

Why housing price in Hong Kong is so high? An explanation in game theory

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Abstract

In most studies about housing price, the price is related to factors such as housing supply and demand, interest rate and money supply. A complete competition between suppliers and demanders in the housing market is assumed in most studies. However, when the land supplier is monopoly and the number of land demanders is very limited, the assumption may be violated. Thus, a different theoretical approach is proposed to tackle the problem. In this paper, a game theory approach is used to explain the housing price in Hong Kong. Two main findings are found. Firstly, using public auction for land selling in an oligopolistic housing market would lead to a high housing price which government is hard to adjust. Secondly, enforcing windfall tax is an effective method to lower the housing price while maximizing government income at the same time.

Keywords: housing price, game theory, Hong Kong

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1. Introduction

In recent years, housing prices of Hong Kong and mainland China raised constantly and sharply. Hong Kong government has tried to prevent the overpricing of housing by supplying more land, limiting bank mortgage and increasing stamp tax rate. Although Hong Kong government has

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enforced so many strategies to control the housing price, housing price in Hong Kong is still very high.

Researchers usually related housing price with land and housing supply, interest rate and money supply (Lastrapes, 2002). Under the framework of supply and demand model, housing price is further suggested to be highly related to the amount of land supply. In some researches, a negative correlation between land supply and housing price was found (Peng, 1993; Peng, 1994). Based on the supply and demand model, construction is a slow process, any reduction of land supply leads the property developers to lag behind schedule on supplying required amount of housing, thus the stock of housing fails to keep pace with demand and results in raising price. However, in Hong Kong, there is no clear or lagged relationship between the land supply and new built private housing supply. It suggests that this model is not a likely explanation to Hong Kong housing market.

With the increased concern on the development and application of game theory (Zhang, 1996), many experts used game theory to explore the product pricing strategy. For example, Ozgur and Leandros (2005) applied duopoly game to investigate the performance of pricing scheme. Relating game theory in housing price, Mu and Ma (2007) studied equilibriums under the cooperative and non-cooperative conditions. They found that cooperation is the optimal strategy.

In this paper, a brief description on the special environment in Hong Kong housing market and how this special environment weaken the explanation power of common supply and demand model will be discussed. Since common supply and demand model cannot fully explain the uniqueness of Hong Kong housing market, this paper aims to use game theory to explain the housing price in Hong Kong. It is found that a high housing price is the only Nash equilibrium in the model. Based on the model, a windfall tax, which aims at lowering the housing price, is proposed. And its effect on the property market is also analyzed. It showed that by applying a suitable amount of windfall tax, the Nash equilibrium will be shifted to a lower housing price. Under the new Nash equilibrium, both Hong Kong government and property developers can obtain optimal benefit.

2. Uniqueness of Hong Kong housing market

Although Hong Kong is a market economy, its government plays a key role in land and housing prices. Because of its colonial history, unlike other countries in which land can be privately owned, Hong Kong government is the sole owner of the territory. Rather than selling land, Hong Kong government leases land to private developers. Normally, a lease term of 75 years or longer is leased to the highest bidder in public auctions. A large lump-sum premium and a relatively small amount of rent are included in each lease term. Because public auction is the easiest way for Hong Kong government to capture the land value (Hong, 1998), Hong Kong government relies heavily on public land auctions to capture land value. The number of land developers is also very limited in Hong Kong. Therefore, rather than market orientation, housing market in Hong Kong is basically seller-oriented (Tse, 1993).

Being the auctioneer of land, government receives revenue directly from it. The bidding provides government a great capital for expenditure or reserve. For instance, it would sell the six residential sites located in Peng Chau, Sha Tin Kau To, Tseung Kwan O and Ma On Shan in July to September 2012 by auction (HKSAR Government, 2012). But at the same time, as the controller of land, government is also responsible for the housing policy. The government should review policies continuously and employ the best measures to meet the changing needs of the community. Therefore, the objectives of Hong Kong government are maximizing the income that received from the land auction and keeping the housing price in an affordable level in order to fit the needs of the community.

However, many studies have manifested that stakeholder’s strategic planning is affected by the powerful connections between the institutional background and market processes (Healey, 1992; Van der Krabben and Lambooy, 1993; Keogh and D’Arcy, 1999; Adams et al., 2005; Buitelaar, 2007). In this way, developers’ strategies are affected by the policy set by the government and the market processes. With government’s bidding policy and material gains, it initiates the developers to construct real property for sale to earn profits and at the same time maintains the stability of land supply and demand in Hong Kong.

In most of the models used to explain housing price, housing market is assumed to be fully competitive. Therefore, the oligopolistic housing market in Hong Kong cannot be fully explained by typical land supply and demand model. A new approach should be applied to explain the constant rise of housing price in Hong Kong.

3. Application of game theory in explaining Hong Kong housing price

In this section, a game model was built according to the relation between government and housing developers. To simplify the model, all housing developers are assumed to be as a group sharing the same profit. Therefore, there are two players in the model: government (G) and developer (D).

The action set of government $A_G = \{High, Low\}$ represents that government can either set the land price to a relatively high or low value. Similarly, the action set of developers $A_D = \{High, Low\}$ represents that developers can either sell the real property in a high price or a low price. The payoff matrix of the game is shown below:

Table 1. Payoff matrix of housing market without windfall tax

		Government (G)	
		High	Low
Developers (D)	High	$D_H-G_H, G_H-(L \times D_H)$	$D_H-G_L, G_L-(L \times D_H)$
	Low	D_L-G_H, G_H	D_L-G_L, G_L

In the payoff matrix, D_H and D_L stand for the actual price that developers sell the real property in relatively high and low prices respectively.

Similarly, G_H and G_L stand for the land price when government leases the land to housing developers in relatively high and low prices respectively.

We assume when developers sell the real property in a high price, some low income families will be suffered. Government needs to provide housing subsidy to the lower income families. The subsidy amount is accounted by $L \times D_H$, where L is any positive number. In the model, the amount of subsidy is assumed to be proportional to the price that real property developers sell their product.

In the model, it is assumed that real property developers will only sell their products when profit can be made, therefore, $G_L \leq G_H \leq D_L \leq D_H$.

Hong Kong housing market is perfectly agreed with the assumptions in the above game model. Firstly, Hong Kong government is the sole land owner in the territory. Secondly, Hong Kong housing market is oligopolistic which leads to a seller-oriented market (housing developers determine the housing price). Therefore, I believe the high housing and land price phenomenon in Hong Kong housing market can be explained by the above game model with game theory.

From the payoff matrix, we found the dominated strategy of developers is selling the real property in a high price. Similarly, dominated strategy of government is selling the land to developers in a high price neglecting the response action from property developers. A Nash equilibrium (High, High) is found in the model. In other words, high housing price and high land price is the natural outcome in Hong Kong housing market.

The model results agree with the real situation in Hong Kong. Hong Kong government has always been blamed by media for the high land price policy. Our game model suggests that government sells the land at a high price because selling land to developers in high price is the dominated strategy. In the other words, government enforced high land price policy is a natural outcome according to game model even if the strategy cannot maximize government income.

4. The effect of windfall tax on housing price

In this section, a modified game model is used to illustrate how applying windfall tax can lower the housing price effectively.

Modifying the payoff matrix of the same game mentioned in previous section, the effects of windfall tax on housing market can be examined. Assuming the windfall tax is represented by T , the new payoff matrix becomes:

Table 2. Payoff matrix of housing market with windfall tax

		Government (G)	
		High	Low
Developers (D)	High	$D_H - G_H - T, G_H - (L \times D_H) + T$	$D_H - G_L - T, G_L - (L \times D_H) + T$
	Low	$D_L - G_H, G_H$	$D_L - G_L, G_L$

Developers are assumed not to sell their real property without profit making, therefore, $G_L \leq G_H \leq D_L \leq D_H$. According to the modified model, the windfall tax (T) is charged when developers try to sell their real property at a high price which exceeds price limit or violates any predefined regulations.

According to the payoff matrix, the dominated strategy government in game having windfall tax is selling the land to developers at a high price. Developers would choose their action according to the amount of windfall tax. Developers sell their real property at a low price when

$$T > D_H - D_L$$

Therefore, by setting the windfall tax over the above threshold (i.e. $D_H - D_L$), developers would like to sell their products in a low price rather than high price according to the proposed model.

Comparing the modified model with the original one, the payoff of both players has changed. For developers, the payoff is changed from $D_H - G_H$ to $D_L - G_H$. While for government, the payoff is changed from $G_H - (L \times D_H)$ to G_H . The changes in payoff between two models are summarized as below:

Table 3. Summary on payoffs

	Developers	Government
Model without windfall tax	$D_H - G_H$	$G_H - (L \times D_H)$
Model with windfall tax	$D_L - G_H$	G_H
Change in payoff	$-(D_H - D_L)$	$L \times D_H$
Total change in payoff	$D_L - D_H \times (1 - L)$	

To summarize, introducing windfall tax causes developers to make less profits and income of government increases. Total change in payoff for both players depends on the D_H , D_L and L . When $D_H - D_L$ is small, or L (the sensitivity of the loss in social wealth towards housing price) is high, the total change in payoff is positive, which means a “win-win” situation is achieved. Otherwise, the total change is negative, which means the loss of developers is more than the gain of government.

A windfall tax is a higher tax rate imposed on the profit of a particular company from a sudden windfall gain. Implementing a windfall tax on housing price can claw-back some of the benefits received by the private developers to raise the revenue for financing welfare-to-work scheme

(Chennells, 1997). The tax system should not impose administrative burden excessively by compliance or enforcement and should be fairly distributed between different parties.

After the implementation of windfall tax, whether the windfall tax burden would be shifted to buyers would be a great concern. Suppose the situation of market fulfills the following two assumptions. First, the land supply is constant and sufficient every year. Second, the threshold, which is used to determine the imposed windfall tax, is higher than the average purchasing ability of general Hong Kong citizens. Following the assumptions, private developers may shift the tax burden to buyers if they want to maximize their profit the same as before tax after the introduction of windfall tax. But in fact, it would only lead to a lower profit. It is because the overpriced housings make people unaffordable to buy. When the demand decreases, the profit earned by the private developers decreases as well. Indeed, the private developers would not shoulder the tax burden themselves either for the sake of maintaining the profits. In the aspect of selling lands, the auction price is predicted to be lower. If the private developers still use the high pricing strategy to capture the most of the lands, it would just lower its competitiveness. In case private developers use high price to buy the land, they cannot sell the houses at high price due to the windfall tax, as well as the decline in demand. In this way, private developers can only accumulate the lands. If private developers continuously buy in the lands in high price, cash flow decreases due to accumulation of lands. Once cash flow decreases, the competitiveness for the next auction would decrease. Then some small competitors may grasp the opportunity to enter the market and eventually oligopoly of housing market would be broken down. The rising number of competitors would definitely make the housing price to decline. Therefore, with the implementation of windfall tax, private developers would use a reasonable price but not too high to bid the lands to ensure the competitiveness can be maintained.

5. Conclusion

This paper analyzed the unique housing market phenomenon in Hong Kong by applying game theory. Since the housing market in Hong Kong is oligopolistic, the common supply and demand model weakly explains the situation in Hong Kong. Both games with windfall tax and without windfall tax were analyzed. Results showed that under the absence of windfall tax and the special situation in housing market of Hong Kong, high land price policy is the natural outcome of Hong Kong housing market. If Hong Kong government aims to lower the housing price, it is suggested to enforce windfall tax which is shown to be the effective method. However, there are some limitations in the applications of game theory to the housing market in Hong Kong (Berkman, 1965; Mu and Ma, 2007). First, the modeling of the pricing strategies between government and property developers is so much dependent on specific environmental factors. Second, the interactions between different parties are too complex and somehow unpredictable. However, suggested by Samsura et al. (2010), the land and property development modeling is actually supported by a

review of analytical tools by Ball (1998) which considers game theory as a promising methodology in this field of study. In some practices like economics, it is greatly accepted to interpret the real situation into theoretical model (Samsura et al., 2010). The game theoretical modeling certainly simplifies and abstracts the real housing market in Hong Kong. By enforcing a fair amount of windfall tax to the profit receivers with government's guidance, Hong Kong government may be able to solve the social problems caused by high housing price, whereas increasing the benefits of both the government and developers.

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