpha + \beta \times \text{Agent}_{it} + \gamma \mathbf{X_i} + \mu_d + \varphi_t + \varepsilon_{itd}, \quad (3)$$

We exclude developers' sales from the sample when estimating the sellers' selection models of Eq. (3). The OLS results with the three different binary seller variables as dependent variables are summarized in Column 1 to Column 3 of Table 6. The results show that the coefficients on the Agent dummy are positive but insignificant in the individuals (Column 1) and investors (Column 2) models. The 95% confidence interval of the coefficient in Column 1 is [−0.5%, 4.8%]. The coefficient is negative but insignificant in the institutions model (Column 3). The results show that agents are more likely to buy houses from individual sellers and investors and are less likely to buy houses from firms. However, the selection channel is not statistically significant in the models.[13] Therefore, the hypothesis that agent buyers' use information advantages to self-select houses when buying their own houses is not supported.

We conduct further tests on the cherry picking channel using a new proxy for the weak sellers in Column 4. In this model, sellers are involved in lawsuits, and this group of sellers is under the time pressure to quickly sell their houses. By merging the law event data set into the housing transaction data set, we identify sellers who are involved in various lawsuits, which include bankruptcy, car accident, sales of goods, credit card, and tenancy disputes. We sort this group of sellers into the treatment group and identified them by a lawsuits dummy, which has a value of one if a seller is involved in one of these law events, and zero otherwise.[14] The results show that the coefficients on the

[12] In the precompletion sales by developers, show-flats, which are either units in a new project or temporary units built on the site, are flats that developers will outfit with interior finishes, furniture, and appliances, as part of developers' marketing strategy to attract potential buyers. The show-flats mimic the layout of the units launched for sales in precompletion development. For show-flats created in real flats in a project, developers could sell the units together with the fixtures and furniture, but at discounted costs, to interested buyers after the completion of the sales of the project.

[13] When we exclude institutions sellers from the samples, the coefficient on the Agent variables is still not significant. We find no evidence to suggest that real estate agents cherry pick a specific group of buyers when buying their own houses.

[14] We also use the five different indicators to separately identify the law events, (ι_i), and substitute the seller indicators (k_i) in Eq. (3) by the new set of lawsuit indicators for the sellers, (ι_i), to test if agents' selection for a particular group of sellers is observed. The results are consistent when we split the law events into different categories. The results do not support the cherry picking story that agents are expected to exploit information advantages to buy their own houses from sellers involved in different law events.

Table 6
Agents' selection on weak sellers.
This table shows results of OLS regression analysis using only the resale samples. The dependent variables in Columns 1 to 4 are represented by four binary variables that represent different sellers, such as individuals, investors, institutions, and sellers involved in lawsuits. The binary variable has a value of one, if a seller type is as defined in the top row of the table. The dependent variable in Columns 5 to 8 is log-total price of houses. "Weak seller" is a dummy variable that has a value of one if the seller is involved in lawsuits (Column 5 and 6) or is an individual seller (Column 7 to 8). "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable	Weak seller				Log(total transaction price)			
Types of seller	Individual seller	Investor seller	Institutional seller	Seller involved in lawsuits	Seller involved in lawsuits		Individual seller	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weak seller					−0.0350***	−0.0350***	−0.0957***	−0.0955***
					(0.0047)	(0.0047)	(0.0040)	(0.0040)
Agent	0.0215	−0.0085	−0.0130	0.0049		−0.0246***		−0.0248***
	(0.0137)	(0.0066)	(0.0127)	(0.0055)		(0.0052)		(0.0073)
Intercept	0.8255***	0.0800***	0.0944**	0.0794***	13.1203***	13.1218***	13.1684***	13.1707***
	(0.0453)	(0.0220)	(0.0422)	(0.0191)	(0.0180)	(0.0180)	(0.0244)	(0.0244)
Socioeconomic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Housing variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,978	17,978	17,978	40,737	40,737	40,737	17,978	17,978
R-squared	0.0761	0.0179	0.0995	0.0299	0.7574	0.7575	0.7850	0.7851

Agent dummy are insignificant, indicating that there is no correlation between the fire sale sellers and the agent buyers. The 95% confidence interval of the coefficient in Column 4 is [−0.6%, 1.6%]. There is no evidence to suggest that agents are more likely to buy houses from sellers involved in lawsuits.

One concern is that our results could neither reject a zero coefficient, nor reject a positive coefficient on cherry picking. We further analyze the relationship between housing prices and weak sellers in Column 5 to Column 8 of Table 6, where the dependent variable is log-total transaction price of houses. The weak seller dummy variable has a value of one, if a seller is either involved in lawsuits (Column 5 and 6) or is an individual seller (Column 7 to 8). We find that houses sold by weak sellers are cheaper, and more specifically, houses sold by sellers involved in lawsuits are 3.5% lower, and those sold by individual sellers are 9.57% lower than other comparable houses. We run the seemingly unrelated regression (SUR) to account for correlations between the two regressions. Thus, cherry-picking individual sellers can explain about 0.21% (=2.15% x 9.57%) of agent discounts, and we can reject the hypothesis that the effect is larger than 0.46% at the 5% level. Cherry-picking sellers involved in lawsuits can explain about 0.02% (=0.49% x 3.5%), and we can reject the hypothesis that the effect is larger than 0.06% at the 5% level. Therefore, even if the cherry picking of sellers were not rejected, the effect is unlikely to explain the observed agent discounts of 2.54% in the main results.

In summary, there is no evidence suggesting that agent buyers are more likely to buy houses from the weak sellers, either individual sellers or distressed sellers. Our results do not support the hypothesis that real estate agents use information advantages to cherry pick weak sellers in the market.

4.3.2. Intensive margin: bargaining power of agents

The second possible explanation is that real estate agents use information advantages on the intensive margin to tilt their bargaining power against weak sellers. We test the bargaining power channel by adding an interactive term, (Agent_{it} x k_{j}), to the extended log-price model:

$$\ln\left(\text{P}_{\text{i,d,t}}\right) = \alpha + \beta \times \text{Agent}_{\text{it}} + \sum_{j=1}^{2} \theta_j \times \left(\text{Agent}_{it} \times \text{k}_j\right) + \sum_{j=1}^{2} \delta_j \times \text{k}_j + \gamma \mathbf{X_i} + \mu_{\text{d}} + \varphi_{\text{t}} + \varepsilon_{\text{itd}}, \quad (4)$$

A negative coefficient on the interaction term ($\text{Agent}_{it} \times \text{k}_j$) implies that agents receive larger discounts when buying houses from weak sellers. The result, if significant, is consistent with the bargaining power explanation. We use the same two sellers' characteristics (individual sellers and sellers involved in lawsuits) to proxy weak sellers.

Based on the first proxy, we identify individuals (owner occupiers) who face liquidity constraints in their mobility decisions as weak sellers. Given that they live in the same houses that they sold, they were under the time pressure to sell their existing houses in the shortest possible time so that they could use the proceeds to pay for their new houses. However, investors, who usually own multiple houses, would not face such time pressure in selling their houses. The exit strategies of investors, who are strong negotiators and more informed about housing price trends, are motivated by investment returns. Institutions are not liquidity-constrained sellers, and they buy houses to provide residences as the perks for their top foreign executives. They will sell the houses quickly when the houses are no longer needed for their foreign executives and move

Table 7
Bargaining power of real estate agents: weak sellers.
This table shows results of OLS regression analysis using the resale samples. The dependent variable is the log-total price of houses. "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. "Before lawsuits" and "After lawsuits" are time dummies that represent transactions that occur before or after the law events convicted by sellers. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Regression results in Columns 1, 2, 4, and 5 are estimated using the full resale sample, whereas Column 3 is estimated using samples that exclude institutional sellers. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	Resale samples		Exclude institutional seller	Resale samples	
Model	(1)	(2)	(3)	(4)	(5)
Agent	−0.0233***	−0.0232***	−0.0235***	−0.0241***	−0.0239***
	(0.0083)	(0.0084)	(0.0081)	(0.0053)	(0.0053)
Institutional seller	0.1104***	0.1103***			
	(0.0044)	(0.0044)			
Investor seller	0.0324***	0.0330***	0.0264***		
	(0.0084)	(0.0085)	(0.0082)		
Agent × Institutional seller	−0.0132	−0.0129			
	(0.0180)	(0.0180)			
Agent × Investor seller	0.0126	0.0166	0.0133		
	(0.0357)	(0.0361)	(0.0349)		
Lawsuits				−0.0344***	
				(0.0048)	
Agent × Lawsuits				−0.0086	
				(0.0192)	
Before lawsuits					−0.0298***
					(0.0108)
After lawsuits					−0.0447***
					(0.0104)
Agent × Before lawsuits					0.0315
					(0.0413)
Agent × After lawsuits					−0.0545
					(0.0382)
Intercept	13.1007***	13.0787***	13.1314***	13.1218***	13.1218***
	(0.0231)	(0.0241)	(0.0262)	(0.0180)	(0.0180)
Socioeconomic variables	No	Yes	Yes	Yes	Yes
District fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	18,148	18,148	13,847	40,737	40,737
R-squared	0.7856	0.7860	0.8019	0.7575	0.7575

the housing sale proceeds back into the firms for other operational needs. Firms do not usually haggle on selling prices as long as they are able to recover their costs after depreciation from their sales. Based on the seller characteristics, we hypothesize that individual and institutional sellers are more likely to face time pressure to sell their houses compared to investors, who are more likely to wait for the right prices before selling their houses. Therefore, individuals and institutions do not have as strong a bargaining power as investors in selling their houses in the market.

The results for the models in Eq. (4) are summarized in the first three columns of Table 7. Using individuals as the reference in Columns 1 and 2, we find that the agents' price advantages are significant when they engage in transactions with individual sellers. For transactions involving individual sellers, real estate agents pay 2.33% lower in prices when buying houses for their own use compared to other comparable houses bought by nonagent buyers. The coefficients on institutions (Columns 1 and 2) and investors (Column 2) are positive, indicating that houses bought from institutional sellers and investors (controlling for the buyers' characteristics) are higher relative to houses bought from individuals. When we interact the Agent with the two sellers' dummies (institutions and investors) (with the individual sellers as the reference), we find that the coefficients on the Agent × Institutions are negative at −1.32% (Column 1) and −1.29% (Column 2) after controlling for buyers' characteristics. The coefficients on Agent × Investors are positive at 1.26% and 1.66% in the base model (Column 1) and the model with controlled socioeconomic variables (Column 2), respectively, but the results are statistically insignificant. The results imply that while agents enjoy 2.33% discounts when buying houses from individual sellers, they enjoy larger discounts when buying houses from institutional sellers. However, we find no significant discounts in the transactions involving investor sellers. When we exclude institutional sellers from the samples and reestimate the model in Column 3, the results are consistent with the early results in Columns 1 and 2.

Using the weak sellers involved in lawsuits as an alternative proxy, we estimate the log-unit price models in Eq. (4) by replacing the seller identity k_i with the law-

suits dummy that denotes distressed sellers who are under pressure to sell their houses in the shortest possible time. The results are summarized in Columns 4 and 5 of Table 7. The results in Column 4 show that the Agent coefficient is significant at −2.41%, which indicates that agents could exploit their information advantages by paying lower prices when buying their own houses from the average sellers without lawsuits. The lawsuits dummy is significant at −3.44%, indicating that sellers involved in lawsuits sell their houses for even larger discounts, which is consistent with the fire sales cases. However, the interactive term Agent × Lawsuits is not significant in the model, which implies that there are no significant price differences between agent buyers and nonagent buyers when buying houses from the distressed sellers.

The early model, which does not control for the sequence of the law events and the housing transactions, could bias the results downward. We further differentiate sellers' housing sales that occur before the law events from those sold under fire sale conditions after the law events by defining two new time dummies-Before lawsuits, which has a value of one if a housing transaction occurs before the seller of the house is sued in a law event or zero otherwise, and After lawsuits, which has a value of one if a housing transaction occurs on or after the date of a law event in which the seller is sued or zero otherwise. We rerun the log-price model and report the results in Column 5 of Table 7. The results show that the Agent coefficient is still significant at −2.39%, and more interestingly, the two time dummy variables Before lawsuits and After lawsuits are also significant at −2.98% and −4.47%, respectively. When we interact the two time dummies with the Agent, we find that the coefficients on the two interactive terms have opposite signs. The coefficient of 3.15% on the Agent × Before lawsuits variable indicates that agent buyers enjoy smaller discounts when buying their own houses from sellers before the sellers were implicated in the lawsuits. However, when agent buyers buy houses from the distressed sellers after the law events, the agent buyers enjoy a larger discount of 5.45% compared to buying comparable houses from the average sellers.[15]

In summary, the results suggest that agent buyers are able to bargain down prices and obtain larger discounts when buying houses from weak sellers. The results are consistent with the explanation that agent buyers use information advantages to tilt their bargaining power against weak sellers such that they pay lower prices for their own house purchases relative to other non-agent buyers.

4.4. Sources of information advantage: evidence from house listings

This section investigates sources of information advantage by examining agent buyers' potential choice sets using the new listing data set. One reason that agents have information advantage is that they have better knowledge about potential houses for sale, usually through their dealings as listing agents for potential sellers. Agents will have more houses from which to choose in the listings when they consider buying houses compared to other buyers. To understand the information advantage channel, we need to know the agent buyers' choice set of houses and how they pick the house they purchase from that choice set. We collect a new house listings data set in Singapore from a proprietary source covering the period from 2010 to 2013.[16] The data set includes information on address of the houses, listing price, house size, posting date, and name of the agents posting the listing. We merge the listing data set with the resale transaction data set using the common address together with the posting date and the transaction date. We are able to merge approximately 40% of the resale transaction data to the listing data. The merging process is discussed in the Online Appendix.

We construct the agent buyers' choice set based on the agent buyers' listings for the period before they buy the subject houses. We investigate the relationship between the characteristics of houses on the agents' listings and the houses agents actually bought. In Column 1, Table 8, we define the agent buyers' choice set based on houses in the agents' listing in a 30-day period before they bought the subject houses. The coefficients on both the listing price and the days of listing (time on the market) are negative and significant, which suggest that the agent buyers choose houses with a lower listing price and with a shorter time on the market after the listing.[17] The magnitude is small; agents choose houses approximately 0.50% lower in listing price, which is the equivalent of approximately 20% of the agent discounts to the transaction prices. In Column 2, we use the sample listings of the agent buyer in the window of 90 days before they buy the subject houses and find the same results that agent buyers choose houses with a shorter time after listing and with a lower listing prices. In Columns 3 and 4, we add the agent buyers' listings after they have bought the houses into the choice set and conduct the same analyses. We find the same patterns in the results, which suggest that the agent has information advantage because they can pick cheaper houses in the listings for their own housing purchases.

To test whether agents have information advantage over nonagent buyers, we conduct a counterfactual analysis

[15] We truncate transactions that occur outside a three-year window before and after law events to minimize possible distortions caused by other unobserved extraneous factors. The results based on the truncated sample are largely consistent with the earlier results. In addition, we sort the events by type into five different categories, including car accident, sale of goods, credit card, tenancy and bankruptcy, and run the log-total housing price model using only resale housing transactions for the full sample periods. We also run the regressions using only the six-year truncated sample period that is three years before and three years after the occurrence of the law events. The results are largely robust and consistent.

[16] The data set covers the electronic listing records found in all the major electronic portals used by listing agents in Singapore, which include PropertyGuru, 99.Co, SRX, and others, and the sample listings are large and representative of the available listings in the housing market in Singapore.

[17] There is another possible explanation for shorter time on market for the agent buyers. Agents might be more likely to buy houses off the market and then put the houses on the listings before the closing to provide a comparison for other houses in the local areas. Due to the data limitations, we are not able to test the possible.

Table 8
Choice set based on the listing data: agent buyer and nonagent buyer.
This table shows results of OLS regression analysis. The dependent variable is a binary variable has a value of one, if the house is transacted. The agent buyers' choice set based on the listing they represent before and after they buy houses. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Agent buyer's choice				Nonagent buyer's choice (same day match)			
Choice sample	Listing date within 30 days before transaction date	Listing date within 90 days before transaction date	Listing date within 30 days before and after transaction date	Listing date within 90 days before and after transaction date	Listing date within 30 days before transaction date	Listing date within 90 days before transaction date	Listing date within 30 days before and after transaction date	Listing date within 90 days before and after transaction date
Dependent variable	House bought =1				House bought =1			
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(Listing price)	−0.0050*	−0.0033***	−0.0095***	−0.0047***	0.0002	−0.0004	0.0015	−0.0013
	(0.0030)	(0.0013)	(0.0032)	(0.0012)	(0.0030)	(0.0022)	(0.0035)	(0.0021)
Log(Days from listing to transaction)	−0.0169***	−0.0112***	−0.0120***	−0.0089***	−0.0071***	−0.0097***	−0.0019	−0.0105***
	(0.0025)	(0.0009)	(0.0021)	(0.0007)	(0.0025)	(0.0014)	(0.0022)	(0.0011)
Intercept	0.1246	−0.3503***	0.1243	−0.3691***	1.0052***	1.0746***	0.2724	1.0655***
	(0.1718)	(0.0465)	(0.2382)	(0.0552)	(0.2169)	(0.2125)	(0.1767)	(0.1551)
Socioeconomic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Housing variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Person fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5127	14,024	6719	19,933	6029	12,119	7917	19,044
R-squared	0.3972	0.4825	0.4114	0.4927	0.9327	0.9158	0.9249	0.9015

Table 9
Information advantage of real estate agent over weak seller.
This table shows results of OLS regression analysis. The dependent variables are defined in the top row of the table. "Log(TOM)" is log-time on the market, where time on the market is defined by the days from listing date to transaction date. "Log(Listing price)" is log-listing price of houses. "Bargaining power" is defined by log difference between the transaction price and the listing price. "Performance1 of seller's representative agent" is the number of house he/she represent over a year in our listing data. "Performance2 of seller's representative agent" is the number of house he/she represent over a year in our transacted data. "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample	Public sample				
Dependent variable	Log(TOM)	Log(Listing price)	Bargaining power	Performance1 of seller's representative agent	Performance2 of seller's representative agent
Model	(1)	(2)	(3)	(4)	(5)
Agent	−0.4614***	−0.0127	−0.0179**	−0.0821	−0.1789
	(0.1147)	(0.0212)	(0.0088)	(0.0846)	(0.1491)
Log(TOM)		0.0001	0.0130***		
		(0.0041)	(0.0017)		
Log(Listing price)	0.0019		−0.1246***		
	(0.1198)		(0.0088)		
Bargaining power	2.2135***	−0.7154***			
	(0.2829)	(0.0504)			
Weak seller	−0.3319	0.0032	0.0175	−0.2322	−0.2031
	(0.2838)	(0.0522)	(0.0224)	(0.2100)	(0.3701)
Agent*Weak seller	−1.3064	−0.2437	0.0091	−0.0894	−0.2686
	(1.2903)	(0.2374)	(0.0717)	(0.9769)	(1.7213)
Intercept	4.0374**	12.9073***	1.5532***	0.1181	1.5085***
	(1.6011)	(0.0781)	(0.1182)	(0.3141)	(0.5534)
Socioeconomic variables	Yes	Yes	Yes	Yes	Yes
Housing variables	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	2102	2102	2102	2175	2175
R-squared	0.4381	0.8193	0.2302	0.0349	0.0369

by assigning the agent buyer's choice set as the placebo choice set to the nonagent buyers. We assume that the agent buyers have larger choice set due to the nature of their work. If an agent buyer and a nonagent buyer bought houses on the same day, we use the agent buyer's choice set as a placebo choice set for the nonagent buyer. We show that agent buyers pick cheaper houses from their choice set. Given that the nonagent buyers are assigned the same placebo choice set, and if agent buyers have information advantage over nonagent buyers, we should observe that nonagent buyers buy houses with the same price in the placebo choice set. From Columns 5 to 8 in Table 8, we find that nonagent buyers buy their houses with the same prices as the prices in the placebo choice set. Therefore, from the same listing set, agent buyers are able to choose a lower listing price compared to nonagent buyers. The results suggest that one source of information advantage comes from the choice set of houses in the agents' listings. Agent buyers make a better choice by choosing houses with lower listing prices, whereas nonagent buyers do not have that information in making their housing choice decisions.

Based on the merged listing data, we next test the information advantages of agent buyers using three new outcomes: time on the market, listing price, and bargaining power. The time on the market is defined by the number of days between the listing date and the transaction date. Bargaining power is defined by the log difference between the transaction price and the listing price where a more negative value implies greater bargaining power of agent buyers. The results of the log-time on the market model in Column 1, Table 9 show that agent buyers choose houses that stay 46% less time on the market, which is equivalent to approximately 79 days on the market. They also choose houses with a lower listing price, but the result is not statistically significant. Interestingly, while both agent buyers and nonagent buyers are able to bargain the prices down from the listing prices, agent buyers bargain the prices down by 1.8% more from the listing prices, which is approximately 70% of the agent discounts based on the average transaction price estimated in the main results. The results suggest that agent buyers have relatively stronger bargaining power than nonagent buyers.

Why do agent buyers have stronger bargaining power than nonagent buyers? One possible explanation is that agent buyers with information advantages could bargain down the prices more easily relative to non-agent buyers. One source of information could come from the previous purchase price of the same house. The literature shows that home sellers often use the past purchase price as a reference point (Genesove and Mayer 2001). If agent buyers learn about low prices in the previous purchases, they could bargain with the seller to bring the listing price down to a level that is close to the previous purchase price.

In Singapore, real estate agents could access past housing transaction price data through either a publicly available website of the URA, a government agency in Singapore, or through the agents' own firm database. Real

Table 10
Bargaining power of real estate agents with information advantage.
This table shows results of OLS regression analysis. The dependent variables are defined in the top row of the table. "Log(previous purchase price)" is log-previous purchase price, where previous purchase price is defined as the last transaction price of building. "Log(transaction price)" is log-transaction price of houses. "Bargaining power" is defined by log difference between the transaction price and the listing price. "Agent" is a dummy variable that has a value of one, if a buyer is also an agent, and zero otherwise. The control variables in the model include housing variables using the house characteristics and socioeconomic variations using the buyer characteristics. The spatial fixed effect, which is represented by the 28 planning districts, and the transaction year fixed effects are included in the regression. Standard errors are reported in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable	Log(previous purchase price)	Log(transaction price)	Listing price premium	Bargaining power
Sample	All samples		Matched sample	
Model	(1)	(2)	(3)	(4)
Agent	−0.0212**		−0.0943	
	(0.0091)		(0.1024)	
Agent with high previous purchase price		0.0589***		
		(0.0116)		
Agent with low previous purchase price		−0.0729***		
		(0.0107)		
Agent with unknown previous purchase price		−0.0250***		
		(0.0034)		
Nonagent with high previous purchase price		0.0719***		
		(0.0030)		
Nonagent with low previous purchase price		−0.0599***		
		(0.0030)		
Agent with high listing price premium				−0.0616***
				(0.0197)
Agent with low listing price premium				0.0116
				(0.0197)
Agent with unknown listing price premium				−0.0276**
				(0.0112)
Nonagent with high listing price premium				−0.0295***
				(0.0073)
Nonagent with low listing price premium				0.0163**
				(0.0070)
Intercept	12.6857***	13.0525***	−0.3550	−0.0151
	(0.0365)	(0.0130)	(0.3635)	(0.0338)
Socioeconomic variables	Yes	Yes	Yes	Yes
Housing variables	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes
Observations	14,440	105,929	556	2175
R-squared	0.6702	0.7875	0.1077	0.1394

estate agents acquire information advantages via their dealings in the market and interaction with other agents and sellers/buyers, and that information gives agents an edge over nonagents in identifying and buying houses at bargain prices. This explanation, if not rejected, predicts that agent buyers have stronger bargaining power and obtain more price discounts when buying houses with relatively low prices in the previous sales. We test the prediction and report the results in Table 10. In Column 1, we find that agent buyers are more likely to choose houses with low prices in the previous sales compared to nonagent buyers. In Column 2, we define a house as having a high previous purchase price if the previous purchase price was above the median purchase price in our sample. We find that agent buyers enjoy 7.3% discounts when buying houses with a low previous purchase price. By contrast, nonagent buyers only enjoy a 6% discount when buying similar houses. Agent buyers enjoy larger discounts when they buy houses with low prices in previous sales. In Columns 3 and 4, we define the listing price premium as the difference between the listing price and the previous purchase price using the merged listing data. When the listing price premium is high, buyers are likely to have large bargaining power. We find that both agent buyers and nonagent buyers have large bargaining power when the listing price premium is high. They can bargain down the price by 6.2% and 3.0%, respectively. Agent buyers have greater bargaining power for houses with high listing price premiums. The results imply that agent buyers with information advantages in previous purchase price have stronger bargaining power.

In summary, agent discounts are likely to come from both information advantage and bargaining power, and the bargaining power story contributes more to the agent discounts in the main results. Agent buyers have information advantage over nonagent buyers, given that they have a larger choice set from which to choose and thus pick cheaper houses. Agent buyers, who are better informed of past transaction prices, are found to have stronger power in bargaining down the purchase prices on houses.

5. Conclusion

This paper extends the early empirical studies on information advantages and market distortion in the real estate brokerage industry using Singapore's real estate market

data. We merge multiple data sets from different sources, which include the registry of real estate agents (salespersons), law events, personal details with current home addresses, and the transaction records of more than 100,000 private non-landed houses in Singapore, for the periods from 1995 to 2012. With these large and unique merged data sets, we empirically test information advantages of real estate brokers/agents and sources of information advantages used by agents in buying their own houses. The empirical evidence, which derives mainly from the buy-side activities of agents, adds a new contribution to the early evidence of US studies that use data from the sale-side activities. We find strong evidence to suggest that real estate agents exploit information advantages when buying houses for their own use and that they pay approximately 2.54% less for their houses relative to comparable houses bought by nonagent buyers. We conduct various robustness tests using the repeat sales samples and the matched samples derived from the PSM technique, and the results remain robust and consistent.

We find that agent buyers have more information advantages in a less informative environment, and high ability agent buyers have even more information advantages. Given the asymmetries in information, we also find that nonagent sellers (buyers) are less likely to trade with agent buyers (agent sellers) who are well informed. In equilibrium, there is a segmentation in the market where agent sellers are more likely to sell to agent buyers. These results are consistent with the predictions of information asymmetries in Garmaise and Moskowitz (2004) and Levitt and Syverson (2008).

We further investigate sources of information advantage and show that agent discounts come from both extensive margin (cherry picking) and intensive margin (bargaining power of agent buyers). We show stronger evidence supporting the bargaining power story relative to the cherry picking story in explaining the agent discounts. Agent buyers use their information advantage from their choice set of houses to cherry pick cheaper houses relative to nonagent buyers. Information advantage gives greater bargaining power for agent buyers to buy their own houses at lower prices relative to other nonagent buyers. The results contribute to the literature by showing that real estate agents with special knowledge could tilt bargaining power to their favor and cause price distortion in the real estate market. Our findings also contribute to the broader literature that examines the role of financial intermediaries in the markets subject to information asymmetries.

References

Agarwal, S., Ambrose, B., Yao, V., 2017. The Effects and Limits of Regulation: appraisal Bias in the Mortgage Market. National University of Singapore, Pennsylvania State University, and Georgia State University Unpublished working paper.

Agarwal, S., Ben-David, I., Yao, V., 2015. Collateral valuation and borrower financial constraints: evidence from the residential real estate market. Manag. Sci. 61, 2220–2240.

Agarwal, S., Choi, H.-S., He, J., Sing, T.F., 2019. Matching in Housing Markets: The Role of Ethnic Social Networks. The Review of Financial Studies.

Agarwal, S., Song, C., Yao, V., 2017a. Banking Competition and Shrouded Attributes: evidence from the US Mortgage Market. Georgetown McDonough School of Business Unpublished working paper.

Agarwal, S., Song, C., Yao, V., 2017b. Relational Contracts, Reputational Concerns, and Appraiser Behavior: Evidence from the Housing Market. Georgetown McDonough School of Business Research Unpublished working paper.

Allen, M., Rutherford, J., Rutherford, R., Yavas, A., 2016. Conflicts of Interest in Residential Real Estate Transactions: new Evidence. Florida Gulf Coast University, University of South Florida, and University of Wisconsin, Madison Unpublished working paper.

Barbon, A., Di Maggio, M., Franzoni, F., Landier, A., 2017. Brokers and Order Flow Leakage: Evidence from Fire Sales. Harvard Business School Unpublished working paper.

Bernheim, D., Meer, J., 2013. Do real estate brokers add value when listing services are unbundles? Econ. Inquiry 51, 1166–1182.

Di Maggio, M., Kermani, A., Korgaonkar, S., 2015. Deregulation, Competition and the Race to the Bottom. Columbia Business School and University of California, Berkeley Unpublished working paper.

Di Maggio, M., Franzoni, F., Kermani, A., Sommavilla, C., 2017. The Relevance of Broker Networks for Information Diffusion in the Stock Market. Harvard University Unpublished working paper.

Garmaise, M., Moskowitz, T., 2004. Confronting information asymmetries: evidence from real estate markets. Rev. Financ. Stud. 17, 405–437.

Genesove, D., Mayer, C., 2001. Loss aversion and seller behavior: evidence from the housing market. Q. J. Econ. 116, 1233–1260.

Giglio, S., Maggiori, M., Stroebel, J., 2015. Very long-run discount rates. Q. J. Econ. 130, 1–53.

Hendel, I., Nevo, A., Ortalo-Magné, F., 2009. The relative performance of real estate marketing platforms: MLS versus FSBOMadison.com. Am. Econ. Rev. 99, 1878–1898.

Levitt, S., Syverson, C., 2008. Market distortions when agents are better informed: the value of information in real estate transactions. Rev. Econ. Stat. 90, 599–611.

Rutherford, R., Springer, T., Yavas, A., 2005. Conflicts between principals and agents: evidence from residential brokerage. J. Financ. Econ. 76, 627–665.