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

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Abstract

This paper examines the role that agents play in fraudulent activities in the housing market in China. Using a representative sample of housing transactions in Beijing from 2014 to 2017, we investigate the existence and magnitudes of the so-called *Yin-Yang* contracts, and explore whether and how agents affect tax evasion. First, we find that agents can learn the monitoring distance of local tax authorities through their cumulative experiences and strategically report prices as close as possible to the internal guideline prices set by local authorities. At the same time, agents' involvement in tax evasion is significantly affected by the tax evasion behaviors of their peers. Second, we show that agents' work experiences contribute to creating more severe *Yin-Yang* contracts in the presence of loosening financial constraints, and *vice versa.* Our results suggest that agents' expertise becomes more important for buyers who face a trade-off between reporting higher to borrow more from the bank and reporting lower to evade taxes.

Keywords: Tax evasion; housing market interventions; housing market

JEL Code: R21, R28

1 Introduction

Agents are contracted to facilitate transactions in various business activities, such as investment management (Dvořák, 2005), insurance service (Eckardt and Räthke-Döppner, 2010), and real estate transaction (Levitt and Syverson, 2008; Agarwal et al., 2019a,b). However, agents have been criticized for problems of moral hazard and conflicts of interest. For instance, agents and brokers promotes 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 buyer their own houses at lower prices (Agarwal et al., 2019b) 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 or illegal practises has been identified due to the lack of microdata. This study fills this literature gap by answering three questions: Do agents facilitate fraudulent activities? What are the underlying mechanisms? What are the economic consequences caused by agents' involvement in those fraudulent activities?

This paper focuses on the agents' involvement in a fraudulent practice, tax evasion, which prevails in China's resale housing market. Tax evasion is a prevalent phenomenon that involves dishonest tax reporting - such as declaring less income, profit, or gain, than the amounts actually earned, or overstating deductions (Slemrod, 2007). The so-called *Yin-Yang*[1] contracts in China are a common but illegal practice to avoid paying taxes. In property transactions, a buyer and a seller agree to sign two contracts, one is an under-the-table contract, which states the true value of their transaction, another one reflects a lower price for the official registration. A buyer is keen to go along because in practise all the costs of a property transaction are offloaded onto buyers, including the seller's tax from any capital gain. Although anecdotal evidence of agents' unethical role is ample[2], academic evidence on *Yin-Yang* contracts in real estate market is scant due to the lack of microdata. The prevalence of *Yin-Yang* property transactions has created many problems, such as frequent disputes between sellers and buyers, and a downward biased housing price index that misleads the public. Thus, it is essential to examine the determinants of the

[1] *Yin* contract shows the real transaction price of the parties. *Yang* contract is divided into two categories according to the use needs: one is to do low house prices in order to pay less tax in the real estate transaction center, and the other is to do high house prices in order to apply for more loans from bank. The first class in practice is more common.

[2] For instance, Reuters has reported that, "Real estate agents play a pivotal role in faking purchase agreements, according to industry insiders. China has an army of these agents, many of them poorly trained but highly motivated to make sales". Source: `https://www.reuters.com/investigates/special-report/china-risk-mortgages/`.

Yin-Yang contracts and the magnitude of tax evasion, and to assess the the impact of real estate agents on forming *Yin-Yang* contracts.

Using a novel and comprehensive transaction data provided by the largest real-estate brokerage firm in China, this study examines the impact of agent involvement on the magnitude of tax evasion. In particular, the data contains detailed information of individual housing transaction, including both the actual transaction prices agreed by both parties, the registered prices submitted to tax authorities, as well as the characteristics of buyers, sellers, and real estate agents. We identify a transaction to be a *Yin-Yang* contract if the registered price is lower than the transaction price. The registered-actual price ratio precisely measures the magnitude of tax evasion.

Based on a representative sample in Beijing from January 1, 2014 to March 1, 2017, we find that around 97% of the transactions in the sample are reported under the real transaction price, with an average price reported 32% below the actual price. We first study factors contributing to the tax evasion, including static characteristics of properties, buyers, sellers, and agents. We find that the level of tax evasion is positively associated with mortgage issuance and the holding periods of a property, as well as the involvement of experienced real estate agents. Specifically, the inclusion of agent fixed effect largely explains the variation in tax evasion, which suggests that agents do affect the severity of *Yin-Yang* contracts.

We then attempt to explore how the involvement of real estate agents affects tax evasion. Our analysis offers two mechanisms: self-learning and peer effect. Both self-learning and peer effect are identified as ways through which agents gain information and acquire tax evasion tactics. We demonstrate agents' self-learning effects 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. Moreover, we find that agents can learn the monitoring distance of local tax authorities through their cumulative experiences and then discreetly report lower prices. Using the instrumental variable approach, we identify agents' peer effects: a 100% increases in the average registered-actual price ratio of peers causes 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 self-learning effects, suggesting that self-learning and peer effect jointly contribute to explaining an agent's tax evasion behavior.

Moreover, we study the unintended policy consequences of two policy shocks on March 30, 2015 and September 30, 2016 (see detailed introduction in Section 2.2) with a focus on

examining agents' involvement. The difference-in-differences analyses 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 severe *Yin-Yang* contracts in the presence of a reduction in minimum down-payment requirement, and *vice versa*; 3). agents' expertise becomes more important when buyers face a trade-off between reporting a lower price to evade taxes and reporting a higher price to borrow more from the bank.

Our results survive various robustness checks, including tests on parallel pre-trend assumption and falsification tests using alternative placebo policy dates. In the heterogeneity tests, we find that the learning effects are not salient for properties without mortgages, and male agents are more aggressively producing *Yin-Yang* contracts. We also show that the peer effects are more prominent in larger branches.

The study contributes to three strands of literature. First, we 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., 2018). 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 (Agarwal et al., 2018). Keen et al. (2015) estimate that global tax evasion amounts to 5% of the global economy. The real estate market, which raises substantial amount of tax revenue[3] due to the large transaction value, attract fraudulent activities (Ben-David, 2011; Carrillo, 2013). This study is most closely related to Agarwal et al. (2018), which shows that the tax evasion gap increases with the capital gains tax in China's residential resale market.

Second, our study contributes to the literature on agents' behavior. Agents are usually hired for their expertise and specialized knowledge, as well as their developed ancillary relationships with different parties (Levitt and Syverson, 2008; Benjamin et al., 2009; Eckardt and Räthke-Döppner, 2010; Barwick and Pathak, 2015; Agarwal et al., 2019a,b). However, hiring agents may suffer the "principal–agent problem" if an agent's incentive is not aligned with clients and the clients cannot monitor the agent's actions. Mehran and Stulz (2007) and Bolton et al. (2007) document the conflict of interests problem that financial intermediaries do not recommend products that best suit customers' needs. Levitt and Syverson (2008) and Agarwal et al. (2019b) document that real estate agents strategically sell their own

[3]As discussed in Best and Kleven (2017), countries such as Austria, Australia, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Iceland, Israel, Italy, Japan, the Netherlands, Norway, Poland, Portugal, South Korea, Spain, Sweden, Turkey, the U.K., the U.S., Hong Kong, India, Pakistan, Singapore, and China, have property transaction tax.

properties higher and buyer their own properties lower, respectively. 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 more participation of agents in housing market.

Third, our study relates to the learning literature. A great amount of studies shows that learning from prior experiences gains information and improve 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 important evidence that experienced agents involve in more severe tax evasion activities than rookie agents.

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

The remainder of the article is organized as follows. Section 2 presents a background of housing market interventions in China. Section 3 introduces the data and presents the summary statistics. Section 4 presents the empirical methodology and results. Section 5 reports the heterogeneity and other tests. Section 6 concludes.

2 Policy Background

2.1 *Yin-Yang* Contracts in the Housing Resale 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 with a broker firm, which hires many real estate agents with expertise and specialized knowledge on the local housing market. A real estate agent searches for potential home buyers in their client pool and matches to a seller to expedite a transaction, while also promises the potential home buyer that transaction prices will be minimized. Levitt and Syverson (2008) point out that an agent's optimal strategy is to advise a homeowner to accept any offer that is in the best interest of the agent. Agents who are well informed about the market also want to convince clients 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 real estate secondary market.

In addition, a large amount of anecdotal evidence points out that real estate agents in China influence the formation of *Yin-Yang* contracts significantly. To avoid high tax payments, home buyers and sellers have developed a dual-contract process: one contract stating the transaction's actual price is kept under the table, while another contract understating the actual price is submitted to a registration office for the purpose of evading transaction 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 the Chinese housing market. Buyers are keen to cooperate because, effectively, they bear all the costs involved in a property transaction, including the tax the seller pays on any capital gain. In practice, the additional tax burden has been transferred from the seller to the buyer and reflected in the transaction price. Therefore, a buyer faces the trade-off of under-reporting the price to pay less tax 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. Anecdotal evidence indicates that real estate agents (rather than the buyers or sellers) frequently suggest the *Yin-Yang* contracts to facilitate a transaction.

[Figure 1 inserted here]

Figure 1 shows the serious and persistent tax evasion during the sample period. The prevalence of *Yin-Yang* contracts not only leads to disputes between sellers and buyers, but also distorts property prices because the official record of housing prices no longer provides a reliable and accurate measure to help buyers and sellers to determine the fair value of a property. Local housing authorities have realized the problem and introduced tough monitoring guidelines in many cities in China.

In principle, due diligence procedures should be carried out by tax authorities to pre-

vent tax evasion. More specifically, tax authorities should check whether a registered price is realistic when they receive a property transaction contract. A registered price will be reassessed to determine the applicable taxes when the registered price is below the guideline price. The guideline price is not released to public and updated from time to time. In practise, a well-informed and experienced agent can estimate the minimum guideline prices set by the local housing authorities. Market expertise and information advantage enable agents to advise the buyers/sellers an acceptable price as close as to the minimum guideline price[4]. Thus, it is important to investigate the agent's role in tax evasion.

In addition, the unenforced local rules and low penalties on the parties involved in the fraud worsen the phenomenon. It is worth mentioning that although all the actual property transaction prices are publicly available on brokers' websites, local authorities have little incentives to identify a *Yin-Yang* contract to the tax evasion problem because they are under pressure from the central government to stabilize the housing market. Thus, the *Yin-Yang* contracts, which on average report only 68% of the actual transaction price, veil the actual price surge in the housing market.

2.2 Policy Interventions in the Housing Market

The Chinese government has been implementing various housing policies since 2010, such as purchase restrictions, financing constraints, and the housing transaction tax, 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 in Beijing from 2010 to 2017. Using two policy shocks on March 30, 2015 and September 30, 2016, our study tackles the impact of tax change and the impact of down-payment change on the tax evasion and agents' behavior.

[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][5] that lowered the minimum down payment for a second home from 70% to 40% and cancelled the sales tax (5.6% of the total transaction price) for homes transacted after *two* years. It is a bundled policy that includes two types of

[4]Source: `http://house.people.com.cn/n1/2017/0418/c164220-29217345.html`

[5]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". See `https://wiki.mbalib.com/wiki/3.30%E6%96%B0%E6%94%BF` for more details of the policies.

policy instruments: 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, lower tax rate would reduce buyers' incentive to evade taxes; on the other hand, the reduction in down-payment would affects buyers with and without financial constraints differently: some cash buyers would choose to issue mortgages after the change, which decreases their incentive to evade taxes; buyers with mortgages could report lower prices to get the same amount of loans, which increases their incentives to evade taxes. Therefore, it is critical to isolate the impact of tax changes from the impact of down payment changes and analyze the unintended policy effects to various groups.

On September 30, 2016, the central government issued another Decree No. 46 [2016][6] 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 obtain the transaction data from the largest real estate brokerage firm, which have 120,000 employees and more than 6,000 branches in over 25 cities in China. The data we use consists of 299,115[7] home sales in the secondary market of Beijing from January 1, 2014, to July 1, 2017.

The data has numerous strengths. First, the data contains extremely detailed information about the listed and transacted housings, including the address, housing characteristics (storey, 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. With the precise information on registered price, we are able to

[6]Source: `http://www.waizi.org.cn/law/13390.html`

[7]The full sample of the data contains 483,436 transactions covering the period between January 2011 and September 2018.

compare it with the transaction price and identify the tax evasion. 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. It shows that our data spreads all over the city.

[Figure 3 inserted here]

Second, the data provides detailed information on the real estate agents, including their demographics (gender and age), portraits, and total completed transactions till September 2018. In particular, since the data provides a full sample of transaction records for every agent from the larges real estate agency in China, we can calculate an agent's experience before a specific transaction with backward induction. For instance, let's suppose 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 at the 40^{th} transaction before January 1, 2015 is 39. Rich information on real estate agents offers us an valuable opportunity to study agents' involvement in tax evasion activities, which has not been addressed in the existing literature.

Third, the data provides information on both buyers and sellers, including gender, age and place of birth[8]. 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 does, however, have a few limitations. For instance, the data does not cover new sales in the primary market and does not cover homes that are not sold through agent brokers.

Table 1 presents the summary statistics for key variables in the data. Panel A reports the transaction information. For the resale units in Beijing, the registered price is one third lower than the transaction price, which suggests the existence of dual contracts and the magnitude of tax evasion. Following Agarwal et al. (2018), we use the ratio of registered price over the actual price as a measure of tax evasion. Accordingly, the ratio decreases with the evasion gap and averages at 0.68. $YinYangContract$ is a dummy equal to 1 if the registered price is lower than the actual price. The registered price is lower than the actual price in 97% of the sales, which suggest that the *Yin-Yang* contract is pervasive in the resale market. Figure 1 also indicates that registered price is persistently lower than actual price during the sample period. Panel A shows that 85% of the sales have mortgage loans.

[8]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 the city and the final two digits 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

[Table 1 inserted here]

Panel B presents the summary statistics of housing attributes. A property is listed around 20 days on the market and the average size is 85 square meters (sq.m). Panel C, D, and E report the demographic characteristics of agent, buyer and seller, respectively. Agents have 21.28 total transactions on average as of 2018, and 9.83 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. With regard to 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 residential estates and 15,802 agents. Around two third of the houses are held for over five years since their last transactions.

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

[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 specification is given as follows:

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

where i, j, t indexes the transaction, the housing estate, and the transaction date, respectively. The dependent variable $Y_{i,j,t}$ takes three forms, including 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. The control variables included in vector X are summarized in Table 1. Housing estate fixed effect (denoted by θ_j) is included to eliminate the unobserved heterogeneity, such as location, quality, brand, and etc., across housing estates. 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 district level.

The baseline results are reported in Table 2. All models include the characteristics of housing, buyer, and seller, as well as the fixed effects of housing estates, days of week, and year-month. The estimated coefficients on *mortgage* are significantly and positively correlated to registered price and the ratio, implying that buyers with mortgage loans report higher prices (induce less tax evasion) 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 total price is 398,420 yuan[9] larger for properties with mortgage than those without. However, coefficients of *mortgage* on actual transaction price 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 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". Notably, we do not include any variables capturing the characteristics of agents in Table 2. The identification strategy here is to examine the change in R-square without and with agent fixed effect. The agent is deemed to have a significant explanatory power on the variation of the outcome variable if the inclusion of agent fixed effect substantially increases the R^2.

[Table 2 inserted here]

Panels A and B 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, adding agent fixed effect significantly increases R^2 for registered price from 0.678 to 0.878, 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. 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 important role in producing *Yin-Yang* contracts and tax evasion. This raises the question: why do real estate agents involved in transactions with *Yin-Yang* contracts? Appendix Table A1 shows that the magnitude of tax evasion is positively associated with a property's days-on-market, suggesting that agents are incentivized

[9] 29.4%*(3833250-2478080)=398420

to produce *Yin-Yang* contracts in order to sell properties faster.

4.2 Agents' Self-Learning Effect

Table 3 investigates the channels through which real estate agents affect the formation of *Yin-Yang* contracts and the magnitudes of tax evasion. All regressions include agents' demographic characteristic, such as gender and age, although none of them is significantly associated with tax evasion (as reflected in the registered-actual price ratio). Moreover, we study whether an agent's experience affects tax evasion. 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)[10], we use the number of historical transactions of an agent upon each transaction as a proxy for an agent's experience in the local housing market. The Beijing Municipal Bureau of Local Taxation sets a minimum price as an internal guideline for previously owned apartments in each region[11] 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. An experienced agent could learn from the past experiences to estimate the guideline price in each district.

[Table 3 inserted here]

Specifically, Panel A of Table 3 includes the number of historical transactions of an agent upon transaction i. The coefficients on *ln(Experience)* are significantly negative in Columns (1) to (3). The magnitude of *ln(Experience)* in registered price (Column 2) is 2.3 times the magnitude of *ln(Experience)* in actual price (Column 1), which leads to the negative coefficient in registered-actual price ratio (Column 3). This suggests that experienced agents produce contracts with higher level of tax evasion than their fresh peers. More specifically, 100% increase in number of experience results in a decrease in average registered-actual price ratio by 4.4 percentage points, which is approximately 186,335 CNY[12].

For a robustness check, we employ a binary measure of learning in Panel B. $First$ is a dummy equal to 1 for the first transaction of an agent, and 0 otherwise. The coefficient of $First$ turns out to be significantly positive in Columns (4) to (6), with magnitude in Columns (5) being 0.04 units greater than that in Column (4). This implies that the agents

[10] Barkema and Schijven (2008) provides a comprehensive review of firms' learning mechanisms.

[11] "Yin-yang' contracts on the rise", Global Times, 2010. See details on `http://www.globaltimes.cn/content/560560.shtml`.

[12] $\frac{4.4\%}{32\%} * (3833250 - 2478080) = 186335.875$

report higher prices to the tax authority and produce less serious *Yin-Yang* contracts in their first-time transactions.

The results that agents' experiences decrease with the actual transaction price (as shown in Columns 1 to 3) 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. We also provides additional tests to show that experienced agents sell houses faster in the cost of low transaction prices as shown in Appendix Table A2. Since the transaction price would not affect agents' self-learning effects from previous transactions, the reverse causality is less of a concern in Table 3.

What do agents learn from their past experiences? To answer this question, we test two hypotheses: first, the registration offices could possess greater monitoring capability on surrounding housing estates than on remote ones because they are better informed about the surrounding market condition; second, an experienced agent could learn the monitoring capability of the real estate authorities from the past experiences.

Table 4 tests the first hypothesis. The physical distance serves as a classic measure of information in the existing literature because proximity facilitates monitoring and access to information (Coval and Moskowitz, 2001; Agarwal and Hauswald, 2010). In Table 4, $ln(Distance)$ is the logarithmic distance between the housing estates and the local registration offices. Figure 3 plots the geographic distribution of the property registration offices at the district level. 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 support our first hypothesis that the monitoring capability of local governments decreases with the monitoring distance and the severity of tax evasion increases with the monitoring distance.

[Table 4 inserted here]

Table 5 tests the second hypothesis that agents' accumulated experiences allows them to estimate the guideline price in each district. The estimated coefficient on $ln(Distance)$ present an interesting pattern. Results in Panel A show that the distance is significantly and positively correlated with the actual transaction prices, and the effects are significant no matter whether a transaction is completed by a fresh agent or by a more experienced agent. In Panel B, the coefficients on $ln(Distance)$ is statistically significant on registered price only if the transaction is completed by a fresh agent. $ln(Distance)$ is insignificantly correlated with

registered price from the second transaction onwards, and the magnitudes of the coefficients on $ln(Distance)$ decrease with agents' experiences, which support 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 onward. The results support our conjecture that agents learn about the monitoring distance of the tax authority from their past transactions and strategically report lower prices if the the housing estates locate further away from their corresponding tax authorities.

[Table 5 inserted here]

4.3 Agents' Peer Effects

Peer effects refer to externalities in which the behaviors or characteristics of peers affect an individual's behaviour (Manski, 2000; Arcidiacono and Nicholson, 2005; Bayer et al., 2009; Dahl et al., 2014). In China, real estate agents work in the same branch have opportunities to exchange information on the internal guideline prices, discuss new listings, and update buyers and sellers' needs. The extensive and intensive interactions among agents within branches allow each agent to quickly exchange information and update knowledge about the local market. Therefore, it is worth to examine whether peer effects affect the magnitudes of tax evasion.

We first repeat the regressions in Table 2 by replacing the agent fixed effect with the branch fixed effect and present the results 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 to 0.598 for register-actual price ratio, pointing to the potential impact from peers in the same branch in explaining the variation in tax evasion.

The comprehensive information on each agent's transaction records enables us to further explore the peer effect, which has been difficult to identify and measure in the empirical studies. 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 in 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 "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 own 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 own tax evasion behavior. *Tenure_of_Peers* is equal to the average length of service (# of month) of agent k's all senior peers in the same branch. Senior peers are agents who join the branch earlier than agent k. The length of service of senior peers is calculated from the year they started to work, which implies that *Tenure_of_Peers* is exogenous to agent k's behavior because the entry of all senior peers are pre-determined and is not inversely affected by agent k's behavior. However, the peers' *Tenure_of_Peers* could significantly affect their tax evasion behavior. The following equation estimates the first-stage effect of *Tenure_of_Peers* on *Ratio_of_Peers*:

$$Ratio\_of\_Peers = \alpha + \varphi * Tenure\_of\_Peers + \beta * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \epsilon_{i,t} \tag{2}$$

The second-stage regression is as follows:

$$Y_{i,j,t} = \alpha + \rho * Ratio\_of\_Peers + \beta * X_t + \theta_j + \gamma_{day} + \delta_{ym} + \epsilon_{i,t} \tag{3}$$

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 the causal effect of peers is over 10 times as large as the OLS estimate of Column (1). This OLS underestimates the peer effect because the average tax evasion of agent k's peers increases with agent k's tax evasion, *vise versa.*

To sum, 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(Experience)* remains negative and statistically significant in Table 6, suggesting that the agents' self-learning effects and peer effects are different mechanisms that jointly affect the tax evasion in the housing market.

4.4 Difference-in-Differences Analysis on Two Policies

Will agents' involvement lead to unintended consequences in a market with frequent policy interventions? The two policy shocks on March 30, 2015 and September 30, 2016 provide us opportunities to answer this question. Table 7 summarizes two policies. As stated in the background 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. The tax reduction would lower the incentives to create severe *Yin-Yang* contracts for properties with holding periods between two to five years[13]. 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 attract some cash buyers to issue mortgages, leading to an increase in registered price and a decrease incentive to evade taxes. Second, a lower down-payment enables buyers with mortgage loans to report lower prices to borrow the same amount of loans, resulting in an increase in tax evasion. For instance, with the same amount of mortgage loan of CNY 900,000, the reduction of 30 percentage points could reduce the registered price by half, from CNY 3,000,000 to CNY 1,500,000[14].

Therefore, we conduct two separate tests to disentangle the effects of tax reduction policy from the effects of 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 transaction, 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

[13]Agarwal et al. (2018) show that the increase in tax rate incentivize buyers to report lower prices and evade more taxes, and *vice versa.*

[14]For example, in Test 2, a buyer with mortgages need to report a total price of 3 million yuan to borrow CNY 900,000 from bank before March 30, 2015 policy, while the buyer only need to report a total price of 1.5 million yuan to borrow CNY 900,000 maximum from the bank after March 30, 2015 policy.

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 after the imposition of the financing constraints, which increases their incentive to report a higher registered price and produce less severe *Yin-Yang* contracts. The treatment and control groups in Test 3 are the same as that 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 the *Yin-Yang* contracts. The specifications for transaction volume and *Yin-Yang* contracts are given as follows:

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

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

where $Vol_{m,t}$ in Equation (4) represents the number of transacted properties for group m on date t. m equals 1 for the treatment group, and 0 otherwise. The daily fixed effect, δ_t, is included in Equation (4). $Treat_1$ is a dummy equal to 1 if the treatment group is defined as in Test 1, and 0 otherwise. $Treat_2$ is a dummy equal to 1 if the treatment group is defined as in Tests 2 and 3, and 0 otherwise. $After_{2015}$ is a dummy equal to 1 if the transaction took place after March 30, 2015; and $After_{2016}$ is a dummy equal to 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 test 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. However, in Column (2), we find that tax

reduction policy does not lead to less severe *Yin-Yang* contracts 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. 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, *vice versa*[15]. The composition change conjecture is supported by the results in Columns (3) and (5).

[Table 9 inserted here]

We then examine whether the involvement of experienced real estate agents 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 composition change from cash buyers to mortgage buyers, we observe a significantly negative coefficient on $Treat_2 * After_{2015} * ln(experience)$. This indicates that the transactions involving experienced agents report lower prices when down-payments are reduced, confirming that agents' experiences contribute to creating more severe *Yin-Yang* contracts after the March 30, 2015 policy. This also points to the fact that agents' expertise becomes more important when buyers facing a trade-off between reporting a lower price to evade taxes and reporting a higher price to borrow more from the bank.

The effect in September 30, 2016 policy is symmetric: we find that when down-payment increases, transactions involving experienced agents suggest higher registered prices due to an increased need for higher loans. This is consistent with results in Appendix Table A4,

[15]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. Buyer with mortgages would report higher prices to gain higher loans from the bank.

which shows the impact of two policies on extensive and intensive margins. In summary, the reduction in tax rates and the reduction in required down-payment in March 2015 policy increase both the percentage of buyers with mortgage loan and cause the LTV ratio to increase by 1.9 percentage points. The tightening of financial constraints in 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' experiences contribute to creating more severe *Yin-Yang* contracts under the loosening of financial constraints, and *vise versa.*

To examine the parallel trend assumption in the pre-treatment period, we add 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 an artificial 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 artificial dates, which are three months before the actual policy dates; and 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 also conduct the heterogeneity tests of self-learning and peer effects across different types of transactions. Appendix Tables A7 presents the results for self-learning. More specifically, the self-learning effects is significantly negative at -0.042 for transactions with mortgage loans, while bears a small and insignificant coefficient (-0.027) for transactions without mortgage loans. In addition, we find that experienced male agents are more aggressively producing *Yin-Yang* contracts, while the self-learning effects for female agents are

insignificant.

Appendix Tables A8 reports the results for peer effects. The peer effects are statistically significant for both male and female agents, although the effects are larger 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 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 practises. 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 practice to induce substantial tax evasion, as an empirical 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. Specifically, the *Yin* contract shows the real transaction price of the parties. The *Yang* contract is divided into two categories according to the requirements: one is to reflect lower house prices in order to pay less tax in the real estate transaction center, and the other is to reflect higher house prices in order to gain higher loans from banks and other financial institutions. The first practice is more common in China's resale housing market. The tax authority will check whether the transaction price is plausible or not. If the transaction price is unreasonably lower than the market average, the price will be reassessed for collection of higher taxes. The real estate agents, who have information advantages in the housing market, involve in and suggest to the buyers/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.

The study investigates the motivation of real estate agents' involvement in tax evasion behaviors and examines how the involvement of real estate agent brokers affects the transaction prices and the registered prices. We find that agents learn from their past transactions and their peers when forming *Yin-Yang* contracts. We also examine the unintended consequences of two policy changes that occurred in March 2015 and September 2016 by

exploring the impact of more experienced agents on tax evasion. The results show that agents' experiences contribute significantly to reporting lower prices to tax authorities when down-payment are reduced, and *vice versa.* This suggests that agents' experiences become critical when buyers facing controversial considerations between reporting higher to borrow more from the bank and reporting lower to evade taxes. This study provides solid evidence on agents' fraudulent and illegal behaviors and points to the role of agents in tax evasion, which highlights a serious problem for the tax administration.

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Figure 1: The Trends of Prices and Ratio

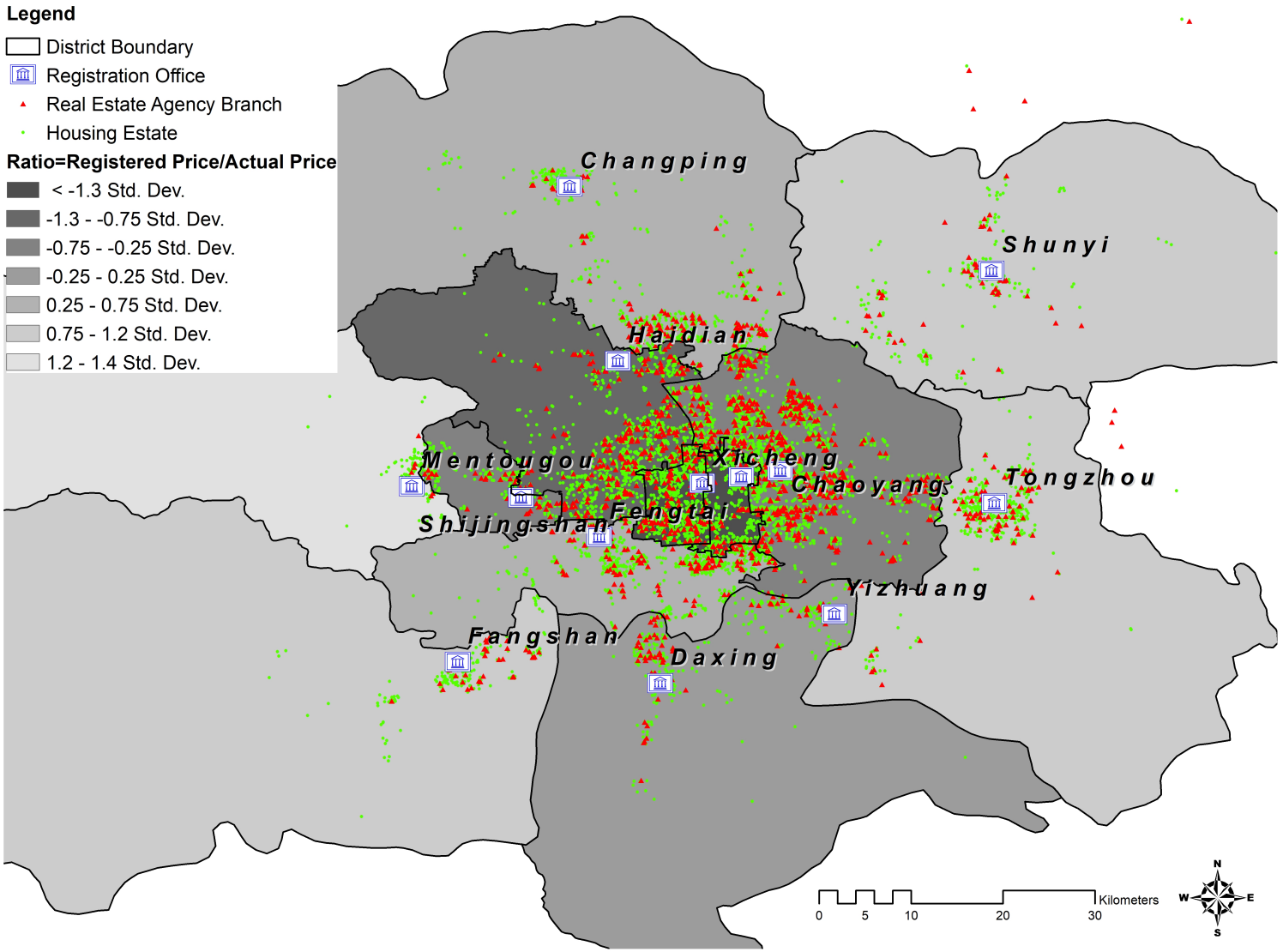
Notes: This figure presents the trends of actual unit price, registered unit price, and registered-actual price ratio in Beijing's resale residential housing market through the sample period. The two red vertical lines indicate two waves of policies introduced in Section 2.2.

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: *Notice on Resolutely Curbing the Soaring of Housing Prices in Some Cities*	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: *Notice on Further Improving Regulation of the Real Estate Market*	-	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: *Notice on Adjusting the Preferential Policies on Deed Tax and Individual Income Tax during Real Estate Transactions*	-	-	Redefine ordinary housing that entile 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: *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* No. 39 [2015] of the Ministry of Finance: *Notice of the Ministry of Finance and the State Administration of Taxation on Adjusting the Business Tax Policies on Individual Housing Transfers*	-	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: *Notice on Promoting the Sustained and Healthy Development of the Real Estate Market*	-	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%.	-

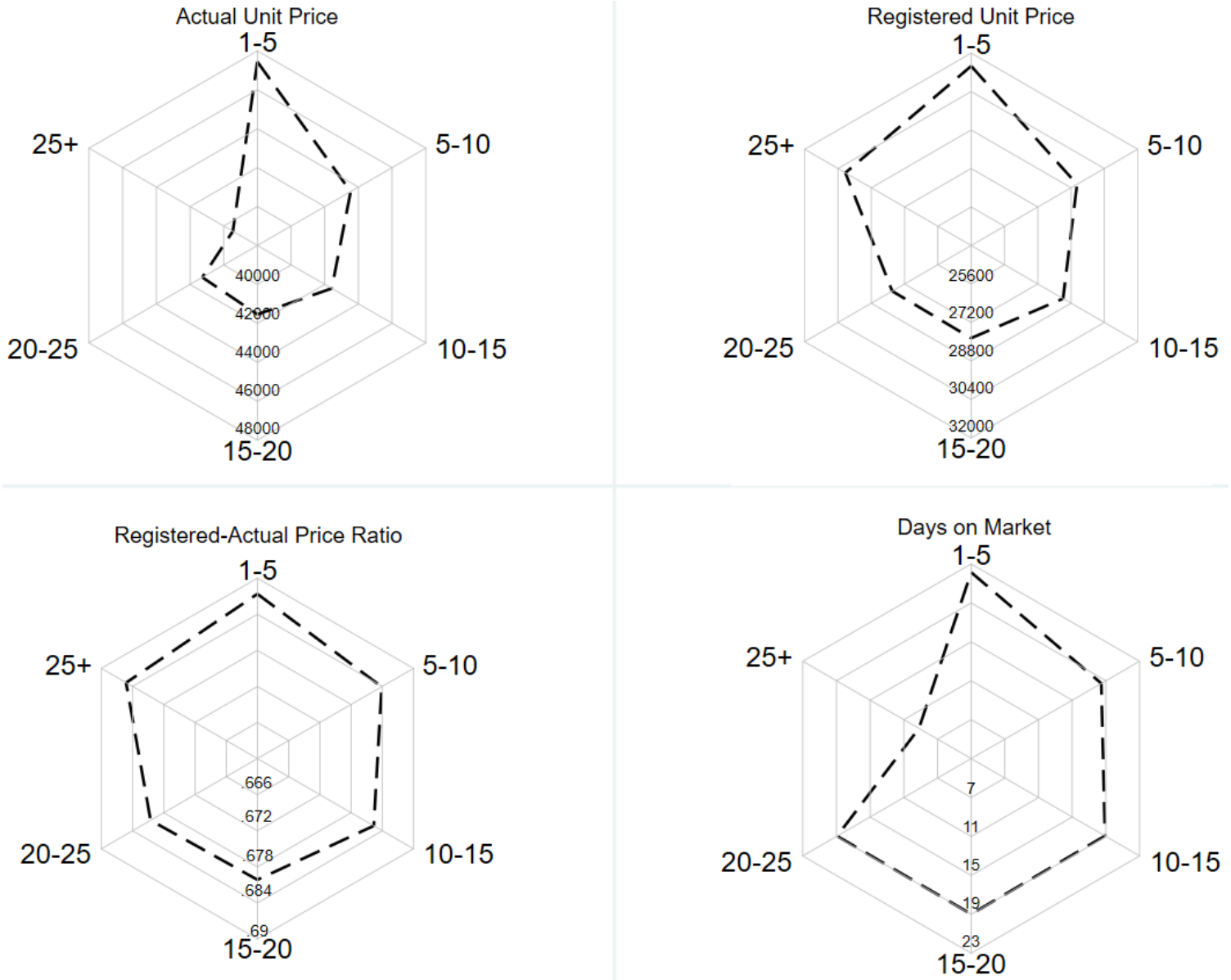
Notes: This figure summarizes major policy changes from 2010 to 2017. The policy implemented on Sep 30, 2014 only applied to tax changes in the real estate transactions, and the policy implemented on Sep 30, 2016 only applied to bank financing constraints. All other three policies contains more than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

Figure 3: The Sample Distribution



Notes: This figure presents the sample distributions of housing estates, 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	30,841.94	16,916.25	0	615,000
Registered Unit Price	179,580	46,033.65	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
Yin-Yang contract	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					
Fine Decoration	92,406				
Simple Decoration	62,316				
None Decoration	4,457				
Other	20,401				
Panel C. Agent Characteristics					
# of Total Transactions	162,258	21.28	18.28	1	144
Experience	162,258	9.83	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-Years	33,400				
# of Two-to-Five-Years	23,277				
# of over Five-Years	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	**Panel A.** Without Agent FE			**Panel B.** With Agent FE		
Dep. Variable	ln(A-Price)	ln(R-Price)	Ratio	ln(A-Price)	ln(R-Price)	Ratio
Model	(1)	(2)	(3)	(4)	(5)	(6)
Housing Characteristics						
ln(UnitSize)	-0.202***	-0.304***	-0.055***	-0.203***	-0.305***	-0.051***
	(0.008)	(0.010)	(0.004)	(0.015)	(0.020)	(0.009)
ln(Visit)	-0.006***	-0.008***	-0.002***	-0.006***	-0.009***	-0.002**
	(0.000)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)
Floor level	-0.000	0.002***	0.001***	-0.000	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
# of Bedroom	0.031***	0.021***	-0.012***	0.032***	0.025***	-0.010***
	(0.002)	(0.003)	(0.001)	(0.004)	(0.006)	(0.003)
# of Livingroom	0.031***	0.029***	-0.003***	0.032***	0.030***	-0.004
	(0.002)	(0.003)	(0.001)	(0.005)	(0.006)	(0.003)
# of Bathroom	-0.011***	-0.006	0.003*	-0.009	-0.006	0.002
	(0.003)	(0.004)	(0.002)	(0.007)	(0.007)	(0.004)
Decoration_simple	0.020***	-0.005	-0.013***	0.018***	-0.006	-0.013**
	(0.002)	(0.005)	(0.003)	(0.005)	(0.010)	(0.006)
Decoration_luxury	0.048***	0.005	-0.024***	0.045***	0.002	-0.025***
	(0.002)	(0.005)	(0.003)	(0.005)	(0.010)	(0.006)
Decoration_other	0.034***	0.003	-0.016***	0.033***	0.007	-0.013**
	(0.002)	(0.005)	(0.003)	(0.005)	(0.010)	(0.006)
HP 2-5 yrs	0.007***	-0.048***	-0.036***	0.008**	-0.037***	-0.030***
	(0.002)	(0.003)	(0.002)	(0.004)	(0.008)	(0.004)
HP >5 yrs	0.019***	0.123***	0.067***	0.020***	0.122***	0.067***
	(0.001)	(0.003)	(0.002)	(0.003)	(0.007)	(0.004)
Buyer Characteristics						
Mortgage	0.000	0.158***	0.094***	0.002	0.152***	0.092***
	(0.001)	(0.003)	(0.002)	(0.002)	(0.006)	(0.003)
MaleBuyer	-0.001*	0.011***	0.008***	-0.001	0.008**	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)
ln(BuyerAge)	0.006***	-0.162***	-0.106***	0.002	-0.163***	-0.106***
	(0.001)	(0.004)	(0.002)	(0.003)	(0.007)	(0.005)
LocalBuyer	0.002***	-0.092***	-0.060***	0.004***	-0.082***	-0.055***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.004)	(0.002)
Seller Characteristics						
MaleSeller	0.002***	0.007***	0.003***	0.003***	0.008***	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)
ln(SellerAge)	0.001	0.039***	0.024***	-0.002	0.031***	0.020***
	(0.001)	(0.003)	(0.002)	(0.003)	(0.007)	(0.004)
LocalSeller	0.001	0.002	0.000	0.000	-0.001	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.004)	(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 estates, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	**Panel A.** Continuous Learning Effect			**Panel B.** Binary Learning Effect		
Dep. Variable	ln(A-Price)	ln(R-Price)	Ratio	ln(A-Price)	ln(R-Price)	Ratio
Model	(1)	(2)	(3)	(4)	(5)	(6)
ln(Experience)	-0.054***	-0.125***	-0.044***			
	(0.008)	(0.019)	(0.011)			
First				0.006***	0.010***	0.003***
				(0.001)	(0.002)	(0.001)
MaleAgent	0.000	-0.000	-0.000	0.000	0.000	-0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
ln(AgentAge)	0.004**	0.006	0.001	0.005**	0.006	0.001
	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 4: Self-Learning Effects - Monitoring Capability

Dep. Variable	ln(A-Price)	ln(R-Price)	Ratio
Model	(1)	(2)	(3)
ln(Distance)	0.141***	0.071	-0.043***
	(0.054)	(0.052)	(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 estate, 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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.

Table 5: Self-Learning 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***	0.142**	0.213***	0.169***	0.174***
	(0.025)	(0.063)	(0.081)	(0.015)	(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 estate, 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**	0.078	0.085	0.015	0.018
	(0.031)	(0.068)	(0.105)	(0.019)	(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 estate, 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	-0.040	-0.078***	-0.101***	-0.069***
	(0.018)	(0.030)	(0.015)	(0.009)	(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 estate, 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 experiences. 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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	**Panel A. OLS**	**Panel B. IV**	
Stage		**First-Stage**	**Second-Stage**
Dep. Variable	Ratio	Ratio of Peers	Ratio
Model	(1)	(2)	(3)
Ratio of Peers	0.056***		0.595**
	(0.009)		(0.288)
Tenure of Peers		-0.008*	
		(0.004)	
ln(Experience)	-0.045***	0.005	-0.063***
	(0.001)	(0.015)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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		
	Before	After
Treat: 2-5 year	25.50%	20%
Control: <2 year	25.50%	25.50%

Test 2: Reduction of 30% down-payment		
	Before	After
Treat: Mortgage Buyer	70%	40%
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	March 30, 2015 Policy				September 30, 2016 Policy	
Test	Test 1		Test 2		Test 3	
Dep. Variable	ln(Vol)	Ratio	ln(Vol)	Ratio	ln(Vol)	Ratio
Model	(1)	(2)	(3)	(4)	(5)	(6)
$Treat_1$*$After_{2015}$	0.386***	-0.003				
	(0.060)	(0.003)				
$Treat_2$*$After_{2015}$			0.448***	0.031***		
			(0.043)	(0.004)		
$Treat_2$*$After_{2016}$					-0.132*	-0.045***
					(0.077)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	March 30, 2015 Policy				September 30, 2016 Policy	
Test	Test 1		Test 2		Test 3	
Dep. Variable	ln(Vol)	Ratio	ln(Vol)	Ratio	ln(Vol)	Ratio
Model	(1)	(2)	(3)	(4)	(5)	(6)
$Treat_1$*$After_{2015}$	0.026	-0.004				
	(0.123)	(0.120)				
$Treat_1$*$After_{2015} * ln(Experience)$	-0.005	0.002				
	(0.015)	(0.016)				
$Treat_2$*$After_{2015}$			0.132***	0.045***		
			(0.027)	(0.011)		
$Treat_2$*$After_{2015} * ln(Experience)$			0.009**	-0.002*		
			(0.004)	(0.001)		
$Treat_2$*$After_{2016}$					-0.146***	-0.054**
					(0.036)	(0.022)
$Treat_2$*$After_{2016} * ln(Experience)$					-0.014*	0.003*
					(0.008)	(0.001)
Constant	0.025	0.638***	0.029	0.584***	0.050***	0.469***
	(0.034)	(0.062)	(0.025)	(0.008)	(0.011)	(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 estate, 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 administrative-district 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	ln(DoM)
Model	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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 Experiences on Days on Market

Dep. Variable	ln(DoM)	
Model	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	**Panel A.** Without Branch FE			**Panel B.** With Branch FE		
Dep. Variable	ln(A-Price)	ln(R-Price)	Ratio	ln(A-Price)	ln(R-Price)	Ratio
Model	(1)	(2)	(3)	(4)	(5)	(6)
Housing Attributes						
ln(UnitSize)	-0.202***	-0.304***	-0.055***	-0.201***	-0.307***	-0.055***
	(0.008)	(0.010)	(0.004)	(0.010)	(0.014)	(0.006)
ln(Visit)	-0.006***	-0.008***	-0.002***	-0.006***	-0.010***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Floor level	-0.000	0.002***	0.001***	-0.000	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
# of Bedroom	0.031***	0.021***	-0.012***	0.033***	0.023***	-0.012***
	(0.002)	(0.003)	(0.001)	(0.003)	(0.004)	(0.002)
# of Livingroom	0.031***	0.029***	-0.003***	0.031***	0.031***	-0.002
	(0.002)	(0.003)	(0.001)	(0.003)	(0.004)	(0.002)
# of Bathroom	-0.011***	-0.006	0.003*	-0.012***	-0.012**	0.001
	(0.003)	(0.004)	(0.002)	(0.005)	(0.005)	(0.003)
Decoration_simple	0.020***	-0.005	-0.013***	0.016***	-0.007	-0.012***
	(0.002)	(0.005)	(0.003)	(0.003)	(0.007)	(0.004)
Decoration_luxury	0.048***	0.005	-0.024***	0.044***	0.003	-0.023***
	(0.002)	(0.005)	(0.003)	(0.003)	(0.007)	(0.004)
Decoration_other	0.034***	0.003	-0.016***	0.030***	0.007	-0.012***
	(0.002)	(0.005)	(0.003)	(0.003)	(0.007)	(0.005)
HP 2-5 yrs	0.007***	-0.048***	-0.036***	0.006**	-0.043***	-0.033***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)
HP >5 yrs	0.019***	0.123***	0.067***	0.018***	0.126***	0.070***
	(0.001)	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)
Buyer Characteristics						
Mortgage	0.000	0.158***	0.094***	0.001	0.155***	0.093***
	(0.001)	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)
MaleBuyer	-0.001*	0.011***	0.008***	-0.001	0.011***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
ln(BuyerAge)	0.006***	-0.162***	-0.106***	0.004*	-0.162***	-0.105***
	(0.001)	(0.004)	(0.002)	(0.002)	(0.005)	(0.003)
LocalBuyer	0.002***	-0.092***	-0.060***	0.003***	-0.088***	-0.058***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.002)
Seller Characteristics						
MaleSeller	0.002***	0.007***	0.003***	0.002***	0.008***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
ln(SellerAge)	0.001	0.039***	0.024***	-0.001	0.035***	0.022***
	(0.001)	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)
LocalSeller	0.001	0.002	0.000	0.001	0.001	-0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(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 estates, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	**Panel A.** March 30, 2015		**Panel B.** September 30, 2016	
Dep. Variable	Mortgage	LTV	Mortgage	LTV
Model	(1)	(2)	(3)	(4)
$After_{2015}$	0.019***	0.019***		
	(0.006)	(0.004)		
$After_{2016}$			-0.013***	-0.052***
			(0.004)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	Ratio		
Policy	March 30, 2015		September 30, 2016
Model	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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		
Policy	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 estate, 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	Ratio			
Agent Group	Cash Trans.	Mortgage Trans.	Male Agent	Female Agent
Model	(1)	(2)	(3)	(4)
ln(Experience)	-0.027	-0.042***	-0.051***	-0.029
	(0.028)	(0.012)	(0.013)	(0.021)
Constant	0.729***	1.241***	1.028***	1.066***
	(0.068)	(0.026)	(0.029)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	Ratio			
Agent Group	Male Agent	Female Agent	Small Branch	Big Branch
Model	(1)	(2)	(3)	(4)
Tenure of Peers	0.798***	0.242**	0.481	0.550*
	(0.352)	(0.120)	(0.360)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district 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	**Panel A. March 30, 2015**				**Panel B. September 30, 2016**			
Dep. Variable	Ratio				Ratio			
Buyer Group	Male	Female	Local	Non-Local	Male	Female	Local	Non-Local
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treat_2$*$After_{2015}$	0.031***	0.034***	0.018***	0.034***				
	(0.006)	(0.006)	(0.006)	(0.007)				
$Treat_2$*$After_{2016}$					-0.044***	-0.047***	-0.060***	-0.039***
					(0.003)	(0.004)	(0.004)	(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 estate, days of the week, and year-month are included in all columns. Heteroscedasticity-consistent standard errors are clustered at the administrative-district level as shown in the brackets. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively.