Fiscal Pressure, Land Finance and Ratchet Effects of House Prices

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In this paper, we focus on the issues of local governments' fiscal pressure, land finance and house prices, and systematically analyze how local governments' fiscal pressure and land finance lead to China's ratcheting up of house prices. The results show that to release the fiscal pressure, local governments tend to increase land revenue and obtain high real estate related revenue by raising house prices. In this sense, the increase of the land transfer price will result in the increase of the cost of real estates, and eventually leading to the increase of house prices. That is to say, local governments' fiscal pressure will not only result in the increase of house prices directly but also consolidate the ratchet effects of house prices.

Keywords: land finance, fiscal pressure, ratchet effects of house prices

1. Introduction

After the reform of the tax-sharing system, the fiscal pressure on local governments is gradually increasing, so there is an urgent need to find new sources for revenue increasing. As land finance and estate related revenue gradually become the steady and stable revenue sources for the local government and the main taxes of the local governments at the county (city) level, maintaining the scale of land finance and real estate market evolved into the main method to release local governments' fiscal pressure. Economic data show that China's overall house prices have been increasing since the housing market reform, except in 2008, influenced by the global financial crisis, when the growth of commercial house prices slowed down. However, the house prices rose rapidly and the house price growth rate was far more than that of residents' disposable income growth rate in 2009 (Li and Song, 2016). Faced with the constant increase of house prices, the central government and local governments have passed policies to better control the real estate market. However, neither the effort to focus on interest rates and investment to divert social capital and avoid the excessive concentration of social capital in the real estate industry nor the city-oriented control based on the macroeconomic background has taken effect. After the implementation

of the regulation and policies, after a short period of convergence, the house prices rapidly rebound and keep increasing. This phenomenon is similar to the ratchet effects put forward by economist James Stemble Duesenberry, that is, the consumption level will increase with the increase of the income level, but will not easily decrease with the decrease of the income level. So we apply the ratchet effects here to refer to the high house prices despite regulations and policies or the irreversible trend of the increasing house prices or the rebound after a slight decrease (Wang and Gao, 2011). For a long time, relevant studies of China's scholars mainly focused on how factors such as land finance, income level, and house price expectation have led to the increase of house prices. Their studies have made great contributions in theory and practice. However, their study neglected the issue whether the local fiscal pressure, which is closely related to land finance, affects house prices. As can be seen from the following figure about the trends of the local fiscal pressure and house prices from 1999 to 2014 (Figure 1), both of the two factors are on the rise overall with partial decline of local fiscal pressures and the constant rising of house prices. Based on this phenomenon, this thesis focuses on two issues: (1) whether local fiscal pressure and land finance themselves will lead to the ratchet effects of house price? (2) What is the mechanism of local fiscal pressure and land finance on house prices?
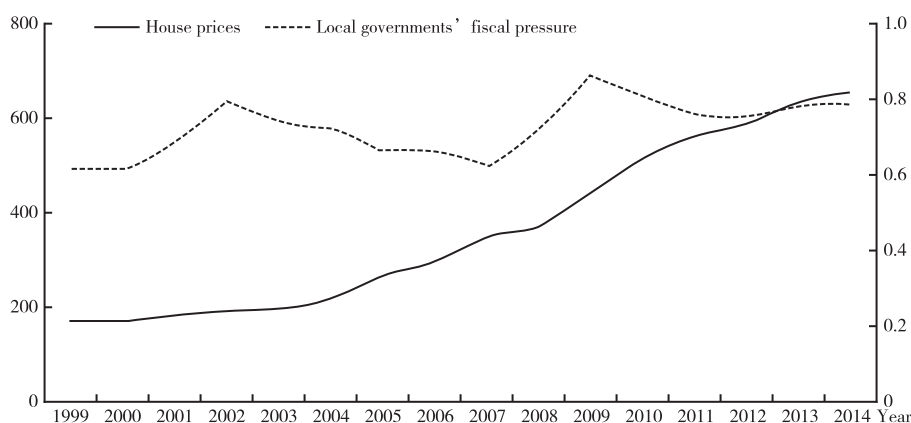

Figure 1. Local Governments' Fiscal Pressure and House Prices

Source: wind.

House prices have always been a focus of the national economy and the people's livelihood. The reason why government regulation has so far failed to drive the rapidly growing house price to a reasonable level lies in the failure to figure out the real cause of the ratchet effects of house prices. We consider the local fiscal pressure and land finance as essential breakthrough points in the analysis of the ratchet effects of house prices. Related literature can be divided into two categories.

The first is the effects of local government's fiscal pressure on the land finance. When discussing the imbalance of power between local governments, already mentioned is the issue that local governments used land revenue to make up for the financial gap. However, there was no in-depth analysis towards the cause behind land finance back then (Kong, 2007). Though reasons for the national prevailing of land finance has not been consistently agreed upon by academics, the most believed one is that local governments' fiscal pressure is one of the reasons leading to land finance (Huang and Cai, 2013; Wang, 2013; Sun and Zhou, 2013).

The second is the impact of land finance on house prices. Since the introduction of the system of "attract investment, auction and hang out the shingle" in 2002, the scale of land finance has been rapidly expanding. For example, the land transfer fees in 2014 were RMB4.294 trillion yuan, 83.5 times of RMB51.4 billion in 1999. Meanwhile, the proportion of the land transfer fees in local governments' fiscal revenue also increased significantly. When land transfer fees rose rapidly, urban house prices also rose rapidly. That is to say, the growing trends of the two are roughly the same. It is generally accepted by academics that land finance is one of the major causes for the rapid growth of house prices (Wu, Feng and Li, 2014).

At present, there are deep theoretical studies on these two aspects. However, studies on the relations of the three are often ignored, leading to the neglect of the impact of fiscal pressure on house prices. In conclusion, the research on ratchet effects of house prices can be further studied in the following aspects: First, most of the existing studies focus on partial analysis among the three factors, namely the impact of local governments' fiscal pressure on land finance, or the impact of land finance on house prices. There have been few studies on the relations between local governments' fiscal pressure, land finance and the ratchet effects of house prices. Second, there is a correlation between land finance and fiscal pressure in economic theory and phenomena. However, the existing literature related to the three almost did not test the intermediary effect through the test of related terms. Based on this, in this thesis, we focus on the issues of local governments' fiscal pressure, land finance and house prices, and further prove that fiscal pressure has direct or indirect effects on the ratchet effects of house price through empirical analysis of their relations. In the empirical test, the relation of land finance and local governments' fiscal pressure is analyzed to test the mediation effect of land finance. Meanwhile, sub-sample is applied to further analyze the differences of the impact of local governments' fiscal pressure and land finance on house prices.

2. Theoretical Analysis and Models

After the tax-sharing reform in 1994, the fiscal authority of local governments was recalled by the Central Government, however, relative responsibilities remained

unchanged. This unbalance caused the local governments' failing to make their ends meet (Liang, 2010; Gong, 2012; 2015). Some of the Central Government's responsibilities were pushed to the local governments, leading to the huge fiscal pressure of local governments. Faced with the unbalance and the so caused fiscal pressure, the local government has to seek for additional revenue from extra-budgetary funds, among which the land transfer fees and the real estate tax revenue become the main sources. (Lv and Gao, 2016). The author of this paper believes that local fiscal pressure has direct and indirect effects on house prices.

The direct effects mean the impact of local fiscal pressure on house prices. The real estate industry is the pillar of the national economy. Apart from the contribution to GDP, the real estate industry can impact the development of industries, including construction, finance and service. Therefore, promoting the prosperity and development of the real estate industry can increase local governments' real estate tax and other local taxes. The pressure of fiscal pressure serves as the motivation of local governments for the increasing of the house prices and the promoting of the prosperity of the real estate industry. For example, local governments may use the news media to lead the public opinion on house prices so as to influence buyers' expectations and to establish their confidence towards the real estate industry. Besides, the adjustment of purchase requirements and the real estate tax could also be applied.

The indirect effects mean the impact of local fiscal pressure on land revenue, and the land revenue further impacts house prices. In addition to real estate revenue, land transfer fees also accounts for a large proportion of the local government's fiscal revenue. Before the implementation of the new *Budget Law of the People's Republic of China* in 2015, land transfer fees are part of local governments' extra-budgetary revenue. There was no strict supervision of central governments towards this revenue. After 2015, canceled was local governments' extra-budgetary revenue and applied was the full scope budgetary budget management, it was still controlled by local governments and can alleviate the fiscal pressure. Limited is the amount of land that can be transferred. To obtain the revenue resulted from the price gap between land acquisition and land sales, the only solution is to limit the supply and raise the price, which directly causes the increase of the real estate costs, up the price of housing. That is, local governments are trying to ease the fiscal pressure and this further results in the increase of house prices. This is how the cost is transferred from the real estate developers to buyers.

Next, with reference to Turnbull's (2004) study, a model that is consistent with China's current economic situation is set to study how local governments' fiscal pressure results in the ratchet effects of house prices. To simplify the analysis, the land within a jurisdiction is divided into two parts: commercial land and agricultural land. The increase of commercial land means the expansion of the scale of land finance and the rising of house prices This can be explained as: faced with the huge fiscal

pressure, the local government will transfer the agricultural land into commercial land (for commercial and residential use) to gain land transfer fees and real estate revenue. Assuming that $s(t)$ is the total area of commercial land in a jurisdiction with a certain period t, then the total area of agricultural land in that jurisdiction during the period t is $1-s(t)$. During t, the transferred land is $a(t)$. When commercial land $s(t) = 0$:

$$s(t)=a(t) \tag{1}$$

During the land transfer, the local governments have to make certain compensation to farmers, therefore, the unit compensation is $c[1-s(t)]$, which can also be considered as a function of the total area of agricultural land within the jurisdiction. Since the compensation depends on the production efficiency of agricultural land, according to the decreasing law of marginal productivity, $\{c[1-s(t)]\}'<0$, $\{c[1-s(t)]\}''>0$. Let $l[t]$ be the land transfer fees and real estate tax revenue, which means the land transfer fees and the real estate tax revenue obtained by the local government during t.

When faced with fiscal pressure, local governments' main sources for more fiscal revenue is the land transfer fees from the expansion of land revenue scale and the real estate revenue from the increased house prices. This can be achieved through the transfer of agricultural land into commercial land. Among them, the land transfer fees from the expansion of land revenue scale can be expressed as $l[t]-c[1-s(t)]t$, the real estate revenue from the increased house prices, $\pi H[s(t)]$, π is the tax rate, $H[s(t)]$ can be regarded as an increasing concave function of commercial land $s(t)$. The discount rate is ε, $\mu \geq 1$ the fiscal pressure that local governments are faced with. Then local governments choose the optimal scale of land finance and house prices during t to maximize their fiscal revenue:

$$max: \int_0^\infty \{H[s(t)] + \mu[\pi Hs(t)] + l[a(t)] - c[1-s(t)]a(t)\} e^{-\varepsilon t}dt \tag{2}$$

$$s.t: s(t) = a(t), s(0) = s_0 \tag{3}$$

s_0 is the initial commercial land within the jurisdiction, $\theta(t)$ the potential profits of commercial land during t, we can get the optimal conditions for the maximizing of the target return function of local government as:

$$\mu[l'(a) - c(1-s)] + \theta = 0 \tag{4}$$

$$\varepsilon\theta - (1+\mu\pi)H'(s) - \mu c'(1-s)a = \frac{d\theta}{dt} \tag{5}$$

Integrating Equation (5), we can get the potential profits of commercial land are:

$$\theta(t) = \int_t^\infty \{H'(s) + \mu[\pi H'(s) + c'(1-s)a]\} e^{-\varepsilon(m-t)} dm \qquad (6)$$

From Equation (6) we can see that when other conditions remain unchanged, the potential profit of commercial land $\theta(t)$ will increase with the increase of the rate of increase of future real estate revenue (reflected as the rapid rising of house prices). With Equation (4):

$$\partial a/\partial \theta = (-1)/(\mu l'') > 0 \qquad (7)$$

From Equation (7) we can see that same is the changing trend of potential profit $\theta(t)$ and the land finance scale. Together with the analysis of Equation (6), we can get the first Hypothesis.

Hypothesis 1: The local government's need of fiscal revenue or other potential revenue serves as the motivation for land transfer and results in the expansion of land finance scale, which leads to the reduction of agricultural land and the increase of commercial land, accelerates the expansion and prosperity of real estate industry, and causes the rising of house prices. That is to say, the expansion of the scale of land finance promoted the continuous rise of house prices, which led to the ratchet effects of house prices.

With Equation (4), we get the derivative of θ:

$$\partial a/\partial \mu = (-1)/(\mu l'') > 0 \qquad (8)$$

With Equation (8), we can get the second Hypothesis.

Hypothesis 2: Local governments' motivation to promote the rising of house prices grows with the increasing of fiscal pressure. With the continuous rise of the house price, the inflow of real estate investment increases and promote the prosperity of the real estate industry, land demand and land transaction price increase and promote the increasing of the land transfer fees and real estate revenue. That is to say, the increase of fiscal pressure also promoted the continuous rise of house prices, which led to the ratchet effects of house price.

The hypotheses above show that to maintain or expand its interest in land finance and real estate, local governments have a strong incentive to promote the continuous rise of house prices. That is to say, for rational local governments, fiscal pressure and relative interest enable the expansion of land finance scale and rising of house prices become the "optimal" choice for local governments. If the house price can not maintain the original price or even decline in a large extent, it will lead to the slump of real estate industry, the shrinking of its scale and the reduction of land demand, reducing the land transfer fees and real estate related revenue; if the price can be maintained or even rise, the real estate industry will be prosperous, real estate investment inflows

will increase, land demand will increase, leading to the soar of land transaction prices and increasing the local government's land transfer fees and real estate revenue. Therefore, the fiscal pressure serves as the motivation for rational local governments to maintain the house price or to promote the continuous rise of the prices, leading to the ratchet effects of house price. Based on the analysis above, this thesis will apply the Chinese provincial panel data from 1999 to 2014 to empirically test Hypothesis 1 and Hypothesis 2 to provide empirical evidence.

3. The Empirical Model Setting, Variable Selection and Data Description

3.1. The Empirical Model Setting

Based on the theoretical analysis above and the analysis of the existing literature, to study the impact of land finance and fiscal pressure on house prices, we set house prices ($HousePrice_{i,t}$) as the explained variable, fiscal pressure ($Press_{i,t}$) and land finance ($Land_{i,t}$) as the main explanatory variables, and the housing function is as follows:

$$HousePrice_{i,t} = \beta_0 + \beta_1\ Land_{i,t} + \beta_2\ Press_{i,t} + \gamma\ Control_{i,t} + \delta_i + \theta_t + \varepsilon_{i,t} \qquad (9)$$

To study whether there is a difference in the impact of land finance on house prices under different fiscal pressures, we set the fiscal pressure ($Press_{i,t}$) and land finance ($Land_{i,t}$) as the interaction term, that is, based on Equation (9), to further study the impact of this term on house prices, then we can get Equation (10):

$$\begin{aligned} HousePrice_{i,t} = {} & \beta_0 + \beta_1\ Land_{i,t} + \beta_2\ Press_{i,t} + \beta_3\ Press_{i,t} \times Land_{i,t} \\ & + \gamma\ Control_{i,t} + \delta_i + \theta_t + \varepsilon_{i,t} \end{aligned} \qquad (10)$$

In formulas above, $HousePrice_{i,t}$ is house prices, $Land_{i,t}$, land finance, $Press_{i,t}$, fiscal pressure, $Control_{i,t}$ refers to a series of other control variables that can influence house prices, $Press_{i,t} \times Land_{i,t}$ is the interaction term of land finance and fiscal pressure, β_0 is a constant term, i and t, i city or province and t year, $\varepsilon_{i,t}$ is random error term.

Urban house prices are not only affected by land finance and fiscal pressure, but also by the house prices of the previous period ($HousePrice_{i,t}$), put it into Equations (9) and (10) to get dynamic panel models with no interaction items and with interaction items, Equations (11) and (12):

Dynamic panel model without interaction items:

$$\begin{aligned} HousePrice_{i,t} = {} & \beta_0 + \alpha\ HousePrice_{i,t-1} + \beta_1\ Land_{i,t} + \beta_2\ Press_{i,t} + \gamma\ Control_{i,t} \\ & + \delta_i + \theta_t + \varepsilon_{i,t} \end{aligned} \qquad (11)$$

Dynamic panel model with interactive items:

$$HousePrice_{i,t} = \beta_0 + \alpha\,HousePrice_{i,t-1} + \beta_1\,Land_{i,t} + \beta_2\,Press_{i,t} + \beta_3\,Press_{i,t} \times Land_{i,t}$$
$$+ \gamma\,Control_{i,t} + \delta_i + \theta_t + \varepsilon_{i,t}$$

$$(12)$$

$HousePrice_{i,t-1}$ is the house price of the previous period, $HousePrice_{i,t}$ is the current price, $Land_{i,t}$, land finance; $Press_{i,t}$, fiscal pressure and, $Control_{i,t}$ other control variables that can influence house prices, $Press_{i,t} \times Land_{i,t}$ is the interaction term of land finance and fiscal pressure, β_0 is a constant term, i and t, i city or province and t year, $\varepsilon_{i,t}$ is random error term. To alleviate the heteroscedasticity caused by the data fluctuation of the sample and eliminate the influence of the unit and the size of each variable on the regression coefficient and obtain a more economic elastic coefficient, variables of Equations (9), (10), (11) and (12) are logarithmic processed.

3.2. Variable Selection

3.2.1. Fiscal Pressure Measurement (Core Explanatory Variables)

Based on Luo's (2010) fiscal pressure measurement method, fiscal pressure in this paper is defined as: (provincial budgetary expenditures – budgetary revenue) / budgetary revenue. With the increase of local governments' fiscal pressure, to ease the gap between revenues and expenditures, the motivation to seek extra revenue from extra-budgetary funds is increasing, leading to local governments' expansion of the scale of land finance or real estate industry. Therefore, the regression coefficient of anticipated fiscal ($Press_{i,t}$) is positive.

3.2.2. Measurement of Land Finance (Core Explanatory Variables)

With reference to the existing literature, in this paper, land revenue ($Land_{i,t}$) is applied to measure the scale of land finance. There are mainly three forms for the measurement of land finance (Luo, 2010): First, a direct measure with land transfer fees; second, the sum of land transfer fees and other land-related revenue; third, the sum of land transfer fees, other land-related revenue and land-related investment (this is seldom used due to data acquisition difficulty). Considering the issue of data acquisition, the second empirical test is applied in this thesis. Meanwhile, for an effective test, applied is the dependence of land finance, namely the sum of the land transfer fees and land-related revenue / the provincial public finance expenditures. Hypothesis 1 shows that the expansion of land finance scale will promote the rise of house prices. Therefore, it is expected that the regression coefficient of land finance and per capita land revenue will be positive.

3.2.3. Other Control Variables

To study the relations between fiscal pressure and the land finance and house prices, the analysis of the two variables is not enough, because many factors can also affect house prices. The neglect of these factors will reduce the loss of the validity of the empirical tests' results. Therefore, other control variables that affect house prices will also be included in the model. To select the control variables, issues including the real estate market supply, demand and credit are taken into account and the existing literature and research are as follows.

(1) Per capita GDP ($AGDP_{i,t}$). Per capita GDP reflects per capita income. The higher the per capita income is, the stronger the residents' spending power is and the more motivated they are to purchase house (Gong, 2012). Therefore, the regression coefficient for per capita GDP $AGDP_{i,t}$) is positive.

(2) Population density ($Density_{i,t}$). With the increase of the urban population, the demand for commercial housing will increase to meet consumers' basic needs (Guo, 2013). Therefore, the regression coefficient for population density ($Density_{i,t}$) is positive.

(3) Sales area of commercial residential building ($Sales_{i,t}$). It reflects the impact of demand on house prices. The increase in demand may result in the increase of house prices (Kuang and Li, 2012). Therefore, the regression coefficient for the sales area of commodity housing ($Sales_{i,t}$) is positive.

(4) Completed floor space ($Area_{i,t}$). It reflects supply's impact on house prices, the increase in supply may result in the decrease of house prices (Kuang and Li, 2012). Therefore, the regression coefficient of completed floor space ($Area_{i,t}$) is negative.

Table 1. Variable Definition and Measurement

Variable	Definition	Measurement method
Explained variable	House prices ($HousePrice_{i,t}$)	Current house prices
Core explanatory variables	Fiscal pressure ($Press_{i,t}$)	(Provincial budgetary expenditures – budgetary revenue) / budgetary revenue
	Land finance ($Land_{i,t}$)	Land transfer fees+ cultivated land use tax + urban land use tax + land value increment tax + deed tax and property tax
Control variables	Per capita GDP ($AGDP_{i,t}$)	Provincial GDP / provincial population by year-end
	Population density ($Density_{i,t}$)	Provincial population by year-end / provincial area
	Sales area of commercial residential building ($Sals_{i,t}$)	Sales area of commercial residential building
	Completed floor space ($Area_{i,t}$)	Completed floor space
	Real estate development loans ($Loan_{i,t}$)	Real estate development loans
	Urbanization rate ($Urban_{i,t}$)	Urban population of a province / provincial population by year-end

(5) Real estate development loan ($Loan_{i,t}$). It can reflect credit. The larger the loan is, the more prosperous the real estate industry is and the higher the prices will be (Su *et al*, 2016). Therefore, the regression coefficient for the real estate development loan ($Loan_{i,t}$) is positive.

(6) Urbanization rate ($Urban_{i,t}$). China is in the process of rapid urbanization. The increasing housing demand caused by urbanization is one of the important reasons for the roar of house prices (Luo, 2011). Therefore, the regression coefficient of the urbanization rate ($Urban_{i,t}$) is positive.

3.3. Data Sources and Descriptive Statistics

3.3.1. Data Sources

China's provincial panel data from 1999 to 2014 are applied in this thesis. Among them, the house price data are from *China Statistical Yearbook* from 2000 to 2015; the data that measure the fiscal pressure [(fiscal expenditure within the budget – budgetary revenue)] / budgetary revenue], the *Financial Yearbook of China* the data that measure the land financial revenue and that are related with per capita land finance, including land transfer fees, farm land occupation tax, land value increment tax, urban land using tax, deed tax, real estate tax and the population of each province, are from 2000-2015 *China Land Resources Yearbook*, *China Statistical Yearbook*, and *China Demographic Yearbook*; per capita GDP (provincial GDP / provincial population by year-end), population density (provincial population by year-end / provincial area), sales area of commercial houses, Completed floor space, real estate development loan, urbanization rate (Urban population of a province / provincial population by year-end) are from wind , *China Statistical Yearbook*, *Financial Yearbook of China* and *China Economic Information Network*. The data in Tibet can not be obtained, so they are now excluded in the analysis.

3.3.2. Data Description

As is shown from the descriptive statistics of various variables (Table 2), in different provinces, varies are data including house prices, fiscal pressure, land finance, per capita GDP, population density, sales area of commercial buildings, Completed floor space, real estate development loans and urbanization rates. The average house price is RMB 3431.35 yuan, the fluctuation range is RMB 729~18499 yuan; the average fiscal pressure is 1.1895, the fluctuation range is 0.0517~5.7447; the average land finance is RMB 49172.17 million yuan, the fluctuation range is from RMB 11.3966 million yuan to 611.496 billion yuan; the average per capita GDP is RMB 24572.56 yuan, the fluctuation range is RMB 2545~105231.4 yuan; the average

population density is 0.0414, the fluctuation range, 0.0007~0.3827; the average sales area of commercial residential building is 22624.16 thousand square meters, the fluctuation range is 307~114547.7 thousand square meters; the average completed floor space is 20539.08 thousand square meters, the fluctuation range is 216~98484 thousand square meters; the average real estate development loans is RMB 26929.27 million yuan, the fluctuation range is from RMB 22.20 million yuan to 243.261 billion yuan; the average urbanization rate is 47.12%, the fluctuation range is 21.99%~89.6%.

Table 2. Descriptive Statistics of Variables

Variable	Symbol	Amount of samples	Mean	Standard deviation	Minimum	Maximum
House prices (yuan / square meter)	$HousePrice_{i,t}$	480	3431.35	2798.56	729	18499
Fiscal pressure (%)	$Press_{i,t}$	480	1.1895	0.8921	0.0517	5.7447
Land finance (ten thousand yuan)	$Land_{i,t}$	480	4917217	7672348	1139.66	6.11e+07
Per capita GDP (yuan)	$AGDP_{i,t}$	480	24572.56	20102.55	2545	105231.4
Population density (%)	$Density_{i,t}$	480	0.0414	0.0567	0.0007	0.3827
Sales area of commercial residential building (ten thousand meters)	$Sales_{i,t}$	480	2262.416	2184.405	30.7	11454.77
Completed floor space (ten thousand meters)	$Area_{i,t}$	480	2053.908	1784.194	21.6	9848.4
Real estate development loans (ten thousand yuan)	$Loan_{i,t}$	480	2692927	4067933	2220	2.43e+07
Urbanization rate (%)	$Urban_{i,t}$	480	47.12	15.31	21.99	89.6

4. Empirical Results and Analysis

After discussing how fiscal pressure and land finance affect house prices, that is, with the control of other factors, both can lead to the rise in house prices, and there may also be intermediary effect on house prices caused by the interaction of fiscal pressure and land finance, we will empirically test the effect of fiscal pressure and land finance on house prices using static panel models (Equations (9) and (10)) and dynamic panel models (Equations (11) and (12)). Table 3 shows the full sample of financial stress, land finance and ratchet effects of house prices.

4.1. Full Sample Regression

In the measurement of the impact of fiscal pressure and land finance on house prices, variables are applied step by step to ensure the accuracy of the estimation

results. In Table 3, model (1) and model (3) show the regression results when there are only fiscal pressures and core explanatory variables of land finance with Equation (9); model (2) and model (4) show the regression results based on model (1) and model (3) and with the application of control variables and interaction terms between fiscal pressure and land finance with Equation (10). In this paper, Hausman test regression model is applied to decide to use the fixed effect model or random effects model. In Table 4, the fixed effect of model (1) and model (2) shows that the Hausman test P is 0.0000, which is totally opposite to the original hypothesis. Therefore, the fixed effect model should be applied. Model (3) is the estimation result of random effects model without control variables. Model (4) is the result of random effects model with control variables and interaction terms between fiscal pressure and land finance.

The static panel estimation results with the fixed-effects model are shown in the models (1) and (2) of Table 3. The coefficient of fiscal pressure and house prices is positive with the average of 5%. The coefficient between land finance and House Price is positive with the average 1%. That is, fiscal pressure and land finance have a positive effect on house prices. From a quantitative view, the elasticity coefficient between land finance and house prices is 0.052, which is positive at 1%. This shows that for every 1% expansion of land fiscal scale, house prices rise 0.052%. This serves as the support for Hypothesis 1. In another core explanatory variable, the elasticity coefficient of fiscal pressure and house prices is 0.061 and passes the 5% significance test. This shows that for every 1% increase in local governments' fiscal pressure, house prices will increase by 0.061%.

The greater fiscal pressure is, the more incentive is for local governments to seek fiscal revenue to ease the gap between income and expenditure, and to expand the scale of the real estate industry, which provides evidence to support Hypothesis 2. With the application of the interaction terms of fiscal pressure and land finance into Equation (10), we can see that the coefficients of interaction terms and explained variables are significantly positive at 1%, and the coefficients of the core explanatory variables and land finance remain unchanged, indicating that fiscal pressure can not only directly result in the ratchet rise of house prices, but can also strengthen the ratchet effects of house prices through its influence on land finance. Under the mismatch between property right and power, local governments are under increasing fiscal pressure and can not make their ends meet, leading to the increasing of land transfer and promoting the rise of house prices through the impact of land finance. The coefficient of other control variables is basically within expectation. The coefficient of per capita GDP and real estate development loan is significantly positive at 1%. The coefficient of completed floor space is significantly negative at 5%. The population density, the coefficient between urbanization rate and house price was significantly positive, and passed the significance test of 5%, which initially confirmed the hypothesis above.

Dynamic panel estimation results are shown in models (5), (6) and (7) in Table 3, with the application of DIF-GMM and SYS-GMM respectively to solve the

endogenous problems in the model. In Equations (9) and (10), house prices of the precious period are applied as explanatory variables to get the regression results. First, without the application of other control variables, Equation (11) is conducted with DIF-GMM. The regression results are shown in model (5) in Table 3. Then, with the application of control variables and interaction terms between fiscal pressure and land finance, Equation (12) is conducted with DIF-GMM and the SYS-GMM respectively. The regression results are shown in models (6) and (7). From the regression results we can see, the coefficients between land finance and house price under DIF-GMM and SYS-GMM are significantly positive at the 1%, which further proves Hypothesis 1. The coefficient of fiscal pressure and house prices under SYS-GMM is significantly positive at the 1%, which is basically in accordance with the land fiscal coefficient at the 5% under DIF-GMM and further supports Hypothesis 2. Fiscal pressure and land finance positively promote the rise of house prices. The elasticity coefficient of the interaction between fiscal pressure, land finance and house price was positive and passed the 5% significance test, which further confirmed that the fiscal pressure can not only directly influence the ratchet rise of house prices, but also strengthen the ratchet effects of house prices through land finance. In both estimations, the house price of the previous period is significantly positive at the 1%, confirming the conjecture that house prices of the precious period have positive impacts on the rise of house prices of next period. There exists obvious economic inertia. From the quantitative view, the estimated land financial coefficient is 0.056 under the SYS-GMM, and under the DIF-GMM, 0.063. The elasticity coefficient between the fiscal pressure and the house prices under the SYS-GMM is 0.059, and under the DIF-GMM, 0.067; the coefficient of the interaction between fiscal pressure and land finance under the SYS-GMM is 0.029, and under the DIF-GMM, 0.031. The regression results are basically the same, so the estimation result is steady. The coefficients of the control variables met the expectation basically. The elasticity coefficients of per capita GDP and the real estate development loans were both significantly positive at 1%, which were within expectation. The coefficients of completed floor space and house price were significantly negative under the DIF-GMM and passed the 10% significance test. The elasticity coefficient of population density is significantly positive at 10% under SYS-GMM, but not significant under. The elasticity coefficient of the sale area of commercial housing is significantly positive, and passed the significance test of 5%, which was within expectation. The elasticity coefficient between urbanization rate and house price was significantly positive under both the SYS-GMM and the DIF-GMM, which is within expectation. Besides, from the test results of AR (2) in Table 3, the results of dynamic panel estimation all pass the second-order uncorrelated test of residuals; the P of Hansen test are all > 0.5, indicating that excessive recognition does not exist in the regression model. Therefore, valid and stable are the estimated results though the overcome of endogenous under the DIF-GMM and the SYS-GMM.

Table 3. Full Sample Estimation Results of Fiscal Pressure, Land Finance and Ratchet Effects of House Prices

Explanatory variables (Logarithmic)	FE (1)	FE (2)	RE (3)	RE (4)	DIF-GMM (5)	DIF-GMM (6)	SYS-GMM (7)
LnLand	0.285*** (0.0108)	0.052*** (0.0183)	0.269*** (0.0110)	0.062*** (0.0203)	0.081*** (0.0243)	0.063*** (0.0192)	0.056*** (0.0087)
LnPress	0.348*** (0.0448)	0.061** (0.0288)	0.194*** (0.0706)	0.060** (0.0300)	0.128** (0.0905)	0.067** (0.0321)	0.059*** (0.0196)
LnPressLand		0.077*** (0.0224)		0.007 (0.0124)		0.031** (0.0126)	0.029** (0.0021)
LnL.House Price					0.905*** (0.0235)	0.897*** (0.0312)	0.833*** (0.0159)
LnAGDP		0.596*** (0.0568)		0.609*** (0.0428)		0.650*** (0.0654)	0.621*** (0.0179)
LnDensity		0.584** (0.243)		0.002 (0.0284)		0.356 (0.224)	0.478* (0.0653)
LnSales		0.079** (0.0381)		0.116** (0.0466)		0.070** (0.0334)	0.081** (0.0189)
LnArea		−0.091* (0.0453)		−0.119** (0.0508)		−0.076* (0.0428)	−0.058 (0.0206)
LnLoan		0.102*** (0.0225)		0.126*** (0.0244)		0.085*** (0.0238)	0.107*** (0.0041)
LnUrban		0.234** (0.0867)		0.091 (0.0778)		0.226* (0.0895)	0.171** (0.0292)
Cons	3.837*** (0.152)	2.921*** (1.008)	4.079*** (0.194)	0.925*** (0.314)	3.871*** (0.131)	1.991** (0.969)	2.093** (0.983)
N	480	479	480	479	420	420	450
Hausmantest	0.0000	0.0000	0.4326	0.5269			
AR(1)					0.000	0.000	0.001
AR(2)					0.487	0.526	0.613
Hansentest					0.624	0.712	0.689

Notes: (1) ***, ** and * indicate the significance levels of 1%, 5% and 10%, respectively; (2) The figures in parentheses are standard errors.

4.2. Sub-Sample Regression

With a vast territory, the real estate industry varies in China's different regions, so is factors that can impact and even determine house prices. Therefore, it is necessary to study the specific impact of fiscal pressure and land finance on house prices from a regional perspective. Based on the geographical location and GNP, three regions, namely the eastern, the central and the western regions, will be studied to get the sub-sample regression respectively. According to the models and regression results above, the SYS-GMM is applied to Equation (12).

The test results of AR (2) in Table 4 show that all the models of the three regions pass the second-order uncorrelated test of residuals. All P of Hansen test are > 0.5, indicating that excessive recognition does not exist in the regression model. Therefore, valid are the estimated results though the overcome of endogenous under the SYS-GMM. From the sub-sample estimation, it is clear that the coefficients between land finance and house prices in the eastern, the central and the western regions are all positive and passed the significant test. However, the degree of the impact of land finance on house prices are different, with the east being the highest, followed by the central and the western regions being the lowest. This reflects the "heat" of land finance in the developed eastern provinces. The elasticity coefficients between fiscal pressure and house prices in three regions are all significantly positive at 5%, which further proves the hypothesis in this paper. Compared with the central and the western regions, the impact of fiscal pressure on house prices is greater in the eastern regions, further proving the existence of regional differences. The coefficient of the interaction between fiscal pressure and land finance and house prices is positive and passed the 5% significance test, further proving the explanations above. From Table 4, it can be seen that different degree are the interaction effect of fiscal pressure and land finance in different regions. The ratchet effects of house prices in the eastern provinces are more obvious than that in the central and western regions.

Table 4. Sub-Sample Estimation Results of Land Finance, Fiscal Pressure and Ratchet Effects of House Prices

Explanatory variables (Logarithmic)	The eastern (SYS-GMM)	The central (SYS-GMM)	The western (SYS-GMM)
LnLand	0.079*** (0.0259)	0.058** (0.0242)	0.021* (0.0281)
LnPress	0.075*** (0.0261)	0.020** (0.0420)	0.038** (0.0146)
LnPressLand	0.041*** (0.0239)	0.070** (0.0297)	0.033** (0.0103)
LnL.HousePrice	0.886*** (0.0493)	0.844*** (0.0301)	0.739*** (0.0256)
LnAGDP	0.445*** (0.0113)	0.380*** (0.0495)	0.371*** (0.0332)
LnDensity	0.117* (0.0605)	0.108** (0.0441)	−0.334 (0.206)
LnSales	0.177*** (0.0347)	0.037** (0.0447)	0.024 (0.226)
LnArea	−0.198 (0.106)	−0.073** (0.0329)	−0.165* (0.0258)
LnLoan	0.134*** (0.0087)	0.056** (0.0263)	0.038*** (0.0264)
LnUrban	0.197** (0.0157)	0.686* (0.131)	0.181 (0.627)

Explanatory variables (Logarithmic)	The eastern (SYS-GMM)	The middle (SYS-GMM)	The west (SYS-GMM)
Cons	2.686[***] (0.705)	1.410[**] (0.235)	1.387[***] (0.183)
N	175	127	175
AR(1)	0.000	0.000	0.000
AR(2)	0.545	0.493	0.457
Hansentest	0.701	0.659	0.682

Notes: (1) [***], [**] and [*] indicate the significance levels of 1%, 5% and 10%, respectively; (2) The figures in parentheses are standard errors.

4.3. Robustness Test

The core variables of fiscal pressure and land finance are represented by the per capita fiscal revenue and expenditure gap and land financial dependence to conduct the robustness test. Land financial dependence is defined as: land transfer fees/ local public financial expenditure (Liu and Wu, 2015); per capita fiscal revenue and expenditure gap is defined as: (provincial budgetary expenditures – budgetary revenue) / provincial population by year-end (Gong, 2015). (12) is further analyzed empirically with the application of fixed effects (FE), random effects (RE), DIF-GMM and SYS-GMM to further prove the impacts of fiscal pressure and land finance on the ratchet effects of house prices.

The test estimation results of the impacts of fiscal pressure and land finance on the ratchet effects of house prices are shown in Table 5. The FE of model (1) shows that the P of Hausman test is 0.0000, which denies the original hypothesis and proves that the FE model is valid. From the test results of AR (2), model (3) and model (4) passed the second-order unrelated test of residuals. The P of Hansen test are all > 0.5, indicating that there is no over recognition between the two models, that is, the results are still valid by overcoming the endogenous difference under the DIF-GMM and the SYS-GMM.

The coefficient between land financial dependence and house prices and that between per capita fiscal revenue and expenditure gap and house prices are both significantly positive at 5%. The coefficient of the interaction term between land financial dependence and per capita fiscal revenue and expenditure remains positive, and passed the 5% significance test, confirming the previous assumption that both land finance and fiscal pressure have positive impact on house prices and the fiscal pressure further strengthened the ratchet effects of house prices through land finance. The control variables in the estimation all passed the significance test, and the coefficient symbols are basically the same with that of the whole sample regression. The test results and regression results of the whole sample show that the coefficients of the control variables have no significant discrepancies.

Table 5. The Robustness Test Results of Fiscal Stress, Land Finance and the Ratchet Effects of House Price

Explanatory variables (Logarithmic)	FE (1)	RE (2)	DIF-GMM (3)	SYS-GMM (4)
LnDependence	0.046** (0.0171)	0.029* (0.0300)	0.035** (0.0142)	0.047** (0.0096)
LnAGap	0.110*** (0.0340)	0.038** (0.0392)	0.042* (0.0740)	0.033** (0.0270)
LnDependenceAGap	0.055*** (0.0168)	0.011** (0.0221)	0.039*** (0.0230)	0.021** (0.0121)
LnL.HousePrice	0.689*** (0.0186)	0.812*** (0.0352)	0.728*** (0.0282)	0.784*** (0.0133)
LnAGDP	0.521*** (0.0459)	0.402*** (0.0409)	0.258*** (0.0198)	0.193*** (0.0085)
LnDensity	0.401* (0.225)	−0.009 (0.0248)	0.121* (0.1990)	−0.128 (0.903)
LnSales	0.073** (0.0311)	0.128*** (0.0310)	0.062** (0.0302)	0.051*** (0.0138)
LnArea	−0.066 (0.0418)	−0.220*** (0.0595)	−0.067 (1.308)	−0.101 (0.616)
LnLoan	0.076*** (0.0218)	0.167*** (0.0351)	0.142** (0.0257)	0.096*** (0.0172)
LnUrban	0.151 (0.0951)	0.0558 (0.0784)	0.144 (1.698)	0.122 (0.866)
Cons	1.871* (0.926)	2.763** (0.323)	2.797*** (0.387)	2.257** (0.302)
N	479	479	420	450
Hausmantest	0.0000	0.4885		
AR(1)			0.000	0.000
AR(2)			0.4956	0.5247
Hansentest			0.729	0.703

Notes: (1) ***, ** and * indicate the significance levels of 1%, 5% and 10%, respectively; (2) The figures in parentheses are standard errors.

The empirical results show that: (1) The estimations results through the FE, the DIF-GMM and the SYS-GMM model show that the coefficients between financial stress, land finance and house prices are all significantly positive at 5%, and with every 1% increase in fiscal pressure and land finance, house prices will rise an average of 0.59% and 0.56% respectively, both factors have positive impact on house prices. (2) To replace the fiscal pressure and land finance with per capita fiscal revenue and expenditure gap and land fiscal dependence, with the same method we can get that every 1% increase of per capita fiscal revenue and expenditure gap and land financial dependence will result in an average of 0.33% and 0.47% increase in house prices respectively. The robustness test results and the previous empirical results all indicate that fiscal pressure and land finance will cause the rise of house prices; (3) Through the construction of interaction terms between fiscal pressure and land finance and

the overcoming of endogenous under the DIF-GMM and the SYS-GMM model, we can see that fiscal pressure can not only directly impact house prices but can also strengthen its impact and the ratchet effects of house prices through land finance with an average impact effect of 0.29%.

4.4. Causality Test

Since this paper is based on the point that fiscal pressure can promote land finance, to make the empirical results more economically convincing, it is necessary to carry out the causality test between fiscal pressure and land finance to eliminate the assumption that the "official promotion mechanism" may promote land finance in the existing literature and reduce possible bias in the empirical study on the impact of the interaction of fiscal pressure and land finance on house prices. Based on the fact that the Granger causality test can only be applied to a smooth sequence, or cointegration of the unit root process. For those without cointegration relationship, differentiation shall be carried out to obtain the stationary sequence before the Granger causality test. To avoid the limitation of the test methods and their effects test results, the HT and IPS are applied first to test the unit root of the fiscal pressure, land finance and house prices respectively. Then, Pedroni and Kao methods are further applied to test the cointegration relationship of the equations.

4.4.1. Test Results of Panel Unit Root

Before the panel root test, through the initial test of logarithm of fiscal pressure, land finance and house prices, we can see there are time-trend items. Therefore, HT and IPS methods were applied to test the unit root of the fixed-effect panel model with time trend. To eliminate the time trend of the variables above, the first-order differential processing is carried out for each variable, and the unit root test of HT and IPS methods is conducted on the first-order differences of the variables above. Table 6 shows the unit root test results of fiscal pressure, land finance and house prices. As shown in Table 6, all variables pass 1% significant test under both the HT test and the IPS test in the first-order difference. Therefore, we can define fiscal pressure, land finance and house prices are first-order single integer I (1).

Table 6. Test Results of Panel Unit Root

Variables	Level value		First order difference	
	HT test	IPS test	HT test	IPS test
$\Delta Press$	0.71	0.88	−5.52[***]	−3.94[***]
$\Delta Land$	1.52	0.97	−6.09[***]	−5.22[***]
$\Delta HousePrice$	0.89	1.02	−9.17[***]	−6.35[***]

Note: [***], [**] and [*] indicate the significance levels of 1%, 5% and 10%, respectively.

4.4.2. Test Results of Panel Cointegration

From the test results of panel cointegration of fiscal pressure, land finance and house prices in Table 7, we can see that in the Pedroni test, except the *Panel-V* and *Group-rho*'s not passing the statistical test, all the other statistics denied the original hypothesis, indicating there is a cointegration between the variables above. Besides, from the results of Kao test, we can see that it still rejects the original hypothesis, which further proves the existence of the cointegration. Therefore, based on the test results, it can be shown that the fiscal pressure, land finance and house prices tend to be consistent in the long term, and there is a significant long-term equilibrium relationship among them.

Table 7. Test Results of Panel Cointegration

Testing method	Test hypotheses	Statistics	Probability value (P) value)
Pedroni test	$H0:\rho=1$ $H1:(\rho i=\rho)<1$	*Panel-V*	0.82(0.39)
		Panel-rho	−4.72***(0.00)
		Panel-PP	−13.41***(0.00)
		Panel-ADF	−9.83***(0.00)
	$H0:\rho=1$ $H1:(\rho i=\rho)<1$	*Group-rho*	2.13(0.69)
		Group-PP	−17.84***(0.00)
		Group-ADF	−11.92***(0.00)
Kao test	$H0:\rho=1$	*ADF*	−8.78***(0.00)

Note: ***, ** and * indicate the significance levels of 1%, 5% and 10%, respectively.

4.4.3. Test Results of Panel Granger Causality

With reference to panel Granger causality test model of Hurlin and Venet (2001), conducted is the causality analysis of fiscal pressure and land finance, and land finance and house prices. With *Press* being fiscal pressure; *land,* land finance; *HousePrice*, house prices, then the test equation between fiscal pressure and land finance, land finance and house prices are:

$$Land_{i,t} = \gamma_{i0} + \sum_{m=1}^{p} \alpha_{m0} Land_{i,t-m} + \sum_{m=1}^{p} \beta_{m0} Press_{i,t-m} + u_i + \varepsilon_{i,t} \qquad (13)$$

$$Press_{i,t} = \gamma_{i1} + \sum_{m=1}^{p} \alpha_{m1} Press_{i,t-m} + \sum_{m=1}^{p} \beta_{m1} Land_{i,t-m} + u_i + \nu_{i,t} \qquad (14)$$

$$HousePrice_{i,t} = \gamma_{i2} + \sum_{m=1}^{p} \alpha_{m2} HousePrice_{i,t-m} + \sum_{m=1}^{p} \beta_{m2} Land_{i,t-m} + u_i + \varepsilon_{i,t} \qquad (15)$$

$$Land_{i,t} = \gamma_{i3} + \sum_{m=1}^{p} \alpha_{m3} \, Land_{i,t-m} + \sum_{m=1}^{p} \beta_{m3} \, HousePrice_{i,t-m} + u_i + \nu_{i,t} \quad (16)$$

α_{m0}, α_{m1}, α_{m2} and α_{m3} are the intercepts in Equations (13), (14), (15) and (16). Suppose $\varepsilon_{i,t}$ and $\nu_{i,t}$ are independent and identically distribute, the mean is 0, and the variance σ_2 is normal distribution. $i=1,\ldots$, N, $t=1,\ldots$,T. If coefficient β_{m0} is not always 0, it indicates that the fiscal pressure is Granger cause of land finance; if β_{m2} is not always 0, it indicates that the fiscal pressure is Granger cause of land finance; if neither β_{m0} nor β_{m1} is always 0, there is mutual effect between fiscal pressure and land finance. Similarly, if coefficient β_{m2} is not always 0, it indicates that the land finance is Granger cause of the house prices; if β_{m3} is not always 0, it indicates that house price is Granger cause of the land finance; if neither β_{m2} nor β_{m3} is not always 0, there is mutual effect between fiscal pressure and land finance.

As there is requirement of stability in Granger causality test, the first-order differences between variables in Equations (13), (14), (15) and (16) are conducted to eliminate the individual effects. As test results of panel Granger causality shown in Table (8), we can see that fiscal pressure impacts land finance, while land finance dose not impact fiscal pressure. Similarly, land finance impacts house prices; while house prices does not impact fiscal pressure. This indicates that fiscal pressure results in land finance, and land finance further strengthened the ratchet effects of house prices.

Table 8. Test Results of Panel Granger Causality

Original hypothesis	F statistic	Whether deny the original hypothesis
Fiscal pressure is not Granger of land finance	15.52[***]	Deny
Land finance is not Granger of fiscal pressure	1.33	Acceptance
Land finance is not Granger of house prices	7.28[**]	Deny
House prices is not Granger of land finance	2.79	Acceptance

Note: [***], [**] and [*] denote deny of the original hypothesis at significance levels of 1%, 5% and 10%, respectively.

5. Conclusions and Implications on Policy

In this paper, we focus on the issues of local governments' fiscal pressure, land finance and house prices, and systematically analyze how local governments' fiscal pressure and land finance lead to China's ratcheting up of house prices. With the application of the national data from 1999 to 2014 and provincial panel data, we further test the hypothesis above. From the analysis above we can see that the reform of the tax system and the removal of local government dependence on land finance is the key to lowering house prices. To control the driving force of the ratchet effects of house prices, following policy recommendations are given based on the analysis above.

First, deepen the reform of the fiscal and taxation system and improve the tax-sharing system. Rational distribution of financial power and responsibilities between the central and the local governments ensures the local government's revenue balance. Other solutions

are necessary to solve the issue of fiscal pressure because land finance is unsustainable and the dependence on land finance to ease fiscal pressure is unsustainable. Land finance revenue and real estate revenue are not the only sources for local governments' release of fiscal pressure. The prevalent dependency is caused by the advantages of land finance and the purpose to avoid the cost of innovation and the hard process of transition.

Second, control the dual monopoly power of local governments in land acquisition and land supply to eliminate the premise for local governments' relying on land finance. The government can gradually allow collective-owned land to enter the land exchange market directly and release the power in land circulation to enable the "cake-sharing of the land" being more automatic, which can not only improve the operation efficiency of the real estate industry but also greatly reduce the development cost of real estate, thereby reducing house price.

Third, promote the process of property tax reform, improve the property tax of the second house. After years piloting, property tax has not been implemented nationwide. The improvement of property tax shall be accelerated based on the shortcomings demonstrated through years of piloting, and then the implementation shall be promoted. The full implementation of real estate tax can, on the one hand, increase local governments' tax revenue, on the other hand, enable the free real estate re-flow into the market to increase the supply whether through selling or renting.

Fourth, control the scale of local government debt and bare the development on the demand. Local governments' debt revenue mainly comes from land revenue. Without the impetus and pressure to explore new finance sources, local governments' dependence on land finance will not decrease. It is necessary to strictly control the scale of local government debt, formulate reasonable debt standards and explore new revenue sources that are not detrimental to people's livelihood.

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