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State intervention in land pricing and endogenous risk aversion

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ABSTRACT

This study explores the cause and effect of endogenous risk aversion in land pricing, where state intervention through taxation remains a general practice. Using a consumption-based asset pricing model incorporating taxation, it is shown that high taxation, due to the indexation effect, supporting land prices and reducing individuals' risk expectations, could lead to an endogenous decrease in risk aversion, which could result in market dysfunction because risk aversion plays a key role in the market mechanism. China, with its wholly state-owned land and the general use of land sales to cover financial deficits, is a typical case for empirical tests. The tests confirm that there, the rise in land prices was driven by the increase in reserve prices set by local governments, a strong means of taxation, and not by the market, indicating the endogenous decrease in risk aversion.

KEYWORDS

Land pricing; stochastic discount factor; land taxation; the Lucas critique; endogenous risk aversion

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1. Introduction

Risk aversion is one of the main determinants of human microeconomic behavior. It shapes decisions made in the face of uncertainty between an unknown payoff and a more predictable but smaller expected payoff. Risk aversion can be endogenous in the sense that it evolves over time according to certain exogenous factors. The key question is the cause and effect of its endogeneity: what factors make risk aversion endogenous, and how does this affect economic outcomes? With respect to cause, economists have shown that in the real world, risk aversion varies according to differences among individuals in terms of wealth, health, and so on. The evolution of risk aversion can also be affected by stochastic changes in the environment, such as economic volatility, that are beyond human control. In terms of effect, in a high-risk environment, people tend to be more cautious, or more risk averse. When risk is lower or insurance conditions are better, people tend to invest more in assets, which leads to a lower rate of growth in asset prices and higher economic growth.

This study explores the cause and effect of endogenous risk aversion in the case of land pricing and from a new perspective. Land is a highly state-controlled resource, and state intervention in pricing remains a common practice around the world. Using a consumption-based asset pricing model (C-CAPM) incorporating state intervention in the form of taxation, it theoretically establishes changes in risk aversion as a consequence of state intervention in land pricing, which induces the dysfunction of the market mechanism. The logic of the model is essentially based on Lucas's critique that policy change will affect the “deep parameters” that reflect individual behavior, leading to changes in the structure of the economic model.

To be more concise, on the one hand, in the absence of taxation, land prices are determined entirely by market conditions and people's risk aversion to land investment is based on their assessment of the uncertainty in the market. On the other hand, with government intervention due to a growing need for public financing, and the indexation of prices to taxation, the effect of taxation is to support the price at a higher level than that determined by market forces alone. This indexation reduces market uncertainty and then risk aversion. Thus, in proportion to the level of taxation, the decrease in risk aversion leads to land prices being increasingly determined by the level of taxation, and less and less by market indicators such as income and consumption growth rates.

This study contributes to the literature by shedding light on an old theoretical topic. State intervention in the presence of a “market failure” has been justified in welfare economics (Pigou 1932). Since the classic work of Lange (1936-1937) on the possibility of simulating the market mechanism through central planning, the feasibility of the visible hand has been questioned from the point of view of incentives on the basis of property rights theory (Alchian and Damsets 1972), limitations in the collection and processing of information (Hayek 1935), or from a public choice perspective on the deviation of the state from the general interest (Buchanan and Tullock 1962). This study explores the role of risk aversion in “state failure”, a topic that has rarely been discussed.

Another contribution of this study is its empirical method for an indirect test of endogenous risk aversion. The key equation of the model is transformed into an econometrically testable equation. Using Chinese land data, we construct variables and run several longitudinal regressions. The key variable reflecting state inferences is conveniently constructed based on the adaptive expectation hypothesis and a two-stage instrumental variable regression method. It is found that while the reserve prices set by the local governments have a significant effect, the market mechanism reflected by consumption growth does not have a significant positive effect on land price growth. Based on the dynamic framework constructed, these results indirectly reveal the decrease in risk aversion. This result explains the unusual persistence of the land and property boom in China as a signal of resource misallocation.

The paper is organized as follows: Section 2 provides a theoretical framework by incorporating government intervention through taxation into a C-CAPM model, and analyzes the cause and effect of endogenous risk aversion. Section 3 on empirical testing, after an introduction to the Chinese context on government finance and the land price regime, derives the equation to be tested, introduces the method to handle the data, constructs the variables and presents the results. Finally, Section 4 concludes and presents the policy implications of the study.

2. Theoretical framework

This section constructs a model of land pricing incorporating government intervention through taxation to illustrate how this intervention could lead to a reduction in risk aversion, which in turn could weaken the market mechanism.

2.1. The baseline asset pricing model

In a competitive market environment, the price of an asset can be easily derived using dynamic stochastic general equilibrium (DSGE) models. The commonly used C-CAPM model is one of the most popular applications of these models (Breeden 1979), in which the link with risk aversion is explicitly shown.

The representative household maximizes:

$$V_t = \sum_{s=0}^{\infty} {\beta_t}^s E_t[U(c_{t+s})] \tag{1}$$

where V_t is the present value of current and future utilities. Utility is a function of consumption c, and is discounted by the time discount factor $0 < \beta_t < 1$. Because the future is uncertain, future utilities $U(c_{t+s})$ take the form of conditional expectations.

The budget constraint is:

$$\Delta a_{t+1} + c_t = x_t + r_t a_t \tag{2}$$

where x_t is income, r_t is the price of the asset in terms of the return on the asset, and a_t is the real stock of the asset.

The logic behind the model is that the household makes a trade-off between current and future consumptions. To increase its future consumption, the household must choose to invest in an asset. The stochastic dynamic programming solution for this problem is a Euler equation (for more details, see Wickens 2011, chapter 11):

$$E_t\left[\beta_t \frac{U'_{t+1}}{U'_t}(1 + r_{t+1})\right] = 1 \tag{3}$$

where $E_t\beta_t \frac{U'_{t+1}}{U'_t}$ is the stochastic discount factor (SDF). Discounting the future by β_t captures impatience. r_{t+1} is the asset price in terms of the next period's return, or a growth rate of the asset price.

The SDF is also known as the intertemporal marginal rate of substitution on consumption (TMRS): the rate at which the investor is willing to substitute consumption at time $t + 1$ for consumption at time t. It is the signal of the market mechanism (for a more technical presentation see Cochrane 2005). The TMRS can be interpreted in terms of risk aversion and expected consumption growth. To see this, a Taylor series expansion of the U'_{t+1} around $c_{t+1}= c_t$ gives:

$$E_t \frac{U'_{t+1}}{U'_t} \cong 1 - \sigma_t E_t \frac{\Delta c_{t+1}}{c_t} \tag{4}$$

where σ_t is the coefficient of relative risk aversion (CRRA) defined as $\sigma_t = -c_t \frac{u''_t}{u'_t}$.

Equation (4) implies that the lower the risk aversion, the higher the expected TMRS, or the higher the importance given to the utility of future consumption relating to the utility of actual consumption. Also, the higher the expected growth of future consumption ($E_t \frac{\Delta c_{t+1}}{c_t}$), the lower the expected TMRS. Using equation (4), and assuming $\beta_t = 1/(1+\theta)$, the reduced solution of equation (3) becomes:

$$E_t r_{t+1} \cong \frac{\theta+\sigma_t[E_t \frac{\Delta c_{t+1}}{c_t} + Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right)]}{1-\sigma_t E_t \frac{\Delta c_{t+1}}{c_t}} \tag{5}$$

with $\frac{\partial E_t r_{t+1}}{\partial E_t \frac{\Delta c_{t+1}}{c_t}} > 0$, and $Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right) > 0$.

Equation (5) implies that in a market environment, asset prices are entirely determined by the DSF, which is a function of the growth rate of consumption for a given risk aversion. The covariance between two random variables evaluated on the basis of past information is a positive risk premium, as occurs in a business cycle. For example, during a recession, both returns and consumption growth are low, while during an expansion, both are high. Higher expected income and consumption growth leads to higher expected asset prices. Risk aversion is based on information gathered from market volatility on income and consumption. Higher risk aversion leads to less investment in assets, so the price of risky assets should be higher.

2.2. Land pricing and tax effect

The asset pricing model can be extended to land pricing, as land is a typical asset in that it is a factor of production, as well as a form of capital in real estate investment. A number of studies have either used land as an asset to model asset pricing (Holmström and Tirole 2001) or applied the asset pricing model to land pricing in a pure market context (Barry 1980; Capozza and Schwarm 1989; Chavas and Thomas 1999, among others).

State ownership of land now covers much of the world. Along with China, there are at least five socialist countries where state land ownership is in the Marxist tradition. Among the former socialist countries, the share of land owned by the state remains significant. In Russia in 2003, 42 percent of agricultural land was still owned by the state (Lerman and Shagaida 2007). As late as 2009, nearly 96 percent of Russian industrial land was state-owned (Pyle, 2009). The other seven countries of the former Soviet bloc and the fourteen member-countries of the former Soviet Union are, to varying degrees, similar to Russia. State-owned land is common in Africa (Chouquer 2011). Even in the most developed countries, a notable share of land, called public land, is held by central or local governments. In the United States, the federal government owns about 28 percent of the nation's land (Vincent 2017). These lands are both exposed to market transactions and subject to discretionary government actions.

Given the importance of public ownership of land, governments feel legitimate to intervene in the use and pricing of land. In addition, property taxes are one of the most important financial resources for most local governments around the world (Bird and Slack 2002). Since the most general form of this intervention is taxation, we will extend the benchmark asset pricing model to land assets, and incorporate taxation into the model. But first, we need to briefly review the literatures on the impact of taxation on land prices.

Since Adam Smith and David Ricardo, many economists have advocated the land tax as a “perfect tax” in the sense of no deadweight loss. This tax is considered to be entirely absorbed by the land supplier, and does not affect the price level. This view applies only to unimproved land, or site land. Land tax and property tax are often imposed together, and property tax involves the taxation of improved land. Therefore, tax-induced land price changes are a concern.

The extent to which property taxes are offset by increases in the price of land or houses is examined from two perspectives. From the income tax perspective, as envisioned by Tiebout (1956) and analyzed in the seminal work of Hamilton (1976), property taxes are simply a payment for public services received. Fischel (2001) demonstrates that "tax capitalization is everywhere". Housing prices rise just enough to offset the value of the utilities received. The property tax paid by the homeowner is offset by an increase in rent, so the tax increases are capitalized into the value of the land or house. According to the view of the capital tax derived by Mieszkowski (1972) and elaborated by Zodrow and Mieszkowski (1986), the property tax is a tax on the use of capital and thus inefficiently distorts the allocation of resources. Despite this distortion, tax differentials are capitalized into land values, so that future buyers of both types of houses pay for what they get in utilities.

These theoretical views are largely consistent with empirical observations. In the real world, another important factor is that land and houses, especially in urban areas, are becoming increasingly demanding resources. Land and house owners have more power to make land prices indexed to taxes. In the case of land for residential use, if, because of the property tax, homeowners sell their homes and choose to rent, resulting in higher rents, the price of the home will increase, resulting in higher rents, the price of the home will increase. If the land is used for agriculture, and because of the property tax, a number of farmers give up agricultural production, this will lead to higher prices for agricultural products and then higher arable land prices. As a result, landowners will feel justified in directly recovering the taxes paid by raising prices. This indexation effect remains an important feature of property taxation.

2.3. Modelling state intervention in land pricing

We have just presented the arguments for an important role for land and property taxation: it supports land prices above those determined by market forces. This is a key point in explaining why people's attitudes to risk might be affected by government intervention. Now we build the land price model with taxation incorporated.

Modeling government intervention in land pricing can be approached from either the supply or demand side. On the supply side, the state can adjust the supply of land to affect its price. The extent of this adjustment depends on the extent to which the state owns land. The state can also affect the price of land on the demand side through taxation. This paper chooses taxation because the validity of the land supply adjustment modeling analysis is limited by the extent of state land ownership. This validity is weaker the lower the share of state land ownership in a country. Analysis through tax modeling, however, is adaptable to all types of regimes, and is therefore better for addressing the broader issue that is the focus of this paper: endogenous risk aversion.

As in the baseline model, we assume that a representative household with the same objective function defined with equation (1), purchases an amount Δa_{t+1} of land, for housing, agricultural, industrial, or commercial purposes. The investment in land is motivated by three factors: 1) by purchasing land, the household can increase its consumption in a direct way. This is the case if the land is used to improve housing and other conditions of habitability (e.g., building a garden); since construction takes time, it is more convenient to consider that the improvement in consumption will occur in the future; 2) like other types of investment, a household may use the land for agricultural, industrial, or commercial purposes, in which case it earns rents; 3) as the owner of the land, a household can expect to earn income from the increase in land prices. Thus, investment in land is a way to increase future utilities.

With respect to the budget constraint in equation (2), we allow for the possibility of government intervention by adding a $t_t = t$. The t_t can be thought of as a tax rate on the land transaction. Thus, to purchase a quantity of land asset, Δa_{t+1}, the cost to the household is $(1 + t_t)\Delta a_{t+1}$.

Based on the previous arguments that land prices are indexed to taxes, if due to tax burden, a household pays $t_t \Delta a_{t+1}$ more for a newly added land asset, the land price will be increased by $\tau t_t a_t$, where $0 < \tau \leq 1$, is a parameter reflecting the extent to which t_t will be recouped in the land price. $\tau = 1$, if tax is fully offset by price increase.

With all of these considerations, we obtain the new budget constraint:

$$(1+t_t)\Delta a_{t+1} + \tau t_t a_t + c_t = x_t + r_t a_t \tag{6}$$

Rearranging equation (6), the final constraint becomes:

$$(1+t_t)a_{t+1} + c_t = x_t + [1 + r_t + (1-\tau)t_t]a_t \tag{7}$$

Comparing equation (7) with the equation (2): the constraint in the baseline model, if $t_t = 0$, two constraints become identical.

Maximizing the objective function formulated by equation (1) subject to the constraint defined by equation (7), the following Euler equation can be easily derived from the first-order condition (see appendix 1):

$$E_t\left[\beta_t \frac{U'_{t+1}}{U'_t}\left(\frac{1 + r_{t+1+(1-\tau)t_t}}{1+t_t}\right)\right] = 1 \tag{8}$$

Using equation (4), the reduced solution for equation (8) is:

$$E_t r_{t+1} \cong \frac{\theta + (\theta+\tau)t_t + \sigma_t[E_t \frac{\Delta c_{t+1}}{c_t} + Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right)]}{1 - \sigma_t E_t \frac{\Delta c_{t+1}}{c_t}} \tag{9}$$

with $\frac{\partial E_t r_{t+1}}{\partial t_t} > 0$, $\frac{\partial E_t r_{t+1}}{\partial E_t \frac{\Delta c_{t+1}}{c_t}} > 0$, and $Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right) > 0$.

Compared to the reduced-form solution for land pricing in the free-market case expressed in equation (5), equation (9) has an additional term: $\frac{(\theta+\tau)t_t}{1-\sigma_t E_t \frac{\Delta c_{t+1}}{c_t}}$ reflecting the extent to which the tax increases land prices.

Equation (9) clearly shows that when risk aversion σ_t is exogenous, the expected land return has two determinants, t_t and $E_t \frac{\Delta c_{t+1}}{c_t}$. In other words, the land return is determined by both government intervention and market force. If, however, σ_t becomes $\sigma_t(t_t)$, or if σ_t changes endogenously due to t_t, the role of market force could be reduced. This is the subject of the next section.

2.4. The cause and effect of endogenous risk aversion

Risk aversion is often treated as a constant (Pratt 1964; Arrow 1965). Nevertheless, varying risk aversion is more consistent with experimental and empirical evidence. Risk preferences change with changes in personal economic circumstances: wealth (Bellemare and Zachary 2010); changes in income and wealth due to a recession or crisis (Sahm 2012; Dohmen et al. 2016), asset returns (Berardi 2016), or job loss (Hetschko and Preuss 2019); Instability in risk aversion is also found to be related to individual life events such as exposure to violence (Callen et al. 2014), experience of poverty (Haushofer and Fehr 2014), childbirth (Görlitz and Tamm 2015), and experience of an earthquake (Hanaoka et al. 2018). Guiso et al. (2018) provide a review on the empirical evidence and theoretical explanations for the existence of time-varying risk aversion in financial asset investments. A more general review by Schildberg-Hörisch (2018) concludes that the correlation of individual risk preferences over time is weak and that risk attitudes change with age and economic crises.

The above studies on endogenous risk aversion have focused on its cause. Other studies have addressed its effects: while risk taking has been recognized as playing an important role in economic activities, how does the shift from exogenous to endogenous risk aversion affect the performance of these activities? Begley and Boyd (1987) studied the correlation between the change in risk aversion and the relationship between the firm's assets and liabilities and the return on assets. Caliendo et al. (2010), Kreiser et al. (2013), and Nieβ and Biemann (2014) find that firm survival is affected by entrepreneurs' willingness to take risks. Malmendier and Nagel (2011), Weber et al. (2013) and Necker and Ziegelmeyer (2016) find that accumulated experience with macroeconomic volatility and financial crises could vary individuals' risk aversion and implied a positive effect of experience on investment performance.

Compared to existing studies on cause and effect of endogenous risk aversion, the originality of this study is to address another important cause: political decision making or government intervention in the economic process. Equally important, this study clearly shows the consequence of the endogenous modification in risk aversion due to this intervention: it biases the functioning of the market mechanism. The logic behind this type of endogenous risk aversion is Lucas critique. Lucas (1976, p. 41) argues that: "given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models". According to Lucas, macroeconomics is shaped by the "deep parameters" of preferences, technology, and resource constraints that are assumed to govern individual behavior. With the change in government policy, individuals will rationally alter their expectations, which leads to changes in the coefficients of econometric models. This argument fits well in our case: as land taxation has the effect of supporting land prices, the environment for land investment will become less risky, leading people to decrease their risk aversion.

Consistent with the Lucas critique, we are able to show that risk aversion is decreasing under government intervention in land pricing. Suppose that the individual chooses between a risky asset: land, which leads to a future consumption c_{t+1}, and current consumption c_t, with $E_t(c_{t+1}) = [(1+g)c_t]$, and g some growth rate of consumption. Furthermore, assume $E_t(c_{t+1}) = \pi_t(t_t)c_1 + (1-\pi_t(t_t))c_2$, with $c_1 > c_2$, and π_t, the probability of obtaining c_1, reflecting the level of risk (the higher π_t, the lower the future risk). This implies that expected future consumption, via π_t, is a function of t_t, it is a faithful expression of the Lucas critique: government action modifies individual expectations. Expanding $E_t[u(c_{t+1})]$ to $g = 0$,

$$E_t[u(c_{t+1})] \approx u(c_t) + \frac{1}{2}{c_t}^2 V(g)u'' \tag{10}$$

where $V(g)$ is the variance of g. In the presence of future risk, the utility function is conventionally convex, so that $E_t[u(c_{t+1})] < u(c_t)$ and $u_t^{''} < 0$. Using the definition of relative risk aversion, equation (10) can be rearranged into:

$$\sigma_t(t_t) \approx \frac{2\{u(c_t) - E_t[u(c_{t+1})]\}}{c_t V(g) u_t'} = \frac{2\{u(c_t) - E_t u[\pi_t(t_t)(c_1 - c_2) + c_2]\}}{c_t V(g) u_t'} \tag{11}$$

Equation (11) constructs the micro-foundation of the land pricing equation (9), in which risk aversion σ_t, was a constant, and now becomes a variable. From this equation, we obtain $\frac{\partial \sigma_t}{\partial \pi_t}\frac{\partial \pi_t}{\partial t_t} < 0$, or risk aversion is a decreasing function of t_t. This result can be decomposed into two effects. $\frac{\partial \pi_t}{\partial t_t} > 0$ implies the effect of the Lucas critique: seeing the tax increase that increases the expected future earnings, individuals reduce their expectations about risk. $\frac{\partial \sigma_t}{\partial \pi_t} < 0$ indicates that the reduction in risk leads to a decrease in risk aversion. The increase in future consumption can also positively affect $V(g)$ and u_t'. Thus, its impact on σ_t via $V(g)$ and u_t' is also negative. In light of equation (11). equation (9) can be written as:

$$E_t r_{t+1} \cong \frac{\theta + (\theta+\tau)t_t + \sigma_t(t_t)[E_t \frac{\Delta c_{t+1}}{c_t} + Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right)]}{1 - \sigma_t(t_t) E_t \frac{\Delta c_{t+1}}{c_t}} \tag{9.1}$$

where the σ_t is now written as $\sigma_t(t_t)$, with $\partial\sigma_t/\partial t_t$<0.

With σ_t assumed to be exogenous to taxation in equation (9), it now becomes endogenous. This change is crucial. Since $\partial\sigma_t/\partial t_t$<0, increasing t_t affects the coefficient of risk aversion. The effect of market strength on land prices depends on risk aversion. Theoretically, equation (9.1) implies that whenever the state intervenes in land pricing, it weakens the role of market force by weakening individual risk aversion. By inference, if 0< $t_t < t_t^h$, where t_t^h is the level of taxation leading risk aversion to be zero, then $0 < \sigma_t(t_t) < \sigma_{tm}$, where σ_{tm} is the level of risk aversion under free market conditions. In this case, both t_t and the stochastic discount factor are at work, or the coexistence of government intervention and market force remains possible. Despite their coexistence, increased taxation always weakens the role of market power by reducing risk aversion. Its underlying mechanism comes from equation (11): as higher taxes increase expected future earnings, individuals reduce their risk expectations, and reduced risk leads to reduced risk aversion. Intuitively, the extent to which risk aversion is also affected by government intervention in land prices could be different from country to country, depending on their differences in economic and political regimes, income levels and culture.

In the extreme case, the visible hand is able to expel the invisible hand. To see this, if t_t=0, then $\sigma_t(t_t) = \sigma_{tm}$, and equation (9.1) reduces to equation (5), or the market force is the sole determinant of land prices. If $t_t = t_t^h$, then $\sigma_t(t_t) = 0$. From equation (4), we get $\frac{U'_{t+1}}{U'_t} \cong 1$. As individuals become indifferent between current and future consumption, changes in expected consumption growth fail to provide a market signal to change individual supply and demand. Therefore, in the face of a constant SRM, the market arbitrage on land prices ceases to work. With $\sigma_t(t_t) = 0$, equation (9.1) becomes:

$$r_{t+1} = \theta + (\theta+\tau)t_t^h \tag{9.2}$$

Land prices become totally determined by the government. This is only a polar case that could occur when land is fully owned by the state. Otherwise, the state has only partial power over the price of land. Even in the case of full state ownership, the state has a short-run interest in maximizing its revenues from land leasing, it may have a long-run interest in sharing power with the market in land pricing because of the well-recognized efficiency of the market. This explains why all former socialist countries have gradually abandoned their old central planning model.

3. Empirical tests

The above formal analysis has shown that government intervention through land taxation causes endogenous changes in risk aversion, and has the effect of weakening the role of market forces in setting land prices. In what follows, we conduct econometric estimations with Chinese data. The empirical tests have two objectives: 1) to find out the extent to which land prices in China are determined by government intervention; and 2) to find evidence that government intervention leads to an endogenous decrease in risk aversion.

3.1. Chinese context

In China, all land is owned by the state. Enterprises, farmers and households lease land from the state for housing, commercial, industrial and agricultural uses. A land user only gets the right to use the land. The price of land is the price of the land use rights. In strict terms, the land use price is the present value of the sum of the rents for a certain parcel of land during a certain lease period. Since lease terms are long (70 years for housing, 40 years for commercial and tourist uses, and 50 years for industrial uses), this value is similar to the price of conventional land.

China's land tenure system has gone through two periods: prior to the 1980s, land use rights were distributed by the state without the possibility of resale or transfer of land use rights. This is a typical central planning system. Since the 1980s, resale and transfer have been allowed. Thus, the price of land can potentially be influenced by the market, as the demand for land is largely determined by the demand for real estate in industry, commerce, and especially housing, depending on the purchasing power of the users. All land users are aware, however, that the state, as owner of the land, has discretionary power in setting the price of land.

Since the 1990s, Chinese local governments have implemented massive expansionary economic development projects and have greatly increased their spending on industrial plantations, transportation, administration and other infrastructure. At the same time, the Chinese central government has launched a reform of the tax-sharing system to centralize tax revenues. According to official statistics, the percentage of national financial revenue collected by local governments decreased from 78% to 50%, while their share of national financial expenditure increased from 71.7% to 85% between 1993 and 2010. Faced with huge accumulated budget deficits, local governments were allowed by the central government to sell land under their administration. This is the origin of so-called “land finance” in China: the financing of local governments' budget deficits through the sale of land.

Most land parcels are sold through public bids and auctions. However, all bidders are guided by the land reserve prices set by local governments, whose official name is “land use rights reserve price”. Although not published, it is often revealed informally. Since profits from the sale of land depend on prices, it is in the interest of local governments to support land prices. Local government intervention in land pricing is primarily through setting their “desired” reserve price growth rate. More details on the channels through which local governments set the reserve price are presented in appendix 2. Reserve prices set the tone for bids and auctions.

Consistent with the theoretical framework in which the government intervenes in land pricing through taxation, reserve pricing involves setting tax rates that push land prices as high as possible given market constraints. For example, the local government sells a piece of land worth 100 million Chinese yuan last year. If, based on the growth rates of past years and the new economic conditions, it judges that the reserve price can be set at 110 million yuan, this corresponds to a tax rate of 10%.

In short, because of their growing financial deficit, Chinese local governments have an incentive to raise the price of land. As landowners, they have the right to do so. Finally, using their discretionary power, they set reserve prices that reflect their desired growth rates, which allows them to obtain the highest possible tax revenues. The extent to which local governments raise reserve prices depends on their behavior, their financial needs, and market responses in different macroeconomic situations.

3.2. The estimation equation, data, and variables

Equation (9.1) above expresses land prices with four key determinants: the tax rate, the expected growth rate of consumption, risk aversion, plus the covariance between consumption growth and price growth reflecting the risk premium.

Since risk aversion is not explicitly observable, equation (9.1) can be expressed as an econometrically testable equation with three observable explanatory variables:

$$r_{i(t+1)} = A + \beta_1 t_{it} + \beta_2 \frac{\Delta c_{i(t+1)}}{c_{it}} + \beta_3 Cov\left(\frac{\Delta c_{i(t+1)}}{c_{it}}, r_{i(t+1)}\right) + \delta_{it} \tag{12}$$

where i, in our case, refers to one of the cities. Since all data are taken from the past period, we have removed the expected expressions in equation (9.1) assuming that the actual terms are all rationally expected, while in the interpretations the variables in $t+1$ are always understood as expected terms.

The coefficient β_1 and the significance of t_{it} provide the effect of the tax rate, or government intervention on land prices. Referring to equation (9.1), β_2 must contain $\sigma_t(t_t)$. Since $\sigma_t(t_t)\frac{\Delta c_{t+1}}{c_t}$ is the SDF reflecting the level at which land price is determined by the market, it follows that in the case where $\beta_1$is large and t_{it} is significant, if β_2 is too small, and $\frac{\Delta c_{t+1}}{c_t}$ is an insignificant variable, two things are confirmed: first, the land price is not determined by the market; and second, risk aversion is abnormally low. Low risk aversion as a consequence of a high reserve price growth rate in a dynamical context implies its endogenous changes. Thus, testing the importance of consumption growth in the presence of a high tax rate is an indirect way to test the hypothesis that high taxation leads risk aversion to decline endogenously. Testing β_3 is also interesting. Since $Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right)$ is a risk premium, when the market mechanism works well, β_3 must be positive and $Cov\left(\frac{\Delta c_{t+1}}{c_t}, r_{t+1}\right)$ must be a significant variable. If not, this is further evidence that the land price is not market driven.

After introducing the estimating equation, we present in what follows the data and methods used to constitute these variables in equation (12). Since 1999, China has published Chinese Land and Resources Statistical Yearbooks, which contain data on "the areas and values of the sales of state-owned construction lands" by city and year. In these yearbooks from 1999 to 2015, we get land prices by city and year from 1998 to 2014, in total 17 years, with these values divided by the corresponding areas.

The dependent variable: r_{t+1}, is the yield on land, or the growth rates of land prices by city and year. At the city level, land prices are highly volatile over time. The main cause of this volatility is geographic differences: land sold in one year was, on average, further from the city center than in another year, making its prices volatile. In this case, the classic smoothing method can be applied, just as the attenuation of the fluctuations of the monthly data. Smoothing creates an approximation function that captures important patterns in the data, while leaving out noise or other fine-scale structures and fast-moving phenomena. The robust nonlinear smoothing Stata 453R2eh, written by Gould (1992), was used for this purpose. This process flattens land prices by city over 17 years to approximate the evolution of land prices for a representative parcel of land, which is the basis for calculating land returns by city and year.

The first explanatory variable to be constructed is t_t. To find an indicator corresponding to the tax rate in the theoretical model, the first to consider could be taxes on land and real estate transactions. However, this is an inappropriate strategy. In the Chinese context, first, there is no data on property taxes at the city level. Second, according to the case studies, property and real estate taxes, although varying from city to city, are rather low. In other words, these taxes are not the main source of revenue for local governments from land and property transactions. As we have said, it is primarily the increase in reserve prices set by the local government that has been their cash cow. Therefore, the growth rate of reserve prices, called the T-rate, is considered.

The main difficulty in constructing the T-rate is that there is no disclosure of data reflecting their manipulation of land prices. Some proxy variable must be found. Our strategy is to approximate it in two steps. In the first step, based on the reserve price formation process described in appendix 2, in which local governments rely on information about past growth rates to adjust reserve prices, we assume that price manipulations by local governments are based on adaptive expectations, or that the T-rate is formed as an average of past observations with geometrically decreasing weights. We use the average amount of increase in the past three years relative to the current year's land price, namely $(\frac{1}{3}(\sum_{\tau=t}^{\tau=t-2}\Delta p_{\tau}))/p_t$ as the assumed T-rate, where p_t refers to the current year's land price. This is an approximate application of adaptive expectations because, in this way, a more distant past year is less weighted than a closer past year.

In step two, this "guessed" variable will be treated in the regressions as an endogenous variable instrumented by three variables. The choice of this strategy is based on the following argument. The dependent variable, expected land yield, and the T-rate are simultaneously determined by some unobservable, and therefore omitted, city-specific variables, such as geographic, climatic and cultural characteristics specific to the region. Thus, the T-rate can be correlated with the error term, a typical symptom of endogeneity. To correct for this, instruments correlated with T-rate, but not with expected returns, are needed.

Since the main cause of the T-rate is local government financial stress, three instrumental variables are chosen: 1) the growth rate of the ratio of government spending to GDP; 2) the growth rate of the ratio of local government deficit to government spending; and 3) the growth rate of the ratio of government employment to total employment. These growth rates are assumed to be positively correlated with the extent to which local governments increase the T-rate to relieve their fiscal constraints. These data are available in the China City Statistical Yearbooks. We believe that these indicators are relatively reliable because local governments have less incentive to manipulate them compared to indicators such as GDP and employment that are directly correlated to their governance performance.

The next variable is the consumption growth rate, which is measured with the growth rate of "total retail sales of consumer goods" per capita from the China City Statistical Yearbooks. For robustness, we also transform consumption growth $\frac{\Delta c_{t+1}}{c_t}$ to $\frac{\Delta c_{t+1}}{c_t - c_{t-1}}$ to obtain an alternative variable in the form of habit-persistence (see Constantinides 1990; Campbell and Cochrane 1999), which increases the variability of consumption growth.

Since consumption growth in fact reflects all macroeconomic factors associated with GDP and income growth, multifactor models are applicable (Dai and Singleton 2000). We also replace consumption growth with growth rates of GDP per capita and net savings per capita as robust tests. Savings is a useful variable because, in general, it has a negative relationship with consumption. Together they provide an alternative representation of consumption growth.

The covariance between land price growth and per capita consumption growth (or per capita GDP and savings growth, respectively) is time-invariant and is regressed individually with each city's data over the period 1999-2013.

Finally, to improve the estimates of key variables, we also construct several control variables for the regressions. The growth rate of population by city and year controls for the effect of migration that was significant over the period; the growth rate of real foreign direct investment by city and year reflects the potential prosperity of the city; the growth rates of passenger transportation, health services, and education services by city and year reflect the attractiveness of the city from an infrastructure perspective. Three dummy variables are used: 1) whether the city is a municipality under the direct control of the central government; 2) whether the city is a provincial capital; and 3) whether the city is located near one of the four most famous mountains (Tai, Emei, Huang, and Lu mountains) or on coastal land. The first two characteristics are supposed to have a positive impact on land prices. The latter is intended to capture the effects of landscape. Table 1 shows the descriptive statistics of all the variables used in our tests.

In Chinese Land and Resources Statistical Yearbooks, the number of cities and regions ranges from 324 (1998) to 348 (2014), while in China City Statistical Yearbooks, the number ranges from 318 (1998) to 358 (2014). Only 286 cities have the required data in both directories. With 15 years of data (1999-2013) in which we are able to calculate both growth rates relative to the past year (required for a number of explanatory variables) and expected growth rates relative to the next year (required for the dependent variable and a number of explanatory variables), the balanced panel should have 4290 observations. Since some cities are missing data for some years and some cities have appeared or disappeared during the period due to administrative reorganizations, the final observations amount to 4125.

Table 1. Descriptive statistics of the variables.

Variable	Mean	Std. Dev.	Min	Max
Ereturn= the expected return (or growth rate) of land prices.	0.160	0.123	-0.194	0.590
T-rate (starting values): the estimated growth rate of the land reserve price by the local government.	0.092	0.056	0	0.333
Vpub-expenditure-rate = the growth rate of the ratio of public expenditure to GDP.	0.209	0.844	-0.884	9.999.
Vdeficit-rate = the growth rate of the local government deficit to government expenditure ratio.	0.037	1.056	-9.999	9.999
Vpub-employ-rate = the growth rate of the ratio of public employment to total employment.	0.025	0.225	-0.958	2.999
Evconsum = the expected growth rate of consumption.	0.142	0.057	-0.143	0.313
Evconsum-habit = *Evconsum* in habit-persistence form.	1.333	0.929	-8.236	13.168
Evgdp = the expected growth rate of GDP per capita.	0.139	0.077	-0.299	0.299
Evsaving = the expected growth rate of savings per capita.	0.181	0.118	-0.391	0.499
Cov-Ereturn-Evconsum: covariance between *Ereturn* and *Evconsum.*	0.014	0.537	-2.112	1.988
Cov-Ereturn-Evconsum-habit: covariance between *Ereturn* and *Evconsum-habit.*	0.001	0.008	-0.042	0.077
Cov-Ereturn-Evgdp: covariance between *Ereturn* and *Evgdp.*	0.073	0.301	-0.817	1.572
Cov-Ereturn-Evsaving: covariance between *Ereturn* and *Evsaving.*	0.071	0.534	-0.532	8.332
Vpopulation = the growth rate of the population of the city.	0.008	0.023	-0.299	0.299
Vforeign_invst = the growth rate of real foreign direct investment per capita.	0.453	1.847	-9.99	9.99
Vtransp_passenger = the growth rate of transportation of passengers.	0.094	0.332	-0.499	2.999
Vhealthcare = equally weighted growth rates in hospital beds and physicians per capita.	0.034	0.106	-0.299	0.299
Veducare = equally weighted growth rate in the number of teachers per capita in universities, colleges and elementary schools.	0.050	0.097	-0.299	0.299
DCM=1 if the city directly controlled by the central government; =0 otherwise.	0.0145	0.120	0	1
Province Capital=1 if provincial capital; =0 otherwise.	0.080	0.271	0	1
Mountain_sea=1 if close to the Tai, Emei, Huang or Lu mountains, or coastal; =0 otherwise.	0.172	0.377	0	1

Notes: 1) all expected values are measured as the values for the following year; 2) the number of observations is 4125 for all variables.

3.3. Results

Table 2 presents the results of six panel regressions in which four apply the generalized two-stage least squares random effects instrumental variable model (G2SLS-RE-IV) and two apply the generalized least squares random effects model (GLS-RE). The low Rho values for all regressions imply that the city-level fixed effects are very small. Therefore, the random effects (RE) model is more appropriate. In these regressions, the Wald Chi2 values are quite high; the R^2 values are all quite satisfactory.

Table 2. Regression results.

	(1)	(2)	(3)	(4)	(5)	(6)
	G2SLS-RE-IV Ereturn	GLS-RE Ereturn	GLS-RE Ereturn	G2SLS-RE-Ereturn	G2SLS-RE-Ereturn	G2SLS-RE-Ereturn
T-rate			1.497			
			(0.023)**			
T-rate (instrumented with:	1.295			1.463	1.266	1.372
Vpub-expend-rate, Vpub-	(0.169)***			(0.162)***	(0.188)***	(0.185)***
Evconsum)	-0.077	-0.045	-0.084	-0.086		
	(0.032)**	(0.045)	(0.030)**	(0.031)***		
Cov-Ereturn-Evconsum	-0.001	-0.002	-0.001	-0.001		
	(0.003)	(0.004)	(0.003)	(0.003)		
Evconsum-habit					-0.001	
					(0.002)	
Cov-Ereturn-Evconsum-habit					-0.029	
					(0.193)	
Evgdp						-0.025
						(0.026)
Cov-Ereturn-Evgdp						-0.003
						(0.005)
Evsaving						0.053
						(0.018)***
Cov-Ereturn-Evsaving						0.007
						(0.002)***
Vpopulation	0.093	0.064	0.107		0.103	0.105
	(0.057)	(0.082)	(0.056)*		(0.057)*	(0.056)*
Vforeign_invst	0.000	0.001	0.000		0.000	0.000
	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)
Vtransp_passenger	0.000	0.001	0.000		0.000	0.000
	(0.004)	(0.005)	(0.004)		(0.004)	(0.004)
Vhealthcare	-0.012	-0.036	-0.009		-0.018	-0.010
	(0.011)	(0.015)**	(0.011)		(0.011)	(0.011)
Veducare	-0.014	-0.007	-0.015		-0.013	-0.021
	(0.014)	(0.018)	(0.014)		(0.014)	(0.014)
DCM	0.031	0.071	0.025		0.032	0.031
	(0.008)***	(0.017)**	(0.005)**		(0.008)***	(0.008)***
Province Capital	0.009	0.025	0.006		0.009	0.008
	(0.005)*	(0.008)**	(0.004)		(0.005)*	(0.005)*
Mountain_sea	0.007	0.005	0.007		0.007	0.008
	(0.004)*	(0.006)	(0.004)*		(0.004)*	(0.004)*
Constant	0.049	0.162	0.032	0.037	0.042	0.025
	(0.015)***	(0.007)**	(0.005)**	(0.015)**	(0.017)**	(0.014)*
Observations	4125	4125	4125	4125	4125	4125
Number of cities	286	286	286	286	286	286
R-sq						
Within	0.450	0.002	0.450	0.450	0.449	0.452
Between	0.682	0.076	0.683	0.669	0.678	0.680
Overall	0.473	0.010	0.473	0.471	0.471	0.475
Wald chi^2 (prob>chi^2 in	254.53	35.93	4994.38	81.64	229.06	402.38
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rho (fraction of variance)	0.019	0.032	0.000	0.014	0.012	0.000

*Notes: 1) * p(>|z|)<0.10; ** p(>|z|)<0.05; *** p(>|z|)<0.01. 2) robust standard error in parenthesis.*

Regression (1) estimates are the final result we expect, while regressions (2) through (6) are used to make comparisons and test the robustness of this regression. Regression (1) includes all explanatory and control variables chosen to minimize the omission problem. It is more robust because the instrumental variables method is used to reduce bias in the estimation.

Regression (1), first, shows a highly significant positive effect of T-rate on expected land price growth, confirming the theoretical issue that land tax induces higher land prices, and the predominant importance of government intervention in setting land prices in China. To fix the idea, the coefficient amounting to 1.295 means that, with, according to Table 1, the expected average annual growth rate of land price (Ereturn) and the average annual growth rate of reserve prices (T-rate) being 16% and 9.2% respectively, the average contribution of reserve price growth to land price growth is 9.2*1.295/16=74.5%.

Second, the effect of expected consumption growth on land prices is significantly negative. According to the previous theoretical deduction, consumption growth, the indicator of market signal can be significantly positive if the government intervention is small. Here, the result clearly means that the Chinese land price was not determined by the market mechanism. More importantly, due to the dominant reserve prices, the consumption growth rate having no positive effect on the land price implies that risk aversion is very low, confirming the theoretical prediction: government intervention has a risk aversion reducing effect.

The negative sign of the consumption growth rate also appears in most successive regressions. This seems to be explained by a Chinese specificity: in less developed cities where the consumption growth rate is lower, local governments with fewer financial sources have more incentives to increase land prices than those in richer cities, which leads to these negative effects.

Third, in this regression, as a risk premium, the covariance between land price growth and consumption growth is insignificant. This indicates the dysfunction of the market force since according to the theoretical model, this covariance is positive if the market mechanism is working. It also indicates that all people have neglected the market risk too much and expected the land and housing boom to last forever. So, this is further evidence of decreasing risk aversion.

Regression (2) is used to test the antithesis of what we have developed: Land prices in China are determined by market forces. To do this, we simply use the expected growth rate of consumption, the covariance between land price growth and per capita consumption growth, and the control variables to explain the expected returns to land prices. The result clearly rejects this antithesis. The effect of the expected growth rate of consumption is insignificant.

Regression (3) uses all explanatory variables and control variables of regression (1), except the T-rate as explanatory variable is not instrumented. Globally, the effects of all explanatory and control variables are quite similar to those derived from regression (1), but the T-rate is stronger in significance and with a higher coefficient. This seems to indicate that the instrumented variable has effectively corrected the sur-estimation when the variable is not instrumented.

Regression (4) is purely based on the theoretical model without using the control variables. The results are in the same direction as regression (1). The stronger positive effects of the T-rate and stronger negative effects of consumption growth on land price growth in regression (4) suggest that the addition of control variables improved the regression results.

In regression (5), as a robust test, the only change from regression (1) is to replace consumption growth with habit-persistence consumption growth. The results are basically the same, except that the effect of Vconsum-habit becomes insignificant. This difference, however, is not inconsistent with a conclusion drawn from equation (1): land prices in China are not determined by market forces and there is decreasing risk aversion.

Finally, in regression (6), instead of expected consumption growth, we use Evgdp, the expected growth rate of GDP, and Evsaving, the expected growth rate of savings. We find that Evgdp has a negative sign and is not significant, while Evsaving is positively significant. Given that consumption is equal to GDP minus savings, the joint effect of GDP and savings confirms that, at least, expected consumption growth does not have a significant positive impact on expected land price growth. This confirms, once again, the robustness of the results obtained in regression (1).

Since the T-rate is based on past observations of rising land prices, another tempting interpretation of the positive impact of the T-rate on Ereturn may be a rational expectation on the part of land investors based on past information. However, this interpretation is not relevant to explain what happened in China for two reasons: 1) rational expectation is only compatible with a market environment, in other words, the market determinants must also work. As the results show, this is not the case; 2) as this past information was used by local governments to support land pricing, consumers rationally regard it as an expression of government will rather than pure information with which to make economic choices.

4. Conclusion and policy implications

This study adapts a C-CAPM model and provides a framework to analyze government intervention in land pricing. It predicts that government intervention through taxation, due to its indexing effect, leads to a support of land prices. This will reduce the risk expectation of individuals, and they will decrease their risk aversion. Since risk aversion is a key factor in the functioning of the market, this will weaken market forces in setting land prices. In the case of excessively high taxation, individuals may move from risk aversion to risk neutrality, and the market mechanism ceases to function.

We tested the derived equation with Chinese data and found that price support by Chinese local governments exerted a significant effect, whereas consumption growth, a proxy for market force, had no positive effect on land prices. This result confirms there the dysfunctional market force and the endogenous decrease of risk aversion in land prices.

Thus, this analysis has explored a new explanation for "state failure": it could also be caused by endogenous risk aversion. This has obvious policy implications. In the case of China, by believing that the state has an interest in supporting land prices, people tend to underestimate market risk. This explains why real estate speculation has become the most dynamic activity. All economic actors are driven to overinvest in real estate, and run the risk of a sudden economic crash resulting from an accumulated lasting imbalance. Its political implications also go beyond the Chinese case. While government intervention through taxation in land pricing is a common practice around the world, and property taxes are considered by most to be the "perfect tax". This study suggests that they may cause varying degrees of distortion in land prices and misallocation of resources. This theoretical prediction has yet to be empirically tested with data from other countries.

This study also provides an insight into the broader context of state intervention in areas where private investment in assets is involved: not only land and real estate, but also the stock market and all types of industrial and commercial enterprise. Governments justify their interventions in all areas where they deem the presence of public goods or, more broadly, merit goods. Thus, for reasons such as reducing social or regional inequalities, or protecting the environment, they tend to use taxation or subsidy methods to "regulate" the market. In these cases, as this study has shown, there is often a price-indexing effect. More importantly. Investors, observing the government's actions, will modify their risk aversion and therefore their investment decisions. If government intervention remains modest and the market mechanism prevails, it may be desirable according to the criterion of welfare economics, since it merely "corrects" market failure. However, government actions tend to be persistent, tendentious, and exceed this limit. Given that the risk aversion of individuals is a key factor in the functioning of the market, such actions excessively reduce the market's role in price determination and bias the efficient allocation of resources by inducing individuals to modify their risk aversion. In so doing, they miss the initial objective of correcting market failure. This is why the risk-aversion approach to the failure of state intervention offers a new perspective on rationalizing public policy-making.

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Conflict of Interest

The author claims that the manuscript is entirely original, and declares no conflicts of interest.

Appendix

Appendix 1: Obtaining equation (8)

The objective function (1) can be written $V_t = U(c_t) + \beta_t E_t(V_{t+1})$. The derivation with respect to c_t gives

$$\frac{\partial V_t}{\partial c_t} = \frac{\partial U_t}{\partial c_t} + \beta_t \left(\frac{\partial V_t}{\partial c_{t+1}} \frac{\partial c_{t+1}}{\partial c_t} \right) = 0 \tag{13}$$

Note that $V_{t+1} = U(c_{t+1}) + \beta_{t+1} E_{t+1}(V_{t+2})$. Hence $\partial V_{t+1}/\partial c_{t+1} = \partial U_{t+1}/\partial c_{t+1}$. To get $\partial c_{t+1}/\partial c_t$, extend the budget constraint to t+1 period,

$$c_{t+1} + (1 + t_t)a_{t+2} = x_{t+1} + [1 + r_{t+1} + (1 - \tau)t_t]a_{t+1} \tag{14}$$

where $t_t = t_{t+1} = t$ is used.

Put the budget (7) in term of a_{t+1} into (14), and derive c_{t+1} with respect to c_t:

$$\frac{\partial c_{t+1}}{\partial c_t} = -\frac{1}{1 + t_t}[1 + r_{t+1} + (1 - \tau)t_t] \tag{15}$$

Put $\partial V_{t+1}/\partial c_{t+1} = \partial U_{t+1}/\partial c_{t+1}$ and (15) into (13), we get equation (8).

Appendix 2: How does a Chinese local government establish a "reserve price" and what are its channels for influencing land prices?

The local government first asks the land transaction organizer to set a "marked price" that will be published. Then based on that price, it makes an unpublished "reserve price".

The determination of the "marked price" of a certain plot of land by the organizer of the transaction is carried out by the application of the land datum value method, initiated in 1978. At present, almost all cities and towns have established their land datum values. A city is divided into several zones around the center. Within each zone, land conditions are similar and land prices in the same zone fall within the same price range, determined by the land grade of the zone and the purpose of the use. The land datum values in all urban areas are found in the manuals promulgated by the government. These prices are set for several years and are then subject to change.

This method to adjust land datum values is recommended by the government with the following formula: $V = V_\circ \times (1 \pm \sum K_i) \times \prod k_j$, where V is the marked price of the parcel to be assessed. $V_\circ$ is the land datum value of the zone to which the parcel belongs, which, as noted above, is periodically adjustable by the local government. These periodical adjustments are the first channel through which local governments are able to influence land prices.

∑Ki are correction coefficients for a series of parcel-specific factors that influence prices, such as proximity to business centers, roads, public traffic, schools, hospitals, green spaces, gardens, population, urban planning, etc. These coefficients are subject to local government adjustments. This is the second channel through which local governments are able to influence land prices.

$\prod k_j$ are three coefficients to be modified, which are related to the valuation date, parcel ratio (or floor area ratio (FAR)), and maturity date. The last factor is parcel specific and is not dependent on the local government's assessment. In the government guidance on how to adjust the ratio at the valuation date, the author of the marked price is often instructed to automatically include the growth in the land price from the previous period. The most important factor is the determination of the FAR. The increase in FAR is a powerful driver of land prices. This increase often coincides with the interests of officials in charge of public bids and auctions. In many revealed cases of corruption, the officials involved have been accused of increasing this ratio for their own interests. Therefore, third channel through which local governments influence land prices is the direction of coefficient changes in the valuation date and in the FAR.

Finally, based on the "marked price", the local government sets a reserve price above the "marked price" based on the micro-location factors of the parcel, its shape, size, etc. This decision is entirely at the discretion of the local government. The reserve price is not published, but indirectly disclosed, as is common practice. This is the fourth channel through which local governments influence land prices.

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