

The Role of Agents in Fraudulent Activities: Evidence from the Housing Market in China[†]

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Abstract

This study examines the role that agents play in fraudulent activities in the housing market in China. We find that the learning-by-doing and peer effects jointly contribute to explaining agents' tax evasion behavior and agents can learn the monitoring capability of local tax authorities. By exploiting two policy shocks, we show that experienced agents create more tax evasions in the presence of loosening financial constraints, and *vice versa*. We also show that agents' experience becomes critical when buyers face controversial considerations between registering higher prices to borrow more from the bank and registering lower prices to evade taxes.

Keywords: Tax evasion, agency problem, housing market interventions, housing market

JEL Code: R21, R28, H26, R31

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The Role of Agents in Fraudulent Activities: Evidence from the Housing Market in China

Abstract

This study examines the role that agents play in fraudulent activities in the housing market in China. We find that the learning-by-doing and peer effects jointly contribute to explaining agents' tax evasion behavior and agents can learn the monitoring capability of local tax authorities. By exploiting two policy shocks, we show that experienced agents create more tax evasions in the presence of loosening financial constraints, and *vice versa*. We also show that agents' experience becomes critical when buyers face controversial considerations between registering higher prices to borrow more from the bank and registering lower prices to evade taxes.

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1 Introduction

Agents are contracted to facilitate transactions in various business activities, such as investment management (Dvořák, 2005), insurance service (Eckardt and Rätthke-Döppner, 2010), and real estate transaction (Levitt and Syverson, 2008; Agarwal et al., 2019). However, agents have been criticized for problems of moral hazard and conflicts of interest. For instance, agents promote high-priced products rather than suitable products to clients and encourage frequent transactions to earn higher commissions (Mehran and Stulz, 2007; Bolton et al., 2007). Market expertise and information advantage allow agents to buy their own houses at lower prices (Agarwal et al., 2019) and sell their own houses at higher prices (Levitt and Syverson, 2008). Although the principal-agent problem has been widely discussed in the literature, limited evidence on agents' fraudulent behaviors and illegal practices has been presented due to the lack of microdata. This study fills this literature gap by answering three questions: Do agents facilitate fraudulent activities? If so, what are the underlying mechanisms? What are the unintended consequences caused by agents' involvement in those fraudulent activities when government takes measures to control property market?

The real estate market, which raises a substantial amount of tax revenue due to the large transaction value, attracts various forms of fraud (Ben-David, 2011; Carrillo, 2013). Using China's resale housing market as an experimental laboratory, we investigate agents' involvement in a fraudulent and illegal practice, tax evasion, which prevails in the housing market. Tax evasion is a prevalent phenomenon that involves dishonest tax reporting - such as declaring less income, profit, or gain, than the amounts earned, or overstating deductions (Slemrod, 2007). In China's resale housing market, a common but illegal practice is that a buyer and a seller agree to sign a *Yin-Yang* contract to pay fewer taxes. *Yin* contract shows the real transaction price of the properties. *Yang* contract is divided into two categories: under-reporting to pay fewer taxes or over-reporting to get higher mortgages. The prevalence of *Yin-Yang* contract has created many problems, such as frequent disputes between sellers and buyers, and a downward biased housing price index that misleads the public. Although anecdotal evidence of agents' unethical role in *Yin-Yang* contracts is ample, academic evidence is scant due to the lack of microdata. Thus, it is essential to examine the determinants of the *Yin-Yang* contracts and the magnitude of tax evasion, and to assess the impact of real estate agents on forming *Yin-Yang* contracts.

We examine the impact of agent involvement on the magnitude of tax evasion using a novel and comprehensive transaction data provided by the largest real estate brokerage firm in China. The study takes advantage of the unique strength of the data to address several questions that are not well understood in the existing literature: 1). we have the precise information of the actual transaction prices agreed by both parties and the registered prices

submitted to tax authorities, which allows us identify *Yin-Yang* contracts; 2). the data contains exceptionally detailed information on the real estate agents, buyers, sellers, and properties, which provides us with a valuable opportunity to study agents' role in forming *Yin-Yang* contracts; 3). the sample covers a long period from January 1, 2014, to June 1, 2017, therefore we can study the role of agents in tax evasion using several exogenous policy shocks. We can deal with the confounding bias caused by bundled policies, which is not addressed in the existing studies in this area.

Specifically, we find that around 97% of the transactions are involved in *Yin-Yang* contracts, with an average registered price reported 32% below the actual price. Most importantly, we find that the inclusion of agent fixed effect leads to a 37.4% percentage points increase in the explanatory power for the variation in register-actual price ratio, which provides evidence that agents affect the severity of *Yin-Yang* contracts. Our main specification controls for a rich set of control variables, including static characteristics of properties, buyers, sellers, and agents. We find that the level of tax evasion is negatively associated with mortgage issuance and the holding periods of a property, as well as the participation of elder sellers and younger buyers.

We then attempt to explore how the involvement of real estate agents affects tax evasion. Our analysis offers two mechanisms: the learning-by-doing effect and the peer effect, and both are identified as ways through which agents gain information and acquire tax evasion tactics. First, we demonstrate agents' learning-by-doing effect by showing that a 100% increase in number of past transactions leads to a 4.4 percentage points decrease in average registered-actual price ratio, which can be translated into CNY 186,335 in total transaction price. Second, we find that agents can learn the monitoring distance of local tax authorities through their cumulative experience and then discreetly register lower prices. Moreover, using the instrumental variable approach, we identify agents' peer effects: a 100% increase in the average registered-actual price ratio of peers cause an agent's registered-actual price ratio to increase by 59.5 percentage points. Notably, the peer effects do not take away the explanatory power of the learning-by-doing effect, suggesting that the learning-by-doing and peer effects jointly contribute to explaining agents' tax evasion behavior.

Moreover, we study the economic consequences of agents' involvement using two plausibly exogenous housing policies introduced on March 30, 2015, and September 30, 2016 (see the details in Section 2.2). The difference-in-differences analysis highlight three key implications: 1). agents do not affect tax evasion when a buyer's only consideration is to minimize tax payments; 2). experienced agents contribute to creating more tax evasion in the presence of a reduction in minimum down-payment requirement, and *vice versa*; 3). agents' experience is essential when buyers face a trade-off between registering a lower price to evade taxes and registering a higher price to borrow more from the bank.

Our results survive a battery of robustness checks, including tests on parallel pre-trend assumption and falsification tests using alternative placebo policy dates. In addition, the heterogeneity tests show that the learning effects are salient for transactions with mortgages and the peer effects of real estate agents are more prominent in larger branches. Male agents are more aggressive in producing *Yin-Yang* contracts.

The study contributes to three strands of literature. First, our study contributes to the literature on agents' behavior. Agents are usually hired for their expertise and specialized knowledge, as well as their developed relationships with different parties (Levitt and Syver-son, 2008; Benjamin et al., 2009; Eckardt and R athke-D oppner, 2010; Barwick and Pathak, 2015; Agarwal et al., 2019). However, hiring agents may suffer the "principal-agent problem" if an agent's incentive is not aligned with clients, especially when the agent's actions are difficult to be monitored. Mehran and Stulz (2007) and Bolton et al. (2007) document the problem of conflict of interests that financial intermediaries do not recommend products that best suit customers' needs. Levitt and Syverson (2008) and Agarwal et al. (2019) document that real estate agents strategically sell (buy) their own properties higher (lower). Kurlat and Stroebel (2015) document that agents use their information advantages in the housing market to maximize their own benefits. Barwick and Pathak (2015) document that consumers barely benefit from agents in the housing market.

Second, our findings add to the tax evasion literature (Fisman and Wei, 2004; Marion and Muehlegger, 2008; Chetty, 2009; Merriman, 2010; Balafoutas et al., 2015; Artavanis et al., 2016; Agarwal et al., 2020). Keen et al. (2015) estimate that global tax evasion amounts to 5% of the global economy. Tax evasion has been revealed in various situations, such as car imports (Fisman and Wei, 2004), income reporting (Chetty, 2009; Artavanis et al., 2016), diesel fuel purchasing (Marion and Muehlegger, 2008), non-uniform tax-rates (Merriman, 2010), and the residential resale market (Dai and Xu, 2018; Agarwal et al., 2020). Fan et al. (2019) investigate the misreporting behavior in response to the housing transaction tax in Shanghai and Dai and Xu (2018) study the relationship between control measures and tax evasion in Beijing's housing market. Our study focuses on the role of intermediaries in aiding tax evasion and is most closely related to Agarwal et al. (2020), which show that the tax evasion gap increases with the capital gains tax in China's residential resale market.

Third, our study relates to the learning literature. A considerable amount of studies shows that learning from prior experience gains information and improves performance (Nadler et al., 2003; Barkema and Schijven, 2008; Van Nieuwerburgh and Veldkamp, 2009). Feng and Seasholes (2005) show that investor sophistication and trading experience alleviate the disposition effect. Benjamin et al. (2009) show that an agent's earning increases with his/her experience. Barwick and Pathak (2015) present that an agent's productivity significantly relies on his/her experience. This study contributes to this strand of literature by providing

valuable evidence that experienced agents involve in more severe tax evasion activities than their rookie peers.

The main contribution of this paper is that we identify the role of agents play in a fraudulent activity, tax evasion, in the housing market. The results suggest that agents learn from their own working experience and are significantly affected by their peers. Moreover, we isolate the causal effects of different policy changes on tax evasion behaviors, an area that has not been properly addressed by existing studies. The analysis can help researchers and policy makers to understand better the existence and the causes of *Yin-Yang* contracts in the housing market. To the best of our knowledge, this is one of the first attempts to present a systematic empirical analysis on agents' fraudulent and illegal behaviors. Our empirical findings on agents' involvement in tax evasion in the housing market also provide important policy implications for regulating intermediaries in various industries.

The remainder of the article is organized as follows. Section 2 presents a background of the *Yin-Yang* contracts and policy interventions in the housing market in China. The data and summary statistics are presented in Section 3. Section 4 presents the empirical methodology and results, followed by the heterogeneity and other tests in Section 5. Section 6 concludes.

2 Background

2.1 *Yin-Yang* Contracts in the Housing Market

In China's real estate market, a real estate agent typically works as a dual agent, representing both the buyer and the seller in a real estate transaction. A home seller first posts a listing through a broker firm, which hires many real estate agents with expertise and specialized knowledge in the local housing market. A real estate agent searches for potential home buyers in their client pool and matches a seller, while also promises the potential home buyer that transaction prices are minimized. Agents who are well informed about the market also convince sellers to sell their houses as fast as possible. Thus, a real estate agent plays a crucial role as a conduit between buyer and seller in the secondary housing market.

Besides, a large amount of anecdotal evidence points out that real estate agents in China significantly affect the formation of *Yin-Yang* contracts. To expedite a transaction, agents usually suggest a *Yin-Yang* contract to help the buyers and sellers to avoid high tax payments: *Yin* contract stating the actual price is kept under the table, while *Yang* contract under-reporting the actual price is submitted to a registration office to evade taxes. This process can reduce the property transaction taxes for a buyer, and lower the capital gains levies for a seller.

Although such *Yin-Yang* contracts—in which real and fake agreements operate jointly to enable the parties to evade tax—are illegal, they remain widespread in China’s housing market (Agarwal et al., 2020). Buyers are keen to cooperate because they eventually bear all the costs involved in a property transaction, including the tax supposed to be paid by the seller. The additional tax burden has been reflected in the transaction price and transferred from sellers to buyers. Therefore, a buyer faces a trade-off of under-reporting the price to pay fewer taxes and over-reporting the price to achieve a higher loan. For home buyers without financial constraints, or those without mortgages, the only consideration would be to report a lower price to evade taxes. Sellers are willing to cooperate to ensure a smooth transaction.

A large amount of anecdotal evidence has shown that the prevalence of *Yin-Yang* contracts distorts property prices and leads to disputes between sellers and buyers because the official record of housing prices no longer provides a reliable and accurate measure of the fair value of a property. Local housing authorities have realized the problem and introduced specific policies and stringent monitoring guidelines in many cities in China. On January 20, 2011, the Ministry of Housing and Urban-Rural Development, the National Development and Reform Commission, and the Ministry of Human Resources and Social Security jointly circulated the “Real Estate Brokerage Administration Measures,” which came into effect on April 1 of the same year. According to the “Real Estate Article 25 (5) and Article 37 of the “Real Estate Brokerage Administration Measures,” *Yin-Yang* contracts is illegal and real estate brokerage firms are prohibited from facilitating the *Yin-Yang* contracts for tax evasion purposes. For any violation of the articles, an individual agent shall be imposed a fine of 10,000 yuan, and a brokerage shall be imposed disqualification and a fine of between 10,000 and 30,000 yuan.

However, even under these stringent regulations, we find the *Yin-Yang* contracts, which on average, report only 68% of the actual transaction price, still prevail the market (Figure 1). One may wonder why the local governments knew the prevalence of the *Yin-Yang* contracts but do not strictly enforce the measures to reduce such tax evasions. Although this question is beyond the scope of the study, a possible explanation has been revealed in the existing studies (Wang and Hui, 2017; Dai and Xu, 2018; Fan et al., 2019; Agarwal et al., 2020). That is, local governments rely heavily on land sales revenues and thus are reluctant to cool down down the housing market. Thus, local governments have little incentive to reduce such tax evasion caused by *Yin-Yang* contracts.

[Figure 1 inserted here]

In principle, due diligence procedures should be carried out by tax authorities to prevent tax evasion. More specifically, tax authorities should check whether a registered price is realistic when receiving a property transaction contract. The registered price shall be rejected

when it is below the guideline price, which is not released to the public and updated from time to time. Therefore, it is important to investigate the role of real estate agents in forming *Yin-Yang* contracts. We propose the hypothesis that market expertise and information advantage enable agents to advise the buyers/sellers an acceptable price as close as to the minimum guideline price and an experienced agent can estimate the minimum guideline prices set by the local housing authorities.

2.2 Two Policy Shocks in the Housing Market

The Chinese government has been implementing various housing policies since 2010, such as purchase restrictions, financing constraints, and housing transaction taxes, in response to the nationwide rapid housing-price appreciation (Wu et al., 2012; Fang et al., 2016; Somerville et al., 2019). Figure 2 summarizes the details of the policies in the housing market announced by the central government from 2010 to 2017. Agarwal et al. (2020) exploit a policy shock that implemented on March 30, 2013 and differentially increased capital gains taxes for housing units with holding period less than 5 years and document the existence of tax evasion. Our study adds to the existing knowledge by examining two policy shocks on March 30, 2015 and September 30, 2016 to understand the changes of agents' behavior in tax evasion.

[Figure 2 inserted here]

On March 30, 2015, the People's Bank of China and the Ministry of Finance issued Decree No. 98 [2015] and Decree No. 39 [2015] to lower the minimum down payment for a second home from 70% to 40% and cancel the sales tax (5.6% of the total transaction price) for homes transacted after a two-year holding period. The policy was issued by the People's Bank of China and the Ministry of Finance, titled "Notice on Issues Concerning Individual Housing Loan Policies", and "Notice on Adjusting the Business Tax Policies on Individual Housing". Obviously, the policy of March 30, 2015 is a bundled policy that includes two types of policy measures: reduction of transaction tax and decrease of minimum down payment. The bundled policy induces mixed predictions on the policy impact on *Yin-Yang* contracts because, on the one hand, the lower tax rate would reduce buyers' incentive to report lower prices to evade taxes; on the other hand, the reduction in down-payment would have differential impacts on buyers with different levels of financial constraints. More specifically, some cash buyers would choose to issue mortgages after the reduction of down-payment, which decreases their incentive to evade taxes; buyers who have mortgages could report lower prices to get the same amount of loans, which increases their incentives to evade taxes (see the example listed in footnote 15). Therefore, in order to understand agents' role in tax evasion and to analyze the unmeasured confounding factors in the existing studies, it is important to separate the impact of tax changes from the impact of down payment

changes.

On September 30, 2016, the central government issued another Decree No. 46 [2016] to modify home financing constraints. The policy raises the minimum down payment from 30% to 35% for a first home purchase, from 40% to 50% for a second home, and 70% down payment for homes not defined as ordinary property. The increase of minimum down payment requirement is expected to reduce the mortgage buyers' incentives to report a lower transaction price.

3 Data and Summary Statistics

We collect micro-level housing transaction data from the largest real estate brokerage firm, which has 120,000 employees and more than 6,000 branches in over 25 cities in China. The data we use consists of 299,115 home sales in the secondary market of Beijing from January 1, 2014, to June 1, 2017. In the previous study, Agarwal et al. (2020) document the pervasive tax evasion in the China by first utilizing the micro-level data from Beijing and then generalize the analysis to all the 35 major cities between January 2013 and September 2013 in China. In this study, we extend the sample period to 2017 to study the role of agents in tax evasion and their behavioral responses to two policy shocks. Our dataset contains rich information not only on properties, buyers and sellers, but more importantly, on agents. It provides us a unique opportunity to investigate the role of intermediaries in aiding tax evasion, a question that has never been addressed in the existing studies. Although our main analysis only uses data from Beijing, it is reasonable to assume that agents in Beijing would behave indifferently from agents in other major cities in China, thus our dataset contains representative samples of housing transactions. Figure 3 presents the geographical distributions of resale transactions and the real estate agency branches, as well as real estate registration offices in 13 administrative districts in Beijing.

[Figure 3 inserted here]

Specifically, the data has numerous strengths. First, the data contains exceptionally detailed information on the real estate agents, including their demographics (gender and age), portraits, and total completed transactions until September 2018. In particular, since the data provides a full sample of transaction records for every agent from the largest real estate agency in China, we can calculate an agent's experience before a specific transaction. For instance, if an agent i has completed 50 transactions before September 30, 2018 and 10 transactions took place between January 1, 2015 and September 30, 2018, then agent i 's experience on a specific transaction on January 1, 2015 is 40. Rich information on real estate agents offers us a valuable opportunity to study agents' involvement in tax evasion.

Second, the data provides detailed information about the listed and transacted proper-

ties, including the address, housing characteristics (story, unit size, number of bedrooms, number of living rooms, and number of bathrooms), number of visits before being sold, listing price, sale price, type of financing (mortgage or cash), holding periods since the last transaction date (below two years, two-to-five years, and over five years), and key dates regarding the home sales (such as the listing date, number of days on the market, and contract date). Of particular importance is that more than half of the data (179,580 transactions) includes additional information that is available only to the brokerage firm, such as the registered price, which is submitted to the government agency for tax reporting purposes. Moreover, with the precise information on registered price, we are able to compare it with the transaction price and examine the existence of *Yin-Yang* contract and the magnitude of tax evasion. We identify a contract to be a *Yin-Yang* contract if the registered price is lower than the actual transaction price. The magnitude of tax evasion is precisely measured by the registered-actual price ratio, with a lower ratio corresponding to a more significant evasion of tax.

Third, the data provides information on both buyers and sellers, including gender, age, and place of birth. The data contains the first six digits Citizen Identity number of clients. The first six digits are an address code pinpointing the place of birth. The first two digits of the Citizen Identity Number represent the province, the next two digits indicate the city, and the final two digits stand for the district or county. A buyer (seller) is classified as a local buyer (seller) if the first two digits of his/her ID numbers are 11, which refer to Beijing. As the sale of a house is a typical case that creates strategic interactions between a seller, an agent (if any), and a set of potential buyers, it is of great interest to examine the effects of participants' behaviors on the tax evasion. The data, however, does not cover new sales in the primary market and does not cover homes that are not sold in private sales without the assistance from real estate agents.

Figure 4 presents the unconditional relationships between agents' experience and the outcome variables used in the study. The figure provides some suggestive evidence that transactions with more experienced agents tend to have a lower registered price, more severe tax evasion, and fewer days-on-market.

Table 1 presents the summary statistics for key variables in the data. Panel A reports the transaction information. The registered price is one third lower than the actual transaction price, pointing to the severeness of *Yin-Yang* contracts and tax evasion in the secondary housing market. Accordingly, the registered-actual price ratio decreases with the evasion gap and averages at 0.68, and results are consistent with the findings in Agarwal et al. (2020). *YinYang* takes the value of 1 if the registered price is lower than the actual price. Panel A also shows that 85% of sales have mortgage loans.

[Table 1 inserted here]

Panel B presents the summary statistics of housing attributes. The average days-on-market is around 20 days, and the average size is 85 square meters (sq.m). Panel C, D, and E respectively report the demographic characteristics of agents, buyers, and sellers. Agents have 21.28 total transactions on average as of 2018, and 3.83 transactions on average upon each deal. The average age for agents, buyers, and sellers is 26, 36, and 47, respectively. 72% of agents are male, while the gender distributions among buyers and sellers are quite even. Concerning the information on place of birth, 36% of buyers and 56% of sellers are local. Panel F presents other information. The sample covers 6,195 housing projects and 15,802 agents. Around two-thirds of the houses are held for over five years since their last transactions.

[Figure 4 inserted here]

4 Methodology and Results

4.1 The Role of Real Estate Agents

We begin the analysis by examining the determinants of tax evasion using the classic hedonic pricing model (Rosen, 1974). The specifications are given as follows:

$$Y_{i,j,t} = \alpha + \beta * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \epsilon_{i,t}, \quad (1a)$$

$$Y_{i,j,t} = \alpha + \beta * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \lambda_{agent} + \epsilon_{i,t}, \quad (1b)$$

where i, j, t indexes the transaction, the housing project, and the transaction date, respectively. The dependent variable $Y_{i,j,t}$ includes the logarithmic actual unit price, logarithmic registered unit price, and the registered-actual price ratio. X is a vector consisting characteristics of properties, buyers, and sellers, which are summarized in Table 1. Housing project fixed effect (denoted by θ_j) is included to eliminate the unobserved heterogeneity, such as location, quality, brand, and etc., across housing projects. Fixed effects for days of the week (γ_{day}) and year-month (δ_{ym}) are included to absorb the effects from time trend and seasonality. The standard errors are clustered at the project level.

Notably, our identification strategy exploits agents' impact on measures of tax evasions by examining the changes in R-square with (Equation 1b) and without (Equation 1a) agent fixed effect (λ_{agent}). Therefore, although all models include the characteristics of housings, buyers, and sellers, as well as the fixed effects of housing projects, days of the week, and year-month, we do not include any variables capturing the characteristics of agents in Table 2. The agent is deemed to have significant explanatory power on the variation of the outcome variable if the inclusion of agent fixed effect substantially increases the R^2 .

Panels A and B in Table 2 present the results without and with the agent fixed effect, respectively. We find that although the inclusion of agent fixed effect barely changes R^2 for actual price (Columns 1 and 4), adding agent fixed effect significantly increases R^2 for registered price from 0.678 (Column 2) to 0.878 (Column 5), which further leads to a 37.4 percentage points increase ($0.759 - 0.385 = 0.374$) in the explanatory power for the variation in register-actual price ratio (Columns 3 and 6). The substantial increase in R^2 for registered price and registered-actual price ratio after including the agent fixed effect suggests that real estate agents play an essential role in producing *Yin-Yang* contracts and tax evasion.

The estimated coefficients on *mortgage* are significantly and positively correlated to registered price and the ratio, implying that buyers with mortgage loans register higher prices (induce fewer tax evasions) than buyers without mortgages. For example, a coefficient of 0.094 in Column (3) suggests that properties with mortgages present a registered-actual price ratio of 9.4 percentage points higher, compared to those without mortgages. Given the average under-reporting level of 32% (i.e., the baseline registered-actual price ratio of 68%) in the sample, this is a 29.4% increase ($9.4\%/32\%=29.4\%$) in the intensive margin of under-reporting. On average, the under-reporting of the total price is $398,420$ yuan ($29.4\% * (3833250 - 2478080) = 398420$) larger for properties with mortgages than those without. However, coefficients of *mortgage* on actual transaction prices are insignificant in Columns (1) and (4), implying that the transaction price is not affected by mortgage issuance. The coefficients on decoration dummies indicate that although more luxury decoration is positively associated with the higher actual price, luxurious home decoration is not reflected in the registered price. This finding is consistent with the phenomenon that in order to evade taxes, buyers/sellers claim a significant amount to be “renovation compensation/costs”.

[Table 2 inserted here]

The results lead to the question: why do real estate agents are willing to involve in transactions with *Yin-Yang* contracts? One possible reason is that agents are incentivized to produce *Yin-Yang* contracts in order to sell properties faster because the magnitude of tax evasion (a higher ratio refers to fewer tax evasions) is negatively associated with a property’s days-on-market (see results in Appendix Table A1).

4.2 Learning-by-doing Effect

Table 3 investigates the channels through which real estate agents affect the formation of *Yin-Yang* contracts and the magnitudes of tax evasion. In particular, we study whether an agent’s experience affects tax evasion. We use the number of historical transactions of an agent upon each transaction as a proxy for an agent’s experience (or learning-by-doing effect) following the extant literature (Nadler et al., 2003; Loewenstein and Thompson, 2006; Barkema and Schijven, 2008; Reuer and Ragozzino, 2008; Knill et al., 2015; Cuypers et al.,

2017). As introduced in Section 2.1, the local tax authorities sets a minimum price as an internal guideline for previously owned properties in each region and a transaction cannot be registered if the reported price is below the internal guideline price. Therefore, reporting a price just above the internal guideline price would help clients to reduce the tax payment as much as possible. We test the hypothesis that an experienced agent could learn from their past experience to appraise the guideline price in each district.

[Table 3 inserted here]

Specifically, Panel A of Table 3 includes the number of historical transactions (indicated as $\ln(\textit{Experience})$) of an agent upon transaction i . The coefficients on $\ln(\textit{Experience})$ are significantly negative in Columns (1) to (3). The magnitude of $\ln(\textit{Experience})$ in registered price (Column 2) is 2.3 times the magnitude of $\ln(\textit{Experience})$ in actual price (Column 1), which leads to the negative coefficient in registered-actual price ratio (Column 3). The results suggest that experienced agents produce contracts with a higher level of tax evasion than their inexperienced peers. More specifically, a 100% increase in the number of transactions results in a decrease in average registered-actual price ratio by 4.4 percentage points, which is approximately 186,335 CNY ($\frac{4.4\%}{32\%} * (3833250 - 2478080) = 186335.875$). All regressions include agents' demographic characteristics, although none of them is significantly associated with tax evasion (as reflected in the registered-actual price ratio).

For a robustness check, we employ a binary measure of learning in Panel B. *First* takes the value of 1 for the first transaction of an agent, and 0 otherwise. The coefficients of *First* are significantly positive in Columns (4) to (6), with magnitude in Columns (5) being 0.04 units greater than that in Column (4), implying that the agents report higher prices to tax authorities and produce fewer tax evasions in their first-time transactions.

The results that actual transaction price decreases with agents' experience (as shown in Column 1) are in line with the findings in Levitt and Syverson (2008), which show that agents advise sellers to accept lower prices in order to facilitate faster transactions. Since the transaction price would not affect the number of previous transactions of an agent, the reverse causality is less of a concern in Table 3. We also provide additional tests to show that experienced agents sell houses faster in the cost of low transaction prices (see Appendix Table A2).

Before we dig deeper into the possible learning mechanism, we first show that local governments possess different monitoring capability on different housing projects. Coval and Moskowitz (2001) and Agarwal and Hauswald (2010) have shown that proximity facilitates monitoring and accessing to information, therefore, the physical distance serves as a standard measure of information. Therefore, in this section, we use the physical distance (indicated as *Distance*) between the local registration offices and the housing projects to proxy the monitoring capability of the local tax authorities. Figure 3 plots the geographic distribution

of the property registration offices at the district level.

The results in Table 4 show that although the estimated coefficient on $\ln(Distance)$ indicates that properties located further away from tax authority tend to be more expensive, the registered prices *do not* increase proportionally and significantly with the proximity to local tax authorities, which leads to a significantly negative estimate (-0.043) on $\ln(Distance)$ in Column 3. The results indicate that the monitoring capability of local governments decreases with the monitoring distance and the severity of tax evasion increases with the monitoring distance. This then drives us to investigate the possible learning mechanism: whether agents learn the monitoring capability of local tax authorities to help buyers/sellers to evade tax as much as possible?

[Table 4 inserted here]

We carry out the tests on learning mechanism by repeating the regressions in Table 4, but in sub-samples. The results are reported in Table 5. In each column of Table 5, we only include the k_{th} -time ($k=1, 2, \dots, 5+$) transactions of an agent. Results in Panel A show that the distance is significantly and positively correlated with the actual transaction prices, and the effects are significant in all columns. In Panel B, the coefficients on $\ln(Distance)$ is statistically significant on registered price only if the transaction is completed by a fresh agent. Coefficients on $\ln(Distance)$ are insignificantly correlated with registered price from the second transaction onwards, supporting the hypothesis that agents report the lowest “acceptable” prices to the registration offices irrespective of the actual prices of properties. In Panel C, the coefficients of monitoring distance show no statistical significance in the first two transactions, but become significantly negative from the third-time transaction onwards. The results point to a mechanism, through which agents learn about the monitoring distance of the tax authority and strategically report lower prices if the housing projects located further away from tax authorities.

[Table 5 inserted here]

4.3 Agents’ Peer Effect

Peer effects refer to externalities in which the behaviors or characteristics of peers affect an individual’s behavior (Manski, 2000; Arcidiacono and Nicholson, 2005; Bayer et al., 2009; Dahl et al., 2014). Real estate agents working in the same branch can exchange information on the internal guideline prices, discuss new listings, and update buyers and sellers’ needs. Interactions among agents within branches allow agents to exchange information and update knowledge about the local market. Therefore, it is worth examining the role of peer effects in tax evasion.

We first repeat the regressions in Table 2 by replacing the agent fixed effect with the branch fixed effect. As shown in Appendix Table A3, the statistical significance and economic

magnitudes of estimated coefficients on the control variables are similar to those in Table 2. More importantly, including the branch fixed effect significantly increases R^2 from 0.385 (Column 3) to 0.598 (Column 6), pointing to the potential impact from peers in the same branch in explaining the variation in tax evasion.

The comprehensive information on agents' transaction records enables us to explore further the peer effect, which has been difficult to identify and measure in the previous studies due to the lack of empirical data. In this study, we construct a new variable, *Ratio_of_Peers*, which is the average registered-actual price ratio of agent k 's all peers in the same branch at transaction i . Specifically, we examine whether the tax evasion of an agent k 's transaction i is affected by the tax evasion behaviors of agent k 's all peers in the same branch. Column (1) of Table 6 estimates the relationship between the an agent's tax evasion and *Ratio_of_Peers*.

The estimated coefficient on *Ratio_of_Peers* suggests a significant and positive peer effect, while the OLS estimation suffers from the reverse causality problem because agent k and k 's peers' behavior are interdependent. There are three common approaches to address the endogeneity concerns in the existing peer-effect studies (Manski, 1993; Dahl et al., 2014): 1). controlling for as many group characteristics as possible; 2). exploiting exogenous assignment to peer groups; 3). using instrumental variables that affect peer achievement but do not directly affect an agent's achievement.

[Table 6 inserted here]

To establish a causal interpretation of peer effect on tax evasion, we utilize an instrumental variable, indicated as *Tenure_of_Peers*, which affects peers' tax evasion behavior but does not directly affect agent k 's tax evasion behavior. Senior peers are agents who join the branch earlier than agent k . *Tenure_of_Peers* is equal to the average length of service (# of months) of agent k 's all senior peers in the same branch, and is exogenous to agent k 's behavior because the entries of all senior peers are pre-determined and are not inversely affected by agent k 's behavior. The peers' *Tenure_of_Peers* could significantly affect their tax evasion behaviors. The following equation estimates the first-stage effect of *Tenure_of_Peers* on *Ratio_of_Peers*:

$$Ratio_of_Peers = \alpha + \varphi * Tenure_of_Peers + \beta * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \epsilon_{i,t} \quad (2)$$

The second-stage regression is as follows:

$$Y_{i,j,t} = \alpha + \rho * Ratio_of_Peers + \beta * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \epsilon_{i,t} \quad (3)$$

The results of estimating the 2SLS are reported in Panel B of Table 6. Column (2) of Table 6 shows the first-stage estimate from Equation (2). The estimate for the correlation between *Ratio_of_Peers* and *Tenure_of_Peers*, φ , is statistically significant at the 10% level,

suggesting that the average length of service of peers is a statistically significant determinant of the magnitudes of peers' tax evasion. Column (3) shows the second-stage estimate from Equation (3). The estimate is larger than the OLS estimate in Column (1) and significantly positive at the 5% level. A 100% increase in the average length of service of agent k 's peers causes agent k 's registered-actual price ratio to increase by 59.5 percentage points. The second-stage estimation suggests that peers' causal effect is over 10 times larger than the OLS estimate of Column (1). The OLS underestimates the peer effect because the average tax evasion of agent k 's peers increases with agent k 's tax evasion, *visé versa*.

In summary, the IV estimation shows that agents can learn from their peers in constructing the *Yin-Yang* contracts. More importantly, we find that the coefficient on $\ln(\text{Experience})$ remains negative and statistically significant in Columns (1) and (3), suggesting that learning-by-doing and peer effects jointly affect the tax evasion in the housing market.

4.4 Difference-in-Differences Analysis on Two Policies

How do agents respond to different types of policies that would change buyers' incentive to evade taxes? Will agents' involvement lead to unintended consequences? Two policies introduced on March 30, 2015, and September 30, 2016 allow us to answer these questions. As stated in the Section 2.2, the policy introduced in March 2015 included both a reduction in tax rates and a relaxation on financing constraints, which is a bundle of policies that leads to mixed predictions on the incentives to evade taxes and has not been well addressed in the existing literature.

Specifically, the tax reduction would lower the incentives to create severe *Yin-Yang* contracts for properties with holding periods between two to five years. At the same time, the loosening of financial constraints would lead to two outcomes, which affect the buyers' tax evasion behavior in opposite directions. First, a lower down-payment requirement could encourage some cash buyers to issue mortgages, leading to an increase in registered price and a decrease in tax evasion. Second, a lower down-payment requirement also enables buyers with mortgage loans to report lower prices to borrow the same amount of loans, increasing tax evasion. For instance, to obtain the same amount of mortgage loan of CNY 900,000, a buyer could reduce the registered price by half, from CNY 3 million to CNY 1.5 million in the presence of a reduction of 30 percentage points in the down-payment requirement as shown in Test 2 of Table 7. In Test 2, a buyer with mortgages needs to report a total price of CNY 3 million in order to borrow CNY 900,000 from a bank before March 30, 2015 policy, while the buyer only needs to report a total price of 1.5 million yuan to borrow CNY 900,000 maximum from the bank after March 30, 2015 policy. Therefore, the definition of treatment group varies by specific design, and we summarize the treatment and control groups for each test respectively in Table 7.

We conduct two separate tests to disentangle the effects of a tax reduction policy from the effects of a down-payment reduction policy. More specifically, as shown in Test 1 of Table 7, to examine the impact of tax cuts on transaction volumes and prices, we exclude transactions with mortgage loans. The treatment group consists of properties with holding periods of 2-5 years, which enjoys a 5.5% tax cut in sales tax after the policy, and the control group consists of properties sold within two years from their last transactions, which do not subject to any tax changes. To examine the effect of changing financial constraints on tax evasion (in Test 2), we use the properties with mortgages as the treatment group, and the properties without mortgages as the control group. To be noted, the sample of Test 2 excludes properties with a 2-5 years holding period to avoid the contamination from the tax reduction policy.

[Table 7 inserted here]

The policy change in September 2016 only involved increasing the required down-payment for both first and second home purchases, therefore providing us an opportunity to study the impact of tightening financing constraints on *Yin-Yang* contracts. Buyers' mortgage-financing incentives play a crucial role in decision making when reporting the transaction prices to the government. More specifically, the maximum loan amount would decrease by 5% to 30% after the implementation of the September 2016 policy, driving the buyers to report higher registered prices and hence produce fewer tax evasions. The treatment and control groups in Test 3 are the same as those in Test 2.

In the difference-in-difference estimations, we first examine the policy impact on daily transaction volume and then study the impact on tax evasion. The specifications for transaction volume and tax evasion are given as follows:

$$Vol_{m,t} = \alpha + \beta_1 * Treat * After + \beta_2 * Treat_n + \delta_t + \epsilon_{m,t} \quad (4)$$

$$Y_{i,j,t} = \alpha + \beta_1 * Treat * After + \beta_2 * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \epsilon_{i,t} \quad (5)$$

where $Vol_{m,t}$ in Equation (4) represents the number of transactions for group m on date t . m takes the value of 1 for the treatment group, and 0 otherwise. The daily fixed effect, δ_t , is included in Equation (4). $Treat_1$ takes the value of 1 if the treatment group is defined as in Test 1; and 0 otherwise. $Treat_2$ takes the value of 1 if the treatment group is defined as in Tests 2 and 3; and 0 otherwise. $After_{2015}$ takes the value of 1 if the transaction took place after March 30, 2015; and $After_{2016}$ takes the value of 1 if the transaction took place after September 30, 2016. The other variables are defined as the same as in Equation (1). To avoid contamination from other policies and assure a long test window, the sample period for the tests of March 30, 2015 policy is from March 30, 2014 to March 30, 2016; and the sample period for the test of September 30, 2016 policy is from March 30, 2016 to May 30,

2017.

Table 8 presents the DID estimation results. The results in Column (1) show that the tax reduction policy causes the transaction volume of properties with holding periods from two to five years to increase by 38.6%, compared to properties with holding periods of less than two years. The results point to a change in preference that more people choose to purchase properties with longer holding periods, which enjoy a tax reduction after the policy. However, in Column (2), we find that tax reduction policy does not lead to less severe tax evasions as expected because buyers with full payment in cash would like to pay as little tax as possible regardless of the tax rate.

[Table 8 inserted here]

We then conduct Tests 2 and 3, and the estimated coefficients in Columns (3) and (5) suggest that the loosening of financial constraints increases the transaction volume of properties with mortgage loans by 44.8%, and that the tightening of financial constraints leads to a 13.2% reduction of transactions with mortgage loans, compared to transactions with full cash payments. Regarding the tax evasion, it is worth noting that the signs on the estimated coefficients in Columns (4) and (6) are not as expected. The significantly positive (negative) estimate in Column 4 (Column 6) suggests a composition change between the treatment and control groups. That is, the reduction in down-payment would cause a shift of cash buyers into mortgage buyers and then lead to an increase in registered-actual price ratio, and *vice versa*. More specifically, cash buyers would report the price as low as possible to the tax authority to minimize tax payments without policy changes. When the minimum down-payment reduces, some cash buyers would choose to issue mortgages. Buyers with mortgages would report higher prices to gain higher loans from the bank. The composition change conjecture is also supported by the results in Columns (3) and (5), which show that relative to the transactions via cash, the transactions via mortgage will increase under the condition of reducing down-payment requirements, and *vice versa*.

[Table 9 inserted here]

We then examine whether experienced real estate agents' involvement exacerbates the *Yin-Yang* contract problem after policy changes. Table 9 reports the results. We interact $Treat * After$ with $\ln(experience)$ to explore changes in agents' tax evasion behaviors. The estimated coefficients on $Treat_1 * After_{2015} * \ln(experience)$ in Column (2) indicate that agents *do not* affect tax evasion when a buyer's only consideration is to minimize tax payments. However, agents can play a significant role in tax evasion if a buyer needs to get a mortgage loan from a bank. As shown in Column (4), with the potential composition change from cash buyers to mortgage buyers, we observe a significantly negative coefficient on $Treat_2 * After_{2015} * \ln(experience)$. The results indicate that the transactions involving experienced agents register lower prices when down-payments are reduced, confirming that

agents' experience contribute to creating more severe *Yin-Yang* contracts after the March 30, 2015 policy. The results also point to the fact that agents' expertise becomes more important when buyers face a trade-off between registering a lower price to evade taxes and registering a higher price to borrow more from the bank.

The effect for the September 30, 2016 policy is symmetric: when down-payment increases, transactions involving experienced agents suggest higher registered prices due to an increased need for higher loans. The results are consistent with findings in Appendix Table A4, which show the impact of two policies on the extensive and intensive margins of the leverage outcomes. Specifically, the reduction in tax rates and the reduction in required down-payment in the March 2015 policy increase the percentage of buyers with mortgage loans and cause the loan-to-value ratio (LTV) to increase by 1.9 percentage points. The tightening of financial constraints in the September 2016 policy reduces the percentage of buyers with mortgage loans and the LTV ratio by 1.3 and 5.2 percentage points, respectively. In summary, the results in Table 9 provide evidence that experienced agents lead to some unintended consequences of housing policies: agents' experience contribute to creating more tax evasions under the loosening of financial constraints, and *vice versa*.

We also examine the parallel trend assumption by adding an interaction term of $Treat * Before$ to the DID specifications. *Before* is a dummy equal to 1 for the period four weeks before the policy date. The results are presented in Appendix Table A5. The interactions of $Treat * Before$ are statistically insignificant and economically indifferent from zero for all three tests, and the estimated coefficients on the interaction $Treat * Aftert$ remain consistently statistically different from zero, suggesting that the parallel trend assumption is satisfied in our DID setting.

To test for possible spurious results in time, we conduct a falsification test by using the pre-policy period as one sample period and creating a fictitious policy date during the new sample period. Doing so allows us to examine whether the DID effects merely reflect more general time patterns, either as a part of the real estate cycle or are caused by the broader macro-prudential restrictions on the housing market, which affected transactions differently. We replace the policy implementation dates with the fictitious dates, which are three months before the actual policy dates, and then repeat the estimations. The results are reported in Appendix Table A6. The interaction terms are statistically insignificant, suggesting that the policy changes trigger the changes in tax evasion.

5 Heterogeneity Tests

We conduct the heterogeneity tests of the learning-by-doing and peer effects across different types of transactions. Appendix Table A7 presents the results for the learning-by-doing

effect. More specifically, the learning-by-doing effect is significantly negative at -0.042 for transactions with mortgage loans, while bears a small and insignificant coefficient (-0.027) for transactions via cash. Also, we find that experienced male agents are more aggressively producing *Yin-Yang* contracts, while the learning-by-doing effect for female agents is insignificant.

Appendix Table A8 reports the results for the peer effect. The peer effects are statistically significant for both male and female agents, although the effects are more substantial for the former group. In the last two columns, we find that the peer effects are more prominent in larger branches. Appendix Table A9 investigates the impact of policy changes in various sub-groups based on gender and residency, and the results are statistically significant in all groups.

6 Conclusion

Although agents' information advantage and the principal-agent problem have been widely discussed in the literature, very little is known about the agent's role in fraudulent or illegal practices. This study fills the gap by answering three questions: Do agents involve in fraudulent activities? What are the underlying mechanisms? What are the economic consequences of agents' involvement in those fraudulent activities?

We use China's resale housing market, where *Yin-Yang* contract is a common but illegal practice causing substantial tax evasion, as an experimental laboratory. Although the Chinese government has devoted considerable efforts to blocking the *Yin-Yang* contract phenomenon, little progress has been made. The reason is that buyers and sellers can reach a deal privately and collude on price reporting strategy to reduce the transaction taxes and local governments have little incentive to reduce such illegal practise due to their heavy reliance on land sales revenue, As the tax authority will check whether the transaction price is plausible or not, the real estate agents, who have information advantages in the housing market, step in and suggest to the buyers and sellers an appropriate price to be reported to the tax authority. Therefore, it is worth investigating the role of agents in relation to the *Yin-Yang* contracts.

We find that agents learn from their past transactions and their peers when forming *Yin-Yang* contracts. We also examine the unintended consequences of agents' involvement utilizing two policy changes that occurred in March 2015 and September 2016. The results show that agents' experience contribute significantly to reporting lower prices to tax authorities when down-payment are reduced, and *vice versa*. Most importantly, we find that agents' experience becomes critical when buyers face controversial considerations between reporting higher to borrow more from the bank and reporting lower to evade taxes. This

study provides substantial empirical evidence on agents' fraudulent and illegal behaviors and points to the role of agents in tax evasion, which highlights severe problems for the tax administration and the administrative measures for real estate brokerage.

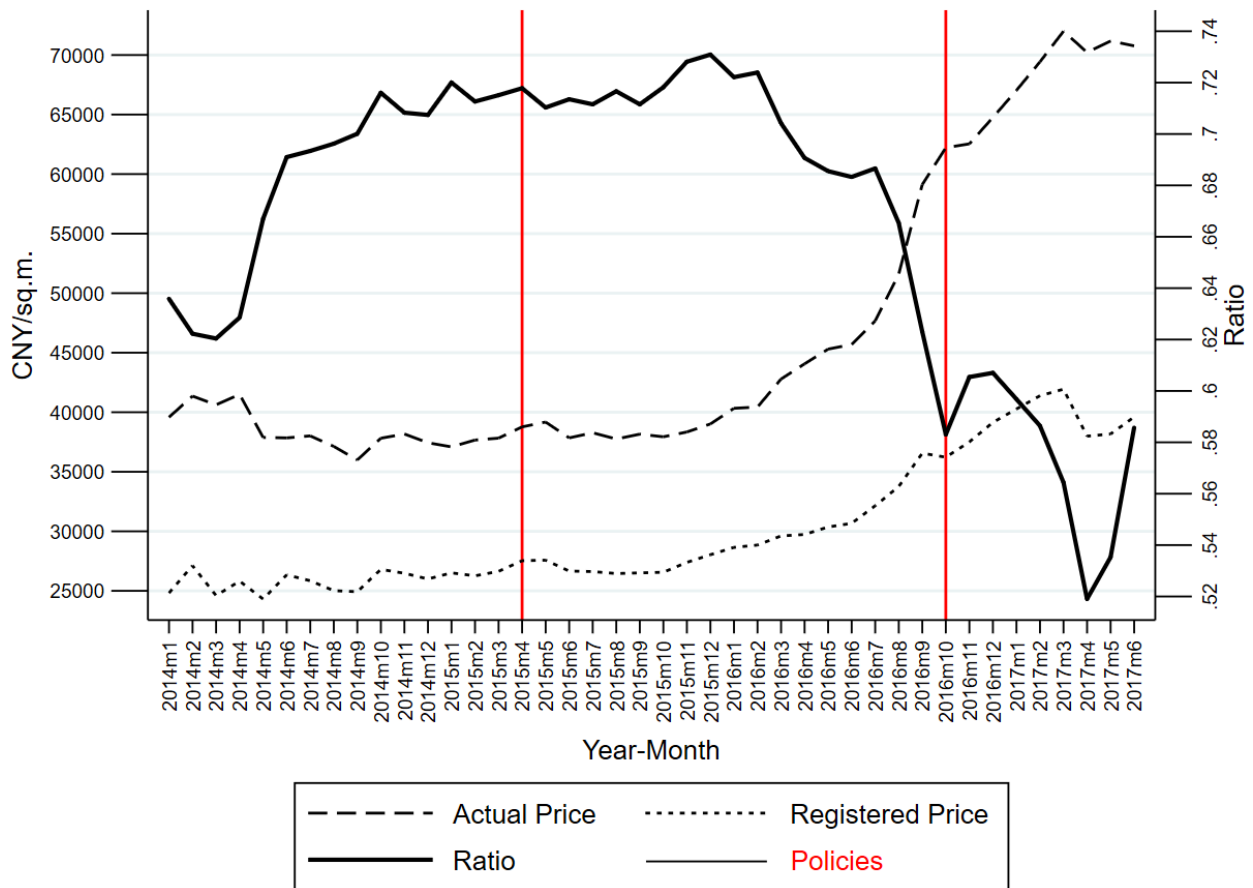
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Figure 1: The Trends of Prices and Ratio



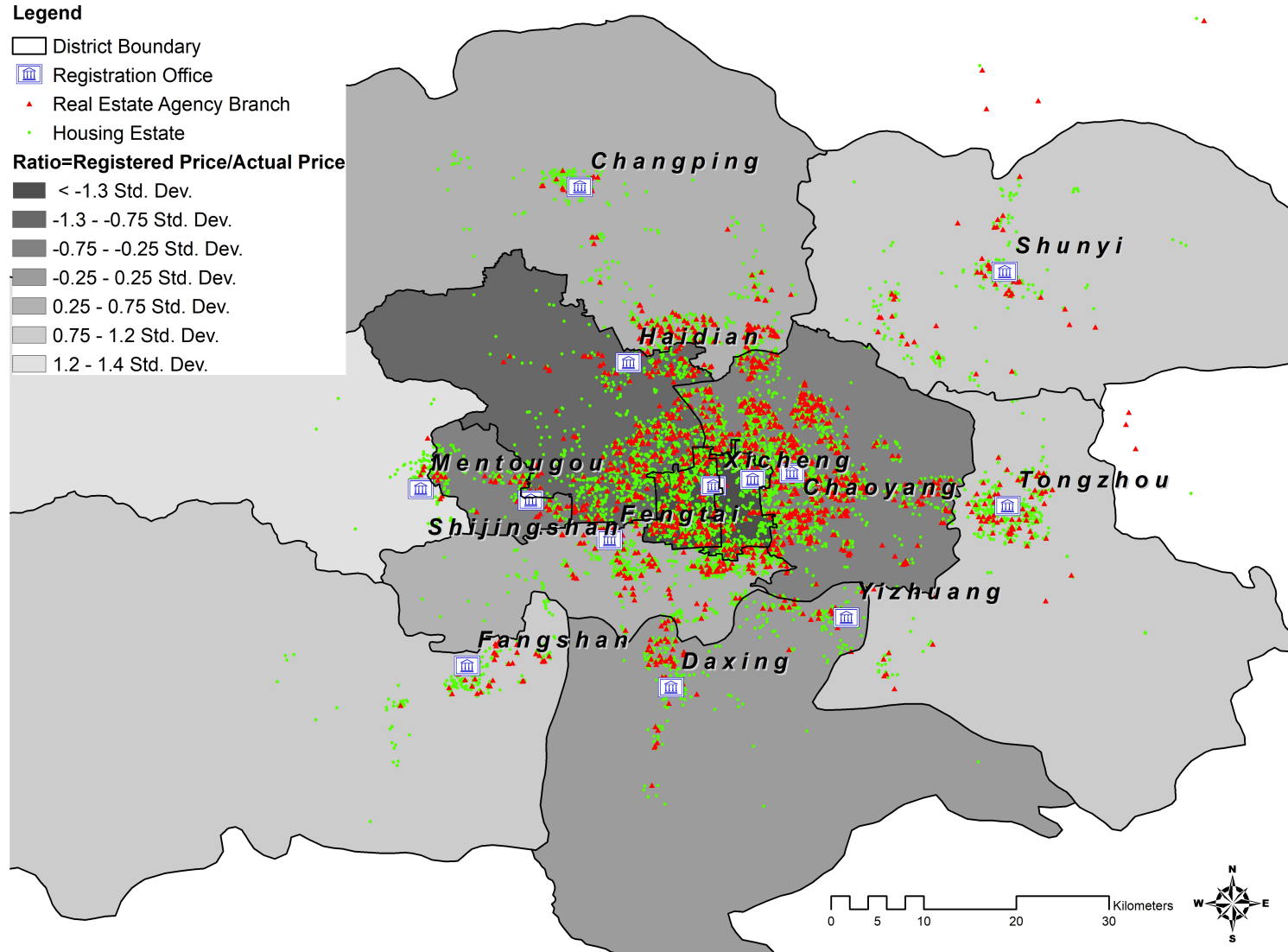
Notes: This figure presents the trends of actual unit price, registered unit price, and registered-actual price ratio in Beijing’s resale residential housing market through the sample period. The two red vertical lines indicate two waves of policies introduced in Section 2.2.

Figure 2: Summary of the Major Policies From 2010 to 2017 in Beijing

Date	Policy	Purchase Restriction	Financing Constraint	Tax Policy
17-Apr-10	[NATIONAL POLICY] No. 10 [2010] of the State Council			
08-May-10	No. 13 [2010] of the Municipal People's Government of Beijing: <i>Notice on Resolutely Curbing the Soaring of Housing Prices in Some Cities</i>	Each family can purchase one additional property	The down payment of the first loan shall not be less than 30% of the total price; for families who purchase a second unit with mortgage, the down payment of loan shall not be less than 50%, and the mortgage rate shall not be less than 1.1 times of the benchmark rate;	-
26-Feb-13	[NATIONAL POLICY] No. 17 [2013] of the State Council			
31-Mar-13	No. 17 [2013] of the Municipal People's Government of Beijing: <i>Notice on Further Improving Regulation of the Real Estate Market</i>	-	For families who purchase a second unit with mortgage, down payment of the loan increases from 50% to 70%	20% of capital gain tax for properties with holding period less than five years
30-Sep-14	No. 382 [2014] of the Beijing Municipal Commission of Housing and Rural and Urban Construction: <i>Notice on Adjusting the Preferential Policies on Deed Tax and Individual Income Tax during Real Estate Transactions</i>	-	-	Redefine ordinary housing that entitle for preferential tax treatment: properties with holding period longer than five years do not have to pay for the sales tax (5.6% of total price)
30-Mar-15	[NATIONAL POLICY] No.98 [2015] People's Bank of China and No. 39 [2015] of the Ministry of Finance			
30-Mar-15	No.98 [2015] People's Bank of China: <i>Notice of the People's Bank of China, the Ministry of Housing and Urban-Rural Development and the China Banking Regulatory Commission on Issues concerning Individual Housing Loan Policies</i> No. 39 [2015] of the Ministry of Finance: <i>Notice of the Ministry of Finance and the State Administration of Taxation on Adjusting the Business Tax Policies on Individual Housing Transfers</i>	-	For families who purchase a second unit with mortgage, down payment of the loan decreases from 70% to 40%	Properties with holding period longer than two years do not have to pay for the sales tax (5.5% of total price)
30-Sep-16	No. 46 [2016] of the Municipal People's Government of Beijing: <i>Notice on Promoting the Sustained and Healthy Development of the Real Estate Market</i>	-	Down payment for the first home loan increases from 30% to 35%, and down payment for the second home loan increases from 40% to 50%; down payment for luxury (non-ordinary) properties is 70%.	-

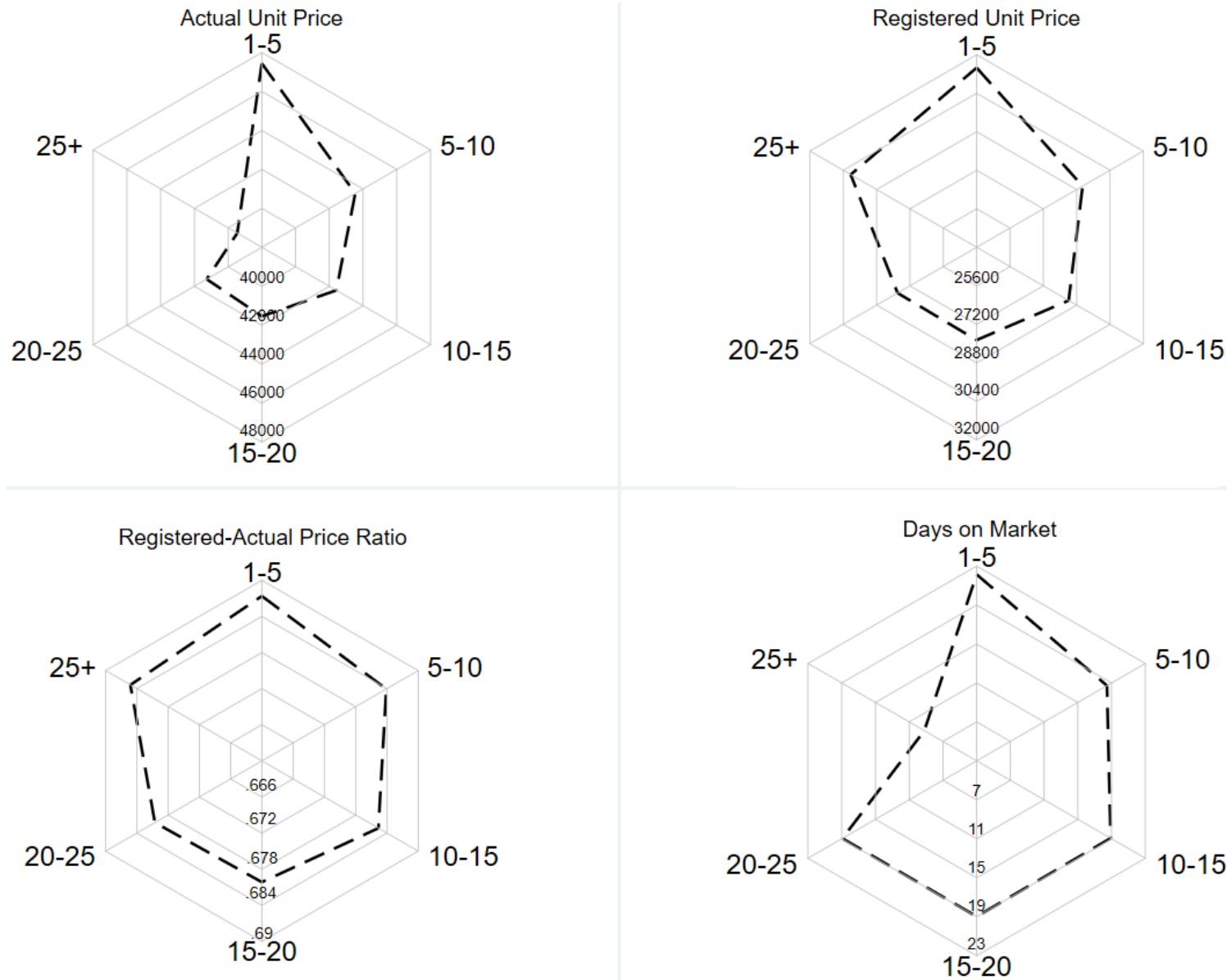
Notes: This figure summarizes major policy changes from 2010 to 2017. The policy implemented on Sep 30, 2014 only applied to tax changes in the real estate transactions, and the policy implemented on Sep 30, 2016 only applied to bank financing constraints. All other three policies contains more than one type of control measures.

Figure 3: The Sample Distribution



Notes: This figure presents the sample distributions of housing projects, real estate agency branches, and corresponding registration offices across 13 administrative districts in Beijing.

Figure 4: The Agent's Experience and Four Outcome Variables



Notes: This figure presents the unconditional relationship between agent's experience and four outcome variables: actual price, registered price, registered-actual price ratio, and days on market. The number of agent's past experience is divided into six categories: 1-5, 5-10, 10-15, 15-20, 20-25, and 25+.

Table 1: Summary Statistics (between January 1, 2014 and June 1, 2017)

	Observations	Mean	S.D	Min	Max
Panel A. Transaction Information					
Actual Total Price (thou.)	179,580	3,833.25	2,558.05	305	250,000
Registered Total Price (thou.)	179,580	2,478.08	1,609.65	0	250,000
Listed Total Price (thou.)	179,580	4,063.97	68,356.82	260	302,500
Actual Unit Price	179,580	46,033.65	16,916.25	0	615,000
Registered Unit Price	179,580	30,841.94	20,684.09	3,938	150,000
Listed Unit Price	179,580	49,177.80	76,679.69	3,937	794,299
Registered-Actual Price Ratio	179,580	0.68	0.20	0.10	1.65
<i>Yin Yang</i>	179,580	0.97	0.16	0.00	1.00
Mortgage	179,580	0.85	0.36	0.00	1.00
LTV	94,299	0.63	0.13	0.00	1.00
Daily Volume	1,223	160	181.05	1	1,454
Panel B. Housing Characteristics					
Unitsize (sq.m)	179,580	85.04	39.42	5	1810
Days on Market	179,580	20.60	46.69	0	1464
Distance (km)	179,580	7.43	5.54	0.02	58.15
Level of Storey	179,580	7.44	6.07	-2	40
# of Visits	179,580	29.28	32.71	1	567
# of Bedrooms	179,580	2.05	0.78	0	9
# of Livingrooms	179,580	1.18	0.53	0	6
# of Bathrooms	179,580	1.20	0.46	0	9
Decoration Type					
<i>Fine Decoration</i>	92,406				
<i>Simple Decoration</i>	62,316				
<i>None Decoration</i>	4,457				
<i>Other</i>	20,401				
Panel C. Agent Characteristics					
# of Total Transactions	162,258	21.28	18.28	1	144
Experience	162,258	3.83	5.82	1	128
Agent Age	162,258	26.57	4.39	14	49
Male Agent	162,258	0.72	0.45	0	1
Ratio of Peers	158,479	0.71	0.06	0	1.16
Tenure of Peers (# of month)	158,479	28.84	9.28	0	66.59

Table 1 to be continued.

Continuing Table 1

Table 1: Summary Statistics (between January 1, 2014 and June 1, 2017)

	Observations	Mean	S.D	Min	Max
Panel D. Buyer Characteristics					
Buyer Age	179,580	35.90	9.91	10	109
Male Buyer	179,580	0.52	0.50	0	1
Local Buyer	179,580	0.36	0.48	0	1
Panel E. Seller Characteristics					
Seller Age	179,580	47.08	14.30	10	106
Male Sller	179,580	0.55	0.50	0	1
Local Seller	179,580	0.56	0.50	0	1
Panel F. Other Information					
# of Administrative Districts	13				
# of Estates	6,195				
# of Agents	15,802				
# of below Two-year	33,400				
# of Two-to-Five-year	23,277				
# of over Five-year	122,903				

Notes: This table presents the summary statistics for the variables used in this paper. **Yin-Yang contract**, equals 1 if the Registered-Actual Price Ratio is less than 1; **Mortgage**, equals 1 if the buyer uses a mortgage loan; **LTV**, Loan-to-value ratio; **Daily Volume**, the number of transactions on the daily basis; **Days on Market**, the number of days that a property stays on the market before sold; **Distance (km)**, the physical distance between the estate and the corresponding registration office; **# of Total Transactions**, the number of completed transactions for an agent as of September 2018; **Experience**, the number of completed transactions for an agent upon the focal transaction; **Ratio of Peers**, the average Registered-Actual Price Ratio of peers in a branch; **Tenure of Peers (# of month)**, the average length of service of peers in a branch

Table 2: Hedonic Regressions with and without Agent Fixed Effect

Panel Dep. Variable Model	Panel A. Without Agent FE			Panel B. With Agent FE		
	ln(A-Price)	ln(R-Price)	Ratio	ln(A-Price)	ln(R-Price)	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Housing Characteristics</i>						
ln(UnitSize)	-0.202*** (0.008)	-0.304*** (0.010)	-0.055*** (0.004)	-0.203*** (0.015)	-0.305*** (0.020)	-0.051*** (0.009)
ln(Visit)	-0.006*** (0.000)	-0.008*** (0.001)	-0.002*** (0.000)	-0.006*** (0.001)	-0.009*** (0.002)	-0.002** (0.001)
Floor level	-0.000 (0.000)	0.002*** (0.000)	0.001*** (0.000)	-0.000 (0.000)	0.002*** (0.000)	0.001*** (0.000)
# of Bedroom	0.031*** (0.002)	0.021*** (0.003)	-0.012*** (0.001)	0.032*** (0.004)	0.025*** (0.006)	-0.010*** (0.003)
# of Livingroom	0.031*** (0.002)	0.029*** (0.003)	-0.003*** (0.001)	0.032*** (0.005)	0.030*** (0.006)	-0.004 (0.003)
# of Bathroom	-0.011*** (0.003)	-0.006 (0.004)	0.003* (0.002)	-0.009 (0.007)	-0.006 (0.007)	0.002 (0.004)
Decoration_simple	0.020*** (0.002)	-0.005 (0.005)	-0.013*** (0.003)	0.018*** (0.005)	-0.006 (0.010)	-0.013** (0.006)
Decoration_luxury	0.048*** (0.002)	0.005 (0.005)	-0.024*** (0.003)	0.045*** (0.005)	0.002 (0.010)	-0.025*** (0.006)
Decoration_other	0.034*** (0.002)	0.003 (0.005)	-0.016*** (0.003)	0.033*** (0.005)	0.007 (0.010)	-0.013** (0.006)
HP 2-5 yrs	0.007*** (0.002)	-0.048*** (0.003)	-0.036*** (0.002)	0.008** (0.004)	-0.037*** (0.008)	-0.030*** (0.004)
HP >5 yrs	0.019*** (0.001)	0.123*** (0.003)	0.067*** (0.002)	0.020*** (0.003)	0.122*** (0.007)	0.067*** (0.004)
<i>Buyer Characteristics</i>						
Mortgage	0.000 (0.001)	0.158*** (0.003)	0.094*** (0.002)	0.002 (0.002)	0.152*** (0.006)	0.092*** (0.003)
MaleBuyer	-0.001* (0.001)	0.011*** (0.001)	0.008*** (0.001)	-0.001 (0.001)	0.008** (0.003)	0.006*** (0.002)
ln(BuyerAge)	0.006*** (0.001)	-0.162*** (0.004)	-0.106*** (0.002)	0.002 (0.003)	-0.163*** (0.007)	-0.106*** (0.005)
LocalBuyer	0.002*** (0.001)	-0.092*** (0.002)	-0.060*** (0.001)	0.004*** (0.001)	-0.082*** (0.004)	-0.055*** (0.002)
<i>Seller Characteristics</i>						
MaleSeller	0.002*** (0.001)	0.007*** (0.001)	0.003*** (0.001)	0.003*** (0.001)	0.008*** (0.003)	0.003 (0.002)
ln(SellerAge)	0.001 (0.001)	0.039*** (0.003)	0.024*** (0.002)	-0.002 (0.003)	0.031*** (0.007)	0.020*** (0.004)
LocalSeller	0.001 (0.001)	0.002 (0.002)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.004)	-0.001 (0.002)
Observations	179,599	179,594	179,594	179,585	179,580	179,580
R-squared	0.942	0.678	0.385	0.977	0.878	0.759
Agent FE	No	No	No	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes	Yes	Yes
Day of the Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines changes of R-square with/without including the agent fixed effect. Fixed effects for housing projects, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 3: Hedonic Regressions with Agent Characteristics

Panel Dep. Variable Model	Panel A. Continuous Learning Effect			Panel B. Binary Learning Effect		
	ln(A-Price) (1)	ln(R-Price) (2)	Ratio (3)	ln(A-Price) (4)	ln(R-Price) (5)	Ratio (6)
ln(Experience)	-0.054*** (0.008)	-0.125*** (0.019)	-0.044*** (0.011)			
First				0.006*** (0.001)	0.010*** (0.002)	0.003*** (0.001)
MaleAgent	0.000 (0.001)	-0.000 (0.002)	-0.000 (0.001)	0.000 (0.001)	0.000 (0.002)	-0.000 (0.001)
ln(AgentAge)	0.004** (0.002)	0.006 (0.005)	0.001 (0.003)	0.005** (0.002)	0.006 (0.005)	0.001 (0.003)
Observations	162,258	162,258	162,258	162,258	162,258	162,258
R-squared	0.943	0.677	0.387	0.943	0.677	0.387
Housing Char.	Yes	Yes	Yes	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines the effects of agent characteristics on actual unit price, registered unit price, and registered-actual price ratio. *ln(Experience)* is continuous measure of agent learning effect used in Panel A; and *First* is the binary measure of agent learning effect, which is equal to 1 if the transaction is the first-time transaction of an agent, and 0 otherwise. The headers in the second row denote the dependent variable used in respective column. Characteristics for housing, buyer and seller, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 4: Learning-by-doing Effects - Monitoring Capability

Dep. Variable	ln(A-Price)	ln(R-Price)	Ratio
Model	(1)	(2)	(3)
ln(Distance)	0.141*** (0.054)	0.071 (0.052)	-0.043*** (0.006)
Observations	162,258	162,258	162,258
R-squared	0.943	0.677	0.387
Controls	Housing features, buyer and seller characteristics		
Fixed Effects	housing project, year-month, DoW		

Notes: This table examines the effect of monitoring distance on actual unit price, registered unit price, and registered-actual price ratio. The headers in the first row of both panel denote the dependent variable used in the corresponding column. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 5: Learning-by-doing Effects - Learning the Guideline Prices

Panel A. ln(Actual Price)					
Experience	1 st	2 nd	3 rd	4 th	5 th and +
Model	(1)	(2)	(3)	(4)	(5)
ln(Distance)	0.123*** (0.025)	0.142** (0.063)	0.213*** (0.081)	0.169*** (0.015)	0.174*** (0.005)
Observations	78,603	24,008	13,551	8,999	37,020
R-squared	0.958	0.964	0.968	0.971	0.941
Controls	Housing features, buyer and seller characteristics				
Fixed Effects	housing project, year-month, DoW				

Panel B. ln(Registered Price)					
Experience	1 st	2 nd	3 rd	4 th	5 th and +
Model	(1)	(2)	(3)	(4)	(5)
ln(Distance)	0.076** (0.031)	0.078 (0.068)	0.085 (0.105)	0.015 (0.019)	0.018 (0.019)
Observations	78,598	24,008	13,551	8,999	37,020
R-squared	0.743	0.805	0.823	0.850	0.709
Controls	Housing features, buyer and seller characteristics				
Fixed Effects	housing project, year-month, DoW				

Panel C. Registered-Actual Price Ratio					
Experience	1 st	2 nd	3 rd	4 th	5 th and +
Model	(1)	(2)	(3)	(4)	(5)
ln(Distance)	-0.029 (0.018)	-0.040 (0.030)	-0.078*** (0.015)	-0.101*** (0.009)	-0.069*** (0.004)
Observations	78,598	24,008	13,551	8,999	37,020
R-squared	0.515	0.616	0.659	0.703	0.464
Controls	Housing features, buyer and seller characteristics				
Fixed Effects	housing project, year-month, DoW				

Notes: This table examines the effect of monitoring distance on actual price, registered price, and registered-actual price ratio conditioning on the number of agents' transaction experience. The header in the first row of each panel denotes the dependent variable. Column (1), Column (2),..., and Column (5) include the first-time transactions, the second-time transactions,..., and the fifth-time and onward transactions of all agents, respectively. Characteristics for housing, buyer, seller and agent, fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 6: Peer Effects

Panel Stage Dep. Variable Model	Panel A. OLS	Panel B. IV	
		First-Stage	Second-Stage
	Ratio	Ratio of Peers	Ratio
	(1)	(2)	(3)
Ratio of Peers	0.056*** (0.009)		0.595** (0.288)
Tenure of Peers		-0.008* (0.004)	
ln(Experience)	-0.045*** (0.001)	0.005 (0.015)	-0.063*** (0.014)
Observations	158,479	158,479	158,479
R-squared	0.389	0.922	0.216
Wald Test (F-Stat)		7.130	
Hausman Test (F-Stat)			5.884
Housing Char.	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes

Notes: This table examines the peer effect on registered-actual price ratio. Panels A and B use the OLS estimation and Instrumental Variable estimation, respectively. The headers in the third row denote the dependent variable used in respective column. **Ratio of Peers**, is the measure of peer effect. **Tenure of Peers**, is the instrument variable. The definitions of **Ratio of Peers** and **Tenure of Peers** are presented in Table 1. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 7: March 30, 2015 Policy and September 30, 2016 Policy

Panel A. March 30, 2015 Policy

Test 1: Reduction of 5.5% sales tax			Test 2: Reduction of 30% down-payment		
	Before	After		Before	After
Treat: 2-5 year	25.50%	20%	Treat: Mortgage Buyer	70%	40%
Control: <2 year	25.50%	25.50%	Control: Cash Buyer	0%	0%

Panel B. September 30, 2016 Policy

Test 3: Increase of 5%-30% down-payment		
	Before	After
Treat: Mortgage Buyer	30%-40%	35%-70%
Control: Cash Buyer	0%	0%

Notes: This table presents the key policy clause, treatment group, and control group for March 30, 2015 Policy (Panel A) and September 30, 2016 Policy (Panel B). There are two tests in March 30, 2015 Policy and one test in September 30, 2016 Policy. **Test 1:** transactions with mortgage loan are excluded, with houses of holding period between 2 and 5 years comprising the treatment group and houses of holding period less than 2 years comprising the control group; **Test 2:** transactions of houses held between 2 and 5 years are excluded, with transactions with mortgage loan comprising the treatment group and transactions without mortgage loan comprising the control group; **Test 3:** transactions with mortgage loan comprise the treatment group and transactions without mortgage loan comprise the control group.

Table 8: DID Analysis on Policy Impact

Policy Test Dep. Variable Model	March 30, 2015 Policy				September 30, 2016 Policy	
	Test 1		Test 2		Test 3	
	ln(Vol)	Ratio	ln(Vol)	Ratio	ln(Vol)	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)
$Treat_1 * After_{2015}$	0.386*** (0.060)	-0.003 (0.003)				
$Treat_2 * After_{2015}$			0.448*** (0.043)	0.031*** (0.004)		
$Treat_2 * After_{2016}$					-0.132* (0.077)	-0.045*** (0.002)
Observations	1,323	3,658	1,429	76,569	837	74,560
R-squared	0.805	0.740	0.865	0.345	0.810	0.431
Housing Char.	No	Yes	No	Yes	No	Yes
Buyer Char.	No	Yes	No	Yes	No	Yes
Seller Char.	No	Yes	No	Yes	No	Yes
Agent Char.	No	Yes	No	Yes	No	Yes
Estate FE	No	Yes	No	Yes	No	Yes
DoW FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines the effects of March 30, 2015 Policy and September 30, 2016 Policy on daily transaction volume and registered-actual price ratio. The sample period for March 30, 2015 Policy is between March 30, 2014 and March 30, 2016. The sample period for September 30, 2016 Policy is between March 30, 2016 and May 30, 2017. In Columns (1)-(2), the transactions of with mortgage loan are excluded and $Treat_1$ is a dummy equal to 1 if a transacted house is held between two and five years since its last transaction dates, and 0 if a transacted house is held less than two years. In Columns (3)-(4), the transactions of houses held between two and five years are excluded and $Treat_2$ is a dummy equal to 1 if the houses are bought via mortgage, and 0 otherwise. $After_{2015}$ is a dummy equal to 1 if the transaction took place after March 30, 2015, and 0 otherwise. $After_{2016}$ is a dummy equal to 1 if the transaction took place after September 30, 2016, and 0 otherwise. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 9: DID Analysis on Learning Behavior

Policy Test Dep. Variable Model	March 30, 2015 Policy				September 30, 2016 Policy	
	Test 1		Test 2		Test 3	
	ln(Vol)	Ratio	ln(Vol)	Ratio	ln(Vol)	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)
$Treat_1 * After_{2015}$	0.026 (0.123)	-0.004 (0.120)				
$Treat_1 * After_{2015} * \ln(Experience)$	-0.005 (0.015)	0.002 (0.016)				
$Treat_2 * After_{2015}$			0.132*** (0.027)	0.045*** (0.011)		
$Treat_2 * After_{2015} * \ln(Experience)$			0.009** (0.004)	-0.002* (0.001)		
$Treat_2 * After_{2016}$					-0.146*** (0.036)	-0.054** (0.022)
$Treat_2 * After_{2016} * \ln(Experience)$					-0.014* (0.008)	0.003* (0.001)
Constant	0.025 (0.034)	0.638*** (0.062)	0.029 (0.025)	0.584*** (0.008)	0.050*** (0.011)	0.469*** (0.018)
Observations	1,323	3,658	1,429	76,569	837	74,560
R-squared	0.640	0.853	0.394	0.355	0.480	0.431
Controls	Housing features, buyer and seller characteristics					
Fixed Effects	housing project, year-month, DoW					

Notes: This table examines agents' learning effect in the policy analysis. The definitions of the variables are the same as in Table 7. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Appendices

Table A1. Incentive of Agents

Dep. Variable Model	ln(DoM) (1)
Ratio	0.111* (0.059)
Observations	162,258
R-squared	0.808
Housing Char.	Yes
Buyer Char.	Yes
Seller Char.	Yes
Agent Char.	Yes
Estate FE	Yes
DoW FE	Yes
Year-Month FE	Yes

Notes: This table examines the incentive of the agent in doing *Ying-Yang* contracts by regressing the properties' days on market against the registered-actual-price ratio. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A2. The Impact of Experience on Days on Market

Dep. Variable Model	ln(DoM)	
	(1)	(2)
ln(Experience)	-0.126*** (0.045)	
First		0.014*** (0.004)
Observations	162,258	162,258
R-squared	0.807	0.808
Housing Char.	Yes	Yes
Buyer Char.	Yes	Yes
Seller Char.	Yes	Yes
Agent Char.	Yes	Yes
Estate FE	Yes	Yes
DoW FE	Yes	Yes
Year-Month FE	Yes	Yes

Notes: This tnes the agent learning effect on properties' days on market (ln(DoM)). Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A3. Hedonic Regressions with and without Branch Fixed Effect

Panel Dep. Variable Model	Panel A. Without Branch FE			Panel B. With Branch FE		
	ln(A-Price)	ln(R-Price)	Ratio	ln(A-Price)	ln(R-Price)	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Housing Attributes</i>						
ln(UnitSize)	-0.202*** (0.008)	-0.304*** (0.010)	-0.055*** (0.004)	-0.201*** (0.010)	-0.307*** (0.014)	-0.055*** (0.006)
ln(Visit)	-0.006*** (0.000)	-0.008*** (0.001)	-0.002*** (0.000)	-0.006*** (0.000)	-0.010*** (0.001)	-0.003*** (0.001)
Floor level	-0.000 (0.000)	0.002*** (0.000)	0.001*** (0.000)	-0.000 (0.000)	0.002*** (0.000)	0.001*** (0.000)
# of Bedroom	0.031*** (0.002)	0.021*** (0.003)	-0.012*** (0.001)	0.033*** (0.003)	0.023*** (0.004)	-0.012*** (0.002)
# of Livingroom	0.031*** (0.002)	0.029*** (0.003)	-0.003*** (0.001)	0.031*** (0.003)	0.031*** (0.004)	-0.002 (0.002)
# of Bathroom	-0.011*** (0.003)	-0.006 (0.004)	0.003* (0.002)	-0.012*** (0.005)	-0.012** (0.005)	0.001 (0.003)
Decoration_simple	0.020*** (0.002)	-0.005 (0.005)	-0.013*** (0.003)	0.016*** (0.003)	-0.007 (0.007)	-0.012*** (0.004)
Decoration_luxury	0.048*** (0.002)	0.005 (0.005)	-0.024*** (0.003)	0.044*** (0.003)	0.003 (0.007)	-0.023*** (0.004)
Decoration_other	0.034*** (0.002)	0.003 (0.005)	-0.016*** (0.003)	0.030*** (0.003)	0.007 (0.007)	-0.012*** (0.005)
HP 2-5 yrs	0.007*** (0.002)	-0.048*** (0.003)	-0.036*** (0.002)	0.006** (0.002)	-0.043*** (0.005)	-0.033*** (0.003)
HP >5 yrs	0.019*** (0.001)	0.123*** (0.003)	0.067*** (0.002)	0.018*** (0.002)	0.126*** (0.005)	0.070*** (0.003)
<i>Buyer Characteristics</i>						
Mortgage	0.000 (0.001)	0.158*** (0.003)	0.094*** (0.002)	0.001 (0.002)	0.155*** (0.004)	0.093*** (0.002)
MaleBuyer	-0.001* (0.001)	0.011*** (0.001)	0.008*** (0.001)	-0.001 (0.001)	0.011*** (0.002)	0.008*** (0.001)
ln(BuyerAge)	0.006*** (0.001)	-0.162*** (0.004)	-0.106*** (0.002)	0.004* (0.002)	-0.162*** (0.005)	-0.105*** (0.003)
LocalBuyer	0.002*** (0.001)	-0.092*** (0.002)	-0.060*** (0.001)	0.003*** (0.001)	-0.088*** (0.003)	-0.058*** (0.002)
<i>Seller Characteristics</i>						
MaleSeller	0.002*** (0.001)	0.007*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.008*** (0.002)	0.003*** (0.001)
ln(SellerAge)	0.001 (0.001)	0.039*** (0.003)	0.024*** (0.002)	-0.001 (0.002)	0.035*** (0.005)	0.022*** (0.003)
LocalSeller	0.001 (0.001)	0.002 (0.002)	0.000 (0.001)	0.001 (0.001)	0.001 (0.003)	-0.000 (0.002)
Observations	179,599	179,594	179,594	162,206	162,201	162,201
R-squared	0.942	0.678	0.385	0.962	0.791	0.598
Branch FE	No	No	No	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes	Yes	Yes
Day of the Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines changes of R-square with/without including the branch fixed effect. Fixed effects for housing projects, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A4. Policy Impacts on Leverage Outcomes

Panel Dep. Variable Model	Panel A. March 30, 2015		Panel B. September 30, 2016	
	Mortgage	LTV	Mortgage	LTV
	(1)	(2)	(3)	(4)
<i>After</i> ₂₀₁₅	0.019*** (0.006)	0.019*** (0.004)		
<i>After</i> ₂₀₁₆			-0.013*** (0.004)	-0.052*** (0.002)
Observations	76,572	38,288	74,562	37,581
R-squared	0.224	0.167	0.236	0.338
Housing Char.	Yes	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes

Notes: This table examines the effects of the March 30, 2015 Policy (Panel A) and the September 30, 2016 Policy (Panel B) on two leverage outcomes: *Mortgage*, and loan-to-value ratio (*LTV*). The sample periods in Panels A and B are between March 30, 2014 and March 30, 2016, and between March 30, 2016 and May 30, 2017, respectively. The headers in the second row denote the dependent variable used in respective column. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A5. Tests for the Common Trend Assumption

Dep. Variable Policy Model	Ratio		
	March 30, 2015		September 30, 2016
	(1)	(2)	(3)
$Treat_1 * Before_{2015}$	0.011 (0.014)		
$Treat_1 * After_{2015}$	-0.008 (0.012)		
$Treat_2 * Before_{2015}$		0.009 (0.008)	
$Treat_2 * After_{2015}$		0.033*** (0.004)	
$Treat_2 * Before_{2016}$			-0.014 (0.013)
$Treat_2 * After_{2016}$			-0.045*** (0.002)
Observations	3,658	76,569	74,560
R-squared	0.740	0.345	0.431
Housing Char.	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes

Notes: This table examines the parallel trend assumption. $Before_{2015}$ is dummy equal to 1 if the transaction took place during the period of four weeks before March 30, 2015. $Before_{2016}$ is a dummy equal to 1 if the transaction took place during the period of four weeks before September 30, 2016. Other variables are the same as in previous tables. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A6. Placebo Tests

Dep. Variable	Ratio		
	2015.3.30 Policy	206.9.30 Policy	
Model	(1)	(2)	(3)
$Treat_1 * After_{FalseDate1}$	-0.024 (0.131)		
$Treat_2 * After_{FalseDate1}$		0.006 (0.011)	
$Treat_2 * After_{FalseDate2}$			0.002 (0.003)
Observations	1,388	17,286	32,642
R-squared	0.741	0.741	0.372
Housing Char.	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes

Notes: This table reports the results of a placebo test. The pre-policy period is used as sample period. The artificial date is set as three months before the actual policy dates. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors clustered at the date level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A7. Heterogeneity Tests of the Learning-by-doing Effect

Dep. Variable Agent Group Model	Ratio			
	Cash Trans. (1)	Mortgage Trans. (2)	Male Agent (3)	Female Agent (4)
ln(Experience)	-0.027 (0.028)	-0.042*** (0.012)	-0.051*** (0.013)	-0.029 (0.021)
Constant	0.729*** (0.068)	1.241*** (0.026)	1.028*** (0.029)	1.066*** (0.043)
Observations	23,587	138,671	116,059	46,199
R-squared	0.539	0.342	0.393	0.437
Housing Char.	Yes	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes

Notes: This table examines the heterogeneity of agent learning effects across different agent groups. The dependent variable is registered-actual price ratio (Ratio). The headers in the second row denote the sample group used in respective column. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A8. Heterogeneity Tests of Peer Effect (2SLS)

Dep. Variable Agent Group Model	Ratio			
	Male Agent (1)	Female Agent (2)	Small Branch (3)	Big Branch (4)
Tenure of Peers	0.798*** (0.352)	0.242** (0.120)	0.481 (0.360)	0.550* (0.297)
Observations	113,075	44,402	118,410	38,960
R-squared	0.177	0.228	0.213	0.247
Housing Char.	Yes	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes

Notes: This table examines the heterogeneity of peer effect across different agent groups. The dependent variable is registered-actual price ratio (Ratio). The headers in the second row denote the sample group used in respective column. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table A9. Heterogeneity Tests of Policy Impact

Panel Dep. Variable Buyer Group Model	Panel A. March 30, 2015				Panel B. September 30, 2016			
	Ratio				Ratio			
	Male	Female	Local	Non-Local	Male	Female	Local	Non-Local
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treat_2^*After_{2015}$	0.031*** (0.006)	0.034*** (0.006)	0.018*** (0.006)	0.034*** (0.007)				
$Treat_2^*After_{2016}$					-0.044*** (0.003)	-0.047*** (0.004)	-0.060*** (0.004)	-0.039*** (0.003)
Observations	39,999	36,570	27,852	48,717	38,131	36,429	25,817	48,743
R-squared	0.374	0.389	0.415	0.332	0.466	0.467	0.462	0.418
Housing Char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Buyer Char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seller Char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agent Char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estate FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DoW FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines the heterogeneity of policy effect across different buyer groups. Panels A and B correspond to the March 30, 2015 policy, and the September 30, 2016 policy, respectively. The dependent variable is registered-actual price ratio (Ratio). The headers in the third row denote the sample group used in respective column. Characteristics for housing, buyer, seller and agent, in association with fixed effects for housing project, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the project level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.