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THE IMPACT OF EXOGENOUS DEMAND SHOCK ON THE HOUSING MARKET: EVIDENCE FROM THE HOME PURCHASE RESTRICTION POLICY IN THE PEOPLE'S REPUBLIC OF CHINA

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Abstract

In order to deal with the rampant increase in housing prices, the Government of the People's Republic of China implemented the home purchase restriction (HPR) policy to curb speculation and prevent housing bubbles. This policy triggered an exogenous demand shock to the housing market. Employing a two-step difference-in-differences approach, we find significantly negative policy effects on property transaction volume but a small impact on housing prices. Cities relying heavily on land sales for fiscal revenue experience a considerably higher increase in property investments after implementation of the HPR policy.

Keywords: home purchase restriction policy, demand shock, housing bubble, land financing

JEL Classification: G12, G18, H83

Contents

1. INTRODUCTION

Considerable evidence indicates that the collapse of debt-laden housing bubbles is the main cause of many financial crises such as the recent Great Recession (Reinhart and Rogoff 2009). Jordà, Schularick, and Taylor (2015a) conclude that housing bubbles fueled by credit booms are most dangerous and costly. These facts have drawn renewed attention to the necessity and effectiveness of public policy in controlling real estate bubbles. Almeida, Campello, and Liu (2006) and Mian and Sufi (2009, 2015) argue that monetary policies such as low interest rates and easy credit cause bubbles and bursts.[1] Cheng, Raina, and Xiong (2014) suggest that financial intermediaries contribute to housing bubbles. Glaeser (2013) finds that housing bubbles often occur when government intervention is minimal. There is an emerging literature investigating the effects of government intervention on the property market.[2] Whether government intervention can help avoid housing booms and busts or simply postpone them remains a lingering question. These discussions suggest it is necessary to study the effects of government intervention in the housing market.

The People's Republic of China (PRC) provides a compelling setting for exploring the role of government regulations in the housing market for several reasons. Despite its short history, the importance of the PRC's housing market cannot be underestimated. As one of the main drivers of the PRC's economic growth, the real estate sector accounts for one-sixth of its GDP, one quarter of total fixed asset investment, 14% of total urban employment, and approximately 20% of bank loans (International Monetary Fund 2014). Unlike most countries, the PRC's local governments are the ultimate owners of land and play the dominant role of controlling and managing housing and credit supply. They rely heavily on real estate-related income—land sales in particular—as a source of fiscal revenue. As the second largest economy and the largest trading nation in the world, a sharp slowdown in the PRC's property sector could have a domino effect on the world economy, especially in the emerging markets. Ahuja and Myrovda (2012) predict that a 10% reduction in the PRC's real estate investments would shave about 1% off the PRC's real GDP within the first year and cause global output to decline by roughly 0.5% from the baseline.

The PRC's government has heavily interfered in the housing market through various regulations aimed at maintaining a stable market and curbing speculations or preventing bubbles. Evidently, the PRC's real estate market has witnessed price upsurges in the past decade, although there were a few setbacks. MacDonald, Mussita, and Sobczak (2012) show that property prices in the PRC increased at a compound annual growth rate (CAGR) of about 16% between 2005 and 2011, more than the 13% recorded in the United States housing market between 2000 and 2005. The drastic price surge has caused extensive concern about a possible housing bubble in the PRC. Studies by Wu, Gyourko, and Deng (2012) and Ren, Xiong, and Yuan (2012) find no conclusive evidence of a housing bubble in the PRC but raise great concern about the over-valuation of housing prices. More recently, Fang, Gu, Xiong, and Zhou (hereafter FGXZ 2015) show that the rampant run-up in housing prices and speculation present significant challenges to the PRC's economy and regulators. Chen,

[1] In addition to Mian and Sufi (2009, 2015), there is a rapidly growing literature examining the links between monetary policy, mortgage borrowing, and housing price appreciation, including Jordà, Schularick, and Taylor (2015b); Del Negro and Otrok (2007); Goodhart and Hofmann (2008); Glaeser and Sinai (2013); Jarocinski and Smets (2008); Williams (2011); and Bernanke (2010).

[2] See Almeida, Campello, and Liu (2006); Crowe et al. (2013); International Monetary Fund (2011); Igan and Kang (2011); Kannan, Rabanal, and Scott (2012); and Wong et al. (2011) for studies on government regulations on the real estate sector.

Liu, Xiong, and Zhou (2017) report on the real effect of investments crowded out by the housing bubble in the PRC. Several papers (Du and Zhang 2015; Jia et al. 2014; Sun et al. 2015) have examined the impacts of the HPR policy on the housing prices and sales in the markets of Beijing, Shanghai, and Guangzhou. None of them provide a systematic study of the impact of the policy.

Faced with rampant price surges and speculation, the PRC's government has adopted various policy tools, including the increase of the minimum down payment ratio; a cap on the loan-to-value ratio; higher mortgage rates for the second house; taxes on capital gains; credit rationing for real estate developers;[3] and so on. When the effectiveness of these measures diminished, the PRC's government resorted to the heavy-handed home purchase restriction (HPR) policy to curtail speculation. This policy was implemented first in Beijing in May 2010 and was later adopted by 45 other major cities. The PRC's HPR policy is similar to the measures adopted by the Australia, Hong Kong, and Singapore governments[4] in the sense that it directly reduces housing demand by disqualifying certain buyers. Under the PRC's HPR policy, only investors who have local household registration (*hukou*) or those with work records in their cities for certain consecutive years are qualified to purchase new homes. Unlike other nationwide cooling measures, such as control of the mortgage rate, the HPR policy is decentralized in that cities can decide whether or not to adopt this policy on their own.[5] The variation in the timing of the HPR policy adoption across cities provides a rare opportunity to study exogenous demand shock and its impact on the real estate sector.

Using detailed city-level quarterly panel data for the years 2008–2013, we systematically assess the effects of government intervention on the PRC's housing market. Our data cover various indicators for the real estate sector, including housing price (or index); sales of new homes; investment and construction by the developers; and land sales. We not only systematically analyze the HPR policy's effect on the housing market but also capture heterogeneous market responses to the policy across cities. This study thus enables a deep understanding of the misalignment of interests when the housing market becomes "too big to fail" for the local economy.

Considering that the adoption of the HPR policy is not random, we employ the two-step difference-in-differences (DID) approach developed by Donald and Lang (2007) and Greenstone and Hanna (2014) as our main empirical strategy to draw the causal inference of the policy effect on the housing market. Further, we perform a structural break test as the robustness check on the validity of DID design. We discover a temporary decrease in housing prices and a sharp plunge in the transaction volume of new homes following HPR policy implementation. This evidence is consistent with the policy motivation of curbing speculative demand in the property market. The policy, however, does not address the problem of excessive supply as the increase in property investment and construction continue after the implementation of this policy.

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[3] People's Bank of China issued its No. 359 regulation in 2007 to strengthen the management of commercial real estate credit loans to real estate developers.

[4] For example, the Singapore and Hong Kong, China governments have implemented several demand-managing measures to restrict property purchases by foreigners, including a higher down payment ratio, a higher rate of buyer's stamp duty on property transactions, etc. The Australian government has strengthened its restrictions on property buying by foreigners since 2010. Under those restrictions, temporary residents are allowed to buy established homes with approval from the foreign-investment regulator but have to sell when their temporary visas expire.

[5] The central government only provides guidelines that the policy be implemented in the first-tier cities and can be extended on a need basis to the second- and even third-tier cities, rather than being mandated for all cities.

More importantly, we investigate the economic mechanisms that explain why the HPR policy is effective in dampening housing prices and transactions but ineffective in reducing construction. This finding echoes the crowd-out effects of the housing boom on manufacturing investment documented by Chen, Liu, Xiong, and Zhou (2017). Real estate booms are usually characterized by rapid increases in prices, but the accompanying construction boom and substantial increase in the number of vacant homes are particularly prominent issues in the PRC and are worthy of further investigation. Our results suggest that the effectiveness of the HPR policy is limited due to strong demand by the PRC's residents for housing as a major investment vehicle and local authorities' misaligned incentives and circumvention. In doing so, we relate the effectiveness of the policy with government incentives, especially the reliance on land financing for fiscal revenues. The empirical findings show that cities with heavy reliance on land financing experience no salient impact when they adopt the HPR policy. These findings suggest the moral hazard problems of local politicians in choosing regulatory measures for the "too-big-to-fail" sectors (Choudhry and Landuyt 2011).

Our findings are similar in spirit to the recent literature on asset bubbles and speculation. It is well known that in an economy with heterogeneous agents, optimistic investors will bid up asset prices (Miller 1977; Harrison and Kreps 1978; Hirshleifer 2001; Xiong 2013). The HPR policy does not specifically target optimistic investors or speculators and hence will not dampen investor sentiment. Furthermore, the HPR policy can ultimately be considered as an alternative to raising the transaction cost for speculators who can strategically circumvent the HPR policy at some cost. However, Shiller (2000) shows that high transaction cost does not deter asset bubbles in the real estate sector. Thus, it is important to draw analytic inferences on the effect of the HPR policy and provide policy recommendations since the PRC's government continued to strengthen home purchase restriction policies in many cities in 2016 and 2017 due to the failure of other standard policies in preventing housing bubbles and curbing speculation.

The rest of this paper proceeds as follows: Section 2 summarizes the evolution of government policies toward the residential property market and reviews the relevant literature; Section 3 presents the data source and summary statistics and outlines the empirical strategy; Section 4 reports on the main empirical results; Section 5 compares the effects of the HPR policy across cities and Section 6 concludes the paper.

2. POLICY BACKGROUND AND LITERATURE REVIEW

The PRC's private housing market, barely existent twenty years ago, largely continued to boom throughout the last decade both in volume and price.[6] It is important not only for the households but also for the overall economy. Due to the shortage of investment tools in the PRC, households in general tend to devote most of their wealth to housing, both for consumption and investment. With the highest home ownership rate of 88% in the world (Economist Intelligence Unit 2011), the value of the PRC's urban residential property market is estimated to be RMB 115 trillion as of the end of 2012, far outstripping the RMB 23 trillion for the stock market and RMB 26 trillion for the bond market. Real estate has made up more than 60% of the PRC's household assets since 2008, dwarfing the 48% in the United Kingdom, 32% in Japan, and 26% in the United States.[7] Moreover, housing investment is an important pillar for economic

[6] A review of China's housing market can be found in Chen et al. (2011).

[7] Standard Chartered Report, "China—Real Estate: Good News in Tough Times," 4 July 2013.

growth, particularly in the PRC, owing to its significant share in overall economic activity (Chen and Zhu 2008). Investment in housing accounts for 25% of total fixed asset investments, contributing to roughly one-sixth of the PRC's GDP growth (Barth et al. 2012).

What is therefore potentially dangerous is a housing market meltdown that can cause a catastrophic crisis, given its size and critical role in the economy (Helbling and Terrones 2003; Goodhart and Hofmann 2008).[8] Zhou (2005) and Glindro, Subhanij, Szeto, and Zhu (2005) attempt to explain the underlying factors that caused the housing prices fluctuations, while some focus on the price misalignment and the sustainability of the PRC's housing boom (Wu, Gyourko, and Deng 2012; Ahuja et al. 2010; Barth et al. 2012; Economist Intelligence Unit 2011). Others look at the relationship between housing prices and land policy regulation (Cai, Henderson, and Zhang 2013; Du, Ma, and An 2010).

The PRC's government has interfered actively and significantly in the private housing market. Ahuja et al. (2010) find that during the past decade, any discrepancies in housing prices were corrected relatively quickly due to government intervention. FGXZ (2015) point out that through major interventions, the PRC's government has played a more important role in affecting the housing market than its counterparts in the rest of world.

Since the mid-1990s, the PRC's government has made great efforts to promote housing finance and stimulate the growth of the real estate sector to support housing reform and fight against the adverse economic impacts of the 1997 Asian financial crisis. For example, between 1998 and 2002, the central government lowered the mortgage rate five times to encourage home purchases. By 2005, the PRC had become the largest residential mortgage market in Asia, with an outstanding balance exceeding RMB two trillion ($300 billion), an almost 89-fold increase compared to the 1997 balance (Deng and Liu 2009; Zhu 2006). Meanwhile, the government rolled out various policies favoring housing development, such as broadening the scope of development loans and allowing pre-sales. As a result, annual housing investments increased by about six times between 1997 and 2005 (Ye and Wu 2008).

The PRC's housing market has experienced a rapid boom since early 2004. In response, the government implemented a series of policy tools to curtail speculative activities. For example, the minimum down payment ratio was raised to 40% in September 2007 and the mortgage rate was set 10% higher than the benchmark rate. These measures worked well for a short period, partially aided by the global financial crisis that began in 2007.

In an effort to avoid an economic slowdown caused by the global financial crisis, the PRC's government reversed its housing policy in October 2008. This included a series of measures to support housing market growth. Among them, the minimum mortgage rates were adjusted downward to 70% of the benchmark rate and the down-payment ratio was lowered to 20%. Preferential policies were also introduced for first-time home buyers. Fueled by easy credit and lax monetary policy, the housing market regained momentum in mid-2009 and started a new round of price run-ups and a massive construction boom across the nation.

In response to the continuing surge in housing prices, the government launched a campaign against the overheated property market in early 2010. Various tightening measures were put in place, such as raising the down payment ratio, prohibiting

[8] Davis and Van Nieuwerburgh (2014) provide an excellent review of the literature that explores the interconnections of macroeconomics, finance, and housing.

mortgages on second home purchases, and imposing a business tax and personal income taxes on housing transactions. However, none of these measures can be compared to the most stringent policy instrument—the HPR policy adopted by various local municipalities. In Beijing, for example, the policy dictates that each family with Beijing *hukou* can own a maximum of two homes. Families without local *hukou* are not allowed to buy any homes unless they can provide documents to prove payment of taxes and social security contributions in the last five consecutive years. The goal of the HPR policy is to prevent a housing bubble, although it does not touch upon the fundamentals driving the speculative demand, e.g., the shortage of other investment tools for residents.

Since late 2013, an alarming economic slowdown has emerged with the residential property market declining. Housing prices started to fall in an increasing number of cities while residential property inventories increased sharply. Between 2003 and 2014, the PRC's builders added 100 billion square feet of floor space, or 74 square feet for every person, leaving the nation with a large amount of unsold property as of the end of 2015.[9] Much of this unsold property is in smaller or inland cities known as "third- or fourth-tier" cities. Not able to sit idly and watch the free fall of housing prices, most municipal authorities abolished the HPR policy in mid-2014. By the end of that year, the policy was only in force in the four megacities of Beijing, Shanghai, Guangzhou, and Shenzhen.

Not surprisingly, the PRC's housing market has been the topic of many empirical investigations. Some research attempts to explain the underlying factors of the housing price movement and the sustainability of the housing boom (Economist Intelligence Unit 2011; Wu, Gyourko, and Deng 2012; Chivakul et al. 2015). Others look at the association of housing prices with land policy (Cai, Henderson, and Zhang 2013; Du, Ma, and An 2010). Fang, Gu and Zhou (2014) measure the corruption of home purchasing in the PRC. Although the PRC's government has actively intervened in the real estate sector, especially in light of the United States subprime mortgage crisis, very few studies have examined the effects of these cooling measures.

A few papers focus on the introduction and evolution of HPR policies, such as Wang and Murie (1999); Deng, Shen, and Wang (2011); and Zou (2014). The lack of systematic analyses of the heavy-handed government restrictions on home purchases motivates our research. To our knowledge, there are only three papers examining the policy impact but they each look at individual markets. Sun et al. (2015) investigate the effects of the policy on Beijing's resale and rental market while Jia, Wang, and Fan (2017) focus on the response of Guangzhou's real estate sector to the policy implementation. Using a counterfactual analysis, Du and Zhang (2015) evaluate the effects of the HPR policy and the trial property tax on housing prices in Beijing, Shanghai, and Chongqing. They find that the HPR policy lowers the annual growth rate of housing prices in Beijing by 7.69% while the trial property tax had no significant effects on housing prices in Shanghai. In this paper, we aim to bridge the gap by assembling a set of empirical analyses on real estate market dynamics in relation to the HPR policy across various municipalities. Aside from housing prices and sales, we also investigate the responses of housing supply to the policy as the construction boom and substantial increase in the number of vacant homes are distinct features of a housing bubble. All of these distinguish our study from the existing literature.

[9] The data is collected from NBS (http://www.stats.gov.cn/tjsj/ndsj/2014/indexeh.htm); Chivakul et al. (2015); and the China Residential Property Development Report 2016–2017, available at: http://finance.ifeng.com/a/20161130 /15044828_0.shtml.

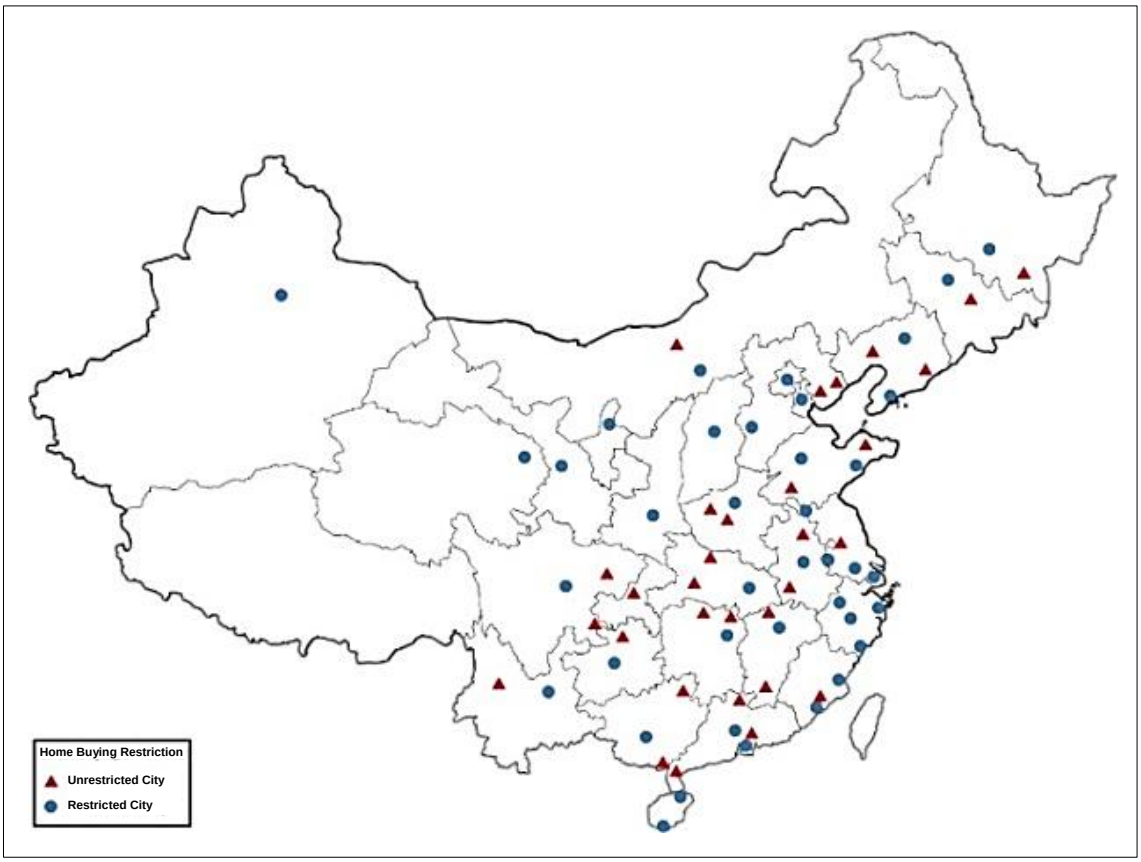
3. DATA AND EMPIRICAL STRATEGY

To perform the empirical analysis, we construct a city-level panel data file for the years 2008–2013 at a quarterly frequency from a number of sources, including the National Bureau of Statistics (NBS), a leading residential real estate data vendor in the PRC (*Soufun*), a nationwide independent agent (*City House*), and the scholars FGXZ (2015). Our main empirical analysis focuses on the 70 cities whose housing prices are regularly surveyed by NBS. A more detailed description of data sources can be found in Appendix 1.

3.1 Data

The HPR Policy. The HPR policy was initiated by the Chinese central government under the so-called "New National Ten Clauses" and "New National Eight Clauses" issued in April 2010 and January 2011, respectively.[10] It was implemented in 46 cities afterward. Among the 70 cities of which NBS regularly publishes their property price indexes, 39 of them adopted the policy. Figure 1 plots the locations of these 70 cities and classifies them into two groups of restricted and unrestricted cities.

Figure 1: Location of 70 Major Cities



Note: This figure shows the location of our 70 sample cities where the dots denote the cities implementing the HPR policy and triangles denote the cities not adopting the HPR policy.

[10] The full name of the "New National Ten Clauses" is "Notice of the State Council on Resolutely Curbing the Soaring of House Prices in Some Cities" while the full name of the "New National Eight Clauses" is "Notice of the State Council on Further Problems Related to the Intervention of Real Estate Market."

Manually collecting the local versions of "New National Ten Clauses" and "New National Eight Clauses," we assemble a comprehensive dataset that traces the policy changes. Table A2 in Appendix 1 summarizes the policy implementation statuses of all our sample cities. Beijing was the first city to enforce the HPR policy in May 2010, followed by Shenzhen in September; Dalian, Fuzhou, Hangzhou, Xiamen, Guangzhou, and Wenzhou in October; and Lanzhou and Zhengzhou in November and December, respectively. In the spring of 2011, due to the requirements set by the "New National Eight Clauses," the other 29 municipal governments launched HPR policies in their cities.

Housing price. We obtain the housing price or price index data from several sources, among which the most widely used measures are NBS price indices of newly constructed (*PINew.NBS*) and secondary residential property (*PISecond.NBS*). Considering the potential underestimation concerns about NBS data,[11] we collect the sale prices of new houses (*Price.CREIS*) from the China Real Estate Index System (CREIS) developed by *Soufun*, and the transaction prices of secondary houses (*Price.Cityhouse*) from City House. The rental prices used in this paper are provided by City House as well.

The price indexes or sale prices released by NBS, CREIS or City House simply compare the mean or median sale prices per square meter. Without adjusting for property features, they represent not only changes in the prices of similar homes but also changes in the quality and composition of transacted homes. To address these concerns, we also use the housing price index (*PI.FGXZ*) recently constructed by FGXZ (2015) with a hybrid hedonic approach to study the effects of the HPR policy.

Housing transaction, investment, construction, and land sales. The transaction of new residential property is measured by three NBS indicators of sales amount (*SaleAmount*), number of flats sold (*SaleUnit*), and floor space sold (*SaleFloor*). The HPR policy could affect the transactions of secondary houses. However, no such data is available because NBS only releases the transaction data for new homes.

We measure the activities of real estate developers with four indicators of real estate investment (*Investment*), floor space started (*FloorStarted*), floor space under construction (*FloorUnderConstruction*), and floor space completed (*FloorComplete*). All of them are published by NBS.[12] We collect the land sales data from the CREIS.[13]

Control variables. Housing prices are usually pushed up disproportionately in times of rapid economic growth because housing demand is often more elastic than housing supply and can remain strong (Economist Intelligence Unit 2011; Chen, Guo, and Wu 2011). In this paper, demand for housing is measured by disposable income per capita of urban residents and the residential population of each city. Moreover, we use the developed areas of city construction to reflect the housing supply potentials of each city. The data for disposable income and developed area of city construction are both obtained from the CEIC database.

[11] As criticized by Ahuja et al. (2010); Wu, Gyourko, et al. (2012), Wu, Deng, et al. (2014), and FGXZ (2015), the NBS property price index is likely to underestimate the housing price appreciation.

[12] Although the property price index of newly constructed and secondary housing transaction, investment, and construction data are published by NBS, we collect them from the CEIC database which has a clear definition for each item.

[13] Land here refers to the land sold via bidding, auction, and listing.

3.2 Summary Statistics

We apply the seasonality adjustment to property investment, floor space started and under construction, land sales, and disposable income that show seasonal fluctuations. Table 1 lists the summary statistics of all variables for the full sample of 70 cities. The mean of the property price indices (*PINew.NBS* and *PISecond.NBS*) indicates that housing prices on average have grown by approximately 35% since 2005, much lower than the appreciation rate estimated by MacDonald, Mussita, and Sobczak (2012). The mean value of sale prices published by the City House is around RMB 7,730 per square meter. The transaction volume averages 13,632 units of flats and 1.39 million square meters of floor space valued at RMB 11,765 million per quarter.

There is clear evidence of an investment and construction boom in the housing market. For example, the quarterly investment by real estate developers averages RMB 12,144 million (slightly below $2,000 million) per city. Construction of residential property grew at an extraordinarily high pace in the sample period. The summary statistics indicate that there is on average about two million square meters of floor space started and 22.3 million square meters of floor space under construction per city-quarter.

Table 1: Summary Statistics

	Obs	Mean	Std. Dev.	Normalized Std. Dev.	Minimum	Maximum
PINew.NBS	1,680	138.05	20.21	0.15	90.99	226.49
PISecond.NBS	1,680	135.68	22.65	0.17	84.10	234.75
Price.Cityhouse	1,550	7,730.66	5,099.41	0.66	1,943.00	37,469.00
PI.FGXZ	1,050	1.33	0.31	0.23	0.78	2.74
SaleUnit	992	13,632.13	12,249.75	0.90	571.00	73,875.00
SaleFloor	1,015	1,390.30	1,213.42	0.87	55.50	8,058.20
SaleAmount	903	11,764.59	13,965.61	1.19	193.00	101,534.00
Investment	1,680	12,144.03	14,448.50	1.19	115.43	93,929.22
FloorStarted	1,680	2,010.10	1,906.28	0.95	0.00	16,812.08
FloorUnderConstruction	1,680	22,333.40	21,648.64	0.97	234.50	192,489.00
FloorCompleted	1,653	1,176.69	1,264.32	1.07	11.43	10,561.56

Notes: This table provides the summary statistics of real estate market indicators for the 70 PRC cities. We collect the data for the property price index—PI.FGXZ from FGXZ (2015) and Price.Cityhouse and Rental from the City House. The data for other variables is obtained from the CEIC. The detailed description of each variable can be found in Appendix 1. Obs—observation; Std. Dev.—standard deviation; Normalized Std. Dev.—the ratio of Std. Dev. to the mean.

To assess the volatility of the housing market, we normalize the standard deviation of each variable by its mean. Among all property market indicators, the investment, sales amount, and floor space completed exhibit the highest level of volatility as their normalized standard deviations all exceed one.

3.3 Method of Estimation

We employ the two-step DID approach developed by Donald and Lang (2007) and Greenstone and Hanna (2014) to assess the impact of the HPR policy on the PRC's residential property market.[14] This approach is numerically equivalent to the Generalized Least Square (GLS) and Feasible Generalized Least Square (FGLS)

[14] The two-step DID estimation of this paper is based on the Stata code provided by Greenstone and Hanna (2014).

approaches that are widely used for a single-step DID approach, but it provides a convenient solution to the problem of intragroup correlation in the unobserved determinants of housing market movement and avoids the problem of collapsing the data into group-levels.[15] The first step is a typical event study-style equation:

$$Y_{it} = \alpha + \sum_{\tau} \sigma_{\tau} D_{\tau,it} + \mu_t + \gamma_i + \beta X_{it} + \epsilon_{it}, \quad (1)$$

where Y_{it} are real estate market indicators in city *i* at quarter *t*. $D_{\tau,it}$ is a vector composed of a separate indicator for each of the quarters before and after the policy is enforced. τ is normalized to be zero in the quarter when the policy is implemented and ranges from -8 (8 quarters before the policy adoption) to 8 (8 quarters after its adoption) so that we have enough city-by-quarter observations. τ is set at zero for the non-adopting cities in order to facilitate the identification of time effects and the coefficients of β on the control variables. The city-fixed effects, γ_i, control for all unobserved factors that are time-invariant and peculiar to each spatial unit and prevent the estimates of the treatment effects, σ_{τ}, from being biased upward by the possibly higher levels of real estate market indicators in the adopting cities, both before and after policy implementation. The inclusion of time effects μ_t controls for all city-invariant factors and the trends such as nationwide legislation or policy changes. The control variables of the developed area of city construction, disposable income per capita, and resident population (X_{it}) are included to account for differential supply and demand factors across cities.

The parameters, σ_{τ}, our main estimates, show the mean value of various real estate market indicators before and after the policy is enforced. The variation in the timing of HPR policy adoption across cities enables us to identify σ_{τ} and time-fixed effects separately. A plot of σ_{τ} estimated from equation (1) against τ not only allows us to visually investigate how the policy changes the real estate market but also informs us about the choice of the preferred second-step model by lending insight into whether the mean reversion appears ahead of the policy's impact.

In the second step, we formally test the association of property market dynamics with the HPR policy via three alternative models. We first estimate:

$$\hat{\sigma}_{\tau} = \pi_0 + \pi_1 1(Policy)_{\tau} + \epsilon_{\tau}, \quad (2A)$$

where $1(Policy)_{\tau}$ indicates whether the policy is in force (i.e., $\tau \geq 1$). π_1 tests whether there is a mean shift in one of the measurements of the housing market after the policy adoption. An alternative specification is:

$$\hat{\sigma}_{\tau} = \pi_0 + \pi_1 1(Policy)_{\tau} + \pi_2 \tau + \epsilon_{\tau}, \quad (2B)$$

where a linear time trend, τ, is included to adjust for differential preexisting trends in the adopting cities.

Equation (2A) and (2B) test for the existence of a mean shift in the real estate market after the policy's implementation. However, the full impact of the policy may change over time if individuals find ways to circumvent the home purchase obstacles set by the government. We therefore estimate the third specification:

[15] We also perform estimation with the single-step approach for comparison. Results are available upon request. As a standard practice in DID approaches, the standard errors from the one-step approach are clustered at the city level.

$$\hat{\sigma}_\tau = \pi_0 + \pi_1 1(Policy)_\tau + \pi_2 \tau + \pi_3 1((Policy)_\tau \times \tau) + \epsilon_\tau. \quad (2C)$$

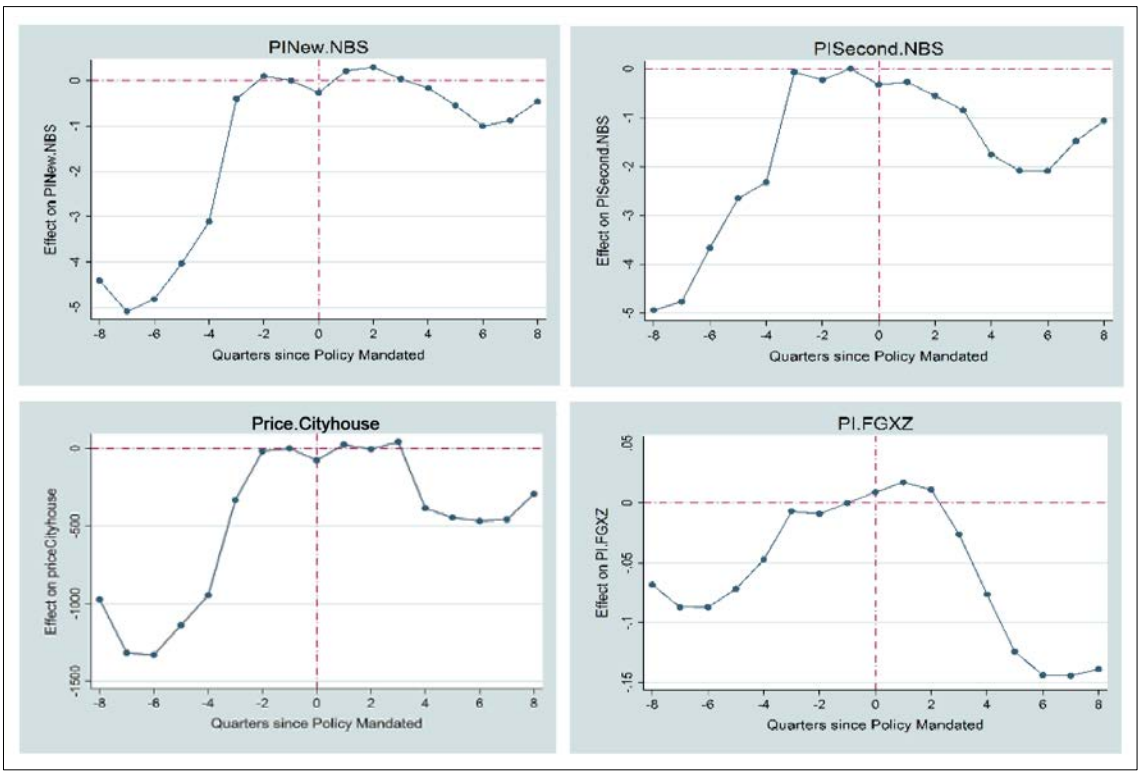
From this specification, we report the policy effect four quarters after its enforcement as $\pi_1 + 4\pi_3$.[16] The second stage equations (2A)-(2C) are weighted by the reciprocal of the standard error of the relevant σ_τ to account for differences in precision in the estimation of these parameters.

4. EMPIRICAL RESULTS

4.1 Effects of the HPR Policy on Housing Prices

We first investigate the policy impact on housing prices. In Figure 2, each event study graph plots σ_τ estimated from equation (1) against τ. The quarter of the policy implementation, $\tau = 0$, is demarcated by a vertical dashed line in all figures. Additionally, all housing price measurements are normalized to be zero at $\tau = -1$ and demarcated by the horizontal dashed line for easy comparison. These graphs not only visually plot the evolution of housing prices around the time of HPR policy adoption but also help identify the most appropriate version of equation (2). Figure 2 indicates that the HPR policy is effective in reversing the upward trend of housing prices. Most price measurements fell to the lowest level six quarters after policy adoption.

Figure 2: Event Study of the HPR Policy on Housing Prices



Notes: The figures provide a graphic analysis of the effect of the HPR policy on housing prices by depicting the estimated σ_τs from equation (1) against the event time τ. The quarter of the policy implementation, $\tau = 0$, is demarcated by a vertical dashed line in all figures. All property market measurements are normalized to equal zero at $\tau = -1$ and demarcated by the horizontal dashed line.

[16] We also test the policy effects eight quarters after the adoption. The results are similar and available upon request.

The oscillating trends observed in Figure 2 suggest that the parallel trends assumption of the simple DID or mean shift model (i.e., equation [2A]) may be violated in many cases. This is particularly true for PRC's housing market where both prices and sales exhibited strong growing trends before the policy's enactment. Equations (2B) and (2C) that account for differential trends are hence more likely to produce valid estimates. Table 2 reports the policy effects estimated by the two-step DID approach. Column (1) lists the estimate of π_1 from equation (2A). It tests how σ_τ on average changes after the policy is mandated. Column (2) presents the estimate of π_1 and π_2 from fitting into equation (2B), where π_1 tests for policy effectiveness by accounting for the trend (τ). Column (3) shows the estimation results of equation (2C) that allow for a mean shift and trend break after the policy is in force. We report the estimated effect of the policy four quarters after the implementation as $\pi_1 + 4\pi_3$.

Table 2: Trend Break Estimates of the Policy Effect on Housing Prices

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. PINew.NBS			***Panel B. PISecond.NBS***		
π_1: l(Policy)	2.42***	0.03	0.06	1.17	–0.80	–0.78
	(0.77)	(1.41)	(0.68)	(0.73)	(1.39)	(0.53)
π_2: Time Trend		0.28*	0.85***		0.23	0.81***
		(0.14)	(0.11)		(0.14)	(0.08)
π_3: l(Policy) × time trend			–0.97***			–1.00***
			(0.14)			(0.11)
4-quarter effect = $\pi_1 + 4\pi_3$			–3.81***			–4.76***
p-value			0.00			0.00
Observations	17	17	17	17	17	17
	Panel C. Price.Cityhouse			***Panel D. PI.FGXZ***		
π_1: l(Policy)	528.96**	146.36	152.17	–0.02	0.06	0.06**
	(201.41)	(399.92)	(228.44)	(0.03)	(0.05)	(0.02)
π_2: Time Trend		45.05	196.41***		–0.01	0.01***
		(40.78)	(36.18)		(0.01)	(0.00)
π_3: l(Policy) × time trend			–258.60***			–0.04***
			(47.28)			(0.00)
4-quarter effect = $\pi_1 + 4\pi_3$			–882.20***			–0.10***
p-value			0.01			0.00
Observations	17	17	17	17	17	17

Notes: This table presents the regression results estimated from the equations (2A), (2B), and (2C) for the impact of the HPR policy on housing prices and rental prices. Robust standard errors are in parentheses. The "4-quarter effect" reports the effect of the policy four quarters after implementation with the *p*-value testing the significance of linear combinations shown below the four-quarter estimates.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

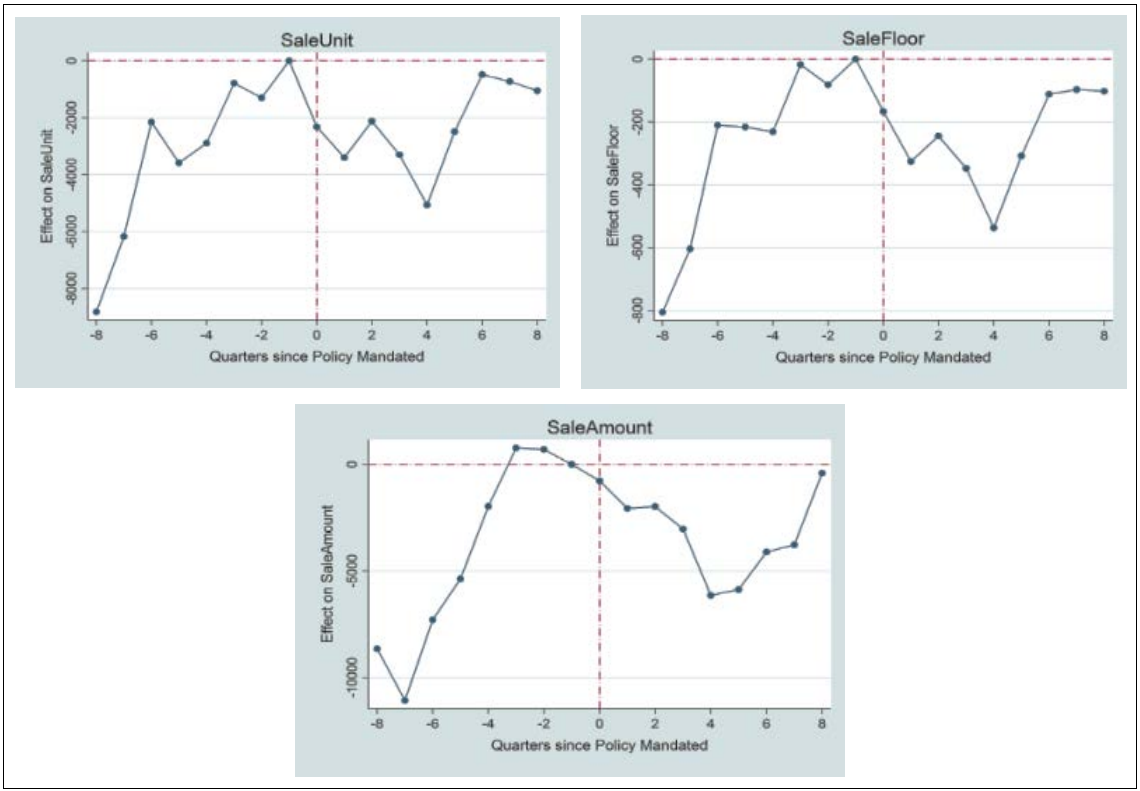
The regression results presented in Table 2 confirm the graphical analysis in the previous subsection that the HPR policy dampened the rampant housing price surge. The results estimated from the most comprehensive second-stage specification (equation [2C]) indicate that four quarters after the policy was in force, NBS property price indexes—*PINew.NBS* and *PISecond.NBS*—declined by 3.81 and 4.76 points, respectively, or 2.8% and 3.5% of the sample mean. However, the fall in the prices released by City House is phenomenal, dropping by RMB 882 or 11.43% of the sample means four quarters after the policy was enforced. The price index estimated by FGXZ

(2015) fell by 0.1 points, or 7% of the mean value of that in the adopting cities a quarter before policy implementation.

4.2 Effects of the HPR Policy on Housing Sales

This subsection examines the policy effect on housing sales. Figure 3 presents event study analysis of the HPR policy impact on housing sales. It indicates that the policy has remarkable impacts on new residential property transactions. Compared with the quarter preceding policy implementation, the floor space sold, the number of flats sold, and the sales amount precipitously dropped in the fourth quarter of policy adoption.

Figure 3: Event Study of the HPR Policy on Housing Sales



Notes: The figures provide a graphic analysis of the effect of the HPR policy on housing sales by depicting the estimated σ_τs from equation (1) against the event time τ. The quarter of the policy implementation, $\tau = 0$, is demarcated by a vertical dashed line in all figures. All property market measurements are normalized to equal zero at $\tau = -1$ and demarcated by the horizontal dashed line.

Table 3 provides the regression results for new housing sales. The results derived from equation (2C) imply that four quarters after the policy adoption, the number of units sold, the floor space sold, and the sales amount plummeted by 7,510 units, 783.3 thousand square meters and RMB 12 billion, respectively, at the magnitudes of 55%, 56.3%, and 102% compared to the whole sample mean. This phenomenal fall in the sales volume hints that the policy enforcement is effective in dampening speculation by nonresidents or policy-sensitive buyers. The plunge in both prices and transaction volume is consistent with the findings reported by Sun et al. (2013) in their Beijing sample.

Table 3: Trend Break Estimates of the Policy Effect on Housing Sales

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. SaleUnit			***Panel B. SaleFloor***		
π_1: I(Policy)	877.99	–4,329.06**	–4,329.75***	20.04	–442.75**	–449.40***
	(1,111.68)	(1,644.34)	(1,333.83)	(107.97)	(170.65)	(137.68)
π_2: Time Trend		613.15***	1,081.28***		54.48***	104.60***
		(167.64)	(212.06)		(17.37)	(22.17)
π_3: I(Policy) × time trend			–795.07**			–83.49**
			(276.36)			(28.61)
4-quarter effect = $\pi_1 + 4\pi_3$			–7,510.0***			–783.3***
p-value			[0.00]			[0.00]
Observations	17	17	17	17	17	17
	Panel C. SaleAmount					
π_1: I(Policy)	972.43	–4,247.24	–4,244.03**			
	(1,696.00)	(3,116.36)	(1,944.24)			
π_2: Time Trend		614.65*	1,750.73***			
		(317.72)	(309.01)			
π_3: I(Policy) × time trend			–1,930.47***			
			(402.80)			
4-quarter effect = $\pi_1 + 4\pi_3$			–11,965***			
p-value			[0.00]			
Observations	17	17	17			

Notes: This table presents the regression results estimated from the equations (2A), (2B), and (2C) for the impact of the HPR policy on the sales of new homes Robust standard errors are in parentheses. The "4-quarter effect" reports the effect of the policy four quarters after implementation with the *p*-value testing the significance of linear combinations shown below the four-quarter estimates.

*** Significant at the 1% level.

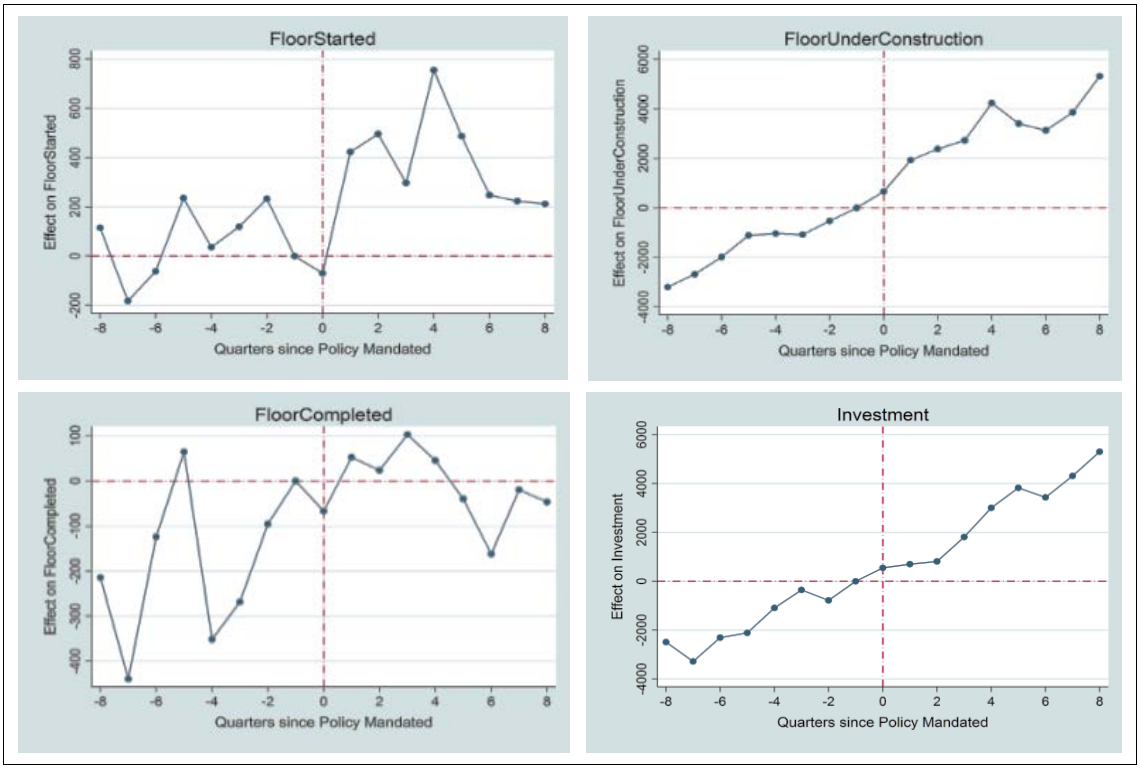
** Significant at the 5% level.

* Significant at the 10% level.

4.3 Effects of the HPR Policy on Housing Construction and Investment

We now turn to investigating the HPR policy effect on investment and construction by real estate developers. Figure 4 shows the event study analysis and Table 4 presents the regression results. No sizable policy effect is observed for real estate investment. On the contrary, its growth momentum remained strong in our sample period. The insignificantly positive regression coefficient on the four quarters' policy effect indicates that property developers did not change their investments despite the policy which was designed to cool the housing market. These findings are reinforced by the insignificant estimation results for the floor space started, under construction, and completed presented in Panels A, B, and C of Table 4. The ineffectiveness of the HPR policy in taming the massive property construction boom is consistent with the reality that the HPR policy is mainly designed to depress speculation from the demand side. A manifestation of this includes the emergence of several ghost cities with an abundance of empty houses.

Figure 4: Event Study of the HPR Policy on Housing Construction



Notes: The figures provide a graphic analysis of the effect of the HPR policy on housing construction by depicting the estimated σ_τs from equation (1) against the event time τ. The quarter of the policy implementation, $\tau = 0$, is demarcated by a vertical dashed line in all figures. All property market measurements are normalized to equal zero at $\tau = -1$ and demarcated by the horizontal dashed line.

Table 4: Trend Break Estimates of the Policy Effect on Housing Investment and Construction

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. FloorStarted			***Panel B. FloorUnderConstruction***		
π_1: I(Policy)	279.12**	196.87	196.02	4,519.11***	803.13	802.69
	(95.65)	(195.77)	(202.10)	(602.06)	(491.48)	(509.59)
π_2: Time Trend		9.68	18.98		437.18***	427.82***
		(19.94)	(32.40)		(50.09)	(80.54)
π_3: I(Policy) × time trend			–15.59			16.03
			(41.96)			(105.37)
4-quarter effect = π_1 + 4π_3			133.68			866.79
p-Value			[0.62]			[0.36]
Observations	17	17	17	17	17	17
	Panel C. FloorCompleted			***Panel D. Investment by Developers***		
π_1: I(Policy)	166.49**	120.50	121.58	4,189.16***	–428.02	–432.95
	(63.87)	(131.57)	(126.17)	(725.36)	(478.88)	(434.71)
π_2: Time Trend		5.41	28.14		543.20***	438.31***
		(13.41)	(19.94)		(48.80)	(68.70)
π_3: I(Policy) × time trend			–38.91			179.55*
			(26.09)			(89.89)
4-quarter effect = π_1 + 4π_3			–34.05			285.26
p-value			[0.45]			[0.25]
Observations	17	17	17	17	17	17

continued on next page

Table 4 *continued*

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel E. Pieces of Land Sold			
π_1: I(Policy)	–0.24	–1.57	–1.57			
	(1.04)	(2.12)	(2.20)			
π_2: Time Trend		0.16	0.21			
		(0.22)	(0.35)			
π_3: I(Policy) × time trend			–0.10			
			(0.45)			
4-quarter effect = $\pi_1 + 4\pi_3$			–1.96			
p-value			[0.50]			
Observations	17	17	17			

Notes: This table presents the regression results estimated from the equations (2A), (2B), and (2C) for the impact of the HPR policy on the construction of residential property, land price, and land sales revenue. Robust standard errors are in parentheses. The "4-quarter effect" reports the effect of the policy four quarters after implementation with the *p*-value testing the significance of linear combinations shown below the four-quarter estimates.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

Construction of residential properties is a long process and may respond to policy implementations with long lags in construction. For example, floor area completed may be determined by housing investment decisions made two to three years ago. Even floor area started may lag as land purchases and removal of old residents and structures take time. To avoid this measurement issue, we test the policy impact on land transactions because they provide more timely reflections of developers' willingness to construct. Panel E indicates that the policy has no measurable impacts on the pieces of land sold, implying that the purchase of land by developers did not change after the policy was implemented.

4.4 Robustness Check

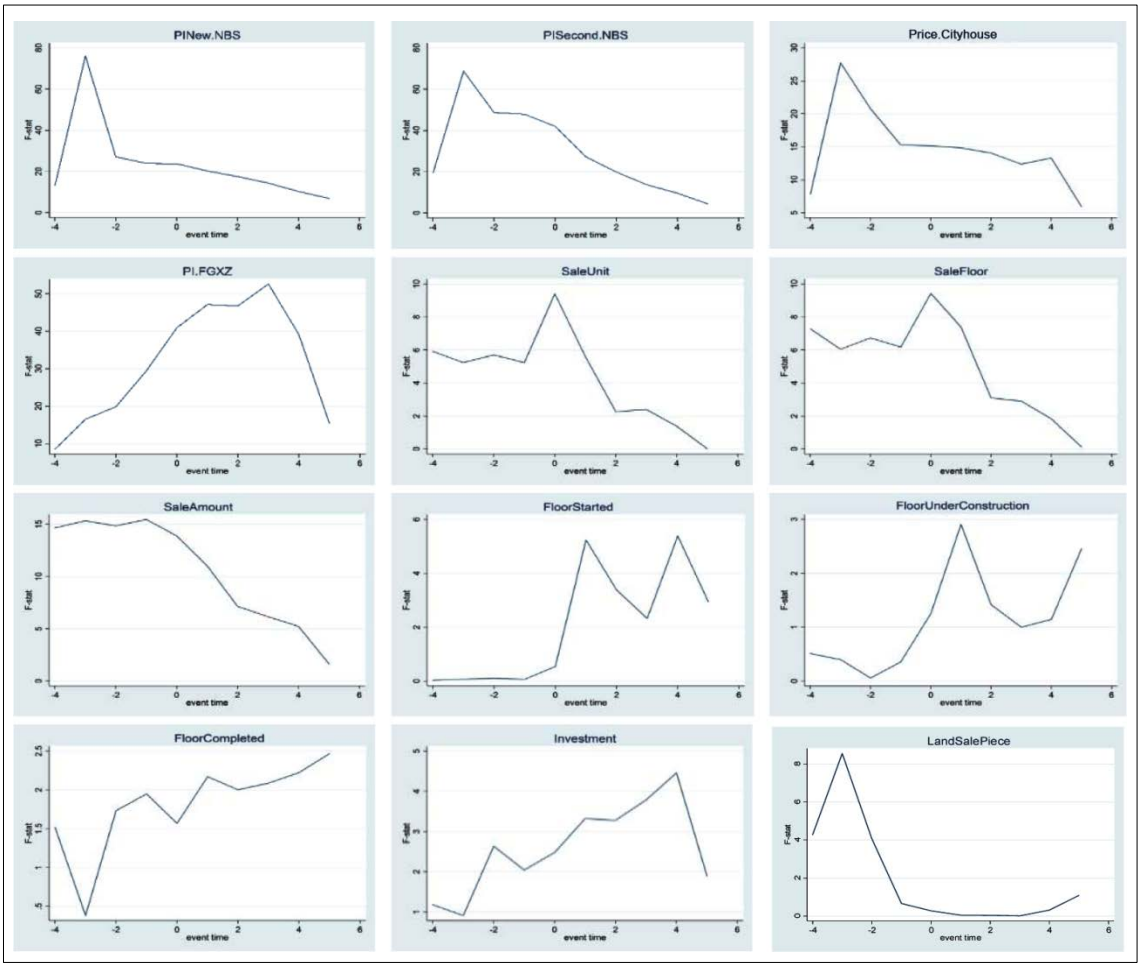
We perform several robustness checks to verify the validity of the two-step DID estimation results. Considering that some variables like housing prices, sales, and construction might grow exponentially, we replace them with logarithm value and re-estimate all models. All the results are qualitatively similar.[17] In addition, we conduct the structural break test and a different sample test.

Structural Break Test—We first employ the structural break test developed by Greenstone and Hanna (2014) to check the robustness of the two-step DID design. The basic idea is to assess whether there is a structural break in the policy parameters (i.e., π_1 and π_3) estimated from the second-stage specification of equation (2C) around the time of policy implementation. The test first identifies the time at which the largest change in parameters (represented by the largest change in the *F*-statistics) occurs and then generates *p*-values to judge whether the changes in those parameters are different from zero. A significant break around the time of policy implementation, i.e., $\tau = 0$, or some quarters after $\tau = 0$ would prove the existence of a policy effect from the DID results. In contrast, failure to find a break, or finding of a break significantly before the time of policy adoption, would imply the ineffectiveness of the policy.

[17] Due to space constraints, we do not report the results here. They are available upon request.

We follow Greenstone and Hanna (2014) to use the Quandt Likelihood Ratio (Quandt 1960) statistic to select the maximum value of the F-statistics to test the existence of a break at an unknown date. Figure 5 and Table 5 report our estimation results. As shown in Figure 5, the structural breaks of the NBS price index—*PINew.NBS* and *PISecond.NBS*—occur before policy implementation while the QLR statistic identifies the significant breaks three quarters preceding the event. This finding implies the ineffectiveness of the policy in curbing the surge in housing prices. However, the test on the price index calculated by FGXZ (2015) is very significant because it shows the precipitous drop in housing prices three quarters after policy enforcement, i.e., $\tau = 3$. The evidence might indicate that the hedonic housing price index developed by FGXZ (2015) has a better quality than the NBS property price index.

Figure 5: F-statistics from the QLR Test for the HPR Policy



Notes: The figures show the structural break tests using the Quandt Likelihood Ratio (QLR) statistic. The horizontal axis is the event time τ. The vertical axis is the F-statistics for the QLR tests.

With respect to the transactions, Figure 5 evidently chooses the occurrence of the biggest F-statistics around $\tau = 0$. Moreover, Table 5 reveals that the null hypothesis of no break at $\tau = -1$ can be significantly rejected for the sales amount. These findings further prove that the policy causes a sharp decline in the property transaction volume.

The structural break test results for real estate investment, floor space started, under construction, and completed, as well as the pieces of land sold, are broadly supportive of the findings of the previous two subsections. The null hypothesis of zero effect cannot be rejected, confirming that the policy does not stop the construction boom, nor does it help to address the potential oversupply of housing.

Table 5: Structural Break Analysis

	Quarter of Maximum F-statistics	QLR Test Statistic
PINew.NBS	–3	76.007***
PISecond.NBS	–3	68.713***
Price.Cityhouse	–3	27.751***
Price.CREIS	–3	9.294
PI.FGXZ.	3	52.614***
SaleUnit	0	9.405
SaleFloor	0	9.4297
SaleAmount	–1	15.456***
Investment	4	4.462
FloorStarted	4	5.387
FloorUnderConstruction	1	2.908
FloorComplete	5	2.469

Notes: This table presents the results of structural break tests using the QLR test statistic and the corresponding quarter of the break in the data estimated from the specification of equation (2C).

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

Robustness Test with Alternative Model and Different Samples—NBS reports the property price index for a relatively small sample of 70 cities. Using the housing price data from CREIS, City House, and FGXZ (2015), we expand the sample to include 139 cities (45 of them adopting the HPR policy). The robustness results reported in Appendix 2 are consistent with those for the sample of 70 cities. Several points need to be noted: First, the decrease in the housing prices or price index following policy implementation is much larger than that of the 70-city sample; second, the transaction measured by the sales amount, sales unit, and floor space sold plummeted significantly after the policy was in force, although it was smaller in magnitude than that of the 70-city sample; and third, the HPR policy had no measurable impacts on housing construction and investment.

4.5 Sources of Cross-Sectional Variations

The empirical evidence presented in the previous sections implies that the HPR policy successfully dampens home purchases but does not curb the construction boom and excessive supply. This subsection explores the factors that may explain why demand and supply respond differently to the policy. The qualitative and quantitative evidence suggest the discrepancy reflects real estate developers' positive expectations of housing demand and local authorities' over-reliance on the real estate sector.

Due to the shortage of investment channels, the property market is the main outlet for PRC households saving for retirement or children's marriages (Wei and Zhang 2011). Real estate has made up more than 60% of Chinese household assets since 2008, dwarfing the 48% in the United Kingdom, 32% in Japan, and 26% in the United States. In the PRC, the demand for housing is especially strong in cities where income rises rapidly. We hypothesize that if price does not decline after policy implementation in the cities where demand is expected to be strong, then the developers will continue to build, even if the implementation of the HPR policy is a big and surprising shock to the market.

We follow Greenstone and Hanna (2014) to assess this hypothesis. The main idea is to divide the sample cities into those above and below the median values of their GDP growth rate which reflect the demand for housing, estimate separate σ_τs for these cities with equation (1), stack the two sets of σ_τs obtained from the estimation of equation (2C), and then test whether the policy effects after implementation are the same for the two sets of policy-adopting cities. Considering that real estate developers' response to the HPR policy may lag behind demand, we test the effect across two types of cities for four ($\pi_1 + 4\pi_3$) and eight quarters ($\pi_1 + 8\pi_3$) after the policy was enforced.

Panels 1–4 of Table 7 show that the estimates of all price indicators are positive, indicating that housing prices not only did not decline but actually increased in cities whose GDP growth rates were above the median values. Hence, we expect real estate developers in these cities to continue construction. Consistent with our expectation, Panels 5 and 6 in Table 6 suggest that the investment and floor space increased after policy implementation in cities where long-run demand for housing is expected to be strong.

Table 7: Differences in HPR Policy Effects across Cities on GDP Growth

	Difference in 4-quarter Effect	Difference in 8-quarter Effect
Panel 1. PINew.NBS	2.56	4.85*
	(0.10)	(0.19)
Panel 2. PISecond.NBS	0.75	1.55
	(0.51)	(0.64)
Panel 3. PI.FGXZ	0.04**	0.12
	(0.07)	(0.41)
Panel 4. Price.Cityhouse	920.87**	1824.1***
	(0.05)	(0.01)
Panel 5. Investment	484.46	1527.4
	(0.39)	(0.68)
Panel 6. FloorStarted	200.14	619.67
	(0.66)	(0.37)

Notes: This table explores how the HPR policy's effect four quarters after implementation varies in cities above (as opposed to below) the median measures of GDP growth. *p*-values are in parentheses.

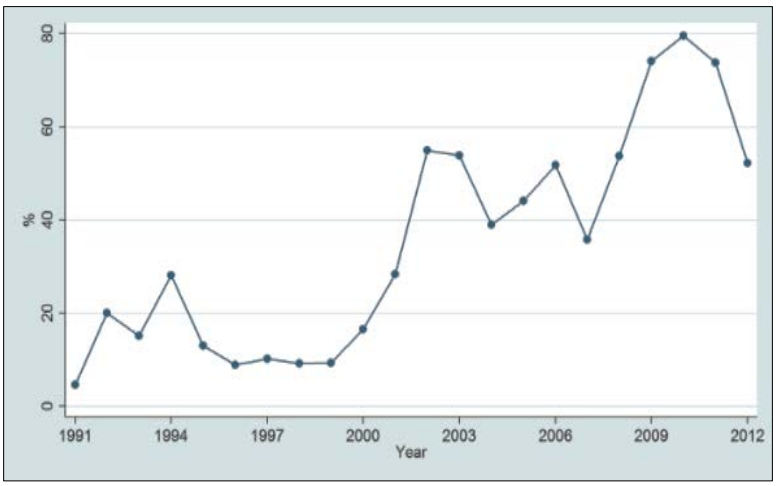
*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

The heavy and growing reliance of Chinese local governments on the real estate sector for fiscal income and economic growth generates far-reaching impacts on the housing market. Due to the intergovernmental fiscal relationship established in 1994, local governments receive half of the nation's fiscal revenue but are responsible for 80% of spending (The Economist 2012). Having heavy expenditure responsibilities, local governments depend substantially on off-budgetary sources such as profits from expropriating farmers' land, revenue related to land sales and transactions, and so forth (Huang and Chen 2012). As shown in Figure 6, the ratio of land sales revenue to municipal government budgetary revenue[18] increased from less than 1% in the early 1990s to around 80% in 2010. Among our 70 sample cities, the average ratio of land sales revenue to budgetary revenue for the years 2001–2011 shows large variations across cities, ranging from 11% to 117%. Cities having meager fiscal resources or tremendous needs for infrastructure investment exhibit higher degrees of reliance on land finance.

Figure 6: Ratio of Land Sales Revenue to Budgetary Revenue



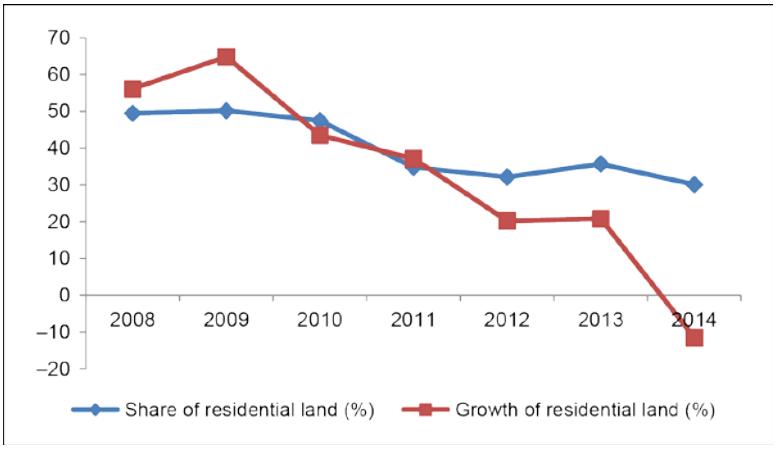
Notes: The data for the years 1989–2009 is from Barth, Lea, and Li (2012), and the rest is calculated by the authors where the data of land sales revenue is obtained from the China Land & Resources Yearbook (2011–2013) and the data of budgetary revenue is from the CEIC.

With heavy reliance on the real estate sector to finance their spending and investment in infrastructure, local governments face the dilemma of whether to correct housing bubbles or maintain land prices and economic growth via property investment. To understand local governments' real incentive in the housing market, we first examine the change in land supply for residential property before and after the HPR policy was implemented because local governments are the ultimate owners of land in the PRC. If cooling down housing prices is the main objective of local governments, more land will be supplied to the market following policy implementation. However, Figure 7 indicates that the supply of residential land declined considerably in HPR-implementing cities after 2011. The share of residential land in total land supply was on average approximately 50% before 2010, but fell to 30% in 2014. The change in the annual growth rate of residential land supplied to the market is more phenomenal, declining sharply from 65% in 2009 to –11% in 2014.[19]

[18] Budgetary revenue consists mainly of tax revenue and state-owned enterprise contributions.

[19] We do not use DID estimation to test the change of land supply following the policy implementation because the quarterly data on land supply is currently unavailable.

Figure 7: Residential Land Supply in HPR-implementing Cities



Note: The data is from CREIS.

Despite political pressure from the central government to control the housing price surge, local governments may still support construction activity by requiring government-controlled banks to provide cheap and easy credit to the developers (Glaeser et al. 2017). Following Greenstone and Hanna (2014), we divide the sample cities into those above and below the median value of the ratio of land sales revenue to budgetary revenue and then estimate separate σ_τs for these cities with equation (1), stacking the two sets of σ_τs obtained from the estimation of equation (2C), and then test whether the policy effect is the same for the two sets of policy-adopting cities.

Table 8 reports the estimation results. The positive estimate of the 8-quarter policy effect on real estate investment, floor space started, and floor space under construction indicates that construction activity continued to increase after policy implementation in cities where land sales revenue accounts for a large share of local fiscal revenue. This implies that the top-down effort in curbing housing prices via the HPR policy was not fully supported by the local authorities. Excess supply in the housing market is an unavoidable consequence of misaligned incentives. A manifestation of this includes the emergence of several ghost cities with an abundance of empty houses.

Table 8: Differences in HPR Policy Effects across Cities for Land Finance Reliance

	Difference in 4-quarter Effect	Difference in 8-quarter Effect
Panel A Investment	1,947.0*	3,577.0**
	0.09	0.04
Panel B FloorStarted	–68.21	84.03
	0.89	0.91
Panel C FloorUnderConstruction	810.54	577.48
	0.47	0.73

Notes: This table explores how the HPR policy's effect four quarters after implementation varies in cities above (as opposed to below) the median measures of land finance reliance.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

5. CONCLUSION

Due to skyrocketing housing prices across the nation and the failure of monetary policies to curb speculative investment in properties, the PRC's central government encourages local authorities to stabilize housing prices by imposing home purchase restrictions. Among the 70 major cities, 39 local authorities adopted home purchase restriction policies starting in 2010. *This paper* investigates the effectiveness of the PRC's housing purchase restriction policy on property markets with a two-step difference-in-differences method which enables us to make causality inferences without endogeneity biases.

We find that the HPR policy has limited impact on property price but pronounced effect in reducing trading volume. However, the duration of the policy's impact is short-lived, averaging four quarters. On the other hand, the HPR policy has a significant impact on property trading volume. Although the policy has a significant economic impact on the demand side, it by and large fails to restrain the supply side of property markets as evidenced by the increased investment of property developers after the implementation of the housing restriction policy. The cross-sectional variation analysis shows that cities with greater demand for housing or high reliance on land finance continue to experience housing price appreciation after implementing the housing policy.

The evidence in this research casts serious doubts on the effectiveness of the HPR policy in the PRC. In general, any policy that does not address the expectation of asset price appreciation will not help correct speculation or bubbles in markets. Regulators need to consider policy implementation, incentive alignment, and market circumvention jointly to achieve effective policy goals.

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