Strategic Land Pricing among Chinese Cities

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Abstract

With rapid urbanization and decentralization of public finances in China, cities have struggled to manage their budgets. By leasing land they have been able to both finance infrastructure improvements and generate revenues for the provision of public services. In this context, this paper presents a model of the strategic pricing behavior of Chinese cities as they determine how much land to lease and what prices to charge for the land leases. They effectively sell the land asset at a price that may or may not reflect its market value, and in so doing they buy a flow of funds in the form of business tax (BT) and value added tax (VAT) revenue from the economic activity generated using the land. Cities retain all of the BT revenue, but receive only one-quarter of VAT revenue generated in their jurisdiction returned from the central government. A theoretical model is presented explaining how a land-providing monopolist may deviate from the usual monopoly pricing rule of operating at the unitary elastic point of the land demand curve, depending on the share of tax revenue that can be retained from economic activity in the city. Using data from prefecture and provincial level cities over the period 2003-2011 and fiscal data on BT and VAT shares of revenue in city budgets, the implications of the theoretical model are tested. Empirical tests of strategic pricing indicate that cities more reliant on VAT revenue operate close to the unitary elastic point of their land demand curve, but cities that rely more heavily on BT revenue operate further down below the unitary elastic point, charging lower lease prices and leasing more land. Regional variations in leasing and public finance patterns are explored. JEL codes: H71, H77, P35, R14

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1 Introduction and background

1.1 Introduction

The phenomenal economic growth in China over the past few years has been fueled in large part by rapid urbanization and local economic development in the special economic zones and large cities of the country. Chinese cities have been using land leases as an innovative means of facilitating urban growth. That is curious to western eyes because urban land ownership is retained by the state in China. Despite that reality real estate markets have boomed. The origin of this phenomenon goes back to a constitutional amendment in 1988 that permitted transferable land use rights. That development, coupled with long-term leases of urban land, has resulted in quickly developing and fast growing real estate markets in many Chinese cities. The land leasing regime allows land for commercial, industrial, or residential use to be leased for 40, 50, or 70 years, respectively. With the very substantial amount of off-budget revenue derived from these leases, cities are both financing the provision of local public goods/services and, importantly, financing the expansion of their infrastructure.

An important question is whether Chinese cities are strategically pricing the land leases in order to maximize the government revenue. They effectively sell the land asset (at a price that may or may not reflect its market value) and in so doing they buy a flow of funds in the form of business tax (BT) and value added tax (VAT) revenue. BT and VAT are important revenue sources for the city government and they differ by that city governments could retain nearly all of the BT revenue while they retain approximately 25 percent of the VAT revenue. The two sources of revenue considered in this paper are revenue derived from land leasing and revenue derived from taxes on the output of the firm (largely in the form of BT and VAT in the context of Chinese cities' public finances). The key issue for the municipality is that there is a trade-off between land lease revenue and tax revenue. If the municipality charges a low price for the land leased to the firm its lease revenue is reduced, but on the other hand the low lease price makes the firm more profitable and increases its output which is taxable. For Chinese cities, strategic land lease pricing means that the less reliant they are on tax revenue, the higher land lease price they should charge firms, and the more reliant they are on tax revenue, the less land lease price they should charge firms. By using variation across cities in the BT and VAT shares of revenue prices can be proxied and insights are gained on the strategic pricing issue.

This paper reports analysis of land lease revenue generated by Chinese cities, and the role of that revenue within the larger context of Chinese cities' public finances and economic development strategies. It begins by using both provincial and prefecture-level data over the period 2003-2011 to describe empirical models that explain the determinants of land leasing strategy and reveal the factors responsible for the importance of this revenue source. Yearly and regional variations in leasing patterns are also explored. Finally, the paper reports the outcome of an indirect test of the prevailing hypothesis that Chinese cities price their land leases strategically in order to stimulate economic development and generate VAT or BT revenue from that economic activity. A major contribution of this paper is that it is the first to look at the trade-off between land lease revenue and tax revenue and considers the optimal land pricing strategy for the city government.

1.2 China background

Starting in 1980, China began a process of fiscal decentralization that transferred additional fiscal autonomy to sub-national governments. Su and Zhao (2004) describe the process of decentralization and the resulting expenditure and tax assignment that resulted from the so-called tax assignment system reform of 1994. The foundation of Chinese city land lease revenue was laid with that set of tax reforms in 1994, which were designed to support the movement to a more market-based economy. There were four major aspects of the reforms according to Toh and Lin (2005): (1) converting the existing turnover taxes into a unified VAT, (2) harmonization of enterprise income tax rates across various types of firms, (3) changes in minor tax sources including the personal income tax and selective sales taxes, and (4) reform of the fundamental fiscal relationship between the central government and local governments. It was this fourth aspect of the reforms that prepared the way for Chinese cities to have the ability to generate substantial off-budget revenue from land leases.

Sub-national governments were assigned a whole portfolio of local taxes, according to Su and Zhao (2004), that included the business tax, company income tax, local company profits tax, personal income tax, urban land use tax, urban maintenance and development tax, fixed assets investment adjustment tax, house property tax, land value increment tax, and other taxes. While the overall level of sub-national fiscal revenue relative to total fiscal revenue in China fell as a result of these reforms, the autonomy granted to collect local taxes and extra-budgetary revenue was an important change. Shen et al (2006) provides additional background on fiscal decentralization in China.

For more background on how land use rights were made transferable in 1988 see Walker and Li (1994). The transition to land development rights is described in Zhu (2004, 2005) and the process of fiscal decentralization is outlined in Zhang (2010). Financing of urban infrastructure development in China is described in Anderson (2009b). For an extensive background on the general issue of land leasing in China see Bourassa and Hong (2003), Hong (1996), and Deng (2002, 2003, 2005). In addition, Li (1997), Xie et al (2002), and Han and Wang (2003) provide useful background on early developments in Chinese property markets. Finally, Anderson (2010) examines the potential path to property taxation in China, and Anderson (2012) considers the compatibility of property taxation in China in the context of leasehold land tenure.

1.3 Government use of ground leases

China is not alone in retaining ownership of land but permitting ground leases. Leases are common mechanisms used by many governments around the world. This form of land tenure is typically used in situations where the government wishes to retain ownership of the land but wants to partner with a private entity to develop that land. With a ground lease the government leases the land to a developer for eventual development typically involving the erection of a building that generates a stream of rent over time. When the lease ends the land and any improvements added to the land by the developer revert to the government, unless the lease is renewed. Ground leases generally have long terms (more than 50 years) with multiple renewal options. Furthermore, ground leases typically include specifications for the type and form for improvements that are permitted on the land. In this way, the government can control land use.

An important aspect of land leasing is the desire by the city government to capture value created by economic development, as explained and reviewed in Hong (2003) and Anderson (2012). Ground leases are long-term contracts granted by the city government (the ground lessor) which leases the land to a developer (ground lessee) for a fixed term. The developer benefits from use of the public land and shares some portion of the proceeds of the development with the lessor according to the terms of the lease contract. The primary way this sharing occurs is by way of the pricing of the lease contract. Since the property rights conferred with the ground lease are limited, they yield the lessee less value than would be the case under fee simple ownership. A major reason for this outcome is that at the end of the lease the lessee has no option to redevelop. All improvements placed on the land revert to the lessor and have zero residual value to the lessee as a result.

Dale-Johnson (2001) indicates that there is substantial variation in the form of ground leases as they are implemented by governments around the world. For example, in Hong Kong and the Peoples' Republic of China he says that, "...significant lump sum fees equivalent to the discounted value of the leasehold interest are paid up front and periodic fees are low, rather like property taxes." The Chinese cities' requirement of front-loaded lease payment reflects both the cities' needs for infrastructure finance at the outset of a project and the lack of mature capital markets in which cities can borrow. Recently, this requirement also reflects desire of the Chinese central government to cool down the hot property market which has evidenced asset bubble signs.

In China the ground lease regime is complicated by the fact that the government retains control in multiple ways. Deng (2003) makes the important observation that in the Chinese leasehold system the government plays three simultaneous roles: the government is the landowner, the provider of public goods, and the owner of the state owned enterprises (SOEs). Furthermore, it is essential to recognize that local governments in China often act as real estate developers and economic development agencies. The combination of these roles provides the local government units with many opportunities to implicitly price their services.

A notable feature of Chinese city ground leases is that they require the lessee to make several up-front payments, including the payment of a land premium and prepayment of all community and urban infrastructure fees. Thereafter the lessee must pay annual land use fees. Deng (2003) identifies three major forms of payment currently associated with land leases in China: (1) a lump-sum premium for the lease, (2) an urban infrastructure fee paid to support infrastructure in the whole community, and (3) a community infrastructure fee paid to support infrastructure in the neighborhood. Even after payment of these items, the lessee must also pay a land use tax every year. Deng (2003) indicates that the land use tax is small, however, in comparison to the size of the three payments listed above.

1.4 Previous empirical research on Chinese city land leases

To date, there is limited published research on land transfer fees in China. Man (2011) provides a new and useful survey of land transfer fees and local government finances in China. She identifies three key trends over the period 1999-2007: (1) There has been a general increase in the volume of land transfers over time, (2) There are significant differences in land leases for different types of land, and (3) Negotiation continues to be the most prevalent form of transfer or lease conveyance.

In addition, there are three notable empirical studies on land leases in China to date, one covering rural land leases and two others focusing on city land leases. First, Yao (2000) empirically examined the land lease market in rural China using data from three counties of Zhejiang province. Yao found two factors that increased the number of leases in rural areas: productive heterogeneity in the agricultural sector, and a freer labor market. The second study of note is that of Tao et al (2010). That study provides the most extensive empirical evidence to date on land leasing among Chinese cities. They examined how leasing behavior by prefecture level cities affected budgetary tax revenue (from enterprise income tax, business tax, VAT, other taxes, and total local taxes). Data is used for the period 1999-2003 and city tax revenue sources are regressed on measures of leasing activity, including the number of leases auctioned, tendered, or negotiated. The strongest evidence in the study indicates that the number of negotiated leases granted by a city has a positive impact on tax revenues three years later (but not for lags of one or two years). Auctioned leases did not appear to have any impact on tax revenues. Wu, Gyourko and Deng (2012) provide an overview of the urban land supply system and land market in China, with empirical estimates of housing prices in major cities. They estimate a constant quality land price index for Beijing residential property. One of their most interesting findings is that state-owned enterprises that are controlled by the central government pay higher prices than other bidders for equivalent parcels of land. Finally, a recent unpublished paper by Zheng et al (2011) provides an ambitious investigation of urban development financing and the investment cycle in Chinese city real estate markets. The authors use a panel data set for 35 Chinese cities over the years 2003-2008 and build a simultaneous equations model of housing and land markets. Their results indicate that city governments that rely more heavily on land leasing revenue have an incentive to lease out additional land for residential purposes thereby increasing the supply of land for residences, which then slows the rate of growth of housing prices.

Most of the studies on land transfer fees in China have been focusing on the issue of land lease itself, the interactions between land lease revenue and other revenue source, such as tax revenues, have not been analyzed systematically. The objective of this article is to analyze the trade-off between land lease revenue and the tax revenue in order to examine that whether the Chinese cities are pricing their land strategically.

2 Theoretical model

In order to model the Chinese municipality land leasing process we can consider a two-part process. A Chinese firm decides how much land to lease in order to produce its output, and the Chinese municipality decides the price to charge for the land it leases. The key issue for the municipality is that it has two sources of revenue with a trade-off between the two. Revenue is derived from taxes on the output of the firm and revenue is derived from land leasing. If the municipality charges a low price for the land leased to the firm its lease revenue is reduced, but on the other hand the low lease price makes the firm more profitable and increases its output which is taxable.

2.1 Firm choice of optimal amount of land

Consider first the firm's problem of choosing the amount of land to use in production. Suppose that a firm has a concave production function $f(l)$ where l is the amount of land it uses which it purchases from the city at price p per hectare. In addition to the price it pays for the land, the firm pays an effective rate of tax τ on its output. The firm maximizes profit π by choosing the optimal quantity of land. The objective function is,

$$\pi = (1 - \tau)f(l) - pl \tag{1}$$

The first order condition for the optimal choice of the amount of land is given by the condition,

$$\frac{\partial \pi}{\partial l} = (1 - \tau)f'(l) - p = 0 \tag{2}$$

This condition indicates that at the optimal quantity of land the value of the marginal product after tax must equal the price of land. Denote the optimal quantity of land satisfying this condition as l^*. Second order conditions assuring a maximum are assured to hold given concavity assumption for the production function.

Figure 1 illustrates the optimal choice of the amount of land, assuming that the marginal product of land is declining and the business tax rate is constant.

A higher (lower) price of land will result in a smaller (larger) optimal quantity of land desired by the firm. The city can choose its land price, and the firm will take that price into account as it demands land. The Chinese city has control over the price it charges for a land lease, but it does not control the business tax rate which is set by the central government in this model, although the city is able to retain the full amount of the business tax revenue generated in its jurisdiction. The city generates land lease revenue illustrated by the rectangle of size pl^*. Tax revenue generated by the firm's output is illustrated as the rectangle with height given by the tax rate τ times the optimal quantity of land leased, l^*.

2.2 City choice of land lease price

Next, consider the problem of the city deciding what price to charge for land leases. The city government owns all of the land in the jurisdiction and leases land to firms. It has two revenue sources in addition to exogenous transfers from the central government, the tax revenue it generates from the output of firms and the land lease revenue it derives from leasing land to firms. The city government is able to retain share s of the tax revenue it derives from firms operating in its jurisdiction so the firm is assumed to maximize the revenue R it derives from taxes and land leasing, with the objective function,

$$R = s\tau f(l^*) + pl^* \tag{3}$$

The city chooses the lease price of the land p. Differentiating R with respect to the lease price of land, p, gives the first order necessary condition

$$\frac{\partial R}{\partial p} = s\tau f'(l^*)\frac{\partial l^*}{\partial p} + p\frac{\partial l^*}{\partial p} + l^* = 0 \tag{4}$$

which can be written in elasticity form,

$$\varepsilon = \frac{-p}{[p + s\tau f'(l^*)]} \tag{5}$$

Equation (5) is simply a rearrangement of the first-order necessary condition. As long as equation (5) holds, the city government is maximizing the total revenue as stated in equation (3). The elasticity expression indicates that the elasticity is minus one only in the special case where $s = 0$ (assuming that $\tau > 0$ and $f\prime(l^*) > 0$). In that case, the elasticity is unitary and land lease revenue itself is maximized. For values of $s > 0$ the elasticity measure is contained in the interval $\varepsilon \in (-1, 0)$ and is less than one in absolute value. Figure 2 illustrates the revenue maximizing solution for the city. If the city is acting as a land-providing monopolist we would expect the price and quantity to correspond to the unitary elastic point of the land demand curve, where total revenue derived from land leasing is maximized. We would not expect the city to charge a land lease price different from the revenue-maximizing price since that reduces total revenue (marginal revenue is negative). However, equation (5) reveals that it is only under the condition that the city can keep none of the tax revenue it generates from the output of firms to which it leases land should it choose to operate at the unitary elastic point. In this extreme situation the city retains no tax revenue from taxation, so it behaves as a land monopoly and derives revenue only from leasing land. Consequently, it maximizes the amount of land lease revenue it can derive from that practice and should operate at the unitary elastic point of the demand curve.

In the context of Chinese cities, the city government keeps both the land lease revenue and a portion of the tax revenues. As the share of tax revenue s retained increases from zero the denominator in equation (5) grows and the elasticity shrinks (in absolute value). The derivative of $|\varepsilon|$ with respect to s is strictly negative:

$$\frac{\partial\,|\varepsilon|}{\partial s} = \frac{-p\tau f'(l^*)}{[p + s\tau f'(l^*)]^2} < 0. \tag{6}$$

For larger values of s cities locate southeast of the unitary elastic point on the demand curve for land and lease land at lower prices at points on the demand curve where the elasticity is less than one in absolute value. There are two revenue sources for the city to consider when s exceeds zero, and there is a trade-off to manage between the land lease revenue and the tax revenue derived from the output of the firms locating in the city. This simple model indicates that because s is bounded on the unit interval, $s \in [0, 1]$, the city will be pricing land leases on its demand curve from the unitary elastic point or lower. The more tax revenue it can derive and retain from firms operating in the city, the lower on the land demand curve the city will operate. Therefore, we would expect that a larger share of the tax revenue should be corresponding with a lower land price (i.e., locating down further southeast of the unitary elastic point on the demand curve for land lease) while a smaller share of the tax revenue will correspond to a higher land price (i.e., locating close to the unitary elastic point on the demand curve). Differences in the tax revenue share of the Chinese cities can be proxied by the cities' reliance on BT and VAT revenue, given that the Chinese city governments retain virtually all of the BT revenue while they only retain approximately twenty-five percent of the VAT revenue. Chinese cities strategically price land leases in order to maximize the total revenue from combined land lease revenue and tax revenue they generates from the output of firms in their jurisdiction, adjusting land lease prices depending on their reliance on BT and VAT tax revenue.

2.3 Testable implications

Two testable hypotheses follow from this two-part model. First, in order to maximize total revenue from both land leases and taxation, cities should operate below the unitary elastic point of their demand curves as long as their tax revenue share from the central government is not zero. Second, cities that rely more heavily on BT revenue will operate further southeast of the unitary elastic point of their land demand curve and charge lower prices than cities that rely more on VAT revenue.

To estimate the revenue elasticity of leased land area the traditional approach is to model land area leased A, as a function of land price P,

$$A = \alpha P^{-\beta} \tag{7}$$

which when transformed by taking logs and including an error term becomes the estimating equation,

$$\ln(A) = \ln(\alpha) - \beta \ln(P) + \varepsilon. \tag{8}$$

The estimated value of $-\beta$ in this equation is the price elasticity of land lease area with respect to the land price.

Now, in order to include the effect of BT or VAT reliance in the model, suppose that land lease area A is a function of land price P, with the exponential function,

$$A = \alpha P^{-(1+\beta r)} \tag{9}$$

where the exponent $-(1 + \beta r)$ captures the possibility that the basic unitary elasticity is augmented by the term βr which reflects the incremental amount by which the elasticity changes with r measuring revenue reliance on BT relative to VAT. In addition,we include GDP in the estimating model in order to control for economic development which shifts the land demand curve. We use GDP rather than GDP per capita because the regional demand for land depends more on the regional total GDP than on per capita GDP. For example, there may well be more demand for land in Hebei than Beijing even though Beijing has a larger GDP per capita than Hebei.

Taking the natural logs of both sides of (9) and including GDP and an error term ε yields the estimating equation,

$$\ln(A) = \ln(\alpha) - (1 + \beta_1 r) \ln(P) + \beta_2 \ln(GDP_{it}) + \varepsilon. \tag{10}$$

In this equation, the estimated value of the parameter β_1 is the incremental amount by which the elasticity differs from unity, depending on the reliance on BT and VAT revenue of the cities. We expect that the estimated elasticity $(1 + \beta r)$ will be significantly less than one for all Chinese cities on average.

This study also examines how the price elasticity has been changing over years within the sample and across provinces in China. By including year fixed effects and an interaction term between the year dummy variables and the term $s \ln(P)$ we can calculate the price elasticity, accounting for the year effects as $-(1+\beta_1 r_{it}) \ln(P_{it}) + \gamma_t Year_t r_{it}$. The estimation equation in this case is given by (11),

$$
\begin{aligned}
\ln(A_{it}) &= \beta_0 - (1+\beta_1 r_{it})\ln(P_{it}) + \beta_2 \ln(GDP_{it}) \\
&\quad + \sum_{t=2004}^{t=2011} \delta_t Year_t + \sum_{t=2004}^{t=2011} \gamma_t Year_t r_{it} \ln(P_{it}) + \varepsilon_{it}. \qquad (11)
\end{aligned}
$$

Given that our sample begins in the year 2003, we use that year as our reference year and our first dummy variable is for the year 2004.

In order to examine provincial effects, we include provincial fixed effects for the 31 provinces and provincial-level cities in China. We use Anhui province as the reference province in our estimations, so 30 provincial dummy variables and interaction terms are included in the estimating equation (12). The price elasticity for province i can be calculated as $-(1+\beta_1 r_{it}) + \gamma_i r_{it} Province_i$:

$$
\begin{aligned}
\ln(A_{it}) &= \beta_0 - (1+\beta_1 r_{it})\ln(P_{it}) + \beta_2 \ln(GDP_{it}) \\
&\quad + \sum_{i=1}^{i=30} \delta_i Province_i + \sum_{t=1}^{t=30} \gamma_i Province_i r_{it} \ln(P_{it}) + \varepsilon_{it} \qquad (12)
\end{aligned}
$$

We also include analysis of regional effects. For that purpose we divided China into six regions as illustrated in Figure 3. In the analysis to follow, North China is used as the reference region. The estimating equation for regional effects is given as,

$$
\begin{aligned}
\ln(A_{it}) &= \beta - (1+\beta_1 r_{it})\ln(P_{it}) + \beta_2 \ln(GDP_{it}) \\
&\quad + \sum_{i=1}^{i=5} \delta_i Region_i + \sum_{i=1}^{i=5} \gamma_i Region_i r_{it} \ln(P_{it}) + \varepsilon_{it} \qquad (13)
\end{aligned}
$$

3 Empirical estimation

3.1 Data

For the purpose of the analysis in this paper, data were collected on all provincial and prefecture-level Chinese cities over the period 2003-2011. Both land transfer fee data and fiscal data were obtained from annual statistical yearbooks and were combined to compile a single database. The data come from the China Statistical Year Book for Land and Resources and the China Statistical Year Book for Regional Economy, various years. Using this data we can provide an overview of Chinese city leasing by considering some basic descriptive statistics.

Table 1 reports the number of land leases granted by both prefecture-level and provincial cities over the years 2003-2011. The average number of leases provided by these cities has varied over time from a low of 360 leases in 2009 to a high of 613 leases in 2003. Despite variation over time, the mean number of leases per city is generally in the range of 400 to 500 per year. The median number of leases is smaller than the mean in each year reflecting the fact that there are a few cities with much higher numbers of leases, pulling the mean upward. The maximum number of leases granted per city falls in the range of 3,000 to 7,000 per year. The minimum number of leases is at least one in each year indicating that all cities are involved in land leasing.

Table 2 reports the land area leased (in hectares) by cities over the period 2003-2011. On average, these cities have been leasing in the range of 500 to nearly 1,000 hectares of land each year. Here again the means are larger than the medians each year, indicating that there are a few cities leasing much larger land areas which has the effect of making the means larger than the medians. The maximums reveal that the most active leasing cities added from 3,000 to 9,000 hectares of land to their leasehold portfolios each year. These data also indicate that both the number of parcels leased (Table 1) and the land area leased (Table 2) have rebounded since the Great Recession of 2008-2009.

Table 3 reports the average land lease price in the form of gross lease revenue per hectare (measured in nominal yuan per hectare) each year over the period 2003-2011. The average gross lease revenue per hectare has ranged from 2.2 million yuan in 2003 to 7.7 million yuan in 2011. The upward trend is monotonic and reflects substantial inflation over that period of time. Median gross lease values per hectare have ranged from approximately 1.8 million yuan to 5.7 million yuan in 2011. Mean values each year are above median values, indicating that there are high gross lease revenues pulling up the means. The maximum gross lease values per hectare have ranged from 7.7 million yuan in 2003 to nearly 97 million yuan in 2011.

Table 4 provides an overview of the major sources of city revenue in China over the period 2003-2011. Each source of revenue in the table is computed as a share of total general budgetary revenue. Over the entire period, VAT revenue accounted for an average of about 16 percent of total budgetary revenue while the business tax accounted for about 24 percent. Data on the company tax and the personal income tax is incomplete and is therefore omitted from the table, but in any case these sources generate a small share of revenue. Gross land lease revenue is off-budget, but generates a significant amount of revenue, varying from about 40 percent to 75 percent of total budgetary revenue, depending on the year. On average over the full time period, land lease revenue is approximately 55 percent of total budgetary revenue, which amounts to more than twice the revenue generated by the business tax, or put another way, an amount greater than the combined revenue of the VAT, business tax and company tax. With the downturn in the Chinese economy in 2008 and 2009, reflecting the global recession, the land lease share fell from its peak of 56 percent in 2007 to 39 percent in 2008, then rose to 50 percent in 2009. Since then, the land lease share has rebounded strongly with the 2011 share at an average of 75 percent. The maximum share of revenue generated by land leases across cities was generally two to three times total budgetary revenue—dwarfing total budgetary revenue. In one anomalous case in 2011, the case of Ningxia, lease revenue was a whopping 17.8 times total budgetary revenue.

Considering the summary statistics for each revenue source over time, we see that the average VAT share of revenue has generally been in the range of 16-17 percent, although it fell substantially in 2009-2011; the business tax share has held relatively stable at about 24 percent; and the company tax share has held stable at about 6%. The share of revenue generated by land leases has fluctuated between a low of 39 percent in 2008 and a high of nearly 80 percent in 2011. Most notably, the cities with the greatest reliance on land lease revenue have generally earned two to three times as revenue much from land leases as they have received in total budgetary revenue.

In the empirical estimation, we define the revenue reliance factor r as the ratio of BT to VAT revenue to measure the relative tax revenue shares of the cities. The larger the ratio, the more reliant is the city on BT, and the larger the tax revenue share of the city. Table 5 reports the reliance factor by cities for each year over the period 2003-2011. The average reliance factor has ranged from approximately 1.67 to 2.40 over the period of our analysis. The mean values each year are above median values for all years, indicating that there are some cities heavily rely on BT relative to VAT, pulling up the average values. The maximum values and minimum values show that some cities rely more on BT while some cities rely more on VAT.

Table 6 reports the summary statistics of all the variables used in the estimation: leased land area, real average land lease price, reliance factor and real GDP per capita.

3.2 Model estimation

3.2.1 Pooled sample estimation

Table 7 provides the results of strategic land pricing test among Chinese cities by estimating equation (10). The estimated value of coefficient β_1 is -0.027, which is significantly different from zero at the one percent level. This estimate indicates that the higher the reliance factor the further the city moves away from the unitary elastic point. The price elasticity, evaluated at the mean reliance factor, is -0.950.

These results, based on our pooled sample estimation, are informative regarding the essential strategic pricing behavior of Chinese cities. We find that Chinese cities tend to price land leases strategically so that they are operating below the unitary elastic point of their demand curves. When the tax share reliance is large, indicating heavier reliance on BT revenue relative to VAT revenue, cities operate well below the unitary elastic point. On the other hand, when the tax share reliance is small, indicating less reliance on BT revenue relative to VAT revenue, they operate much closer to the unitary elastic point of their demand curves. These findings illustrate that Chinese cities tend to strategically price land leases in order to maximize the total revenue from both land leases and tax revenue. For additional insight we control for year, provincial, and regional effects in the following section.

3.2.2 Year, province, and regional effects

Year effects Year fixed effects are included in the estimating model, as indicated in equation (11). Table 8 reports the yearly price elasticities for Chinese cities over the period 2003 to 2011. The estimate of coefficient β_1 in this case is -0.30, which is significantly different from zero at the one percent level. The estimated elasticities evaluated at the mean range from -0.94 to -0.96, with no significant variation over the time period. All yearly estimated price elasticities are less than one in absolute value, which strongly supports the conclusion that Chinese cities are strategically pricing their land leases.

Provincial effects In order to identify provincial effects, estimating equation (12) is used. Estimation results and computed elasticities are reported in Table 9. The estimate of coefficient β_1 is -0.046 which is statistically different from zero at the one percent level. The table reports the interaction effects where it is evident that the estimated coefficient for the provincial interaction terms is significantly different from zero in ten provinces or provincial cities (Guizhou, Hainan, Inner Mongolia, Jiangxzi, Jilin, Ningxa, Shanxi, Sichuan, Tibet, and Zhejiang). In those cases we have evidence of province-specific pricing effects. The Tibet result is unexpected (significantly larger than unitary elasticity), however, it is not significantly different from unity when using a three standard deviation interval estimate.

Regional effects Given that the four provincial-level cities (Beijing, Tianjin, Shanghai, and Chongqing) only have nine annual observations, the estimation in the provincial model may be impaired. To overcome the small t problem, we group the thirty-one provinces and provincial level cities into six regions. Figure 3 illustrates the regions and Table 10 reports the provinces and provincial cities that included in each of the six regions.

The estimated regional effects model, equation (13), overcomes the insufficient number of annual observations for the provincial cities. The results indicate that the coefficient estimate of the β_1 is -0.044 which is statistically different from zero at the one percent level. The regional interaction effects reported in Table 11 indicate that the Northeast, South Central, and Southwest regions have region-specific effects. In Northeast China the estimated elasticity at the mean reliance factor is smaller than all of the other regions. Cities in this region tend to rely more on BT tax revenue, resulting in a relatively large tax share. Cities prices their land leases at lower levels and lease more land than cities in other regions. The estimated elasticity in Southwest China is the largest among the regions, and unexpectedly, larger than unity, however, the estimated elasticity is not significantly different from unity when compared to a three standard deviation interval estimate.

Endogeneity of the tax revenue reliance factor Inclusion of the tax revenue reliance factor, r, in our model holds the potential to introduce a problem of endogeneity. To investigate this possibility it is important to consider the

BT and VAT tax bases in greater detail. The KPMG Asia Pacific Tax Centre (2012) provides information on the Chinese tax system indicating that the VAT is applied to the supply of goods, provision of services, and importation of goods into the PRC; whereas the BT is a turnover tax that is applied to the provision of services that are not covered by VAT, the transfer of intangible assets, and the sale of immovable property. Therefore, it is possible that cities which lease a relatively large amount of land may collect relatively more BT revenue than VAT revenue, resulting a large reliance factor. That could lead to the reverse causality in the estimating equations or the problem of the reliance factor being endogenous.

In order to guard against the potential endogeneity problem we implement a panel-specific form of the Granger causality test for $ln(A_{it})$ and the reliance factor, r_{it}. To pick an appropriate lag length for the causality test we run several VARs for these two variables with different lag lengths. We select the reasonable lag length based on the AIC information criteria. Table 11 reports the AIC associated with different lag lengths. Since there are nine years in our sample, the maximum lag length is eight. From the result we can see that AIC decreases as lag length increases. Given that result we should choose the lag length which gives the smallest AIC. In our case, we should use eight lags in the Granger Causality test. However, as Bruns and Stern (2015) have shown, using the AIC criteria the VAR model may be overfitted and result in an increased rate of false-positive findings in Granger causality tests. The over fitting problem results from using more lags than is appropriate. Together with the short panel we have, we suspect that the Granger Causality test result with eight lags is not reliable. We then run the test for all possible lag lengths. Table 12 reports the causality test results for one to eight lags. Results are sensitive to the lag length, when using less than four legs. AICs show that more lags are preferred to fewer lags in our sample, so we draw a conclusion of this causality test based on using four, five, six, and seven lags, for which the results are consistent. When using four to seven lags, we reject the hypothesis that the reliance factor r_{it} does not Granger Cause $ln(A_{it})$ at no more than five percent but fails to reject the other direction of causation. So it appears that Granger causality runs one-way, from the reliance factor r_{it} to $ln(A_{it})$ and not the other way. Therefore, we have reason to believe that there is no reverse causality issue or endogeneity problem with the reliance factor in our estimations.

4 Summary and conclusions

This paper analyzes land lease revenue generated by Chinese cities, and the role of that revenue within the larger context of Chinese cities' public finances and economic development strategies. Using both provincial and prefecture-level data over the period 2003-2011, the role and importance of land transfer fees is described. These off-budget fees derived from land leases account for an average of 55 percent of the cities' total budgetary revenue. For the fast growing large cities these fees amount to two or three times their budgetary revenue. The cities effectively sell the land asset and in so doing they derive a flow of funds in the form of business tax (BT) and value added tax (VAT) revenue. The key difference between these two tax sources in the Chinese system of intergovernmental fiscal relations is that cities retain nearly all of the BT revenue they derive, but they only derive 25 percent of the VAT revenue of activity in their jurisdiction as it is collected by the central government and a portion is returned to the city.

Theoretical models of firm demand for land and city supply of land are developed, with testable implications drawn for the strategic pricing behavior of cities. The objective is to test of the prevailing hypothesis that Chinese cities price their land leases strategically in order to stimulate economic development and generate BT or VAT revenue from that economic activity and maximize the sum of land lease and tax revenue. A theoretical model of city revenue sources is developed that identifies the role of shared taxes in the revenue portfolio of cities, along with land lease revenue. By using variation across cities in the reliance on BT and VAT we can proxy prices and gain insight on the strategic pricing issue. The innovative insight of the paper is that the strategic pricing behavior of cities is dependent on the intergovernmental revenue system. The empirical results indicate that Chinese cities are strategically pricing land lease on average during the time period of 2003 to 2011. Cities which rely more heavily on BT than VAT revenue price land leases at a lower level and lease more land, operating southeast of the unitary elastic point on their land demand curves. The implication of this pricing is that cities relying more heavily on BT than VAT revenue are willing to forgo some land lease revenue in order to stimulate additional tax revenue that they can retain. By pricing land at a lower level and leasing more land than necessary to maximize lease revenue, they are deriving a more significant share of their revenue portfolio from taxes. BT-reliant cities price land at lower prices and lease more land. That stimulates economic development which generates tax revenue, especially BT revenue which the cities can retain. In contrast, cities that rely more heavily on VAT than BT revenue price land close to the unitary elasticity point and price their land leases at higher levels.

Models including year fixed effects do not show strong temporal patterns in the estimated elasticities. When provincial fixed effects are included, we find significant effects for certain provinces. On a regional basis, the elasticity is lowest in Northeast, indicating more land leased at lower prices, while there is a significantly higher elasticity in the Southwest than other regions, indicating less land leased at higher prices in that region. The province and regional effect results indicate quite distinct behavior among BT-reliant and VAT-reliant cities.

Looking forward, the recent tax reform in China that eliminates the BT tax, combining it into the VAT, may have implications for city behavior in land leasing as well. Our results suggest that BT-reliant cities may react to this tax policy change by moving to the unitary elastic point of their land demand curves. That move will involve charging higher prices for land lease and leasing less land in the future. This is consistent with the fact that with a limited amount of land within each city, the cities could lease less and less land in the future.

As a matter of policy, the Chinese institutional structure of intergovernmental revenue, when combined with the freedom Chinese cities have been given to lease land within their jurisdictions, results in aggressive strategic pricing behavior. When the cities are able to retain the revenue generated by business activity within their jurisdiction, they behave in such a way as to maximize the combination of tax revenue and land lease revenue. They do not act as monopolists in leasing land. They price land leases below the monopoly level and lease more land than a monopolist would. That strategy generates additional tax revenue that they can retain, which enables them to maximize the combination of land lease and tax revenue. When cities are less independent and rely more heavily on tax revenue transferred from the central government, which is largely out of their control, they behave as land-providing monopolists and maximize land lease revenue.

Figure 1: Optimal Land Choice by Firm

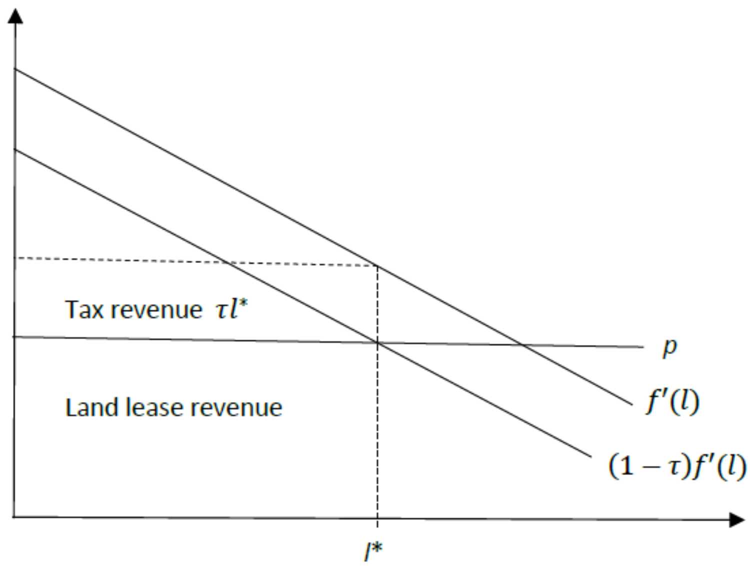

Figure 2: Revenue Maximizing Land Price Choice by City

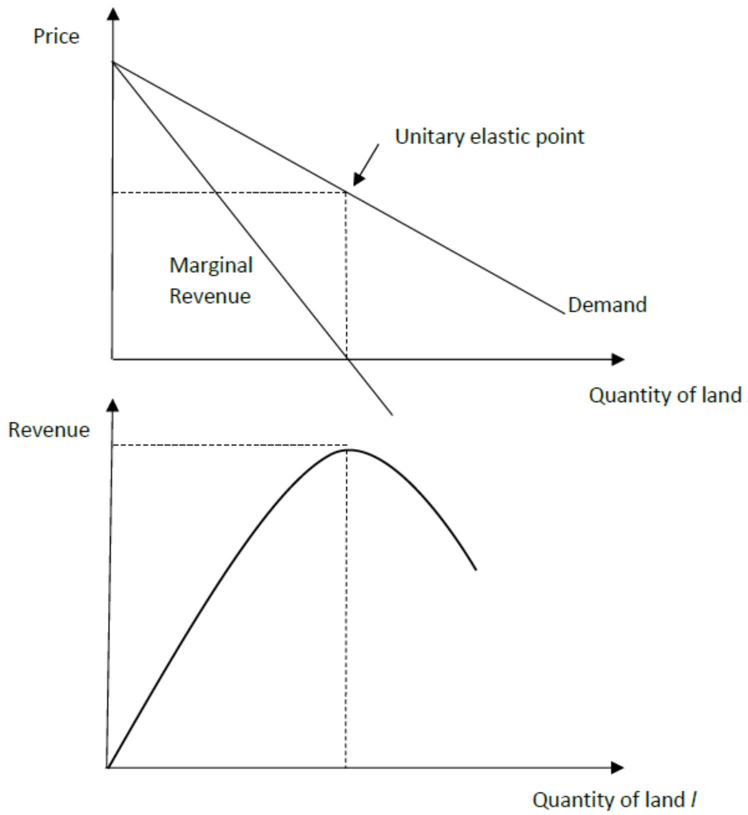

Figure 3: Regions of China

Source: https://en.wikipedia.org/wiki/List_of_regions_of_the_People%27s_Republic_of_China

Table 1: Number of Land Leases, by Year 2003-2011

Year	Mean	Median	Maximum	Minimum	Standard Deviation
2003	612.98	307.00	4,030.00	2.00	768.28
2004	546.05	317.00	4,497.00	1.00	653.85
2005	478.93	257.00	4,298.00	1.00	626.16
2006	558.11	295.00	6,076.00	7.00	749.29
2007	480.73	269.00	5,064.00	1.00	640.08
2008	374.38	190.00	7,315.00	3.00	626.74
2009	359.74	236.00	3,355.00	1.00	456.35
2010	417.72	277.50	3,470.00	1.00	473.05
2011	445.63	305.00	4,040.00	1.00	474.17

Source: author's computations.

Table 2: Land Area Leased (ha), by Year 2003-2011

Year	Mean	Median	Maximum	Minimum	Standard Deviation
2003	575.56	207.24	7,605.69	0.61	1,072.25
2004	542.21	245.62	7,135.04	0.23	867.35
2005	493.01	243.80	6,491.31	0.55	739.29
2006	697.02	352.27	9,086.84	1.59	1,026.41
2007	698.15	405.92	6,080.09	0.06	870.49
2008	491.64	280.80	3,419.22	0.00	580.13
2009	649.49	384.22	8,278.97	0.65	863.18
2010	866.49	595.07	7,086.99	1.00	960.29
2011	988.77	685.95	6,835.95	1.00	1,074.09

Source: author's computations.

Table 3: Gross Lease Revenue per Hectare (yuan/ha), by Year 2003-2011

Year	Mean	Median	Maximum	Minimum	Standard Deviation
2003	2,174,751	1,833,954	7,724,381	10,997	1,462,128
2004	2,412,684	2,040,764	11,025,641	86,704	1,688,394
2005	2,653,872	2,239,228	10,739,611	9,202	1,757,521
2006	2,711,760	2,300,176	12,150,934	7,959	1,929,824
2007	3,784,249	2,969,473	43,824,634	2,852	3,646,365
2008	4,322,209	3,349,015	30,940,414	63,211	4,043,328
2009	5,479,335	3,497,399	51,956,466	194,614	6,190,233
2010	6,993,126	4,721,498	61,270,778	277,572	7,243,134
2011	7,691,292	5,685,965	96,633,658	269,665	8,348,430

Source: author's computations.

Table 4: Sources of Revenue as a Share of Total General Budgetary Revenue, 2003-2011

Year		VAT	Business Tax	Gross Land Lease Revenue
2003	Mean	0.18	0.23	0.49
	Median	0.16	0.22	0.34
	Max	0.73	0.59	3.34
	Min	0.04	0.07	0.00
2004	Mean	0.16	0.25	0.52
	Median	0.15	0.24	0.41
	Max	0.40	0.58	2.43
	Min	0.04	0.03	0.00
2005	Mean	0.18	0.24	0.46
	Median	0.17	0.23	0.37
	Max	0.45	0.52	2.25
	Min	0.04	0.09	0.00
2006	Mean	0.18	0.24	0.50
	Median	0.17	0.23	0.39
	Max	0.49	0.53	2.76
	Min	0.03	0.07	0.01
2007	Mean	0.18	0.23	0.56
	Median	0.17	0.22	0.48
	Max	0.47	0.49	2.22
	Min	0.02	0.07	0.00
2008	Mean	0.17	0.23	0.39
	Median	0.16	0.22	0.32
	Max	0.79	0.49	2.11
	Min	0.19	0.08	0.00
2009	Mean	0.14	0.23	0.50
	Median	0.14	0.22	0.41
	Max	0.34	0.53	2.12
	Min	0.02	0.02	0.00
2010	Mean	0.13	0.24	0.72
	Median	0.12	0.23	0.61
	Max	0.58	0.70	2.33
	Min	0.01	0.09	0.00
2011	Mean	0.12	0.24	0.75
	Median	0.12	0.23	0.64
	Max	0.34	0.71	17.77
	Min	0.01	0.03	0.00
2003-2011	Mean	0.16	0.24	0.54
	Median	0.15	0.23	0.44
	Max	0.79	0.71	17.77
	Min	0.00	0.00	0.00

Source: author's computations.

Table 5: Reliance Factors, by Year 2003-2011

Year	Mean	Median	Maximum	Minimum	Standard Deviation
2003	1.67	1.35	11.94	0.25	1.35
2004	2.02	1.62	12.41	0.25	1.59
2005	1.67	1.30	13.04	0.20	1.51
2006	1.68	1.33	15.45	0.31	1.53
2007	1.70	1.33	20.88	0.31	1.70
2008	1.68	1.38	22.35	0.21	1.58
2009	1.98	1.69	24.02	0.05	1.67
2010	2.29	1.85	31.53	0.36	2.25
2011	2.40	1.90	24.33	0.27	2.13

Source: author's computations.

Table 6: Summary Statistics

	Mean	Median	Maximum	Minimum	Standard Deviation	Observations
Land Leased Area (Hectare)	667.91	349.28	9,086.84	0.06	921.85	2,986
Real Average Land Price (Yuan/Hectare)	3,585,999	2,598,383	72,706,680	2,519.82	4,052,634	2,984
Reliance Factor	1.90	1.51	31.53	0.05	1.74	3,030
Real GDP (100 Million Yuan)	748.72	394.32	14,442.74	5.40	1,173.61	3,040

Source: author's computations.

Table 7: Tests of Strategic Pricing

	Dependent Variable: lnA_{it}
Constant	2.06*** (0.09)
$r_{it}lnP_{it}$	-0.03*** (0.00)
$lnGDP_{it}$	1.49*** (0.02)
Elasticity at mean r	-0.95
Adjusted R^2	0.58

Notes: Standard errors in parentheses; * significant at 10% level, **significant at 5% level, ***significant at 1% level

Table 8: Tests of Strategic Pricing with Year Fixed Effects

Year	Mean of Reliance Factor	γ_t (Coefficient on $Year_t r_{it} lnP_{it}$)	Elasticity at Mean Reliance	n
2003	1.67		-0.95	334
2004	2.02	0.00	-0.94	332
2005	1.67	0.00	-0.95	332
2006	1.68	0.01	-0.94	331
2007	1.70	0.00	-0.95	324
2008	1.68	0.00	-0.95	323
2009	1.98	-0.01	-0.96	336
2010	2.29	-0.01	-0.96	336
2011	2.40	-0.01	-0.95	333

* significant at 10% level, **significant at 5% level, ***significant at 1% level

Table 9: Tests of Strategic Pricing with Province Fixed Effects

Province or provincial city	Mean of Reliance Factor	γ_i (Coefficient on $Province_t r_{it} lnP_{it}$)	Elasticity at Mean Reliance	n
Anhui	1.85		-0.91	152
Beijing	4.17	0.01	-0.75	9
Chongqing	2.38	-0.03	-0.97	9
Fujian	1.90	-0.02	-0.95	81
Gansu	1.89	0.00	-0.91	125
Guangdong	1.02	0.00	-0.96	189
Guangxi	1.69	0.00	-0.93	125
Guizhou	2.53	0.04**	-0.78	81
Hainan	11.32	-0.03***	-0.85	18
Hebei	1.97	0.02	-0.86	99
Heilongjiang	0.99	0.01	-0.95	117
Henan	1.58	0.00	-0.93	153
Hubei	1.51	-0.02	-0.96	117
Hunan	2.01	-0.02	-0.94	126
Inner Mongolia	1.67	0.04**	-0.86	104
Jiangsu	1.47	0.01	-0.91	117
Jiangxi	2.26	-0.04**	-0.99	77
Jilin	1.32	0.11***	-0.80	81
Liaoning	1.84	0.02	-0.88	126
Ningxia	3.24	-0.02*	-0.93	44
Qinghai	4.81	0.00	-0.76	56
Shaanxi	1.70	0.00	-0.92	153
Shandong	1.30	-0.01	-0.96	9
Shanghai	2.37	-0.02	-0.93	98
Shanxi	0.66	0.07*	-0.92	90
Sichuan	1.96	-0.03**	-0.97	189
Tianjin	1.88	-0.01	-0.92	9
Tibet	4.71	-0.08***	-1.16	56
Xinjiang	2.14	0.01	-0.88	133
Yunnan	1.69	0.02	-0.89	139
Zhejiang	2.08	-0.03**	-0.97	99

* significant at 10% level, **significant at 5% level, ***significant at 1% level

Table 10: Six Regions in China

Region	Province or provincial city						
North China	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia		
Northeast China	Liaoning	Jilin	Heilongjiang				
East China	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Jiangxi	Shandong
South Central China	Henan	Hubei	Hunan	Guangdong	Guangxi	Hainan	
Southwest China	Chongqing	Sichuan	Guizhou	Yunnan	Tibet		
Northwest China	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang		

Table 11: Tests of Strategic Pricing with Regional Fixed Effects

Region	Mean of Reliance Factor	γ_i (Coefficient on $Region_t r_{it} lnP_{it}$)	Elasticity at Mean Reliance	n
North China	1.53		-0.93	319
Northeast China	1.40	0.05***	-0.86	324
East China	1.77	-0.01	-0.93	688
South Central China	1.76	-0.02***	-0.96	728
Southwest China	2.34	-0.05***	-1.02	474
Northwest China	2.46	0.00	-0.89	448

Table 12: VARs of r_{it} and $\ln(A_{it})$ and corresponding AICs

Lag Length	AIC
1	4.60
2	3.81
3	3.50
4	3.45
5	3.36
6	3.25
7	2.99
8	2.62

Table 13: Granger Causality Tests

Lag Length	Observations	Null Hypothesis	F-Statistics	Prob.
1	2,612	r does not Granger Cause $\ln(A_{it})$	3.20	0.07
		$\ln(A_{it})$ does not Granger Cause r	4.61	0.03
2	2,251	r does not Granger Cause $\ln(A_{it})$	0.66	0.52
		$\ln(A_{it})$ does not Granger Cause r	0.64	0.53
3	1,901	r does not Granger Cause $\ln(A_{it})$	6.78	0.00
		$\ln(A_{it})$ does not Granger Cause r	4.86	0.00
4	1,567	r does not Granger Cause $\ln(A_{it})$	14.10	0.00
		$\ln(A_{it})$ does not Granger Cause r	1.79	0.13
5	1,244	r does not Granger Cause $\ln(A_{it})$	8.82	0.00
		$\ln(A_{it})$ does not Granger Cause r	1.11	0.35
6	927	r does not Granger Cause $\ln(A_{it})$	2.66	0.01
		$\ln(A_{it})$ does not Granger Cause r	1.58	0.15
7	615	r does not Granger Cause $\ln(A_{it})$	3.55	0.00
		$\ln(A_{it})$ does not Granger Cause r	1.42	0.20
8	306	r does not Granger Cause $\ln(A_{it})$	2.27	0.02
		$\ln(A_{it})$ does not Granger Cause r	3.38	0.00

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