INTERNATIONAL REAL ESTATE REVIEW

2019 Vol. 22 No. 2: pp. 197 – 229

Property Prices: How Effective is a Property-Purchasing Limitation Policy for Managing Affordability?

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In recent years, China has uniquely implemented various policies to control housing prices, particularly its property-purchasing limitation policy. This research proposes a vector autoregression (VAR) model with likelihood-ratio (LR) tests to examine the effects of such a policy on housing prices at the national, provincial and city levels in China, with the use of monthly data from 2002 to 2013. The results show that at the national level, the effect of the policy is very significant, and the impact on housing prices is far greater than monetary and credit policies. However, the policy is not applicable at the provincial level. The policy has a significant role at the city level in first-tier cities, but no significant effect in second-tier cities. Overall, property-purchasing limitations inhibit the growth of housing prices to some extent, and the effects show strong regional characteristics, especially at the city level. Policymakers should therefore take into account regional characteristics in the formulation and implementation of a property-purchasing limitation policy.

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Keywords

Housing Bubble, Property-Purchasing Limitation, Likelihood-Ratio (LR) Test, Vector Autoregression (VAR), China Housing Market

1. Introduction

Empirical studies of the housing market have traditionally taken the orthodox view that equilibrium housing prices can be thought of as the natural outcome of the demand for housing equated with its supply. Under this view, the long-run demand and supply for housing interact to determine the price of housing. There are, however, several reasons to expect that the housing market will be often characterized by significant deviations from this long-run market-clearing price. First, houses can be regarded as monetary assets that can provide a stable rental income and high-quality collateral for a loan. Secondly, adjustments to the level of housing completions are quite slow on the supply-side of the market because land supply is limited and static. For these properties, housing price bubbles have been a broad and serious issue across the globe. The subprime crisis, which was caused by both the housing price bubble burst in the United States (US) and the subsequent serious repercussions, had led to the worst and most widespread economic recession in the 21st century. Many countries are suffering or have suffered from issues related to high housing prices, such as Japan. Meanwhile, governments use various control mechanisms to ensure the affordability of housing prices.

China, the fastest growing emerging economy, has experienced the same dilemma. Prior to 1998, welfare distribution played a dominant role in the property market in China. Instead of buying houses themselves, most individuals relied on their work units to allocate housing. In 1998, China reformed the housing system, abolished welfare distribution and gradually liberalized the housing market. Nationally, housing prices have increased by 40 times since 1998, which is an annual growth rate of 14.06%, compared to the average stock market growth (10.55%), economic growth (9.36%), one-year-deposit returns (3.02%) and inflation (1.88%) in the corresponding period. Unlike many developed countries that rely on market self-control mechanisms, such as the US, the Chinese government has implemented extensive direct-control policies that have a greater emphasis on policy regulations. The Chinese government has imposed policies with unique Chinese characteristics, such as purchasing limitations, to facilitate the stability of housing prices under government scrutiny.[1] Local governments have introduced a series of new

[1] The Chinese government not only implemented purchasing limitation policies, but sometimes also price limitation policies. However, during our sample period, very few cities had price limitation policies. More importantly, these two types of limitation polices were not implemented at the same time in the same area/city in our sample. For example, Shenzhen had the first purchasing limitation policy in October 2010.

policies in the real estate industry, such as the 2010 No.10 Document of the State Council, 2011 No.1 Document of the General Office of the State Council and 2013 No.17 Document of the General Office of the State Council.[2] Some of these direct policies specifically aim to control housing prices – for example, a purchasing limitation policy. Other indirect policies, such as monetary and credit policies, which were introduced based on multiple considerations, exerted influence in a variety of ways.

The property-purchasing limitation policy mainly limits the amount of property that each resident can purchase. No other country in the world has ever implemented such a direct control housing policy. Other countries, such as Switzerland, have policy regulations that just focus on the vacancy rate. After the release of the 2010 No.10 Document of the State Council in April 2010, the concerned restrictions were carried out at the state, province, and city levels and remained strictly enforced until 2013. The regulation of monetary policy has been implemented in a variety of forms to change the liquidity of money flow. Currently, this is done through the bank reserve ratio. From 2003 to 2012, the bank reserve ratio in China increased from 6% to 20% after a total of 39 different modifications. Except for the second half of 2008 and 2012, China has generally tightened its monetary policy throughout the years (see Appendix II). Meanwhile, China has introduced different credit policies for high-density housing since 2002 (see Appendix III). These policies control and adjust housing prices by making distinctions among housing investment, speculation and rigid demand.

Indirect means of market regulation, such as monetary and housing credit policies, are highly relevant to housing price, which has been well documented in many studies (Peek and Wilcox 2006; Iacoviello and Minetti 2008; McDonald and Stokes 2013). However, strict and direct control polices, such as property purchasing limitations, have not been sufficiently researched. The main reason is because other countries have rarely implemented this kind of direct policy in their property markets. The purchasing limitation policy, which is widely adopted in China, therefore provides a unique setting for this research work.

Can the purchasing limitation policy successfully limit demand for speculation? Does the purchasing limitation policy have different effects in different regions due to the unique regional characteristics of the housing industry? This study makes an important contribution to the current body of knowledge by explaining and testing the relationship between the property-purchasing limitation policy and housing prices, especially at different levels of the regions,

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However, the first price limitation policy was implemented in March 2011. Our study focuses on how housing prices react to the implementation of purchasing limitation polices. From this perspective, price limitation policies have almost no impact on our analysis.

[2] See Appendix I for more details on the series of policy regulations.

from cities to provinces and across the nation. To answer these questions and provide a reference for future implementation of housing policies in China and other countries, we propose a vector autoregression (VAR) model based on data between 2002 and 2013 to study the impact of the property-purchasing limitation policy on housing prices at the national, provincial and city levels. The empirical results show property-purchasing limitations inhibit increases in housing prices to some extent. Strong regional characteristics are also evident, whereas the effects in the cities are the most significant. Therefore, the future development and implementation of property-purchasing limitations in China should be adapted to local conditions. The findings from China can provide important policy recommendations for other economies in the world.

The remainder of the paper is divided into six sections. The second section reviews the existing literature. Data are provided in the third section. We discuss the methods and models in the fourth section. The fifth section presents the empirical analysis at the national, provincial and city levels, and the final section draws the conclusions.

2. Literature Review

The increasing urbanization in most countries with employment mostly concentrated in the large cities has made the housing problem acute in major metropolitan areas. Supply of affordable housing has been a challenge for governments of all countries. Acceptable factors that affect housing prices and policies that governments can use to influence the housing market are important considerations. There are two streams of literature that focus on the determinants of housing prices: economic fundamentals and non-economic fundamentals.

From the perspective of economic fundamentals, most researchers examine the relationship between the real estate market and economic fundamentals such as income, unemployment rate, inflation, population growth or the age structure of society. These fundamentals can be used as the main factors for describing economic conditions. On the one hand, real estate is an industry that supports the national economy; on the other hand, the development of the national economy also underlies increases in housing prices.

Researchers have concluded that these factors can explain for the fluctuations in housing prices relatively well. Clapp and Giaccotto (1994) examine three towns in the US and find that economic fundamentals, especially the expected inflation rate and the unemployment rate, can provide good estimates of housing price trends. Capozza, Hendershott, and Mack (2004) find that city size, real income growth, population growth and real building costs help to explain housing price fluctuations based on a study of 62 cities in the US. Levin, Montagnoli and Wright (2009) find a close relationship between demographic

changes and the housing market by comparing Scotland and England. Studies have also used empirical analyses to show that housing prices are largely influenced by economic fundamentals in the long term (Kenny 1999; Jud and Winkler 2002; Lastrapes 2002, Égert and Mihaljek 2007; Wheaton and Nechayev 2007; An,Wang and Gu 2014; Webb, Yang and Zhang 2016).

Non-economic fundamental factors include various control policies, such as land, tax, monetary and administration policies. These factors can directly or indirectly affect housing price by influencing supply and demand. Since the supply of houses is restricted by the supply of land, the government can control the housing price by restricting land supply, the price of land, and land use. Pollakowski and Wachter (1990) analyze the relationship between land and housing prices in the US and find that strict regulations over land supply can significantly increase both land and housing prices. Recently, An and Wang (2013) find that the supply of land markedly influences the real estate price in the long run in China. Wu, Gyourko, and Deng (2012) provide similar results with the use of data from the local land auction market in Beijing.

Governments use tax policies as a means to balance supply and demand in the market (Goulder 1989). However, previous research has shown that it is difficult to reach a consensus on the role that estate taxes actually play in the housing market. There are major opposing views on the relationship between them. Bai, Li, and Ouyang (2014) find that a policy experiment on property taxation reduces the average home price in Shanghai by 11%–15% but increases that in Chongqing by 10%–12%. Chongqing and Shanghai are both major cities in China. On the contrary, Du and Zhang (2015) find that trial property taxes reduce the annual growth rate of housing prices in Chongqing, but have no significant effect on housing prices in Shanghai. First, the conventional view is that estate taxes will increase housing prices if only one area and the local government are considered (Simon 1943). Secondly, some researchers such as Hamilton (1976) and Fischel (2001, 1992) assume that there are different local governments in different areas and a free flow of home buyers. Furthermore, different local governments win buyers through estate taxes and public services. Under these assumptions, all regions would have the same estate taxes which pay for public services. In this situation, the estate taxes are not part of the house value; they are a benefit tax which only affects public expenditures, and does not influence the housing price.

Monetary policy also plays an important role in the housing market and has been the focus of research. Goodhart and Hofmann (2008), who study the US and 17 other developed countries, find that a loose monetary policy causes increases in real estate prices. Davis and Zhu (2011), Iacoviello and Minetti (2008) and McDonald and Stokes (2013) obtain similar results.

Credit policy also influences the money supply in a housing market. Note that our research considers monetary and housing credit policies as two different types of policies: the former usually emphasizes control of the total amount of

money and the use of different tools to adjust the money supply in the market while the latter focuses on the configuration and structure of the market through the benchmark interest rate, different home loan rates and proportion of the equity of an individual for borrowing. A number of studies have also been conducted on housing credit policy to analyze factors such as home loan interest rates. For example, Gerlach and Peng (2005) find that fluctuations in housing prices could affect bank credit, but bank credit plays no role in housing prices. Iacoviello and Minetti (2008) find that reduced credit constraints drive housing prices to unsustainable levels.

Other than these indirect government policies that affect the housing market, there are also direct effects. For example, some governments adopt administration policies to balance supply and demand in the housing market, which directly affects housing prices. From the supply aspect, the construction industry is easily controlled by regulatory constraints, which then affects housing supply. For example, Glaeser, Gyourko, and Saks (2005) find that an increase in local development regulations in certain cities have already increased housing price by reducing the supply of houses.

With regard to the demand side, property-purchasing limitation policies are used to directly control the demand for houses. Studies on these types of policies usually focus on China because among the larger economies, only China implements strict purchasing limitation policies for extended periods of time across the nation. Jin (2012) uses a difference-in-differences model to examine the impact of purchasing limitations based on the panel data of 70 large and mid-sized cities in China from September 2009 to October 2011. He finds that purchasing limitations do not have a notably negative effect on housing prices. Du and Zhang (2015) investigate the impact of purchasing limitations for Beijing from May 2010 to November 2011 by using a counterfactual analysis. The results show that the purchase restrictions reduce the annual growth rate of housing prices in Beijing by 7.69 percent. Sun et al. (2016) use a regression discontinuity design and find that the policy on housing policy restrictions (HPR) in Beijing triggered a 17–24% decrease in resale price and a substantial reduction (1/2 to 3/4) in the transaction volume of the for-sale market.

However, the previous research does not indicate any consensus on whether purchasing limitations have a positive impact on housing price. The perspectives of most studies are at the city level: for example, they focus on Beijing, which is the capital of China, or Shanghai, one of the most developed cities in China. However, the property-purchasing limitation policy has been introduced not only in such developed cities but also throughout all of China, from cities to provinces. All levels of government have felt that it is necessary to measure the effectiveness of the purchasing limitation policy in their housing market.

Two main research methods have been applied to analyze the housing price problem: the VAR (Lee 2007; Elbourne 2008) and the dynamic stochastic general equilibrium (DSGE) models (Kydl amd Prescott 1982, Sims 1980). The DSGE model adds stochastic shocks to a dynamic general equilibrium model that can simulate shocks to economic variables. Iacoviello (2005) uses a DSGE model which includes the estate department to analyze the relationship between housing price and macroeconomic variables. The VAR model, which can analyze the interaction effects among different variables, is more appropriate for testing the dynamic relationships between variables within system and time series analyses which include different periods of interaction between different variables. For example, Lee (2007) and Elbourne (2008) have used this model to research the housing market. Both of these methods have merits and value; however, the VAR model, which is concise and efficient, is more appropriate for research on property-purchasing policy.

This section has reviewed the research on the relationship between housing price and economic and non-economic fundamentals. Economic fundamental factors can explain for the housing price to some extent; however, they influence the housing price in indirect ways and over a longer period of time. Therefore, the government does not restrict the irrational increase of housing price caused by these factors. However, non-economic fundamental factors provide various ways to balance the housing market, from both supply and demand aspects. Research thus far has not given sufficient attention to the effectiveness of direct control measures implemented via purchasing limitation policies. As such, this study aims to fill this gap in the literature related to the property market in China.

3. Data

We use monthly data from January 2002 to December 2013 to better reflect the fluctuations in the housing market. The last year that the entire country and all of the provinces implemented the property-purchasing limitation policy was in 2013, but some of the first-tier cities have maintained the policy to date. All of the macroeconomic conditions changed in 2014, including the monetary and the credit policies. We focus on whether the property-purchasing limitation policy could curb irrational housing price increases, and therefore the sample ends in 2013. Our research sheds light on the impacts of the future implementation of such a non-economic fundamental policy for China and other economies in the world.

Housing prices are measured by using residential housing sales prices which are calculated by taking house sales divided by the area of residential housing

(RMB per square meter).[3] The housing price and real estate investment data are missing for every January; therefore, we supply the missing values with the interpolation method. The personal home loan interest rate and the property-purchasing limitation policy do not have seasonal effects. Therefore, we seasonally adjust the variables by using Census X12 except for these two variables.

All of the data, which are calculated by using unified statistical approach and calculation methods, statistical calibers and file directories for the provinces, autonomous regions and municipalities, are obtained from the National Bureau of Statistics and People's Bank of China.

4. Methods

In recent years, when China experienced skyrocketing housing prices, the Chinese government implemented various polices to rein in property price increases. Moreover, these purchasing limitation policies –unique administrative policies that control real estate market demand – are of significant importance in China's property market. The real estate market has local characteristics in most cases, and the effects of such a policy can vary by region, thus requiring investigation from multiple perspectives. We address regional differences to account for inconsistent policy effects across regions. This will be of interest to policy makers and practitioners in understanding how the sensitivity of housing prices to property-purchasing policies differs across regions.

In order to test the effect of the property control policies in China, we incorporate other policies. China does not implement estate taxes consistently in the country. Also, the land policies and conditions of land supply vary across the country. Therefore our VAR model includes monetary policy and credit policy variables, and focuses on the effects of the property-purchasing limitation policy in China at three different levels (country, province and city). This model tests the dynamic relationships of variables over time, including different periods of interactions between different variables. The likelihood ratio (LR) test (Huelsenbeck and Crandall 1997) is used to determine whether the property-purchasing limitation is significant. To the best of our knowledge, this research is the first to thoroughly examine the regional differences found in the response of housing prices to a property-purchasing limitation policy.

We include four types of policy variables in our model: property-purchasing limitation, and monetary, credit and real estate investments. First, we use a

[3] Researchers widely use this kind of expression of housing prices on the Chinese housing market (Li and Chand 2013, Feng and Wu 2015, Hui and Wang 2014), and this is the only monthly data available for all provinces and cities in our empirical test.

dummy variable = 1 if the property-purchasing limitation policy is in place, and 0 otherwise. At the national level, the New Ten Articles in 2010 stands for the policy implementation, and at the provincial level, the first city of the province that implements the policy marks the beginning of the policy implementation.

Second, monetary policies, which are a common type of macro policy, have a significant effect on housing price (Goodhart and Hofmann 2008). Monetary policies adjust the money supply by the central bank. Therefore, they are represented by the money supply, M2.[4] Monetary policies affect housing prices because a change in the money supply will lead to a change in prices. This can be observed in two ways: a change in raw material prices will affect housing prices on the supply side, while monetary policy implementation will influence the expectations of the public. Therefore, a loose monetary policy indicates the desire of the government to promote economic growth to some extent. Hence, people will anticipate an increase in long-term returns on investment and increase their investments in the housing market. Eventually, housing prices are affected, and a tight monetary policy works the opposite way.

Third, China is in the process of implementing interest rate liberalization, so we consider the interest rate as a separate variable in credit policy and not as part of the monetary policy. According to previous research, the credit policy can indirectly affect purchase intentions (Iacoviello and Minetti 2008). In order to measure the impact of credit policies on the housing market, we choose home loan interest rates as a proxy. Home loan rates are a factor that influences demand in the housing market – a higher home loan rate means that buyers have greater difficulties in obtaining a loan. Thus, increasing home loan rates reduce housing demand, because they will cause significant increases in purchasing costs.[5] In our model, there are three variables from the demand side. We also need a variable to measure supply in the housing market. Investments in real estate can objectively and accurately serve this purpose.

We propose a VAR model (Sims 1980) as the framework of the empirical analysis. The VAR model not only measures the impact of different variables – such as the property-purchasing limitation on housing prices – but also examines the interaction between variables and accounts for the lag of factors. We focus on whether the property-purchasing limitation policy has significant impact on curbing housing prices, while accounting for other factors such as money and housing supplies. The VAR model is suitable for controlling effective endogenous variables (Forbes and Rigobon 2002). In consideration of these, we use the traditional simplified VAR model with a q order that has the following form:

[4] M2: broad money supply which includes total currency, current/savings and time savings account and saving deposits.

[5] Home loans usually have a long repayment period, so we use the home loan rate over five years.

$$Y_t = \beta_0 + \sum_{i=1}^{q} \beta_i Y_{t-i} + u_t \quad (1)$$

where Y_t is an m by 1 vector of observables, β_i is an m by n coefficient vector, and u_t is an error term with a covariance matrix $\sum$.

The following variables are taken into consideration to perform the empirical analyses. We use money supply M2 (MS) to reflect the monetary policy, home loan interest rate over 5 years (LIB) to measure credit policy, and a dummy variable (POLICY) to represent the property-purchasing limitation policy and real estate investment (CI) to capture the supply side of the housing market. This paper adopts these four variables and a dependent variable, housing prices (P), to build the VAR model. The summary statistics for the main variables used in this paper are listed in Table 1.

We first conduct a unit root analysis to check for the stability of the data, based on augmented Dickey-Fuller (ADF) tests (Dickey and Fuller 1979). The results of the ADF tests at the national level are reported in Table 2. It can be observed in this table that all of the variables at all levels have unit roots and we cannot reject the assumption that the series are non-stationary. However, after the first-order difference, a unit root does not exist, and we can reject the null hypothesis at the 1% level of significance; that is, the series are stationary.[6]

Therefore, these variables used in our VAR model are in their first-order difference. The vector $Y_t$consists of the following variables:

$$Y_t = (\Delta \mathrm{P}, \mathrm{POLICY}, \Delta \mathrm{MS}, \Delta \mathrm{LIB}, \Delta \mathrm{CI}) \quad (2)$$

After building the VAR model, we test whether the dummy variable (POLICY) is indispensable for the model. The LR test is used to test the effectiveness of an explanatory variable in the model. The idea is that if the restriction condition holds, then the maximum likelihood function value in the constrained and unconstrained models should be approximately equal. Equation (3) is the maximum likelihood function for the unconstrained model, and Equation (4) for the constrained model:

$$\log L\left(\hat{\beta}, \hat{\sigma}^2\right) = -\frac{T}{2}\log 2\pi\hat{\sigma}^2 - \frac{\sum \hat{u}_t^2}{2\hat{\sigma}^2} \quad (3)$$

$$\log L\left(\tilde{\beta}, \tilde{\sigma}^2\right) = -\frac{T}{2}\log 2\pi\tilde{\sigma}^2 - \frac{\sum \tilde{u}_t^2}{2\tilde{\sigma}^2} \quad (4)$$

where β is a set of parameters, σ^2 is the error variance and T is the sample size.

[6] Before we build the model for the province and cities, we also implement the ADF test, which leads to the same conclusion. Results are available from the authors upon request.

Table 1 Summary Statistics of Variables

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
MS	500,855.800	410,623.700	1,106,509	157,853.500	283,794	0.618	2.082	14.229*
LIB	6.418	6.120	7.830	5.760	0.637	0.865	2.739	18.389*
National-CI	3229.508	2500.730	10,029.970	416.580	2326.897	0.836	2.686	17.381*
Beijing-CI	203.544	178.925	725.180	42.960	111.057	1.327	6.109	100.335*
Shanghai-CI	143.320	126.090	380.170	30.490	64.214	0.937	3.642	23.588*
Guangzhou-CI	77.559	63.112	245.689	20.109	46.475	1.114	3.747	33.189*
Shenzhen-CI	46.837	42.025	101.040	21.510	17.368	1.076	3.510	29.372*
National-P	4083.919	3901.619	7030.113	2165.685	1322.060	0.255	1.841	9.620*
Beijing-P	11,494.170	11,416.150	22,209.080	3168.926	5575.829	0.212	1.714	10.990*
Shanghai-P	9793.630	8332.074	22,134.660	2606.082	4573.640	0.501	2.092	10.981*
Guangzhou-P	8310.989	8187	15,470	4128.804	3598.382	0.389	1.865	11.358*
Shenzhen-P	12,727.270	12,448.500	24,402	5442.060	6035.652	0.319	1.754	11.749*

Notes: The total number of observations for each variable is 144. * represents rejection of the null hypothesis at the 1% level. MS: trillion RMB; LIB: %/year; CI: 100 million RMB; and P: RMB/square meter.

Table 2 Results of Stationary Tests

Variable	ADF test statistics	Conclusion
CI	-0.115	Non-stationary
ΔCI	-4.381*	Stationary
MS	-0.316	Non-stationary
ΔMS	-12.523*	Stationary
LIB	-2.091	Non-stationary
ΔLIB	-8.511*	Stationary
P	-0.141	Non-stationary
ΔP	-16.032*	Stationary

Notes: This table presents the ADF test statistics for the four variables in this study. The optimal lag lengths for the ADF test are determined by using the Akaike information criterion (AIC) method. The critical values for the ADF test statistics are -3.43, -2.86, and -2.56 for the models without a trend, and -3.96, -3.41 and -3.13 for the models with a trend at the 1%, 5% and 10% levels of statistical significance, respectively. We only show the results of the model with a trend; the other results are available from the authors upon request. The null hypothesis of a unit root (non-stationary) can be rejected if the ADF test statistic is less than the critical value at the chosen level of significance. * represents rejection of the null hypothesis of a unit root at the 1% level.

We build the LR statistic as follows:

$$LR = -2\left[\log L\left(\tilde{\beta}, \tilde{\sigma}^2\right) - \log L\left(\hat{\beta}, \hat{\sigma}^2\right)\right] \sim \chi^2_{(m)} \tag{5}$$

where m is the number of constraints that the LR test takes as the null hypothesis. If $LR > x^2a(m)$, we reject the original assumption and the variable cannot be removed.

After the LR test, we use the impulse response function to measure the response of housing price to the shock from the selected variables, and the variance decomposition to calculate the impact of each factor on housing price to test the relationship among the variables and examine how each explanatory variable contributes to housing price.

5. Empirical Results

Looking at the national, provincial and city levels, we conduct empirical analyses to discern the interrelationship between housing price and the property-purchasing limitation policy. We can evaluate the effect of the property-purchasing limitation policy with multiple dimensions; thereby we can point out which level is suitable for the property-purchasing policy so that we can analyze the regional characteristics of the housing market.

5.1 National Level

We perform an LR test on the VAR model to determine whether the restriction policy has any significant effect on housing prices. The corresponding Table 3 shows a significance at the 5% level for the dummy variable or the property-purchasing policy. [7] Therefore, we conclude that property-purchasing limitations have a significant influence on housing prices across the country.

Table 3 LR Test Results

Type of Statistics	Statistics Value	P Value
F Statistics	6.607*	0.001
LR Test Value	13.650*	0.001

Notes: This table presents the LR test statistics for the dummy variable which is the property-purchasing limitation in this study. The null hypothesis is that the variable is unnecessary; the details can be found with Equations (3)-(5). * represents rejection of the null hypothesis at the 1% level.

After the LR test, we conduct an impulse response analysis to calculate the impact of each factor on housing prices. The solid line represents the impulse response while the dotted line represents the upper or lower boundaries.

Figure 1a shows the impact of the restriction policy on housing prices. Under the shock of the restrictions, the housing prices show a quick and sharp decline in the time horizon of two years. Although followed by an increase, the housing prices remain far below the initial level. This result shows that the property-purchasing restriction can immediately curb housing prices with a lasting effect. The reason is because such restrictions inhibit speculative purchasing and therefore can effectively promote a reduction in housing prices. As purchase quantity is limited in all periods of time, the effect of the restriction policy has longevity.

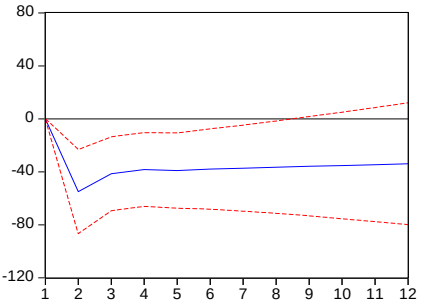
Figure 1b shows the impact of the money supply on housing prices. With a positive impact in the money supply, housing prices rise in the time horizon of two years, followed by small fluctuations; however, the housing prices remain higher than their initial level for all twelve horizons. This result shows that a loose monetary policy will push housing prices higher, which can last for a long

[7] At the national level, we use a dummy variable to measure the effect of the policy. The variable equals to 1 if the property-purchasing limitation policy is in place, and otherwise 0. In this study, the national level policies are not compounded of provincial and city level policies. For example, the New 10 Articles in 2010 first stands for the policy implementation at the national level. After the New 10 Articles was implemented, the provinces and cities then had the right to carry out their own property-purchasing limitation policy depending on their own economic conditions and increase in house prices. In other words, national level policies take place before policies at the province and city levels.

time. This is because the money supply, as an important indicator of control in monetary policy, could lead to excess liquidity of capital and thus cause an increase in housing prices.

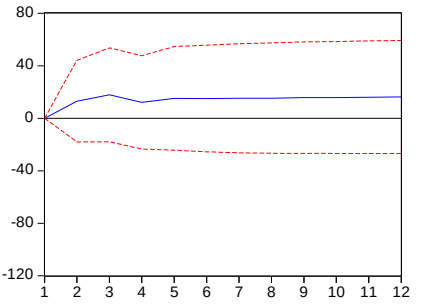
Figure 1 Impulse Response of Housing Price to Variables

(a) Housing Prices to Restriction Policy



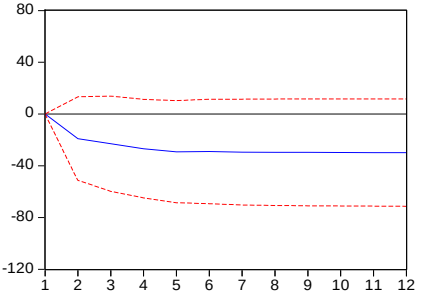
a. Impulse Response of *Price* to *POLICY*

(b) Housing Prices to Money Supply



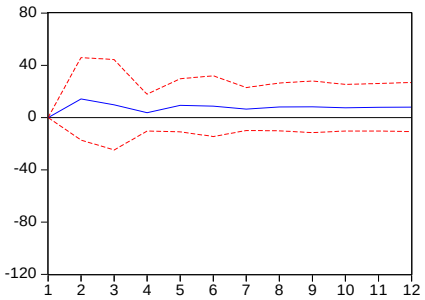
b. Impulse Response of *P* to *MS*

(c) Housing Prices to Home Loan Interest Rate



c. Impulse Response of *P* to *LIB*

(d) Housing Prices to Influence of Real Estate Investment



d. Impulse Response of *P* to *CI*

Figure 1c illustrates the impact of home loan interest rates on housing prices. With a positive shock in home loan interest rates, housing prices will decrease and no longer exceed the initial level. This result shows that an increase in home loan interest rates has a negative impact on housing prices that will last for at least the twelve horizons. This result might be because higher home loan interest rates result in greater loan costs; thus, housing demand is effectively controlled and housing prices decrease. With time, the impact of home loan interest rates causes a decrease in housing prices, which eventually remain at a level below the initial level.

Figure 1d reflects the influence of real estate investment on housing prices. We can see from the graph that when a positive shock is imposed on real estate investments, housing prices increase, followed by a fluctuation, and then they remain stable for 12 periods. Thus, this result shows that an increase in real estate investment can result in an increase in housing prices because the former strengthens the expectation of a boom in the real estate market, which in turn promotes irrational exuberance in the real estate market and causes an increase in housing prices.

We then quantitatively calculate the impact of each factor through variance decomposition. From Table 4, we can see the contribution of each control policy on housing prices with time. In the time horizon of two years, the contribution of the restriction policy rapidly moves to 7.591 which is far above the values for monetary policy (0.423) and credit policy (0.908). In the time horizon of twelve years, the values for monetary and credit policies are still less than 1 and much smaller than the restriction policy value of 7.998. Thus, the results show that (1) at the national level, the restriction policy has the strongest influence compared to the other policies, and its implementation will have a significant influence on housing prices, and (2) monetary and credit policies have little influence on changes in housing prices.

The empirical results show that the restriction policy is significant at the national level, which means that the property-purchasing limitation policy has

an overall significant impact on housing prices in China. The effect of the restriction policy is more significant than that of a monetary policy or credit policy.

Table 4 Results of Variance Decomposition (Unit: %)

Horizon/ # of years	SD	ΔP	ΔMS	ΔLIB	POLICY	ΔCI
1	178.592	100.000	0.000	0.000	0.000	0.000
2	199.503	90.567	0.423	0.908	7.591	0.508
3	200.119	90.020	0.479	0.942	8.000	0.556
4	200.430	89.821	0.559	0.976	7.999	0.643
5	200.561	89.718	0.581	0.988	7.990	0.720
6	200.565	89.714	0.581	0.988	7.993	0.721
7	200.579	89.702	0.581	0.989	7.993	0.732
8	200.587	89.696	0.581	0.989	7.994	0.738
9	200.589	89.694	0.582	0.989	7.995	0.738
10	200.591	89.692	0.582	0.989	7.996	0.739
11	200.593	89.691	0.582	0.989	7.997	0.740
12	200.594	89.690	0.582	0.989	7.998	0.740

Notes: The order of the Cholesky is ΔP, ΔMS, ΔLIB, POLICY and ΔCI;
SD = Standard Deviation.

5.2 Provincial Level

There are prominent disparities in population, economic growth and environment depending on the district in China. These different economic factors give housing markets unique local features; therefore, we analyze the housing price trend and the impact of the property-purchasing limitation policy at the provincial level.

As shown in Figure 2, China has 28 provinces (including Taiwan, and 5 autonomous regions),[8] 4 municipalities and 2 special administrative regions (Hong Kong and Macau). Hong Kong, Macau and Taiwan each has a high degree of autonomy; therefore they each have their own housing markets. Tibet has too many missing values. Therefore, we did not use the data for these four regions and used the remaining 26 provinces in our analysis. As regional differences are significant, we divide the 26 provinces into three regions (east, central and western regions) based on the division methods used by National Bureau of Statistics of China. The east includes Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan; the central region includes Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan; and the west includes Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai,

[8] The autonomous region has the same territorial unit as a province, but different administrative power.

Ningxia, Xinjiang, Guangxi, and Inner Mongolia. Note that China has four municipalities (Beijing, Shanghai, Chongqing, and Tianjin), which have the same administrative units as the provinces.[9]

Figure 2 Regions and Provinces in China

The eastern region is more developed than the western region. Table 5 uses the gross domestic product (GDP) and population as the two fundamental economic variables to show the differences across these three regions.

First, we conduct an LR test for the eastern, central and western region, and the results are shown in Table 6. The results show that, at a 5% significance level, the policy is ineffective in all of the eastern and central provinces. However, in the results for the western region, the restrictions have a significant influence in the Yunnan and Xinjiang provinces.

As a result, the property-purchasing limitation policy is mostly ineffective at the province level. Each province has many cities with different levels of development and size, and sometimes just one or two relatively developed cities make up the centers of the province. The most developed cities such as Beijing

[9] The provincial data do not include these municipalities, but we consider some municipalities for the city level analysis.

and Shanghai are not included in any province because they are self-administered municipalities. Currently, China has a large rural population that is living in villages and towns, as well as less-developed cities with mainly an urban population. In those areas, speculation in the housing markets is rare and the restriction policy is ineffective because most families just have one house as their residence. Thus, the insignificant empirical results may be due to the different responses (cancellation effect) to property-purchasing limitation polices in different cities.

Table 5 Comparison of Population in East, Central and West China (2002 and 2013)

Region / Index	2002			2013		
	East	Central	West	East	Central	West
GDP (Million RMB)	58975	28681	18561	293864	154670	112539
(Percentage)	(55.52%)	(27.00%)	(17.47%)	(52.38%)	(27.57%)	(20.06%)
Population (ten thousand)	45323	42086	32685	50206	42671	33355
(Percentage)	(37.74%)	(35.04%)	(27.22%)	(39.77%)	(33.80%)	(26.42%)

5.3 City Level

In China, it is important to empirically analyze the effects of property-purchasing restrictions at the city level because the housing market at that level has strong local characteristics.

In the Chinese classification of cities, "first-tier cities" refer to metropolises that are economically and politically important or have other social and/or cultural importance, and influence other cities. At each level of development and in overall economic strength, a first-tier city is a leading and influential force in various social activities. The level of economic development is a more important index than administrative functions for measuring first-tier cities. However, not all municipalities are first-tier cities. In China, first-tier cities include Beijing, Shanghai, Guangzhou and Shenzhen. These four cities, as the most influential cities in China, are modern metropolises with the strongest overall growth. In China, the term "BeiShangGuangShen,"[10] a new term coined in recent years, not only represents these economically developed and densely populated four cities, but also refers to their continuously increasing housing prices. We examine these four first-tier cities in our analysis.

[10] First-tier cities do not have an official definition, but the BeiShangGuangShen cities are usually known as first-tier cities. The word "BeiShangGuang" first appeared approximately in 1990, and "BeiShangGuangShen" came into use approximately in 2000 (the growth of Guangzhou surpassed Tianjin in 1989, and Shenzhen surpassed Tianjin in 1999). Thus, when people refer to first-tier cities now, they usually mean "BeiShangGuangShen".

Table 6 LR Test Results of Eastern, Central and Western Regions

LR test results of eastern region			LR test results of central region			LR test results of western region		
Province	LR Value	P Value	Province	LR Value	P Value	Province	LR Value	P Value
Hebei	3.678	0.451	Shanxi	8.727***	0.068	Inner Mongolia	0.054	0.815
Liaoning	0.447	0.503	Jilin	0.465	0.495	Guangxi	0.003	0.954
Jiangsu	1.004	0.316	Heilongjiang	0.026	0.870	Sichuan	0.005	0.940
Zhejiang	1.314	0.251	Anhui	6.248	0.282	Guizhou	0.004	0.997
Fujian	0.593	0.441	Jiangxi	0.728	0.694	Yunnan	18.736*	0.009
Shandong	0.048	0.826	Henan	0.346	0.556	Shaanxi	5.332***	0.069
Guang-dong	1.048	0.592	Hubei	14.022***	0.050	Gansu	0.544	0.761
Hainan	1.645	0.439	Hunan	6.058	0.640	Qinghai	11.948	0.102
						Ningxia	2.772	0.250
						Xinjiang	22.450*	0.004

Notes: This table presents the LR test statistics for the dummy variable which is the property-purchasing limitation in this study. The null hypothesis is that the variable is unnecessary. The method details can be seen in Equations (3)-(5). * and *** represent rejections of the null hypothesis at the 1% and 10% levels, respectively.

Second-tier cities are cities that have relatively high levels of development, although they trail behind first-tier cities in terms of administrative level, scale of the city, total economy and population. Second-tier cities in China include provincial capitals (other than the four cities mentioned above) and municipalities that have an independent planning status. Second-tier cities in China have also experienced a dramatic increase in housing prices, but these are still lower than those of the first-tier cities. Therefore, we chose Tianjin in the eastern region and Changsha in the central region as the second-tier cities for our analysis.

Thus, we narrow the scope of our research to four first-tier cities (Beijing, Shanghai, Guangzhou and Shenzhen) and two second-tier cities (Tianjin and Changsha) as the research sample which is used to analyze the impact of the policies.

5.3.1 First-Tier Cities

First, we performed the LR test for three first-tier cities to determine whether property-purchasing limitations affect housing prices.

Table 7 LR Test Results of First-Tier Cities

City	LR test value	P value
Beijing	16.990**	0.030
Shanghai	24.345*	0.000
Guangzhou	27.776*	0.000
Shenzhen	1.196	0.274

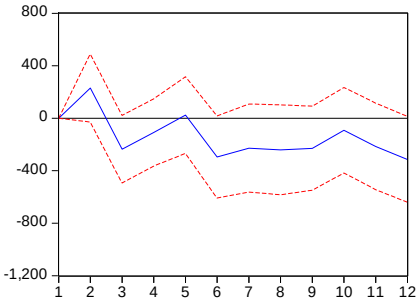
Notes: This table presents the LR test statistics for the dummy variable which is the property-purchasing limitation in this study. The null hypothesis is that the variable is unnecessary. The method details can be seen in Equations (3)-(5). *, and ** represent rejections of the null hypothesis at the 1% and 5% levels, respectively.

The LR test values are 16.990, 24.345 and 27.776 for Beijing, Shanghai and Guangzhou, respectively, which are significant at the 1% level; however, the value of Shenzhen is only 1.196, with a P-value of 0.274. The results show that restrictions play an important role in Beijing, Shanghai and Guangzhou but have a limited role in Shenzhen because the effects of the restrictions concern economic and social development. Shenzhen, the last city to be considered as a first-tier city, is smaller in economic scale, area, population and GDP than the other three cities. The property-purchasing limitation policy restricts the number of houses that can be purchased by individuals or families in order to limit housing investment speculation. However, the rapid development in Shenzhen in the past decade, including its increase in population, means that the larger number of families without a first house has created a huge demand

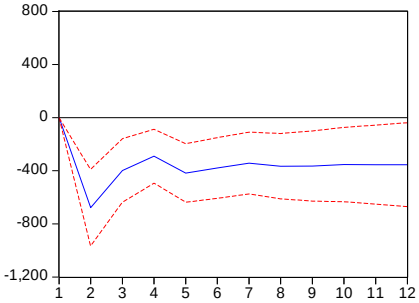
for real estate. From this perspective, the restriction policy is ineffective in the Shenzhen housing market. Thus, in other three more developed and mature first-tier cities, the restrictions have a more significant effect.

Based on the above results, we conduct an impulse response analysis for Beijing, Shanghai and Guangzhou. The results are as follows.

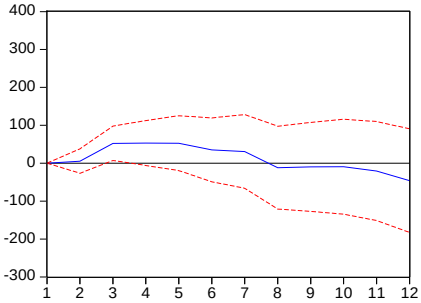
Figure 3 Impulse Response of Housing Prices to Restrictions



Beijing



Shanghai



Guangzhou

The effects of property-purchasing limitations on these cities have both similarities and differences. The similarity is that their impacts are long lasting. The difference is that, after the shock of imposing the property-purchasing limitations, only the housing prices in Shanghai show a rapid decrease (they are more responsive), while those in both Beijing and Shanghai do not decrease in the first few years.

There are several possible reasons for this result. In terms of the rate of growth of housing prices, housing prices in Beijing, Shanghai and Guangzhou increased by 200.7%, 308.2% and 260.4%, respectively between February 2002 and December 2013. In 2013, Beijing, Shanghai and Guangzhou had a population of 21.15, 24.15 and 8.32 million people (National Bureau of Statistics of China, 2014), respectively. The areas of these cities are 16,410.5, 6,340.5 and 7,434.4 square kilometers (National Bureau of Statistics of China, 2014), respectively. Therefore, we can see that, compared to Beijing and Guangzhou, Shanghai has the greatest housing demand and the most competitive purchasing market measured by population per square kilometer. Hence, the restrictions have the most adverse effects on speculative demand in Shanghai.

The variance decomposition results for Beijing, Shanghai and Guangzhou are shown in Table 8.

The variance decomposition results show that: (1) the restrictions have a greater impact in first-tier cities and can effectively restrict housing prices. In the time horizon of twelve years, the contributions of the restriction policy in Beijing, Shanghai and Guangzhou are 10.23, 12.88 and 8.47, respectively, which are higher than those of the other policies; (2) the monetary and credit policies influence housing prices to some degree. In the twelfth year, the contribution of the monetary policy in Beijing is 9.77, and the values of the monetary and credit policies in Guangzhou are 19.92 and 13.44, respectively, which are higher than those at the national level.

To summarize the results of the impulse responses and the variance decomposition, we conclude that in first-tier cities, housing prices have long been very high; thus, the implementation of the various policies affect housing prices significantly given that the housing prices of these cities are very sensitive to government housing policies.

Considering that the first-tier city level dataset is cross-sectional with a time-series, we use a panel framework which is a generalized least squares (GLS) regression to obtain a more robust relationship between house price and the property-purchasing limitation policy. The GLS regression is helpful in addressing potential heteroscedasticity and autocorrelation.

Table 8 Variance Decomposition Results of First-Tier Cities (Unit: %)

Horizon/	Beijing				Shanghai				Guangzhou			
(# of years)	ΔMS	ΔLIB	POLICY	ΔCI	ΔMS	ΔLIB	POLICY	ΔCI	ΔMS	ΔLIB	POLICY	ΔCI
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.11	1.86	0.21	1.86	0.21	11.69	0.90	0.82	0.52	0.09	0.50
3	0.21	0.63	8.74	0.38	3.13	0.20	12.88	2.78	2.72	11.18	5.95	1.76
4	6.01	0.95	8.34	2.44	3.04	0.20	12.66	3.06	12.30	11.47	5.20	2.50
5	5.89	1.57	8.57	3.31	3.09	0.20	12.91	3.18	14.95	11.98	4.89	2.52
6	9.13	1.72	10.13	3.04	3.12	0.20	12.87	3.47	15.68	14.53	5.09	3.78
7	9.02	1.74	10.06	3.90	3.12	0.21	12.88	3.47	15.49	14.67	5.06	3.77
8	8.93	1.81	9.92	3.85	3.13	0.21	12.89	3.50	19.76	13.09	7.69	3.78
9	8.97	1.89	9.71	3.91	3.13	0.21	2.88	3.53	20.30	13.13	7.59	3.75
10	8.77	1.87	9.93	5.39	3.13	0.21	12.88	3.53	20.22	13.78	7.48	4.06
11	9.80	1.88	10.10	5.30	3.13	0.21	12.88	3.53	20.24	13.59	7.59	4.10
12	9.77	1.96	10.23	5.79	3.13	0.21	12.88	3.53	19.92	13.44	8.47	4.81

Notes: The order of the Cholesky is ΔP, ΔMS, ΔLIB, POLICY, and ΔCI;
SD = Standard Deviation.

Table 9 shows the correlation matrix of the variables. In order to reduce potential multicollinearity, we mean centered all of the explanatory variables before performing the regression. The results of the GLS regression analysis are presented in Table 10. Model 1 only includes a dependent variable and the control variables, while Model 2 is a full model with all of the variables. The policy shows a significant negative coefficient (β=-1711.865, $p<0.01$), thus, at the first-tier city level, property-purchasing limitations have a significantly negative influence on housing prices which means that this type of policy can effectively inhibit increases in housing prices.

Table 9 Descriptive Statistics and Correlation Matrix for First-Tier Cities

	Price	Policy	CI	MS	LIB
Price	1.000				
Policy	0.710*	1.000			
CI	0.419*	0.433*	1.000		
MS	0.864*	0.863*	0.481*	1.000	
LIB	0.345*	0.244*	0.142*	0.312*	1.000

Notes: N=576, and * represents rejection of the null hypothesis at the 1% level.

Table 10 Results of GLS Regression Analysis for First-Tier Cities

	Model 1		Model 2		
Variable	Coefficient	Std.Error	Coefficient	Std.Error	VIF
Policy	-	-	-1711.865*	369.267	3.930
CI	0.988	1.612	0.969	1.585	1.300
LIB	690.996*	140.881	656.302*	138.553	1.110
MS	0.016*	0.001	0.018*	0.001	4.330
Constant	10581.520*	1182.858	10581.520*	1389.461	
Wald chi-square	2915.510		3044.640*		
R^2	0.752		0.757		
Mean VIF	-		2.670		

Notes: N=576 and * represents rejection of the null hypothesis at the 1% level.

Then, we used a variance inflation factor (VIF) analysis to examine whether our results are biased by the effects of potential multicollinearity. The results can be found in the last column of Table 10. All of the VIF values of the variables are less than 5, which means that multicollinearity is not an issue in this study.

5.3.2 Second-Tier Cities

We conduct an LR test on the two second-tier cities of Tianjin and Changsha. The results are reported in Table 8. Tianjin and Changsha do not pass the LR test at the 5% level. The results show that restrictions do not have an important role in either city; thus, there is no need to check the impulse responses or perform variance decomposition analyses.

Table 11 LR Test Results in Second-Tier Cities

City	LR test value	P value
Tianjin	0.348	0.555
Changsha	7.618	0.471

Note: This table presents the LR test statistics for the dummy variable which is the property-purchasing limitation in this study. The null hypothesis is that the variable is unnecessary. The method details can be seen in Equations (3)-(5).

From these results, we can see that restrictions have more significant effects on housing prices in first-tier cities than in second-tier cities. Property-purchasing limitations play an especially significant role in terms of curbing increasing prices in the first-tier cities; however, the restriction policy does not have a significant effect in second-tier cities. It is worth noting that even though Guangzhou and Shenzhen are both located in the Guangdong province, they show different responses to the restrictions. The different housing price levels give rise to different implementation results from the policies, which demonstrates that enacting and implementing restriction policies should be adjusted to local characteristics.

6. Conclusions and Policy Recommendations

We have conducted an analysis on the impact of a direct administrative policy, that is, property-purchasing limitations, on housing prices in China, after controlling for other factors. Most economies have been plagued by the growing real estate boom, which has led to unaffordability of residential housing for most people, and in particular, young people. A series of measures such as monetary and credit policies have been applied to rein in property prices by governments. Most of these policies are indirect policies that depend on the market mechanisms. Very few direct administrative polices have been used to control for housing prices due to the speculative demand of the housing market. In order to address this knowledge gap, we examine whether this kind of direct policy could help to effectively regulate the market in the long run. We investigate this issue at three levels: national, provincial and city.

We propose a VAR model and use LR tests to examine whether a property-purchasing limitation policy is necessary in the model or effective in controlling housing prices at different regional levels. At the city level, the policy has a significant role in affecting housing prices in the first-tier cities, but there is no significant effect on housing prices in second-tier cities. The property-purchasing limitation policy is found to be more effective in cities that have a prosperous economy and a higher population density. It has no significant effect in most provinces possibly due to the cancellation effect; however, it is effective at the national level. This is because the national data include first-tier cities, but most of the first-tier cities are self-administered municipalities, which are not included in any province. Overall, property-purchasing limitations indeed inhibit increases in housing prices to some extent, and there are strong regional characteristics, but the effects in the developed cities are the most significant. We also use impulse response and variance decomposition analyses to compare the impact on housing prices between the property-purchasing limitation policy and other policies (credit and monetary policies). We find that these different policies have different levels and duration of influence in the housing market, and therefore the development and implementation of property-purchasing limitations need to consider local characteristics.

The property-purchasing limitation policy or similar polices may not be directly applicable to other major economies in the world because of their unique characteristics; however, our findings can provide important policy lessons for other countries. This study shows that the property-purchasing limitation policy plays a significant role in controlling housing prices, thus curbing property speculation. Hence, under the condition of housing demand in first-tier cities, a compulsory property-purchasing limitation policy should be implemented periodically, together with monetary and credit macro-policies to directly control housing demand and provide a "soft landing" for the housing market. However, we document that this policy is ineffective in cities where housing price increases are normal and investment speculation is not the main reason for housing bubbles. In broader regions such as provinces, this policy is insignificant in general. Therefore, these broader regions could loosen or terminate the property-purchasing limitation policy and instead use a market method to control housing prices. The results from this paper can also serve as a reference for the implementation of future property-purchasing limitations.

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Appendices

Appendix I: Property-Purchasing Limitations in China from 2010 to 2014

Time	Property-purchasing limitations
2010	**At the national level:** Apr 17: The State Council issued *New Ten Articles*, which authorized local governments to implement temporary purchasing limitations based on actual conditions. Sep 29: The State Council required cities in which housing prices were too high or had increased too quickly or with a low supply of housing to implement property-purchasing limitations. **At the city level:** May: Beijing Oct: Tianjin, Dalian, Shanghai, Nanjing, Hangzhou, Ningbo, Wenzhou, Fuzhou, Xiamen, Guangzhou, Shenzhen, Haikou, and Zhoushan Nov: Lanzhou
2011	**At the national level:** Jan 26: The State Council issued the 2011 No.1 Document of the General Office of the State Council which required provincial capitals, except for the above four cities, and municipalities with independent planning status to enact and implement property-purchasing limitations. Jul 12: The State Council required some of the second- and third-tier cities to restrict purchasing. **At the provincial level:** Feb: The governments of Shandong and Gansu proposed the strict enactment and implementation of property-purchasing limitations to rationally guide housing demand. Mar: The governments of Qinghai and Sichuan required the strict enactment and implementation of property-purchasing limitations. Sep: The Department of Construction of Hubei required the implementation of property-purchasing limitations. **At the city level:** Jan: Taiyuan, Changchun, Hefei, Nanchang, Zhengzhou, Wuhan, and Kunming Feb: Shijiazhuang, Harbin, Jinan, Qingdao, Nanning, Chengdu, Guiyang, Xi'an, Xining, Yinchuan, and Wuxi Mar: Shenyang, Changsha, Urumqi, Jinhua, Sanya, Foshan, and Suzhou Apr: Hohhot and Shaoxing May: Xuzhou Aug: Taizhou Sep: Quzhou Nov: Zhuhai

(Continued…)

(Appendix I Continued)

Time	Property-purchasing limitations
2012	**At the national level:** Dec 25: The Department of Construction was required to continue the strict implementation of the restriction policy and was held accountable if housing prices increased too quickly.
2013	**At the national level:** Feb 20: The State Council issued *National Five Articles,* which required the provincial capitals, except for the four above cities, and municipalities with independent planning status to continue the strict enactment and implementation of property-purchasing limitations.

Appendix II: Monetary Policy in China from 2002 to2013

Timeline	Monetary policy (represented by deposit reserve ratio)
2002-2004	Sep 21, 2003: increased from 6% to 7% Apr 25, 2004: increased to 7.5%
2005	-
2006	Jul 5: increased to 8% Aug 15: increased to 8.5% Nov 15: increased to 9%
2007	Jan 5: increased to 9.5% Feb 25: increased to 10% Apr 16: increased to 10.5% May 15: increased to 11% Jun 5: increased to 11.5% Aug 15: increased to 12% Sep 25: increased to 12.5% Oct 25: increased to 13% Nov 26: increased to 13.5% Dec 25: increased to 14.5%
2008	Jan 25: increased to 15% Mar 25: increased to 15.5% Apr 25: increased to 16% May 20: increased to 16.5% Jun 15: increased to 17% Jun 25: increased to 17.5% Oct 15: decreased to 17% Dec 5: decreased to 16% Dec 25: decreased to 15.5%
2009	-

(Continued…)

(Appendix II Continued)

Timeline	Monetary policy (represented by deposit reserve ratio)
2010	Jan 18: increased to 16% Feb 25: increased to 16.5% May 10: increased to 17% Nov 16: increased to 17.5% Nov 29: increased to 18% Dec 20: increased to 18.5%
2011	Jan 20: increased to 19% Feb 24: increased to 19.5% Mar 25: increased to 20% Apr 21: increased to 20.5% May 18: increased to 21% Jun 20: increased to 21.5% Dec 5: decreased to 21%
2012	Feb 24: decreased to 20.5% May 12: decreased to 20%
2013	-

Appendix III: Credit Policy in China from 2002 to 2013

Timeline	Credit policy
2002-2004	Feb 21, 2002: 5LR decreased from 6.21% to 5.76% Jun, 2003: Central Bank increased the down payment required for a second home. Oct 29, 2004: 5LR increased to 6.12%
2005	Mar: Central Bank cancelled preferential home loan rates for second homes. Some regions increased minimum down payments from 20% to 30% of the home's value.
2006	Apr 28: 5LR increased to 6.39% Aug 19: 5LR increased to 6.84%
2007	Mar 18: 5LR increased to 7.11% May 19: 5LR increased to 7.20% Jul 21: 5LR increased to 7.38% Aug 22: 5LR increased to 7.56% Sep 15: 5LR increased to 7.83% Sep 27: Central Bank stipulated that down payments for second homes could not be lower than 40% of the home's value; home loan rate could not be lower than 1.1 times the benchmark rate.
2008	Sep 16: 5LR decreased to 7.74% Oct 9: 5LR decreased to 7.47% Oct 30: 5LR decreased to 7.20% Nov 27: 5LR decreased to 6.12% Dec 23: 5LR decreased to 5.94%

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(Appendix III Continued)

Timeline	Credit policy
2009	Jan: Four large state banks announced the conditions for preferential rates.
2010	Jan 10: The State Council issued the 2010 No.10 Document of the State Council, which required that down payments for second homes could not be lower than 40% of the home's value Apr 2: The Treasury cancelled the preferential deed tax policy for first homes Apr 17: The State Council issued the 2010 No.10 Document of the State Council, which required that down payments for second homes could not be lower than 50% of the home's value. Oct 20: 5LR increased to 6.14% Dec 26: 5LR increased to 6.40%
2011	Jan 18: China Banking Regulatory Commission required to continue the implementation of differentiated credit policy. Jan 26: The State Council issued *New National Eight Articles*, which required that down payments for second homes could not be lower than 60% of the home's value Feb 9: 5LR increased to 6.60% Apr 6: 5LR increased to 6.80% Jul 7: 5LR increased to 7.05%
2012	Jun 8: 5LR decreased to 6.80% Jul 6: 5LR decreased to 6.55%
2013	Feb 20: The State Council issued *National Five Articles*, which required strict implementation of differentiated credit policy

***Note**:* 5LR denotes benchmark interest rates over 5 years.