

# Game Analysis and Strategy Optimization between the Government and Developers in the Land Bidding, Auction, and Listing System

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**Abstract:** The bid-auction-listing system is the primary transfer mode of land usage right in China. This is a landmark in the development of land transfer, improving land utilization efficiency. However, in its practical operation, there are still some drawbacks to be resolved, such as collusion and leading sky-high land price, which severely undermines land market fairness and national asset. A reasonable land transfer system to protect the fair supply of urban land and promote land-use efficiency relates to the development of the urbanization process in China and the improvement of people's living standards. Therefore, how to manage the bid-auction-listing system in a scientific way has become an issue for the whole society. This paper summarizes the historical developing process of the land transfer modes and lists the basic modes of land transfer, utilize mathematical methods, game theory, auction theory, and research literature to analyze the optimal strategies of enterprises under different bidding rules, thus helping to discuss the game between the government and real estate developers under the bid-auction-listing system, and finally put forward suggestions to optimize the bid-auction-listing system.

## 1. Introduction

### 1.1 Research background and Motivation

In China, land resources belong to the state. The transfer method has developed from disorder-free assignment and paid agreement to a transparent bid-auction-listing system. In the past, land resources had low value, and most rights of using lands were transferred from governments to enterprises or individuals through land grant agreements or free assignment. In this case, the phenomenon of rent-seeking is widespread, making governments lose a great deal of grant fees and the real estate industry unfair as a whole. After a set of policies to stipulate the ownership of land use, now China constitutes of mature transfer methods of land use rights, including invitations for bids, auctions, and listing.

Regarding land resources as commodities, resolve the contradiction between the scarcity of land resources and increasing urban development needs to a certain extent, excavate the land value, and optimize configuration and efficient utilization. However, during late several years, the institutes gradually reveal some drawbacks. The bid-auction-listing system reinforces the price factor, and the rule that who bids more can win leads to sky-high land prices which exceed the factual value and still keep the upward trend, especially in residential and commercial land. This facilitates soaring the price of commercial, residential housing. The current transfer system becomes the culprit of increasing housing prices and office rent, causing a majority of citizens to fail to afford the housing price and increasing the operating pressure of enterprises. In the face of the embarrassing state, many governments of core cities have constantly issued a set of controlling measures since 2010 [1]. Governments insist on the transfer system but take some innovative adjustments to reform and accomplish management functions stabilizing the land market.

In reality, its operation lacks an efficient, sufficiently fair business environment and supervision regulation, violating the original intention of governments and producing some negative effects. Governments should analyze different optimal strategies from enterprises' perspectives under specific transfer methods, helping to understand the whole game process, discover the drawbacks and then

suit the remedy to the case. The transfer institution of land usage rights is the root of real estate and is closely related to housing price, public facilities, commercial buildings, and social happiness. A perfect transfer institution of land usage rights can benefit from forming a fair land market, supporting healthy competition, embodying the true value of land resources, and stabilizing housing prices. This paper analyzes and evaluates the existing bid-auction-listing system in many ways and gives some suggestions for reforming the system. I hope that this paper can contribute to being referred by governments and developing a healthier land market.

## **1.2 Literature Review**

Research on the development of land transfer mechanisms. In the early stage, the agreement is the main method to transfer the rights of land usage. Dai Weiping and Guhaiying (2004) pointed out that the market-oriented bid-auction-listing mechanism is more efficient and suitable. That agreement lacks competition, easily causing rent-seeking and lower prices than factual valuation. Yao Ming (2017) and Wu Di (2018) teased out three periods: formation stage, development stage, and improvement stage. The works also illustrated various types of land transfer mechanisms. Meanwhile, Yao Ming (2017) interpreted and analyzed the ‘average bidding system.’

Research on the advantage and disadvantages of different land transfer systems. Duan Yi (2011) suggested that the existing problems in the design of the bid-auction-listing system from many ways and the system causes increasing housing prices. Li Zhiqiang and Wu Shiman (2011) referred that this system pushes up housing prices, causing social contradictions, and some state governments rely on transfer fees excessively; Li Xianghui (2011) used game theory and public choice theory to illustrate the conflicts among players and the reasons of rent-seeking and weak supervision. Du Zhuanping and Yin Aifei (2018) suggested that supply and demand of land resources lose balance; some governments blindly transfer land or drive up the land price, making market disorder.

Research on optimized strategies of bid-auction-listing system. Zhang Huiming and Zhang Xiaoen (2014) suggested transforming advanced auctions into Dutch auctions. Li Haiyan (2011) suggested classifying the lands between normal residential housings and the lands of upscale residential housings, adopting different modes of bid-auction-listing, and exploring pre-application mode. Duan Yi (2011) suggested altering the rules that those who bid higher can win to the rules that suited companies can win and reinforce follow-up managements. Zhang Binbin (2010) and Wei Yiwen (2006) mainly used game theory and a great deal of mathematical functions to analyze Dutch auction, and first-priced sealed auction can effectively prevent collusion between companies. Sun Wei (2021) reported that several cities formulate regulations to prevent shell companies from being used in the ‘average bidding system’ in order to keep the market fair.

Previous literature illustrates the development of the land transfer systems, analyzes the progress and stubborn drawbacks under different land transfer systems, and proposes suggestions to reform. However, the detailed explanations about the ‘average bidding system,’ specific land transfer modes, and the particular suggestions targeted to the illegal behaviors of governments and enterprises remain poor.

## **1.3 Research Contents and Framework**

Part one introduces the research background and motivation, literature review, and the main research contents. Part two introduces the policy development and evaluation of the land usage right, illustrating the land transfer systems under different periods.. Part three explains the main theory about this topic, helping readers to understand. Part four accurately analyzes the optimal strategies of enterprises under the bid-auction-listing system and discusses the game in the process, helping governments to optimize the system. Part five concludes the existing problems of the bid-auction-listing system. Part six proposes some suggestions. Part seven concludes the whole paper and proposes the prospect.

## **2. Basic components of the bid-auction-listing system**

## **2.1 Invitation for bids**

Invitation for bids refers to that governments announce notice of invitation for bids, invite eligible natural persons, corporate representatives, and other organizations to participate in the bidding, and confirm the winner according to bidding result. Governments redact tender documents, generally including the company backgrounds, company experience, capital, design scheme, bidding price, and so on. The bidder who can meet the comprehensive evaluation standards stipulated in the tender documents to the maximum extent or meet the substantive requirements of the tender documents with the highest price shall be determined as the winning bidder [2].

In general, an invitation for bids is mainly applied to a minimal range of commercial or industrial buildings that are not profit-oriented and have specific public welfare requirements, and have high qualification requirements for applicants, or only a few companies apply for [1]. In this case, bidders can evaluate land conditions according to the planning index described in announcements and rationally determine bid schemes. Compared with auctions, invitations for bids have fewer interference factors such as live atmosphere and psychological factors so that bidders have more time to make decisions and avoid bidding blindly to an extent. However, because qualification requirements and contents of tender documents are formulated by a single subject--government, it is possible that some officials do some corrupt behaviors such as rent-seeking and 'cutting the dress according to one's figure.'

## **2.2 Auction**

Land auction refers to governments issuing announcements of the land auction and requiring participants to bid in certain timing and place transparently, and finally, confirm the winner according to bidding results [2].

Auctions comply with the rule that those who bid higher can generally win (there is an exception described below), suitable for the commercial or residential lands with the main purpose of obtaining the highest transfer fee, especially those in central positions or those for upscale buildings. Limitations of bidders are much less than the invitation of bids, and almost all the subjects who can bear the cost can participate. The competition of land auctions is fierce, fair, and transparent, improving on-site engagements and the efficiency of land usage. However, influenced by the hot atmosphere and psychological factors, bidders easily cannot judge rationally and therefore bid blindly or make hostile bids, causing land prices far more than factual and winner curse. It is possible that the winner is hard to bear the sky-high price so that the company cannot accomplish the exploitation in time, construct violating initial scheme involving using cheap materials, or break the contract, making wasting of resources and losing deposits., Sky-price land price also leads to high housing prices, and citizens bear the costs eventually[3].

## **2.3 listing**

Listing refers to governments issuing listing announcements in certain trading venues (generally online) for a period of time. Bidders can bid several times in a legal period, and governments confirm the winner according to the bidding result [2]. Actually, it is an English online auction.

Listings also comply with the rule that those who bid higher can generally win (there is an exception described below), suitable for a majority of lands. Bidders can bid several times in certain periods and have more time to make decisions rationally. This method is transparent and fair relatively and effectively reduces the behavior of blindly bidding to an extent, but the nature of the mechanism also easily causes land prices to be too high. Lack of strict supervision leads to many harmful behaviors such as collusion between enterprises and enterprises or governments and enterprises, which makes the market unfair [4].

## **3. Theory**

### **3.1 Game Theory**

Game theory is concerned with the general analysis of strategic interaction. It is a theoretical framework to conceive social situations among competing players and produce optimal decision-making of independent and competing actors in a strategic setting. Nash Equilibrium is a vital conception in game theory. A pair of strategies is a Nash Equilibrium if A's choice is optimal, given B's choice, and B's choice is optimal given A's choice [5].

### **3.2 Auction Theory**

#### **1) English auction**

The auctioneer starts with a reserve price, which is the lowest price at which the seller of the goodwill part with it. Bidders offer higher prices; generally, each bid must exceed the previous bid by some minimal bid increment. When no participant is willing to increase the bid further, the item is awarded to the highest bidder. If the reserve price is not met or no buyer places an economically fair bid, the seller can take the item off the market [5].

For an English online auction, it must confirm starting and ending timing. Because the duration time is so long that many bidders tend to not bid until the last few minutes or seconds and try to make another have no time to fight back. One of the solutions to this problem is adding an "expansion period." For example, setting an expansion period like 5 minutes means that if in the last 5 minutes in the regular time someone bids, then the closure timing of the auction prolongs 5 minutes [6]. Listings usually apply this solution [7]. Hence, English auction easily causes Winner's Curse, especially live auction.

Every bidder should bid at an initial price and increase by a minimal bid increment until the bidding price reaches the valuation.

#### **2) Dutch auction and the first-price sealed auction**

In a Dutch auction, the auctioneer starts with a high price and gradually lowers it by steps until someone is willing to buy the item. In practice, the "auctioneer" is often a mechanical device like a dial, with a pointer that rotates to lower and lower values as the auction progresses. Dutch auctions can proceed very rapidly, which is one of their chief virtues [5].

In a first-price sealed auction, each bidder writes down a bid on a slip of paper and seals it in an envelope. The envelopes are collected and opened, and the good is awarded to the person with the highest bidder, who then pays the auctioneer the amount that he or she did. If there is a reserve price, and all bids are lower than the reserve price, then no one may receive the item.

## **4. Policy Development and Evaluation of land usage right**

### **4.1 Free land assignment under planned economy (1949-1987)**

China had established a centralized planned economic system that requires all the production factors to turn over to the state and implement fixed supply since establishing the People's Republic of China (PRC). After socialist transformation in 1956, China had accomplished land nationalization through various methods. Since then, more than 30 years ago, China allocated land usage rights to individuals or businesses at no charge through administrative transfer. And the constitution of China during this period stipulated those lands could not be regarded as merchandise so that there was no price, rent, market, and revenue related to lands.

In this period, governments had great power, easily leading to rent-seeking and corruption, unreasonable supply of land resources, and low development efficiency.

### **4.2 Land grant agreement under initial stage of the market economy (1988-2000)**

After the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party in 1978, China implemented a reforming and opening policy and transformed the planned economic system into a market economy. Governments tended to seek a more efficient method to transfer the rights of land usage to individuals or enterprises. Otherwise, the institution of free land assignment would make the demand for land resources exceed supply and lose a great deal of national assets. In the 1980s, China tried to reform the institution several times, including experimental work of land

use fees among some cities and studying the market operation of land resources in Hong Kong. This broke through traditional regulation and laid the foundation of following bids-auction-listing institutions. Subsequently, China revised its constitution in 1988 and ensured that the right of land usage could be legally transferred through grant agreement which means individuals or enterprises could rent the rights of land usage from governments.

The new means greatly improved the efficiency of land use, gave land resources market value, and increased fiscal revenue. However, it also contributed to rent-seeking, and the country still lost a great deal of grant fees. Certainly, the method is unfair to enterprises because enterprises have to spend a lot of money satisfying some officials, and those close to officials can easily gain the land resource at a lower price.

### **4.3 Bid-auction-listing system becoming mature gradually(2001-present)**

A law passed in 2001 suggested that all the commercial lands except those relating to country security must be transferred through invitations for bids or auctions. In 2002, a law suggested that spot transaction(listing) -- list the rights of land usage online which can be bidden during a certain period -- completed the new land system and that a variety of land for business such as commodity housing, entertainment facilities, and traveling should be transferred through bids, auction, or listing. Over the several years, this system has evolved several times. The description below is the basic variants of the bid-auction-listing system:

#### **1) bid price and evaluate bids**

Governments evaluate not only the bidding price but other factors such as designing scheme, company background, and capitals and give each factor a weight; or governments should evaluate the designing schemes if the bids reach the maximum price--limitation of price--and there are still two or more than two companies willing to accept the maximum price [8]. This method suggests a combination of bidding price and evaluation, effectively suppressing the soaring housing price. However, this stimulates government officials to collude with businesses and to make rent-seeking, which leads to a position that resembles that in the land grant agreement described above.

#### **2) bid price and the floor area of social security housing**

The system includes bidding price and bidding the floor area ratio of social security housing such as public rental housing and social security housing for talents--social security housing refers that real estate company should construct residential buildings and transfer them to government free or at a very low price [7]. If the bidding price doesn't reach the maximum price limitation, then the company with the highest bid wins. However, if the bidding price reaches the maximum and more than two companies are willing to pay at the maximum price, then the way to compete for the land resource will transform into bidding the floor area ratio of social security housing, and the company with the highest bid for the floor area ratio of social security housing wins (the maximum ratio:100%) [9-10]. This system complies with the rules that those who pay more can get the prize and effectively suppress the blind bid of companies. Meanwhile, governments can gain much land-transferring fees and complimentary public buildings. However, from the perspective of companies, this is a prisoner's dilemma that impairs the profit of real estate. Then, the real estate companies will reflect the costs on housing prices to make a profit, causing the housing price increases. In the long term, "the craziest company," which is usually the richest company, can always gain land resources. On the one hand, it is not fair for small and medium-sized enterprises. On the other hand, this method undermines the industry of real estate because of vicious competition and leads to an increase in housing prices, finally citizens bearing the prohibitive costs.

#### **3) bid price and the self-control floor area**

The system includes bidding price and bidding the self-control floor area of residential or commercial buildings. If the bids don't reach the maximum price, the condition is similar to that above. If one bid reaches the maximum price, then the qualified companies will compete through bidding the ratio of the self-control floor area of residential or commercial buildings that the company cannot sell for certain years but can rent if the ratio reaches upper limits (100%, then the first company to bid the highest ratio wins, or the qualified companies bid the years of keeping self-control housing,

or randomly do lottery decided on the auction rules [11-13]. In this case, real estate companies can make a profit through renting and selling the "restricted housing" after prescriptive years, and therefore enterprises have the motivation to improve service management and supporting facilities [14]. Although this method improved the above condition that the company makes little profit because of social security housing, the land price per floor area available for sale still rises rapidly, and companies don't increase much profit.

#### 4) bidding price and 'average bidding system.'

In general, if the bidding price doesn't reach the maximum price, then the company bidding the highest price wins; if the bidding price reaches the maximum price, then all the participants can bid only one price ranging from the maximum price in the first round to a certain, highest price (usually plus a minimum bid increment). Eventually, the company bidding the price closest to the average price among all the valid prices wins [7]. This mechanism offers a fair chance to all the real estate companies and contributes to keeping a balance of real estate companies because the top-ranked and richest company cannot win auctions always. However, understanding this mechanism, real estate companies establish a mass of shell companies that are used to participating in 'average bid' in order to increase the probability of reaching the average price. Also, some companies would collude and therefore form a large group. These behaviors adversely affect market fairness, violating the original intention of the mechanism.

#### 4.4 brief summary

Nowadays, more and more governments are adopting a hybrid approach. For example, an official announcement about the right of land usage in Dongguan suggests if the bid price reaches the maximum price, the voluntary companies will bid the floor area ratio of social security housing, whose top limitation is 20 percent. Subsequently, if the bid reaches the highest ratio and more than two companies are willing to compete, the mechanism transforms into an "average bid." Meanwhile, the winner should control all the commercial floor area and cannot transfer through any means for at least 20 years [15]. Indeed, there are many other composite approaches.

The bid-auction-listing system is relatively fair and open, improves the efficiency of land development, and spurs real estate companies to enhance strength. However, there is still black-box operation, especially in the evaluation of bids. Policy transparency is not enough. Some governments shade the supply plan of land resources, making some law-abiding companies cannot reasonably arrange capital [4]. Meanwhile, lack of strict regulation and supervision makes some trade procedures non-standard, especially in the field of shell companies used to participate in "average bid" [16]. Furthermore, some state governments, as the sole sellers, excessively inference markets, collude with enterprises, excessively rely on transfer fees and enforce measures to drive up land prices [17].

### 5. The game process between governments and enterprises

#### 5.1 Games in the invitation for bids

Governments should take action only after understanding company strategies. The mechanism of the first-price sealed auction is mainly applied in the invitation for bids. In this case, each company gives a sealed envelope to the government, and bidders only know their own valuations but know little about others' valuations. Bidders would bid according to their own valuations and the deduction of the rival valuations. This is a Static Game of Incomplete Information [18].

To simplify the circumstance, we can discuss about only 2 bidders. Assume that each bidder  $x$  values the item as  $v_x$ , and don't consider the position that the bidders have the same valuation. Then, the payoff matrix is:

$$u_1(b_1, b_2) = v_1 - b_1, \text{ if } b_1 > b_2 \quad (1)$$

$$u_1(b_1, b_2) = 0, \text{ if } b_1 < b_2 \quad (2)$$

$$u_2(b_1, b_2) = v_2 - b_2, \text{ if } b_2 > b_1 \quad (3)$$

$$u_2(b_1, b_2) = 0, \text{ if } b_2 < b_1 \quad (4)$$

Because each bidder doesn't know the other's valuation, he can regard the other's valuation as a random variable. In other words, bidder  $i$  should regard  $v_j$  as a random variable obeying the Cumulative Distribution Function (CDF). Therefore, the probability of  $v_j > v_i$  is  $F_i(v_i) = P(v_j < v_i)$ . Any bidder determines the own bid after conjecturing others' strategies and evaluating the own valuation, so each bidder's bid should obey the strict function  $b_x = b_x(v_x)$ . In this case,  $b_1 = b_1(v_1)$  and  $b_2 = b_2(v_2)$ . In this static game of incomplete information, each bidder's optimal strategy is to choose a bid maximizing expected payoff  $E$ . The expected payoff of bidder 1 and bidder 2 are respectively:

$$Eu_1(b_1, b_2) = (v_1 - b_1) \cdot P(b_1 > b_2) \quad (5)$$

$$Eu_2(b_1, b_2) = (v_2 - b_2) \cdot P(b_2 > b_1) \quad (6)$$

According to Game theory, If for each bid function  $b_1(v_1)$  of bidder 1, there is always  $Eu_1(b_1 | b_2^*) \leq Eu_1(b_1^* | b_2^*)$  ( $b^*$  refers to one of the bid strategies), and for each bid function  $b_2(v_2)$  of bidder 2, there is always  $Eu_2(b_2 | b_1^*) \leq Eu_2(b_2^* | b_1^*)$ , then  $[b_1^*(v_1), b_2^*(v_2)]$  is a Nash equilibrium [19]. In the real world, the two bidders know the valuation of each other is in the interval  $[v_{min}, v_{max}]$ , and assume that each bidder knows that the bid of the other bidder obeys Uniform Distribution, then

$$f_i(b_i) = \frac{1}{v_{max} - v_{min}}, \text{ if } v_{min} < b_i < v_{max}; f_i(b_i) = 0, \text{ else;} \quad (7)$$

$$0, \quad \text{if } b_i < v_{min} \quad (8)$$

$$P_i(b_j \leq b_i) = F_i(b_i) = \frac{b_i - v_{min}}{v_{max} - v_{min}}, \text{ if } v_{min} < b_i < v_{max} \quad (9)$$

$$1, \quad \text{if } b_i > v_{max} \quad (10)$$

Therefore,  $Eu_1(b_1, b_2) = (v_1 - b_1) \cdot P(b_1 > b_2) = \frac{(v_1 - b_1)(b_1 - v_{min})}{v_{max} - v_{min}}$  (11), and according to its derivative, when  $b_1 = \frac{1}{2}(v_{min} + v_1)$ ,  $Eu_1(b_1, b_2)$  is max. Similar to bidder 2,  $b_2 = \frac{1}{2}(v_{min} + v_2)$ . Therefore, the linear bid rules  $b_1 = \frac{1}{2}(v_{min} + v_1)$  (12) and  $b_2 = \frac{1}{2}(v_{min} + v_2)$  (13) form a symmetrical Nash equilibrium.

The linear bid rule above can be generalized to the condition that exists  $N$  bidders [19]. Similarly, when there are  $N$  bidders, the optimal strategy of bidder  $i$  is bid  $b_i(v_i) = \frac{1}{N}v_{min} + \frac{N-1}{N}v_i$  (14). This formula can also be applied to Dutch auctions. Hence, governments understand enterprises' logic and strategies and are able to take action.

In English auctions (refer to existing land auctions or listings), groupuscule can easily ascertain other companies' valuation and adjust strategies according to the conditions in the spots [20]. As long as the other companies' bids are below the highest valuation among the groupuscule's members, the collusion must exist because they just only need to allocate the 'strongest one' to bid, and the other members keep silent to depress the price. When the member of the group wins, the group numbers will divide up the payoffs according to pre-determined rules such as monetary indemnity and rotation of the dealer [3]. This can make the market unfair, reduce land-transferring fees, and divide up land resources unjustly. However, according to the formula above, it is easy to understand that bids are closer to valuation, and governments can gain deserved fees as the number of participants increase. In addition, Dutch auction and first price-sealed auction are good methods to prevent collusion between companies because no company can accurately predict the bids of other companies which are not the 'groupuscule,' especially when the value of  $N$  is large enough. In this case, every bidder tends to bid the price much closer to valuation, and therefore the groupuscule is collapsed. Hence, governments should publicize announcements of land auctions as far as possible, increasing the number of bidders to make them bid closely to true valuation [21].

The winner is the bidder with the highest valuation, and this trade can accomplish Pareto Efficiency. It is worthy to note that the description above only discusses some themes about bidding

price. Actually, in invitations for bids, governments evaluate elements such as company background and capital power other than bidding price, so invitations for bids are variations of first-price sealed auction. For this, some officials have an incentive to collude with companies for rent-seeking and cause some serious impacts interpreted previously if there are not strict supervisions. Otherwise, if there are strictly fair supervisions, an invitation for bids is an effective way. So, governments should set up a rigorous sector to specialize supervision and punish more heavily.

## 5.2 Games in Auction and Listing

Indeed, the listing is an online auction. Although there are variants such as floor area of the floor area ratio of social security housing and self-control floor area of residential or commercial buildings, we can definitely regard these factors as bidding price, so that land auction and listing are typical English auctions if they do not trigger the mechanism of ‘average bidding system.’ The main differences between auctions and listings are that auctions require bidders to bid on a spot and more easily induce winner curse and higher bidding price due to the hot atmosphere, while listing sets a period time for companies to bid multiple times online, permitting companies to make a rational decision. In order to simplify the conditions, we can see the auction and listing as the same and see the variants as bidding price.

Then, when bids are under the maximum limit of price, each bidder should bid increase by a minimum increment until the bid reaches his or her own true valuation. When a bid reaches the maximum limit of price, then the “average bidding system” starts.

In this case, each bidder gives a bid  $B_i$  belonging an interval  $[a, b]$ , and  $\bar{B} = \frac{B_1 + B_2 + B_3 + \dots + B_n}{n}$  (15). Finally, the bidder with the bid closest to  $\bar{B}$  is the winner. Obviously, all the companies will try their best to increase shell firms and collude with other corporations so that they can have more ‘B,’ increasing the weight in the equation to increase the probability of winning.

In this case, enterprises would adopt the following below strategies:

(i) Randomly choose a bidding price when there are not groupuscule. Certainly, a majority of companies choose the price around  $\frac{a+b}{2}$ . This is an ideal condition obeying normal distribution which is the original intention of governments.

(ii) If a company has sufficient shell companies, it can allocate part of shell companies to bid minimum or maximum price to pull the average, making the average price keep away from  $\frac{a+b}{2}$  because single bidder’s bid concentrates around this price and obeys normal distribution, then allocates the rest of shell companies to bid around predicted value.

(iii) If a company has few shell companies or companions, it can only research the backgrounds and previous auction experiences of the participants to predict their behavior. For example, after researching the backgrounds of participants and speculating the number of shell companies, the single company can predict the groupuscule tend to allocate the shell companies in the minimum or maximum price and then bid more accurately. However, it is too difficult for such a single company to gain accurate information, so the bids among individual companies virtually obey normal distribution.

This method can relatively keep the market fair, nearly obeys market rules, and simultaneously prevent rat race causing housing prices to soar if governments can ensure a fair business environment such as the ideal condition described in strategy (i) above. However, companies would tend to blindly increase the number of shell companies or collude. And large-scale developers have more shell companies than small-scale developers dominantly, impairing market fairness [15]. For this, governments should realize the enterprises’ strategies and take action in advance. They should enact effective regulations and oversee strictly to prevent the behaviors of increasing the number of shell companies or collusion.

## 6. Existing problems of bid-auction-listing system



The design of the mechanism is inconsistent with what governments want to achieve [22]. On the one hand, local governments are obligated to obey the central government's guidance which requires local governments to keep land market fair, reflect land price on true value and simultaneously prevent sky-high land price. On the other hand, some urban planning indexes and city evaluation indexes drive local governments to pull up local land prices and collude with enterprises. Some local governments excessively rely on transfer fees [23]. Revenue from land transfer in 2020 accounts for 84% in the general public budget revenue of local governments for the contemporary period (10.01 trillion). The growth rate of the transfer fees in 2020 is 15.9%, which is 19.8% higher than that of the general public budget revenue of local governments [24]. Due to the demand of short-term administrative performance about GDP, they have an incentive to intentionally pull up land price and speed up land resource supply; meanwhile, in order to achieve some business index. Local governments usually adopt some illegal means such as reducing or returning transfer fees to attract investments and business, especially in industrial lands, violating the original of the bid-auction-listing system and causing land resource waste.

The mechanism remains space for enterprises or governments to collude. For enterprises, English auction makes them trapped into a 'prisoner's dilemma.' They are motivated to collude to depress the land price. It is worthy to note that governments hope bidders not to blindly bid and therefore keep land prices stable and reflect on true market values under a competitive and fair environment, rather than indulge enterprises in harming nation assets. The collusion also possibly eliminates some emerging small and medium-sized enterprises, causing market monopoly and unfairness. For governments, as only sellers of land resources, the officials have the motivation to make rent-seeking and collude with enterprises to make a great profit [4]. There are many corrupt links in land management, especially inland supply, and market management. The behavior pattern of corruption is characterized by diversification, specialization, and intelligence, which are more and more concealed [25].

The mechanism emphasizes price too much still, motivating enterprises to blindly bid. In terms of land development, and the optimal successful bidder should be the one having the strongest comprehensive strength, but indeed the richest company generally becomes the winner. The results depend on the price factor almost and lead to sky-high land and housing price. Fifteen years before running the bid-auction-listing system, the housing price in China increased by 5.1% approximately every year [23]. From 2001 to 2020, the housing price in China soared by 430% [26]. From 2005 to 2009, the commercial land price was doubled [27]. The residential floor price from Jan. to Sep. 2021 increased by 24.76% compared with that in 2020 [28]. The behavior of blind bid easily leads to winner curse; some developers break contracts and give up deposits because they don't have sufficient money to afford the transfer fees, or some developers cannot develop the land with the initial scheme and delay the plan [3]. High land price leads to high housing price and vice versa. This vicious circle aggravates competition in land resources, causing more sky-high land prices and eliminating some emerging small and medium-sized enterprises. Finally, the market remains a few financially strong companies that may not be the most efficient developers, and the oligopoly doesn't serve to comprehensive benefit maximization involving social and economic factors.

Land management and supervisions are imperfect. The standards of various items are obscure, especially in the punishments of particular noncompliance and the standards for evaluation of bids. Lacks of strict and explicit entrance requirements or scientific marking systems increase the chance of corruption. In the process of invitations for bids, the lack of regulatory parties oversees government actions, easily leading to black casework. In the process of auctions and listings, it is hard to identify collusion and shell companies. After invitations for bids, auctions, and listings, the follow-up supervisions and managements are vacant. Illegal behaviors such as delaying afford transfer fees, delaying or violating initial development plan, using cheap materials, constructing over the index, and collusion between officials and enterprises often occur, impairing residents' trust and the healthy development of real estate industry.

The supply and demand of land resources exist in contradiction. At present, many local governments lack a long-term plan for land supply. They usually shade the supply plan; sometimes

they don't supply, and sometimes they oversupply to raise money [29]. Enterprises don't know the plan and cannot arrange capital appropriately, causing abortive auctions. Certainly, if the enterprises collude with government officials, they can know some inside dope in advance. In the long-term, high-quality resources would be depleted.

## **7. Reform suggestions for bid-auction-listing system**

Correctly guide local governments in fulfilling their performance requirements and generating revenue. Firstly, the prefect performance evaluation system of local officials. Governments at all levels should attach greater importance to sustainable development index involving the environment, infrastructure, education, and medical treatment, rather than only focusing on GDP and business index. Secondly, improve local fiscal and taxation systems. For some financially weak areas, central and provincial governments can increase financial aids and encourage these areas to support enterprises, making local governments have stable, constant revenue. This can alleviate the reliance on land transfer fees. Thirdly, implement the scientific outlook on development earnestly. Reinforce ideological education on officials, deterring corruption and rent-seeking.

Reinforce supervision on the operations of the bid-auction-listing system and foster a fair external environment for policy implementation. Firstly, stick to a collective joint trial involving several parties such as the discipline inspection department, legal department, land and resources bureau, planning department, treasury department,. Secondly, establish a diversified supervision mechanism. Place discipline inspection department as the core and give full play to the supervisory role of the masses and the media, unblocking various reporting channels. Thirdly, specify related regulations and the content of each flow. Local governments should specify the requirements of the whole process, such as delivery time, completion time, greening rate, and construction materials, specify the responsibilities of each party, and act in strict accordance with the standards. Fourthly, establish the information system of real estate enterprises, connecting with banks, industrial and commercial bureaus, tax bureau, and other related departments. Timely update the system and keep information sharing, giving local governments an accurate reference for judging. Governments should specify the definitions of collusion and related behaviors in law and increase the cost of collusion. In addition, deterring shell companies is important. Stipulate that the company directly and absolutely controlled by the same natural person, legal person, or other organization shall not participate in the bidding for the same commercial and residential land, and the capital source of the bidder's land transfer fee shall be its own capital; the corporations of the bidders should have a certain number of regular staff and pay taxes for more than prescribed years.

Reinforce information publicity and management of the land resource. Firstly, implement trial on pre-application mechanism: governments issue planning index and conditions of lands and pre-application announcements, and then companies propose pre-applications; finally, governments arrange the land transfers and propose the transfer plans [30]. Under the premise of full disclosure of land information throughout the whole year, enterprises can communicate with governments effectively and pre-apply the land usage right. This can help enterprises grasp comprehensive information so that they won't blindly contend because of the panic of lacking land resources. And enterprises also can reasonably arrange capital and human resources. Governments can also reasonably plan the supply pace and prevent abortive auctions. Secondly, publicize explicit land information through various channels other than the official website.

Adopt appropriate modes of land transfer according to different conditions. For key municipal projects, innovative industrial parks, and tourist attractions, local governments should tend to choose invitations for bids. For commercial and residential buildings, governments should adopt auctions, listings, and composite approaches, which can gain relatively high transfer fees. As for lands for upscale residential or commercial buildings, governments should emphasize price factors, while as for lands for normal residential or social security housings, governments should consider comprehensively involving design schemes, company credit and qualifications, house type, and so on.

Establish a comprehensive mechanism of the bid-auction-listing system, which changes the rule that who bids higher can win to the rule that the most suitable one can win. In auctions and listings, introduce a composite approach combining evaluations forbids, bidding the floor area ratio of social security and self-control housings, and Dutch auction. Firstly, ascertain the requirements of programs such as development cycle, the floor area ratio of social security housing and self-control building, and other rigid requirements and ascertain qualification requirements of bidders. Secondly, establish a scientific system of evaluation for bids involving big items such as economic strength, technical level, project experience, and the planning scheme. Certainly, there are various detailed items assigned scores in big items with explicit standards for marking. According to particular demands, governments should design items and give appropriate weights to them. After preliminary screening, the eligible companies can participate in a Dutch auction. If there are several bidders willing to afford the maximum price, then start a lottery or ‘average bidding system.’

## 8. Conclusion

After analysis on the system, we understand the system is becoming mature gradually but remains some drawbacks: becoming the main tool for officials to achieve administrative performance, motivating bidders to bid too high, remaining collusion space, lacking supervision, and supply-demand imbalance. Knowing these problems, governments can take actions from five ways generally: correctly guide local governments in fulfilling their performance requirements; reinforce the supervision and foster a fair external environment; reinforce information publicity and management of land resources, and adopt appropriate modes of land transfer according to actual situations.

The land transfer policy in China is positively improved with the accumulation of time and experience in a dynamic process of discovering problems and correcting them. In the future, we should aim to perfect the details and optimize the overall mechanism by constantly researching the hybrid approach and making a bold trial.

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