Land leasing and local government behaviour in China: Evidence from Beijing

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Abstract
Since 2004, two auction mechanisms – listing auctions and tender auctions – have played a dominant role in land lease arrangements for real estate development in Beijing. Listing auctions in land markets are similar to general English auctions, where bidders offer the highest price to win. However, in tender auctions, winners are determined by the bidding price and the bidder’s financial capability and reputation. Based on granted land parcels from 2006 to 2012 in Beijing, this paper attempts to examine the price differences between the two auctions and the role of land auction in urban development and price stabilisation. We find that land policy in Beijing, which aims to stabilise land prices and to provide low-price residences, has been integrated with urban development planning in terms of spatial and density pattern. Land leasing in Beijing is not only a land policy but also a part of the strategy framework of local development.

Keywords
Beijing, land lease, listing auction, local government behaviour, tender auction

Introduction
Government intervention in land markets has long been a focus of policy debates among economists, politicians and urban
planners. While some may support government intervention to reduce the significant externalities of land use, others may criticise the same activity. Nevertheless, it is clear that government intervention plays an important role in the modern urban economy. It is widely accepted that land markets are more than parcel size and location. They have implications for the whole economy through their effects on housing production, housing consumption, urban productivity and urban spatial structures (Cheshire and Sheppard, 2004; Yang, 2008). Thus, well-defined land use is critical for utilising scarce resources effectively as well as promoting economic and social development and poverty reduction. Although the degree of government intervention in land markets varies across countries depending on their ideological orientations, land markets are regulated in most developed and developing countries around the world. Thus, government intervention is a key issue in all land market studies.

In China, the land market is heavily controlled by the government. The mechanisms used to exert this control are quite different from those used in other countries. Most fundamentally, perhaps, urban land in China is owned by the state. The rights to lease such land can be transferred from the local government through public auctions, which are tender auctions (zhaobiao), oral auctions (paimai) or listing auctions (guapai). Under the general framework of urban land leasing, government intervention in China occurs both through the allocation of land parcels and the choice of leasing formats. Most research on Chinese land markets has focused on government behaviour in land allocation. Such studies have examined the political economy of land leasing reform (Deng, 2003b; Li, 1997), the effects of government behaviour on regional development (Deng, 2003a; Tian and Ma, 2009) and the deficiencies of government intervention in public land leasing (Che and Qian, 1998; Deng, 2003b; Lal, 1998). However, to our best knowledge, only one study by Cai et al. (2009) focuses on the formats of land leasing. The authors studied the formats of land leasing and land policy specifically in the context of corruption. However, their study excludes China’s capital, Beijing, due to its different auction formats from other Chinese cities.

Given the importance of Beijing in China, this paper concerns land parcel transactions in Beijing and two formats of land leasing: listing auctions and tender auctions. It aims to understand the effects of government intervention on the land market and urban economy. It provides insights into how the behaviour of local governments has influenced land and housing supply which eventually shaped urban spatial structure.

Two areas are addressed in our study. First, we examine the price differences between two auction formats. We apply a hedonic pricing model to correlate parcel characteristics with listing auction prices and compare the price differences between comparable pieces of land leased through listing auctions and tender auctions. This analysis contributes to the literature on the Chinese land market by examining micro-formation of land price and providing empirical evidence on the price effect of governmental interventions in the land market. The second issue is the spatial pattern of land leasing in Beijing. We investigate the spatial distribution of listing auctions and tender auctions to understand how the government uses them to promote desirable urban growth patterns and low price housing.

The rest of the paper is organised as follows. In the next section, a brief review of China’s urban land leasing reform is presented. The subsequent section is concerned with the theoretical framework of local government behaviour in the land market of China. This is followed by a section covering the formulations of empirical tests and data,
and the penultimate section presents data collected and empirical results. Concluding remarks are made in the final section.

**Land leasing reform in Beijing: A brief review**

Since economic reforms in 1979, China has experienced profound institutional and economic transformations. During this process, urban land reform and the introduction of the land leasing system for urban land use played an essential role in the development of the land market as well as the socialist market economy. Land leasing reform in China started in the late 1980s. Since then, policy on land supply has changed from administrative allocation to market disposal by means of land leasing. This transformation allowed market forces to play an important role in land allocation, as well as in the evolution of urban spatial structure. A comprehensive analysis of the reform of the Chinese land market and land use policy can be found in many articles including Ding (2003, 2004), Ho and Lin (2003) and Zhu (2004, 2005).

In 2001, the state council issued a notification on ‘Strengthening the Management of the State-owned Land (SC [2001] NO15)’ requiring that four types of state-owned land use right should be granted by tender, auction or listing. It enforced land development to be more market-oriented. However, this did not effectively influence the land market in China at once. In Beijing, 98.6% of the total parcels were still granted through negotiation by the end of 2003. On 31 March 2004, a special notice was issued requiring all urban land that was planned to be profit making (including residential, commercial and office uses) to be offered by tender (zhaobiao), oral auctions (paimai) or listing auctions (guapai).3 This was a milestone in China’s land market development as from then on, auction mechanisms, specifically tender and listing auctions, began to play dominant roles in the leasing of land for real estate development in China.

The format of a listing auction follows the mode of a typical English auction. The use of such auction originated in Guangdong Province, Jiangsu Province and Chongqing Municipality, where it is used to manage local government land supply. Before bidding, the government releases a notice that includes planning guidelines for the site and requirements for bidding participants. Interested bidders purchase bidding documents and register to attend. Potential bidders are additionally required to prepay approximately 10% of the opening price4 as a deposit. Only after passing a preliminary examination of qualifications are the bidders allowed to attend the land listing process. The site will be sold to the bidder offering the highest price. This price must either equal or exceed the reserve price. At closing time, if two or more bidders want to increase the offer in hand, the listing auction will be proceeded through oral auction, which will be held on the spot. At the end of the auction, the highest bidder wins the parcel.

Tender auctions, on the other hand, are more akin to sealed-bid auctions, but with different rules on how the winning bidders are determined. Under tender auction, each bid is scored by the bid evaluation committee based on a comprehensive comparison of factors, such as bidding price, payment conditions, proposed development plan, financial solvency of the bidder, and the corporation’s performance and reputation. The site is leased to the bidder who obtains the highest score on the combination of these factors. Under this system, the bidder offering the highest price5 may not always win the auction. It should be noted that such tenders will be conducted only if there are more than three bidders at the opening of
the bidding process. Furthermore, the reserve price is hidden.

In summary, a listing auction is an auction mechanism in which the parcel goes to the highest bidder, while in a tender auction, the government leases the land to a chosen firm after a comprehensive evaluation process. For the developer, their decision on land bidding depends more on their development strategy including location and expected profit, while less on the type of land auction. The difference in the price formation processes between these two types of auctions provides an opportunity to investigate the behaviour and intentions of local governments in urban land markets.

Local government behaviour in the Beijing land market

In this section, we provide a brief theoretical background of government actions in Beijing's land market within the framework of urban economic theory and government behaviour.

Land is a finite and irreplaceable urban resource. Furthermore, significant externalities come into the land market which may cause socially undesirable consequences, justifying significant government intervention in it. The government's role is to rectify potentially inefficient land allocation and to promote economic efficiency on a city-wide level. In addition, the government also has to fulfil a number of social objectives, including guarding equity in society.

However, on the other hand, in an increasingly competitive world, local governments have to behave as entrepreneurs to achieve Tieboutian efficiency (Brueckner, 1983; Sonstelie and Portney, 1978). Governments have a clear incentive to maximise rent (George, 1879) as it can be a major source of capital for developing city infrastructure and public facilities. In China, fiscal decentralisation is a consequence of economic reform and has incurred significant inter-city competition. Such competition may further encourage local governments to maximise fiscal revenue to finance local development through leasing lands.

The blended objective of government intervention in the market complicates the role of local governments in land leasing and sometimes may even cause inefficient governmental behaviour. For example, urban economy and social considerations may be overwhelmed by the intention of maximising profits from leasing land. The result may then be a net loss to the society (Brueckner, 2007) in that the intervention may leave the urban economy in a worse position than if the choice of land use was left to commercial forces (Brueckner, 2007; Deng, 2003a). The impact of land use interventions on urban economy and society thus challenges theoretical and empirical studies in transition economies like China.

The effectiveness of land policy depends on the appropriateness of measures within the social, economic, political and historical background of the location (Garba, 1997). In this study, we focus on the unique auction formats of Beijing's land market and assess the effect of local government intervention on leasing price and urban spatial structure. Specifically, two issues are tested empirically in this paper.

Effects of government behaviour on land price formation

It is important to understand whether government intervention in Beijing land leasing significantly affects the price differences between two formats of auctions. This will be the foundation for us to further study the contribution of land policy to urban structure.

Much auction theory evolves from Vickrey's (1961) revenue equivalence theorem concerning revenues from various
marketing mechanisms. It predicts that, in the equilibrium situation, the winner who bids for the highest prices is on average paying the same amount as the second highest bidder. In this sense, any auction will yield the same revenue to the vendor, no matter what the auction format is. Studies by Perry et al. (2000) and Quan (1994) further support this view based on theoretical and empirical analysis.

However, Vickrey’s prediction rests on his assumptions of the behaviour of bidders, and thus may be less applicable in reality. Milgrom and Weber (1982) found that bids under English auctions generally yield higher revenues than sealed-bid (second or first price) auctions. Lusht (1996) further pointed out that English auctions maximise revenues with risk-neutral bidders and affiliated valuations, while sealed-bid auctions maximise revenues with risk-averse bidders and independent valuations. Several empirical studies focused on comparing the performance of auctions to private negotiations (Allen and Swisher, 2000; Dotzour et al., 1998; Lusht, 1996; Mayer, 1995, 1998).

In Beijing, listing auctions and tender auctions do not fit the convention of auction formats. Tender auctions take form as sealed-bid auctions, in which the successful bidder is selected by a bid evaluation committee. Therefore, the bidder that offers the highest bidding price may not always win the auction. In this sense, tender does not follow the principle of maximising market value – it instead goes with the idea of maximising the government’s macroeconomic objectives.

Therefore, a comparison between listing auction prices and tender auction prices is not only a theoretically interesting gap, but is also critical for understanding interventions of the Chinese government in the land market. In September 2003, the central government of China clarified that land policy, along with fiscal and monetary policies, is applied as a major part of national macro-control measures to curb the persistently rising housing prices. Tender auctions would thus take the price that is lower than the maximum market price for the sake of lowering housing prices. Moreover, tender auctions might also be used as a social adjusting measure to encourage affordable housing supply. In 2010, the Ministry of Housing and Urban Rural Development (MOHURD) urged local governments at all levels to strictly implement preferential policies on land provision, tax reduction, and credit support for public rental housing. For these efforts, the government would subsidise housing targeted at low-to-medium households by means of leasing lands below their market prices in order to provide citizens better social benefits. Land policy would also play an important role in urban development as we will discuss in the section on the effects of government behaviour on urban spatial structure.

However, the specific mechanisms of two action types, specifically the use of reserve prices, the processes of bidding and the requirement of a minimum number of bidders, could narrow down the price gap between the two auction formats. Furthermore, other political considerations, such as corruption (Cai et al., 2009), may lead to price differences in the opposite direction. Government fiscal objectives, as we pointed above, could also lead to a higher tendering price. Taking these factors into account, this study will test the differences of land leasing prices between listing and tender auctions in Beijing.

**Effects of government behaviour on urban spatial structure**

Suburbanisation and urban sprawl have altered the form of the classical monocentric city and given rise to new polycentric urban forms (Garreau, 1992; Giuliano,
1991; Heikkila et al., 1989; Richardson et al., 1990). The Beijing Master Plan (2004–2020) proposed at the end of 2004 clarified that the city will be restructured as ‘two urban axes, two development corridors, with a polycentric urban structure’. This development direction was chosen because of the fast growth of population and the need for balancing economic, environmental and social equity objectives.

The role of the government in facilitating the development of polycentric urban regions has been supported by two different views: the natural evolution and the social and fiscal manipulation. The evolutionary view is derived from urban economic theory and concerns transportation costs, rising actual incomes and the heterogeneity of housing stock (Mieszkowski and Mills, 1993). In this context, governments could accommodate the evolution of a city and stimulate outer-city development by, for example, subsidising this development. The second view emphasises the importance of social and fiscal problems that central cities often face. In this case, an effective government policy should concern the redistribution of welfare and social equity (Archer and Smith, 1994; Mieszkowski and Mills, 1993). These two theories are interrelated, thus it is empirically difficult to identify the dominant view in polycentric city formation (Mieszkowski and Mills, 1993). Nonetheless, one cannot underplay the role of government intervention in shaping urban patterns and urban development, as the allocation of urban land largely defines the commercial and social characters of the city.

These general theoretical discussions are the base of the second empirical test in this study. We will study the distribution of listing auctions and tender auctions in Beijing’s urban area by examining parcel locations. This will help to clarify whether the land leasing policy in Beijing contributes to achieving the target of polycentric urban development, and how it does so. We expect that local governments may subsidise development in less-developed regions via the price differential between listing auctions and tender auctions. Alternatively, they may facilitate the development of those areas by optimising the choice of developers.

The choice of policy depends on our first test, where we analyse the price gap between listing auctions and tender auctions. If prices in tender auctions are significantly lower than those in listing auctions, local governments may choose tendering to lease land in emerging or less-developed locations in order to attract developers. In Beijing, this would indicate that parcels further away from the city centre or located in suburban regions which are designed to develop as the central government’s ‘polycentric urban structure’ will be more likely to be leased through tendering at subsidised prices. Moreover, government intervention through tender auction may have to choose between using the land to build residential or commercial buildings by subsiding in lower densities. The result from government intervention may be totally different from the free private market which would engender more high density commercial buildings and less low-price housing.

On the other hand, if there are no significant leasing price discrepancies between listing auctions and tender auctions, local governments may still use tendering, but for a different objective: to facilitate polycentric city development by choosing ‘qualified’ developers based on their judgements. Both cases suggest a potential correlation between the possibility of tender auctions and parcels located on the outskirts of a city, which would indicate that the format of land leasing contributes to the development of Beijing’s urban structure.
Methodology and data

Methodology

The empirical portion of this study attempts to test the issues discussed above. Our analysis will use hedonic and probit models.

Given the nature of listing and tender auctions described above, we cannot directly apply the hedonic model to estimate the value of parcels with varying attributions under tender auction, as it is not determined by market equilibrium. However, we can estimate the hedonic model for listing auctions separately, when the price tends to reflect market price. We then obtain implicit market prices of attributes estimated from the hedonic price, and then use them to estimate the ‘listing price’ of parcels that have been leased by tender auctions. Comparing actual tender prices with the estimated prices, we can obtain the price gap between listing and tender auctions for the same land parcels, which avoids the influence of land heterogeneity.

The hedonic pricing model is used to estimate how much the price of land differs across tender and listing auctions by considering the value of a bundle of land attributes in the model. It thus takes heterogeneity in land parcels into account. Hedonic models have been developed recently as a major analytical tool for the examination of land price behaviour (e.g. Banerjee et al., 2004; Calhoun, 2003; Haughwout et al., 2008; Hidano and Yamamura, 2004). It is based on the assumption of completed competition market, where all the buyers and sellers have information on price and all buyers have homogeneous utility functions. It assumes that a housing unit is a combination of characteristics and the difference in attributes of units is continuous. Moreover, the hedonic model is deduced on the market equilibrium, where housing price is determined by the level at which the supplier would like to offer and buyers would like to purchase.

Although these assumptions could limit the application of the hedonic model to a certain extent, it has long been a mature and standard method in addressing a number of issues in housing valuation (Malpezzi, 2008; Sirmons et al., 2005).

Factors that influence land prices can be summarised as the parcel’s structure attributes (S), location attributes (L) and neighbourhood attributes (N). Hedonic pricing models are typically employed to construct a land price determinant model (Bao and Zhou, 2007; Dale-Johnson et al., 2005), and it can be specified as:

\[ \ln LPRICE_i = X_{1i}B_1 + \epsilon_{1i} \]

where \( \ln LPRICE \) is the logarithm of the land price, \( B_1 \) are estimated coefficients for the respective characteristics of the site \( X_{1i} \), and \( \epsilon_{1i} \) is the residual term. \( E(\epsilon_{1i}) = 0 \) with standard deviation of \( \sigma_1 \). The choice of the characteristics or variables is guided by three rules: (1) our theoretical knowledge of factors that influence land prices; (2) the availability of data; and (3) the need to avoid collinearity among the variables. The choice of function form follows two main standards: the model’s goodness-of-fit and the economic implications of the estimated equation.

The challenge inherent in the use of a hedonic approach is the proper identification of function form and the selection of design matrix in a way that will minimise the problem of missing variables. However, in our case, the objective of applying the hedonic model is not to identify the specific prices of explanatory variables. Instead, we want to estimate the value of a parcel with certain attributes. Therefore, coefficient bias that might be caused by mis-specifying the function form or by omitting causal variables is not a serious problem (Malpezzi, 2008). Our purposes would be fulfilled as long as we include the most important causal variables and the model presents a good fit.
While coefficient bias may not be a significant issue, selection bias may have greater implications in our study. This is because listing auctions are not randomly selected from the total number of listing and tender auctions. We thus use a two-stage Heckman procedure (Heckman, 1979) to control for selectivity and simultaneity bias (Duca and Whitesell, 1995; Haurin and Hendershott, 1991; Jud and Seaks, 1994). We incorporate an inverse Mills ratio (lambda) into equation (1):

\[ \text{Lambda}_i = \frac{\phi(-X_{2i}B_2/\sigma_2)}{\Phi(X_{2i}B_2/\sigma_2)} \]  

(2)

where \( \phi \) demonstrates the normal density function and the equation is determined as follows:

probit function \( \text{listing}_i^* = X_{2i}B_2 + \varepsilon_{2i} \)  

(3)

where \( E(\varepsilon_{2i}) = 0 \) with standard deviation of \( \sigma_2 \). \( \varepsilon_{1i}, \varepsilon_{2i} \) are positively correlated. \( X_{2i} \) should include at least one different variable as in \( X_{1i} \), and \( P(\text{listing}_i = 1) = P(\text{listing}_i^* \geq 0) = P(\varepsilon_{2i} \geq -X_{1i}B_2) \). Otherwise, \( \text{listing}_i = 0 \), \( \text{listing}_i^* \leq 0 \), \( \text{listing}_i \) is dummy variable to determine if land is granted by listing auction.

Mills’ ratio (lambda) is estimated from the probit model with full sample. It is a monotone decreasing function of the probability that listing auction is selected into the sample. By incorporating it as an additional variable into the hedonic model with only the sample of listing auction, the bias raised by omitting variables which represent the impact of auction selection on land prices can thus be corrected.

Estimating probit model is an adjusted function in the hedonic model, but it also allows us to demonstrate the choices available to the local government. If the coefficient of \( \lambda_i \) in the adjusted hedonic model is significant, it means that selection biases exist, and they have been corrected in the adjusted model by means of the Heckman two-stage method; if not, it means that there are hardly any selection biases, so it will be fine to run the original hedonic model without ‘lambda’.

Finally in the paper, we calculate \( \delta \), the deviation of tender price (\( LPRICE \)) from the price estimated by the adjusted hedonic model (\( LPRICE_F \)). It is defined as:

\[ \delta = \frac{LPRICE - LPRICE_F}{LPRICE_F} \]  

(4)

Thus, \( \delta < 0 \) if the tender price is lower than the estimated price, and \( \delta > 0 \) if the estimated price is lower than the tender price. With variable \( \delta \) we can test where and who benefits from the subsidised land policy by means of another probit model.

Data

The dataset used in this paper includes all 691 land parcels granted in Beijing from 2006 to 2012. The data are obtained from Beijing Land Resources Authority which contains all the parcels granted in Beijing during the study period. All detailed information concerning the land parcel’s location, physical attributes as well as its selling price and leasing data are all included in the database. For each parcel, we identify the winning bidder’s characteristics, such as state-owned enterprise (SOE) or non-SOE, from the Beijing Real Estate Authority database.

The parcels in our database were leased either through tender or listing auctions. According to preliminary statistics, over 2006 to 2012, 444 sites were sold by listing auctions and 247 by tender auctions. Among them, 53.11% are granted for residential use, 46.89% are for commercial or office use. As for the spatial distribution, 41.97% of the parcels were located at the south of Beijing centre (Tian An Men), while 27.35%,
17.08% and 13.60% of parcels leased were located at the south, east and west of Tian An Men, separately. More details of descriptive statistics are shown in Table 1. Land which is subsidised higher for affordable housing development is excluded from the paper.

**Empirical results**

*Estimation of Heckman adjusted hedonic model*

As discussed in the methodology section, we first only estimate a Heckman adjusted hedonic pricing model for listing auctions. Ten variables are included in the model, for example: (1) the parcels’ structural attributes, including parcel size (LOTSIZE), planned purpose (USE) and floor area ratio (FAR) (LOTSIZE reflects the land assembly or subdivision effect (Colwell and Munneke, 1999; Colwell and Sirmans, 1978; Thorsnes and McMillen, 1998)); (2) the parcels’ locational attributes, including distance to the city centre (D_TAM). This reflects the land price gradient (Asabere and Huffman, 1992; DeBoer et al., 1992). It is the most important variable in determining the land price. The distance to the nearest subway station in urban areas is (D_SUBWAY). Although other neighbourhood variables are not included in this study, Beijing’s urban spatial structure shows that location and neighbourhood are highly correlated. We exclude several variables related to the real estate market from the equation to avoid collinearity. In addition, we employ a dummy term (YEAR) to capture the time fixed effect. In constructing the probit model for the purposes of the Heckman adjustment, we also specify the location of the parcel by introducing northern, western and eastern regions.

The definitions of the variables and descriptive statistics are presented in Table 1. As can be seen from Table 1, the average tender price in our sample is 29,273 RMB per sqm, which is higher than the average listing price of 9726 RMB per sqm. 35.75% of the parcels leased through tender auctions are for residential use, compared to 64.25% for listing auctions. However, the land heterogeneous attributes are not taken into consideration in such comparison.

We firstly present the probit Heckman adjustment model (shown in Table 2), before presenting the results of the adjusted hedonic model (shown in Table 3). We use a 0.05 significance level as the criteria in this study. In the probit model, the dependent variable *Listing* is a binary variable. The negative coefficients of $USE = 1$ is consistent with our expectations. Parcels meant for residential use are more likely to be leased through tender auctions. In 2010, 2011, 2012, tender auction is likely to be chosen by the government as an instrument to lower the increasing price.

From the Heckman adjusted model (Table 2), we obtain $\Lambda$ estimated by Equation (2), and incorporate it into the hedonic model (Table 3). As the result in Table 3, $D_TAM$ and Ln$D_SUBWAY$ are both significant, and have the expected signs. The significance of FAR indicates a price effect that can be attributed to binding regulatory constraints on property development. USE also has significant effects on land price. Our results indicate that location is the most important contributor to price.

*Price differences between the two auction formats and their effects*

Based on the hedonic model (see Table 3), we can obtain implicit prices for each parcel’s attribute in the market. By applying these implicit attribute prices to those parcels granted by tender, we can value the ‘listing price’ of parcels that have been leased by tender auctions ($LPRICE_F$). More specifically, we estimated the market prices for
Table 1. Summary statistics of the variables in the empirical study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Tender sample (Obs: 247)</th>
<th>Listing sample (Obs: 444)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>StdDev</td>
</tr>
<tr>
<td><strong>LRICEF</strong></td>
<td>Land price per lot area (yuan/m²)</td>
<td>29273</td>
<td>76220</td>
</tr>
<tr>
<td><strong>LOTSIZE</strong></td>
<td>Total lot area (m²)</td>
<td>116550</td>
<td>119203</td>
</tr>
<tr>
<td><strong>FAR</strong></td>
<td>Planning floor area ratio for the parcel, it is measured as the ratio between the total covered area on all floors of all buildings on a certain plot and the area of the plot</td>
<td>3.04</td>
<td>3.69</td>
</tr>
<tr>
<td><strong>USE</strong></td>
<td>= 1 if land is granted for residential use; = 0 if granted for commercial or office use</td>
<td>0.58</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>NORTH</strong></td>
<td>= 1 if land is located in the north of Beijing</td>
<td>0.21</td>
<td>0.41</td>
</tr>
<tr>
<td><strong>SOUTH</strong></td>
<td>= 1 if land is located in the south of Beijing</td>
<td>0.47</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>WEST</strong></td>
<td>= 1 if land is located in the west of Beijing</td>
<td>0.15</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>EAST</strong></td>
<td>= 1 if land is located in the east of Beijing</td>
<td>0.17</td>
<td>0.38</td>
</tr>
<tr>
<td><strong>D_TAM</strong></td>
<td>The distance to the city centre of Beijing (km)</td>
<td>23.74</td>
<td>17.17</td>
</tr>
<tr>
<td><strong>D_SUBWAY</strong></td>
<td>The distance to the nearest subway station (km)</td>
<td>1579.74</td>
<td>7742.08</td>
</tr>
<tr>
<td><strong>New Town</strong></td>
<td>= 1 if land locates to the south side of Chang An Avenue, which is supported by the Beijing government according to the master plan; = 0 if land locates to the north of Chang An Avenue</td>
<td>0.70</td>
<td>0.46</td>
</tr>
<tr>
<td><strong>New Town_USE</strong></td>
<td>= 1 if land is granted for residential use and located in New Town</td>
<td>0.36</td>
<td>0.48</td>
</tr>
<tr>
<td><strong>SOE</strong></td>
<td>= 1 if the winning bidder is a state-owned enterprise; = 0 otherwise</td>
<td>0.47</td>
<td>0.50</td>
</tr>
</tbody>
</table>

*Note: All the variables except the SOE are directly obtained from the Beijing Land Resources Authority from 2006 to 2012. Information on SOE is from the Beijing Real Estate Authority database.*
those 247 parcels – which are actually granted by tender auctions – as if they were granted by listing auction given the market value of attributes obtained from the hedonic model (see Table 3). The deviation of a parcel’s actual tender price from its estimated ‘listing price’, \( \delta \), thus reflects the price difference between two auction formats based on the homogeneous land parcels. Among 247 tender parcels, 221 parcels give out \( \delta < 0 \) while 26 parcels give out \( \delta > 0 \). The mean value of \( \delta \) is –0.101 and median value is –0.093, which indicates that prices in tender auctions involving government interventions are on average lower than those in listing auctions. Few lands in tender auction exceed the price of its estimated ‘listing price’.

It is evidenced that land granted price grew rapidly paralleling the soaring housing price since 2006 (Lichtenberg and Ding, 2009; Peng and Thibodeau, 2012). The land grants fees accounted for an estimated 27% of local government revenue nationally (Ping, 2006) and are even higher in some regions (Liu, 2005). These phenomena raise wide discussion on government behaviour of land leasing to maximise revenue from land transactions and to use the profits to finance public service and infrastructure investment (Ding, 2007; Lin, 2007; Peterson, 2006).

However, our results suggest that the government of Beijing has significantly subsidised land leasing by means of tender auction – surrendering certain profits that they would have obtained by means of listing auction – which is regarded as a purer market transaction behaviour. Therefore, not only being a financial source, land auction has also been used as an economic measure in local government’s policy.

In order to further understand the government’s subsidising behaviour, we examine how these differences in price are reflected in the urban spatial structure and whether land policy is integrated into housing policy.

Table 2. Probit regression results of the Heckman adjusted function (dependent variable: listing = 1).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>Z-stat</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnLOTSIZE</td>
<td>–0.392</td>
<td>0.058</td>
<td>–6.81</td>
<td>0.000</td>
</tr>
<tr>
<td>D_TAM</td>
<td>–0.001</td>
<td>0.004</td>
<td>–0.37</td>
<td>0.714</td>
</tr>
<tr>
<td>FAR</td>
<td>–0.458</td>
<td>0.059</td>
<td>–7.78</td>
<td>0.000</td>
</tr>
<tr>
<td>USE = 1</td>
<td>–0.363</td>
<td>0.121</td>
<td>–3.01</td>
<td>0.003</td>
</tr>
<tr>
<td>NORTH = 1</td>
<td>–0.022</td>
<td>0.174</td>
<td>–0.12</td>
<td>0.901</td>
</tr>
<tr>
<td>WEST = 1</td>
<td>–0.253</td>
<td>0.187</td>
<td>–1.35</td>
<td>0.176</td>
</tr>
<tr>
<td>EAST = 1</td>
<td>–0.036</td>
<td>0.184</td>
<td>–0.19</td>
<td>0.846</td>
</tr>
<tr>
<td>YEAR = 2007</td>
<td>–0.327</td>
<td>0.208</td>
<td>–1.57</td>
<td>0.117</td>
</tr>
<tr>
<td>YEAR = 2008</td>
<td>0.011</td>
<td>0.222</td>
<td>0.05</td>
<td>0.960</td>
</tr>
<tr>
<td>YEAR = 2009</td>
<td>0.946</td>
<td>0.220</td>
<td>4.29</td>
<td>0.000</td>
</tr>
<tr>
<td>YEAR = 2010</td>
<td>–0.459</td>
<td>0.222</td>
<td>–2.06</td>
<td>0.039</td>
</tr>
<tr>
<td>YEAR = 2011</td>
<td>0.433</td>
<td>0.208</td>
<td>2.08</td>
<td>0.038</td>
</tr>
<tr>
<td>YEAR = 2012</td>
<td>0.505</td>
<td>0.235</td>
<td>2.15</td>
<td>0.032</td>
</tr>
<tr>
<td>Constant</td>
<td>5.817</td>
<td>0.712</td>
<td>8.17</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Obs. 691
Wald chi2 (12) 498.34
Prob > chi2 0.000

Note: Definition of values can be found in Table 1. A total of 691 samples are used for the regression. Probit regression function 

\[
\text{listing}^* = X_2 \beta_2 + \epsilon_2 \text{ where } P(\text{listing} = 1) = P(\text{listing}^* \geq 0) = P(\epsilon_2 \geq -X_2 \beta_2).
\]

According to the Heckman adjustment process, we calculate \( \Lambda = \frac{\phi(-X_2 \beta_2 / \sigma_2)}{\Phi(-X_2 \beta_2 / \sigma_2)} \) from the Heckman adjustment function shown in Table 3.
For this purpose, we employ another probit model described above to examine the conditions under which tender prices are more likely to be lower than the listing price, which would indicate that the local government has decided to surrender any potential profit. A total of 247 samples of tender auction are used in the building model and the dependent variable is a binary variable which equals 1 if $d < 0$ and 0 otherwise, while $d$ is the price’s differences between tender auction and listing auction defined in equation 4.

The important variable in the probit model is $D_{TAM}$. $D_{TAM}$ describes the distance of the parcels from the city centre, which can be regarded as a proxy for the maturity of urban developments in Beijing. If tender auctions contribute to urban development by lowering prices, we would expect that the coefficient of $D_{TAM}$ would be positive. The empirical results are demonstrated in Table 4. Consistent with our expectations, the logarithmic form of $D_{TAM}$, $lnD_{TAM}$, has a significant positive coefficient, which reveals the government’s incentive to encourage suburban development by surrendering part of the potential profits from land leasing. This suggests, as we pointed out, that suburban development in Beijing has been influenced by government intervention. In those areas that are not attractive for firms and households because public amenities are not well developed, it is clear that local government plays an active role in urban design as well as in financial supporting.

It is still a correspondingly new policy to support affordable housing construction in China, and we can hardly examine the impact of land subsidising through tender auction on affordable housing development. But we can generally examine whether the lower land granting price by government intervention contributes to any supporting residences’ development. The results in Table 4 indicate that land prices subsidisation ($New Town\_USE$) is significant for the residences’ development in the region that government focusing developed in their master plan, particularly in the southern part. With this effort, the government tends to stabilise housing price by choosing the leasing types of parcels to achieve low-price housing in order to promote harmonious

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>Z-stat</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>6.611</td>
<td>0.729</td>
<td>9.06</td>
<td>0.000</td>
</tr>
<tr>
<td>$D_{TAM}$</td>
<td>–0.022</td>
<td>0.003</td>
<td>–8.24</td>
<td>0.000</td>
</tr>
<tr>
<td>$lnD_{SUBWAY}$</td>
<td>–0.135</td>
<td>0.033</td>
<td>–4.02</td>
<td>0.000</td>
</tr>
<tr>
<td>$lnLOTSIZE$</td>
<td>0.110</td>
<td>0.070</td>
<td>1.56</td>
<td>0.118</td>
</tr>
<tr>
<td>$FAR$</td>
<td>0.695</td>
<td>0.087</td>
<td>8.02</td>
<td>0.000</td>
</tr>
<tr>
<td>$USE = 1$</td>
<td>0.513</td>
<td>0.089</td>
<td>5.79</td>
<td>0.000</td>
</tr>
<tr>
<td>YEAR = 2007</td>
<td>0.750</td>
<td>0.139</td>
<td>5.41</td>
<td>0.000</td>
</tr>
<tr>
<td>YEAR = 2008</td>
<td>0.514</td>
<td>0.126</td>
<td>4.07</td>
<td>0.000</td>
</tr>
<tr>
<td>YEAR = 2009</td>
<td>0.381</td>
<td>0.186</td>
<td>2.05</td>
<td>0.041</td>
</tr>
<tr>
<td>YEAR = 2010</td>
<td>1.360</td>
<td>0.138</td>
<td>9.83</td>
<td>0.000</td>
</tr>
<tr>
<td>YEAR = 2011</td>
<td>1.062</td>
<td>0.237</td>
<td>4.48</td>
<td>0.000</td>
</tr>
<tr>
<td>YEAR = 2012</td>
<td>1.179</td>
<td>0.251</td>
<td>4.7</td>
<td>0.000</td>
</tr>
<tr>
<td>$Lambda$</td>
<td>–0.952</td>
<td>0.386</td>
<td>–2.47</td>
<td>0.014</td>
</tr>
<tr>
<td>Obs.</td>
<td>444</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: A total sample of 444 listing auctions is used in the regression. Description of variables can be found in Table 1. $Lambda$ is obtained from the above probit regression (Table 2).
and stable development of the city. Land policy in Beijing has been integrated in the housing price for prompting housing construction at affordable level. In addition, government land policy impacts the choices between commercial and residential building and hence leads to lower density residential building with low-price housing.

Conclusion

Land reform has been one of the most significant market-oriented economic reforms in China. It has been successful in introducing market-based incentives and changing social and economic structures. In this paper, we studied the land market in Beijing in terms of two different transaction formats: listing auctions (a highest bidder win auction mechanism) and tender auctions (where governments choose the winner potentially by using a non-price mechanism), and investigate the behaviour of local government in the land market. We found that land policy in Beijing has significantly influenced the performance of the land market and the evolution of its urban spatial structure. Based on a total of 691 land parcels granted to developers in Beijing from 2006 to 2012, we used a Heckman adjusted hedonic model to estimate implicit prices of parcels’ attributes and estimated the ‘listing price’ of parcels that have been leased by tender auction. This method allows us to avoid the quality heterogeneity of parcels and to compare the prices’ deviation between listing and tender auctions for the same granting land. By comparing their differences, we found that the average level of the parcel’s actual tender prices from its estimated ‘listing prices’ is negative at the level of -0.10, which suggests that on average, prices in tender auctions are lower than those in listing auctions in Beijing’s land market.

The price difference between two auction formats may be due to the political motivations of local government and the price mechanism itself. However, it is difficult to provide a firm conclusion as to the determinants of a local government’s choice of land leasing format and on the effectiveness of government intervention. Nevertheless, this

| Table 4. Probit model of price difference. |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| Independent variable | Coefficient | Std. error | Z-stat | Prob. |
| Constant | -6.037 | 3.016 | -2.00 | 0.045 |
| lnD_tam | 0.706 | 0.290 | 2.43 | 0.015 |
| SOE | -0.244 | 0.242 | -1.01 | 0.312 |
| USE | -0.006 | 0.441 | -0.01 | 0.989 |
| FAR | 0.441 | 0.114 | 3.86 | 0.000 |
| New Town | -0.208 | 0.508 | -0.41 | 0.682 |
| New Town_USE | 1.116 | 0.570 | 1.96 | 0.050 |
| D_SUBWAY | 0.000 | 0.000 | -1.89 | 0.058 |
| YEAR = 2006 | -0.862 | 0.528 | -1.63 | 0.103 |
| YEAR = 2007 | -0.088 | 0.514 | -0.17 | 0.865 |
| YEAR = 2008 | 0.192 | 0.650 | 0.30 | 0.767 |
| YEAR = 2010 | -0.308 | 0.578 | -0.53 | 0.594 |
| YEAR = 2011 | 3.617 | 2.061 | 1.75 | 0.079 |
| YEAR = 2012 | 3.647 | 2.061 | 1.86 | 0.062 |

Log-likelihood | -56.513
| McFadden R-squared | 0.320
| Obs. | 247

Note: The dependent variable is a binary variable which equals 1 if \( \delta < 0 \) and equals 0 otherwise.
paper suggests a new perspective and method to understand government intervention through analysing the behaviour of the government in choosing land auction formats and determining the related land price subsidising.

In previous studies, financial maximisation has been regarded as the major incentive for government intervention based on the fiscal decentralisation system. It is suggested that leasing lands is a major public finance source of government under rapid urbanisation. However, findings from our study indicate that land policy that aims to provide low-price residences and to stabilise land prices has been integrated with urban development in terms of spatial pattern as well as density pattern. Land leasing in Beijing is not only a land policy but also a part of the strategy framework of local development considering both economic and social aspects.

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**Notes**

1. Land in the countryside is under collective ownership in China.
2. Cai et al. (2009) state that about 97% of land sales in major cities are carried out through listing auctions and oral auctions, except in Beijing and Shanghai. Instead, almost all land parcels are sold in Beijing through tender auctions and listing auctions.
3. On 31 March 2004, the Ministry of Land and Resources and the Ministry of Supervision jointly issued the ‘on the continuation of business land use rights for transferring auction listing of law enforcement work notice’ (MLR[2004] No. 71). The third type of auction (paimai) has not appeared in Beijing.
4. The opening price is essentially the reserve price and is announced before the bidding.
5. However, a higher offering price will be given a higher score in a certain range.
6. Chinese fiscal reform during the 1980s changed from a unitary system, in which the central government had absolute control over revenue collection, to a relatively decentralised system, in which revenues are shared by the central and local government.
7. In our sample, out of the total number of land parcels leased by tender auctions, 53% of them were leased to the bidders who offered the highest prices.
8. It intends to disperse the concentration of economic activities in urban districts and to guide suburban development. After 2010, the southern regions’ development is encouraged by the government.
9. Selection bias may also occur because our sample contains only successful property auctions. However, we believe this issue will not affect our results significantly because there were very few unsuccessful auctions during our study period.
10. As mentioned above, 98.6% of total sold parcels were still granted through negotiation before 2005. In 2005, when land reform initiated, only 1 out of 47 lands were granted through tendering. Therefore, data before 2005 are not included in our study.
11. Several function forms have been tested. We present the results of the model with the best goodness-of-fit and with better economic implications.

**References**


