Equilibrium Pricing and Transaction in Housing Market: an Alternative Explanation to China's Housing Market

Teng Ge[*] and Tao Wu[†]

June 2010

(Preliminary draft, submitted for CEA annual conference 2010, and for the consideration of Best Paper Prize. Please do not cite or circulate without the author's permission)

Abstract

In this paper, we present a model where suppliers of a housing market consummate chances of trade with ex-ante heterogeneous consumers in a frictional market. Profit maximizing supplier endogenously chooses the quality as well as the price of houses to maximize the expected profit. We find that there are multiple equilibria in the housing market, each market scenario associate with specific asking price and quantity of transaction in the property market is jointly determined by the *set up cost* of investment and the *terms of trade*. Policy experiments argue for redistributive taxation, which could be beneficial for social welfare. We find empirical evidence which is consists with our argument.

[*] PhD Candidate, supervised by Professor Melvyn Coles, Department of Economics, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, United Kingdom. Telephone: 01206 87 2883. Email: tgev@essex.ac.uk.

[†] PhD Candidate, supervised by Doctor Helen Weeds, Department of Economics, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, United Kingdom. Telephone: 01206 87 2883. Email: twuh@essex.ac.uk.

1 Introduction

Property price in China's housing market has been observed steady increases in almost a decade. According to UBS, the ratio of average home prices to average annual household incomes is almost 10 times in 2008. What's more, to buy a 100-square-metre home in the capital, the average Beijing household must now spend 17 year's income.[1] The property price is now arguably regarded as overheated. Researchers and policy makers debate on reasons and solutions to over-heated property market. It is widely accepted that the hot property price is mainly derived by speculative investment in housing market and demand of tax revenue of local government. Policies to curb the soaring property price were set to deter entry of supplier and speculative investment by limiting loans from banks or increasing down payment, in some cities more restricted policies like rationing were adopted. However, we argue that given observed property price is based upon mutually agreed transactions in the market, therefore the price must reflect the terms of trade of buyers and sellers. In this project, we investigate how do the terms of trade determine different equilibria of price and transaction in a housing market, which equilibrium if socially efficient and how to use public policy to implement the efficient allocation?

We discuss our theory based on a random-search-and-price-posting model. Ex-ante heterogeneous buyers are differentiated in their disposable wealth, whereas the sellers endogenously choose to invest to building a certain type of house bearing a set up cost before contacting a buyer. Sellers commit to a price on their house; however, the price cannot be conditional on buyer's type due to private information on personal wealth. A trade is consummated based on mutually agreement, under individual rationality; the price reflects the terms of trade in the market for each side. Depends on the distribution of buyers wealth and seller's set up cost, we show there are three equilibria: where in the first one sellers invest more in high quality and charge high price to sell to high type buyers; in the second case, sellers set up low quality houses and serve low type buyers exclusively by posting a low price; in the third equilibrium, sellers built houses acceptable for all types of buyer and charge a price that is affordable for anyone. The first two cases, the market serves one type of buyers exclusively due to unequal distribution of wealth

[1] See *The Economist*, 2010

across buyers. In the first equilibrium, it is because of either the proportion of high type buyers is sufficiently high, or the wealth of low type buyers is sufficiently low; the second equilibrium arises because of the reverse. In an economy where the wealth distribution is relatively equal, the third equilibrium arises where the market serves all type of agents. Furthermore, the set up cost and terms of trade determined the type of houses sellers built, given the type of houses; asking price sellers posted plays a role as screening mechanism justifies the buyers' strategy in equilibrium. We believe that the first equilibrium describes the current Chinese housing market.

Base on our model, we argue that the steady increase in property price is due to inequality distribution of income and economic growth. If the high income buyers benefit more from the economic growth, this will drive the economy moves to the equilibrium where seller built high quality house and charge high price. On the other hand, if the proportion of high wealth buyer is getting larger or income of low health people is getting higher, the seller will serve the low wealth buyer as well, the property price will lower and so does the set up cost.

Housing market is a typical market with trade frictions. Searching buyers and sellers coexist in the market implies the price files to clear out the property market. The search literature on housing market, include Wheaton (1990), Carrillo (2006), and Albrecht et.al. (2007, 2009), they mainly focus on times of trade and equilibrium pricing. Most of the literatures use the search-and-bargaining framework. This is applicable to countries like U.S. or U.K., but not in China, especially for the market of first-hand houses, in which case the sellers typically advertise the property with an asking price, more often than not, the trade is consummated on the asking price. We believe that, the price posting game is more consistent with the facts of Chinese property market and simplifies our analysis. The theoretical framework of our model is similar to Acemoglu (1999), who used search model with Nash bargaining to explain income and unemployment dispersion in U.S. labor market. In his paper, firms chose either a skilled job or unskilled job to create then recruit workers through random matching. The high type job only suit for skilled workers but both skilled worker and unskilled workers are suitable for unskilled jobs. The price posting framework in our model generates very different equilibrium behavior. The separating equilibrium when both types of workers will be hired does not hold in our model. The uniform pricing strategy generates two separating equilibria, in each of them only one type of buyer will be served.

The set up cost, and hence the quality of houses, is endogenously determined in our model. Most of search models of housing market assumed ex-ante homogenous, but ex-post heterogeneous of matching specific qualities. In the later case, there are two possible equilibria may arise, in the first one, if the expected profit margin is positive, the trade will consummated at the reservation value of sellers given the ex-ante cost of investment, or, on the other hand, the market will be shut down if the expected profit margin is non-positive. Our set up avoided this problem by letting sellers making ex-ante investment decisions.

Our model has some interesting comparative static properties which allow us to do policy experiments. For example, by imposing re-distributive taxation, the government tax agents with high income and subsidies these with low incomes. In our model, such policy will drive down the profit margin of sellers who choose to serve high type buyers exclusively, the trade-offs is in favor of serving both types of buyers. Through, the final result depends on the set up cost for different type of houses but the asking price of sellers will be reduced. Second, we discussed the consequences of current housing market policies including tightening restrictions on down pay request of land transactions and increasing the requirement of mortgage application. Our model predicts that such policy will increases the set up cost of sellers hence reduces the profit margin in serving both types of buyers, the market in favor of serving high type buyers exclusively hence it will increase the property price. There are cases, when set up price is sufficiently high, market fiction causes the typical hold up problem and the housing market will shut down.

We start with simplest case by presenting a one-shot-game, then the social welfare and policy experiments are discussed in the following section. Section 3 list empirical evidence we collected related to our theoretical arguments. Then we move to the dynamic model. Final section concludes.

2 The Static Model

2.1 The model setups

We consider a simple housing market with one-shot game. Two types of agents: ex-ante homogeneous sellers and ex-ante heterogeneous sellers. The measure of buyer is fixed at an unit mess and the sellers is s. Proportion λ of the buyers are high type in a sense that the reservation value I^H is lower than the $1-\lambda$ are low type buyers with a higher reservation value I^L.

Sellers in the market becomes active if they pay a cost k_i to build a particular type of house. A house can take three types, good (G), bad (B), and mediate (M), with associated cost $k_G > k_M > k_B$. Active sellers set a price to on the unit of house. The price is a take-it-or-leave-it offer, which the seller is committed to trade with. Buyers randomly search among sellers.

Suppose the matching is frictional. The market tightness is measured by the seller-buyer ratio, which is s. It measures the terms of trade in the housing market. Matching frictions are modeled using a standard constant return to scale matching technology. Each buyer matches with a firm with flow probability $\alpha(s)$, and each seller matches with a worker with flow probability $\alpha(s) = s\mu(s)$, and we have $\alpha\prime > 0$ and $\mu\prime < 0$. We also assume that α and μ map the extended positive real numbers$[0, \infty)$ onto themselves, so $\alpha(0) = \mu(\infty) = 0$ and $\alpha(\infty) = \mu(0) = \infty$. In words, if there are very few buyers per seller, buyer find seller arbitrarily quickly and seller cannot sell her house, and conversely if there are many buyers per seller. We also assume that μ is concave. These technical conditions guarantee the existence of interior equilibria and efficient allocations. A match is consummated-turned into a transaction of a house from seller to buyer upon the agreement of both parties.

2.2 Equilibrium pricing and transaction

The expected present value of a seller, V^S can be defined by

$$V^S(k_i, p_i) = \max_{k_i, p_i} -k_i + \mu(s)[\lambda\beta^H p_i + (1-\lambda)\beta^L p_i],$$

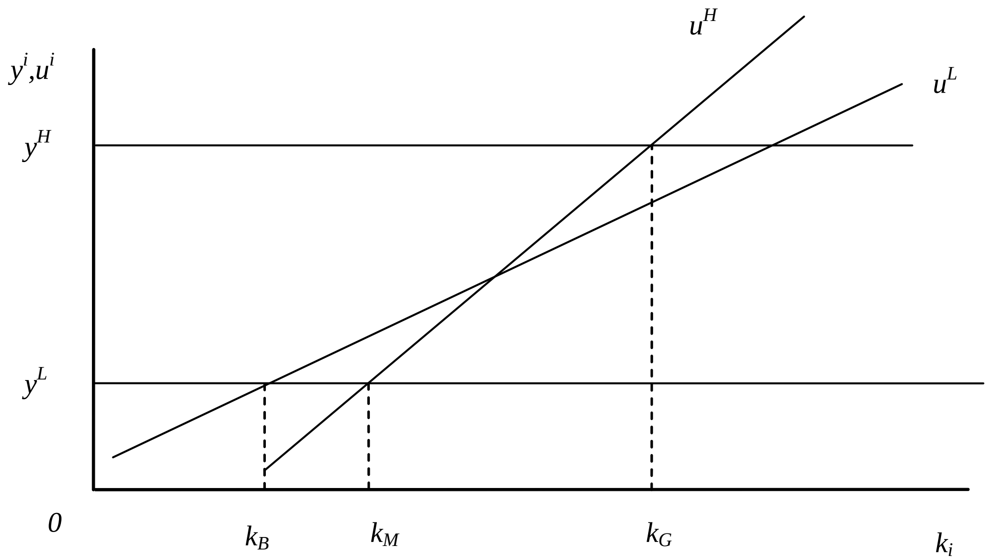

Figure 1: Buyers' utility and income, and sellers' investment choices.

where β^H is the probability that a high type buyer is accepted the price and the transaction completes, similar explains for β^L.

The expected present value of a type H buyer will be

$$\begin{aligned} V^H &= \max\{\alpha(s)(u_i^H + y^H - p_i) + [1-\alpha(s)]y^H,\ y^H\} \\ &= \max\{\alpha(s)(u_i^H - p_i) + y^H,\ y^H\},\ s.t.\ p_i \le y^H. \end{aligned}$$

Similarly, the value of a L type buyer will be

$$V^L = \max\{\alpha(s)(u_i^L - p_i) + y^L,\ y^L\},\ s.t.\ p_i \le y^L,$$

where u is a realization of the valuation of the house. The profit maximizing sellers will choose $k_G > k_M > k_B$ such that $u_G^H = y^H > u_G^L$, $u_B^L = y^L > u_B^H$ and $u_M^L > u_M^H = y^L$. Then we can draw the following figure:

In the first best case, all the information is complete, so sellers can set a price p_i, which will be charged up to the total disposable income of type i buyers. For the equilibrium 1, which the buyers' choice is $\{\beta^H = 1, \beta^L = 0\}$, the value function of the low type buyers is just y^L since they choose not to buy, while the expected value function of the high type buyers is,

$$V_H^B = \alpha(s)(u_G^H - p^H) + y^H,$$

where the optimal pricing choice of sellers is $p^H = y^H + \tau$. Note that $u_G^H - p^H > 0 > u_G^L - p^H$, so low type buyers have no incentive to buy such a house. Then the expected value function of sellers when they choose to serve high type buyers exclusively is,

$$V_H^S = -k_G + \mu(s)\lambda y^H. \tag{1}$$

For the equilibrium 2, which the buyers' choice is $\{\beta^H = 0, \beta^L = 1\}$, the value function of the high type buyers is just y^H since they choose not to buy, while the expected value function of the low type buyers is,

$$V_L^B = \alpha(s)(u_B^L - p^L) + y^L,$$

where the optimal pricing choice of sellers is $p^L = y^L$. Note that $u_B^L - y^L = 0 > u_B^H - y^L$, so high type buyers have no incentive to buy such a house. Then the expected value function of sellers when they choose to serve low type buyers exclusively is,

$$V_L^S = -k_B + \mu(s)(1-\lambda)y^L. \tag{2}$$

For the equilibrium 3, which the buyers' choice is $\{\beta^H = 1, \beta^L = 1\}$, the expected value functions are,

$$V_H^B = \alpha(s)(u_M^H - p^M) + y^H,$$

$$V_L^B = \alpha(s)(u_M^L - p^M) + y^L.$$

where the optimal pricing choice of sellers is $p^M = y^L$. Note that $u_M^L - y^L > u_M^H - y^L = 0$, the consumer surplus of the high type buyers is zero, so they are indifferent between buying such a house or not; meanwhile low type buyers receive a consumer surplus $u_M^L - y^L$. Then the expected value function of sellers when they choose to serve both types of buyers is,

$$V_M^S = -k_M + \mu(s)[\lambda y^L + (1-\lambda)y^L] = -k_M + \mu(s)y^L. \tag{3}$$

We can derive the critical conditions by comparing these three expected value functions of sellers in three equilibria. Comparing equation (1) and (2), equilibrium 1 is better off if and only if,

$$k_G - k_B < \mu(s)[\lambda y^H - (1-\lambda)y^L].$$

Comparing equation (1) and (3), equilibrium 1 is better off if and only if,

$$k_G - k_M < \mu(s)[\lambda y^H - y^L].$$

Comparing equation (2) and (3), equilibrium 2 is better off if and only if,

$$k_M - k_B > \mu(s)\lambda y^L.$$

Let us denote $\gamma = \mu(s)[\lambda y^H - y^L]$ and $\delta = \mu(s)\lambda y^L$, three indifference functions becomes:

$$k_B = k_G - (\gamma + \delta) \tag{4}$$

$$k_G = k_M + \gamma \tag{5}$$

$$k_B = k_M - \delta \tag{6}$$

Proposition 1 *Given the income of the low type buyers y^L unchanged, as the income of the high type buyers y^H increases, sellers are more likely to invest k_G, equilibrium 1 are more likely to achieve.*

Proof. Recall that $\gamma = \mu(s)[\lambda y^H - y^L]$ and $\delta = \mu(s)\lambda y^L$, when the proportion of high type buyers λ increases, γ increases, δ remains unchanged and $\gamma + \delta$ increases, so we can find that equations (4) and (5) shift to right, as shown in Figure 3. It is obvious that the area of "G", which denotes the possibility of equilibrium 1 increases, and the area of "M", which denotes the possibility of equilibrium 2 decreases. Given y^L unchanged, if y^H increases, the relative income y^H/y^L increases, sellers are more likely to invest k_G, serve the high type buyers exclusively. ∎

We can also discuss the effects to equilibria when the proportion of high type buyers λ changes, but it seems impossible to change λ in a static model. However, the relative income y^H/y^L can be affected immediately by some government policies, we will discuss the effects of those policies later.

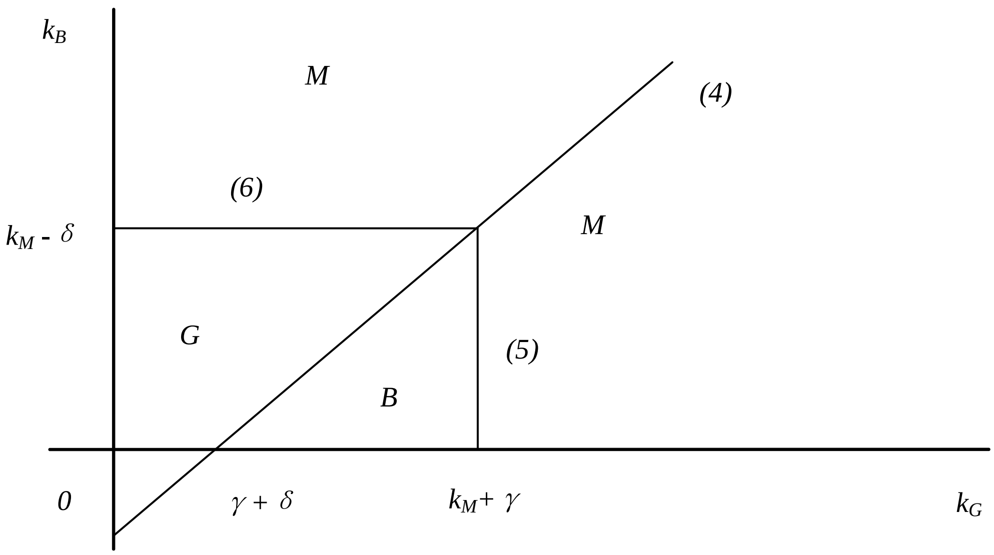

Figure 2: The equilibria in housing market.

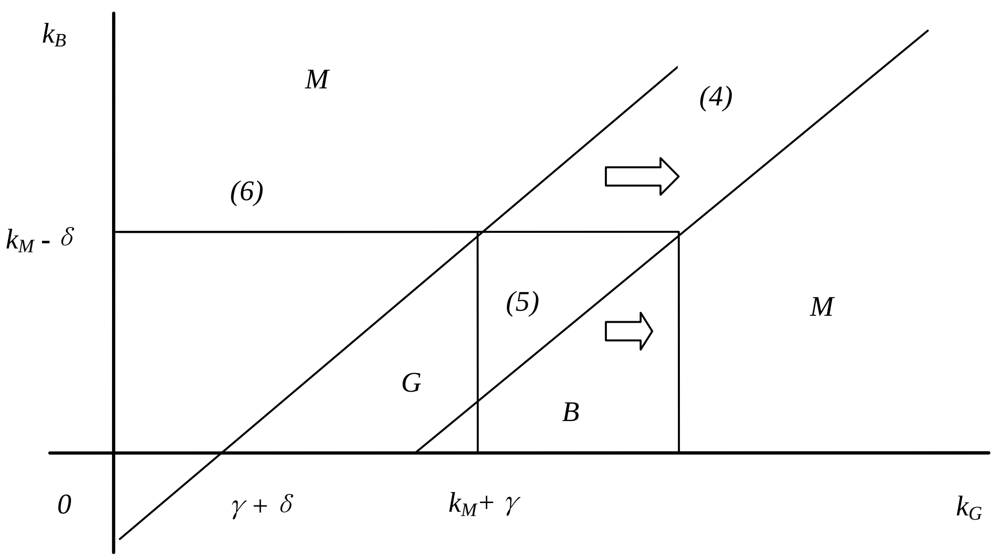

Figure 3: The effects when relative income increases.

2.3 Social Welfare

Now we can solve the social welfare functions for three equilibria, and work out the optimal choice of the social planner. Recall $u_G^H = y^H > u_G^L$, $u_B^L = y^L > u_B^H$ and $u_M^L > u_M^H = y^L$, the social welfare functions are,

$$SW_G = \lambda V_H^B + (1-\lambda)V_L^B + sV_H^S = \lambda y^H + (1-\lambda)y^L + \alpha(s)\lambda y^H - sk_G, \quad (7)$$

$$SW_B = \lambda V_H^B + (1-\lambda)V_L^B + sV_L^S = \lambda y^H + (1-\lambda)y^L + \alpha(s)(1-\lambda)y^L - sk_B, \quad (8)$$

$$SW_M = \lambda V_H^B + (1-\lambda)V_L^B + sV_M^S = \lambda y^H + (1-\lambda)u_M^L + \alpha(s)y^L - sk_M \quad (9)$$

Then we can derive the following proposition in relation to social welfare,

Proposition 2 *The social planner's optimal choice will always be pooling equilibrium if sellers choose to serve both types of buyers; the social planner may still prefers a pooling equilibrium than separating equilibria when sellers choose to serve exclusively high or low type buyers.*

Proof. Comparing equation (7) and (8), government prefers equilibrium 1 if and only if,

$$k_G - k_B < \mu(s)[\lambda y^H - (1-\lambda)y^L].$$

We should notice that $u_M^L > u_M^H = y^L$, then

$$SW_M = \lambda y^H + (1-\lambda)u_M^L + \alpha(s)y^L - sk_M > \lambda y^H + (1-\lambda)y^L + \alpha(s)y^L - sk_M$$

Comparing equation (7) and (9), government prefers equilibrium 3 if and only if,

$$k_G - k_M > \mu(s)[\lambda y^H - y^L].$$

Comparing equation (8) and (9), government prefers equilibrium 3 if and only if,

$$k_M - k_B < \mu(s)\lambda y^L.$$

Recall the equations (4),(5) and (6), we can find that government always prefers equilibrium 3 if it is also the optimal choice for sellers. However, the reverse does not hold because $u_M^L > y^L$. ■

The intuition is simple, since seller can choose the set up cost k_i to take all the consumer surplus in separating equilibria 1 and 2, when they serve high or low type buyers exclusively. When sellers want to serve both types of buyers, they have to choose a house price $y^L = u_M^H < u_M^L$. In such a case, all the consumer surplus of the high type buyers is taken but some consumer surplus of the low type buyers is remaining. Social planner has more incentive than sellers to implement the pooling equilibrium and to make more buyers get houses.

2.4 Policy Implications

By knowing that government have more incentive than sellers to implement a equilibrium of more houses, we can analyze some different policies following this objective.

2.4.1 Tax on buyers

Social planner charges a tax t from high type buyers, and transfer it to the low type buyers. Each low type buyer receives a transfer $\frac{\lambda}{1-\lambda}t$, We assume that $y^L + \frac{\lambda}{1-\lambda}t < y^H - t$, so the high type buyers are still richer than low type buyers after this process of tax and transfer. Following the similar procedure as the benchmark model, we can work out the expected value of sellers in three types of equilibria.

For the equilibrium 1, which the buyers' choice is $\{\beta^H = 1, \beta^L = 0\}$, the value function of the low type buyers is just $y^L + \frac{\lambda}{1-\lambda}t$ since they choose not to buy, while the expected value function of the high type buyers is,

$$V_H^B = \alpha(s)(u_G^H - p^H) + y^H - t,$$

where the optimal pricing choice of sellers is $p^H = y^H - t$. Then the expected value function of sellers when they choose to serve high type buyers exclusively is,

$$V_H^S = -k_G + \mu(s)\lambda(y^H - t). \tag{10}$$

For the equilibrium 2, which the buyers' choice is $\{\beta^H = 0, \beta^L = 1\}$, the value function of the high type buyers is just $y^H - t$ since they choose not to buy, while the expected value function of the low type buyers is,

$$V_L^B = \alpha(s)(u_B^L - p^L) + y^L + \frac{\lambda}{1-\lambda}t,$$

where the optimal pricing choice of sellers is $p^L = y^L + \frac{\lambda}{1-\lambda}t$. Then the expected value function of sellers when they choose to serve low type buyers exclusively is,

$$V_L^S = -k_B + \mu(s)(1-\lambda)(y^L + \frac{\lambda}{1-\lambda}t). \tag{11}$$

For the equilibrium 3, which the buyers' choice is $\{\beta^H = 1, \beta^L = 1\}$, the expected value functions are,

$$V_H^B = \alpha(s)(u_M^H - p^M) + y^H - t,$$

$$V_L^B = \alpha(s)(u_M^L - p^M) + y^L + \frac{\lambda}{1-\lambda}t,$$

where the optimal pricing choice of sellers is $p^M = y^L + \frac{\lambda}{1-\lambda}t$. Then the expected value function of sellers when they choose to serve both types of buyers is,

$$V_M^S = -k_M + \mu(s)(y^L + \frac{\lambda}{1-\lambda}t). \tag{12}$$

The proposition in relation to this policy can be summarized as:

Proposition 3 *When government impose a lump-sum tax on the high type buyers, and transfer it to the low type buyers, sellers are more likely to invest the median set up cost and serve both types of buyers.*

Proof. Comparing equations (10) and (11), equilibrium 1 is better off if and only if,

$$k_G - k_B < \mu(s)[\lambda y^H - (1-\lambda)y^L - 2\lambda t].$$

Comparing equations (10) and (12), equilibrium 1 is better off if and only if,

$$k_G - k_M < \mu(s)[\lambda y^H - y^L - \frac{(2-\lambda)\lambda t}{1-\lambda}].$$

Comparing equations (11) and (12), equilibrium 2 is better off if and only if,

$$k_M - k_B > \mu(s)(\lambda y^L + \frac{\lambda^2 t}{1-\lambda}).$$

Now $\gamma = \mu(s)[\lambda y^H - y^L - \frac{(2-\lambda)\lambda t}{1-\lambda}]$ and $\delta = \mu(s)(\lambda y^L + \frac{\lambda^2 t}{1-\lambda})$, comparing to the benchmark case, we find that γ decreases, δ increases. Furthermore, the

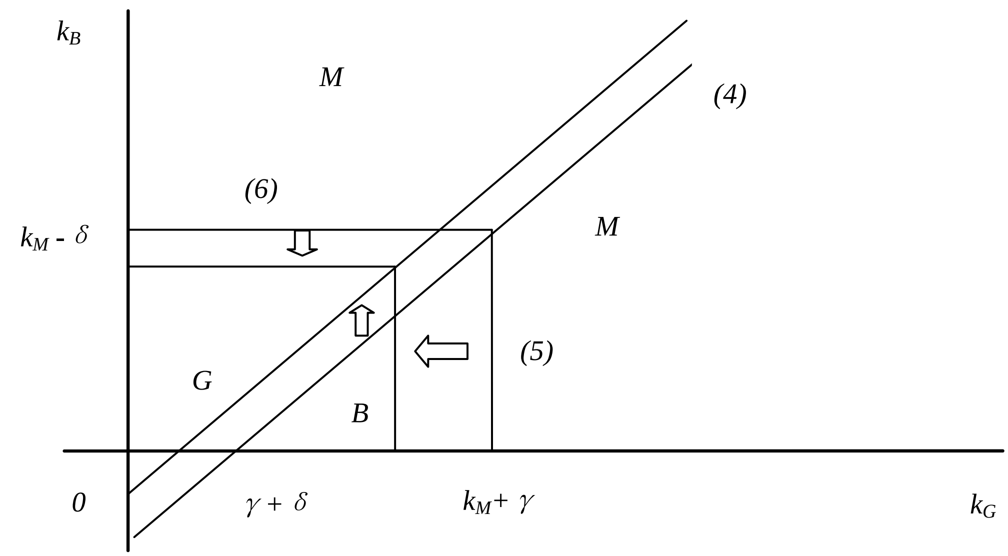

Figure 4: The effects of the tax on buyers.

interception $\mu(s)[\lambda y^H - (1-\lambda)y^L - 2\lambda t] < \mu(s)[\lambda y^H - (1-\lambda)y^L]$. Hence, we can draw the figure 4 showing that equation (4) shifts up, equation (5) shifts to left and equation (6) shifts down. ■

2.4.2 Tax on sellers

Now we consider the case that government charges a tax t on sellers, and transfer it to both high and low type buyers, then the cost of building a house becomes $k_i + t$, consumers' disposable income becomes $y^i + \tau$. such that $t = s\tau$. Following the similar procedure as the benchmark model, we can work out the expected value of sellers in three types of equilibria.

For the equilibrium 1, which the buyers' choice is $\{\beta^H = 1, \beta^L = 0\}$, the value function of the low type buyers is just $y^L + \tau$ since they choose not to buy, while the expected value function of the high type buyers is,

$$V_H^B = \alpha(s)(u_G^H - p^H) + y^H + \tau,$$

where the optimal pricing choice of sellers is $p^H = y^H + \tau$. Then the expected value function of sellers when they choose to serve high type buyers exclusively is,

$$V_H^S = -(k_G + t) + \mu(s)\lambda(y^H + \tau). \tag{13}$$

For the equilibrium 2, which the buyers' choice is $\{\beta^H = 0, \beta^L = 1\}$, the value function of the high type buyers is just $y^H + \tau$ since they choose not to buy, while the expected value function of the low type buyers is,

$$V_L^B = \alpha(s)(u_B^L - p^L) + y^L + \tau,$$

where the optimal pricing choice of sellers is $p^L = y^L + \tau$. Then the expected value function of sellers when they choose to serve low type buyers exclusively is,

$$V_L^S = -(k_B + t) + \mu(s)(1-\lambda)(y^L + \tau). \tag{14}$$

For the equilibrium 3, which the buyers' choice is $\{\beta^H = 1, \beta^L = 1\}$, the expected value functions are,

$$V_H^B = \alpha(s)(u_M^H - p^M) + y^H + \tau,$$

$$V_L^B = \alpha(s)(u_M^L - p^M) + y^L + \tau,$$

where the optimal pricing choice of sellers is $p^M = y^L + \tau$. Then the expected value function of sellers when they choose to serve both types of buyers is,

$$V_M^S = -(k_M + t) + \mu(s)(y^L + \tau). \tag{15}$$

The proposition in relation to this policy can be summarized as:

Proposition 4 *When government impose a lump-sum tax on the sellers, and transfer it to both types of buyers, sellers are more likely to invest the median set up cost and serve both types of buyers.*

Proof. Comparing equations (13) and (14), equilibrium 1 is better off if and only if,

$$k_G - k_B < \mu(s)[\lambda y^H - (1-\lambda)y^L + (2\lambda - 1)\tau].$$

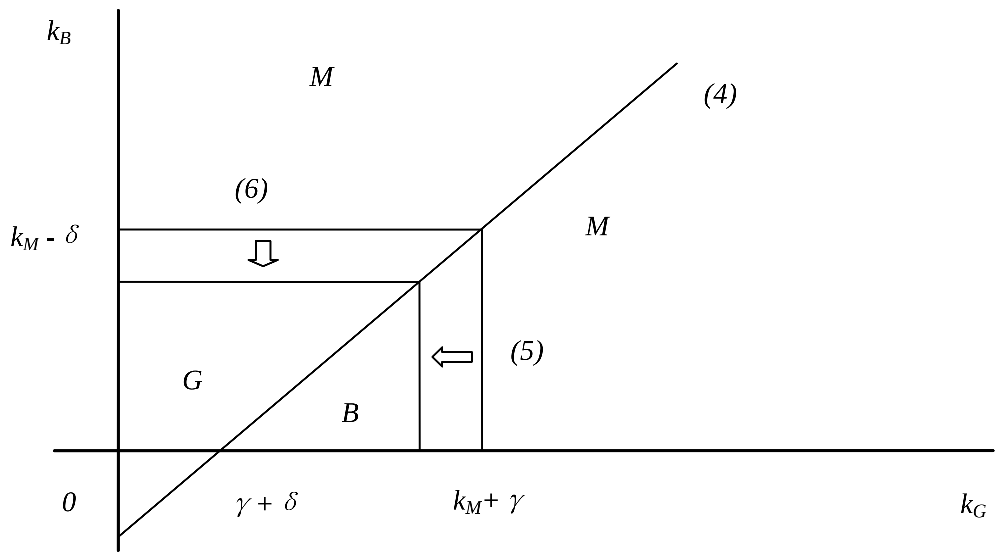

Figure 5: The effects of the tax on seller with $\lambda = 0.5$.

Comparing equations (13) and (15), equilibrium 1 is better off if and only if,

$$k_G - k_M < \mu(s)[\lambda y^H - y^L - (1-\lambda)\tau].$$

Comparing equations (14) and (15), equilibrium 2 is better off if and only if,

$$k_M - k_B > \mu(s)\lambda(y^L + \tau).$$

Now $\gamma = \mu(s)[\lambda y^H - y^L - (1-\lambda)\tau]$ and $\delta = \mu(s)\lambda(y^L + \tau)$, and $\gamma + \delta = \mu(s)[\lambda y^H - (1-\lambda)y^L + (2\lambda - 1)\tau]$, comparing to the benchmark case, we find that γ decreases, δ increases but we do not know if $\gamma + \delta$ increases or decreases, it depends on the value of λ. Hence, we can draw the Figure 4 showing that equation (5) shifts to left and equation (6) shifts down. ■

Gini coefficient is related to the relative income y^H/y^L. As the relative income y^H/y^L decreases, the Gini coefficient is reduced, the income of low type buyers is relatively increased. Hence, to serve those low type buyers is more profitable for sellers. Sellers are more likely to serve both types of buyers, as Figure 5 shows.

3 Related Empirical Evidence

The immediate implication of the model implies that for a given growth rate of aggregate income, the higher the inequality it is more likely the housing market end up in one of the separating equilibrium, whether the price is set up high or low depends terms of trade of seller's. In this section we collect empirical data to show if our argument meets the fact.

As there is no empirical data on seller's set up cost, we collected the data the Land Transaction Price Index from the National Bureau of Statistics. Although, the transaction price does not necessarily reflect the quality of a house, but this price contains information on location and scarcity of the land, and sellers' terms of trade of the market. The higher the price is, it reflects sellers are more willing to invest, in ex-ante, more in housing market, or the land use to build houses is valuable. There are prices of other input materials influence the set up cost, because of it is likely that these prices are determined in other market that is outside out model, we do not consider these factors.

We use the national level data of the Land Transaction Price from 2006 quarter 1 to 2010 quarter 1. Further, we fix the base year as 2005[2] and use the simple mathematical mean to find annual growth rate of the land price. Further, we collected the Gini index for China in the same periods. The Gini index in 2006 is calculated from Asian Development Bank, data for 2007 to 2009 we find it from CIA World Factbook, the 2010 data is averaged between Consensus Bureau and data we found through other medias. To make these two series to be comparable, we take log values of growth rate of land price. The following figure plots these two series.

The picture shows clear positive co-movements between the two series. The model predicts that if it profitable to serve the high type buyers exclusively, the economy converges to equilibrium 1 in which case seller invest more to attract higher type buyers and charge high price to screen out low type buyers. Considering the fact that the average GDP growth rate is more than 9% the 2006 to 2010, the high Gini index implies the wealth is mainly

[2]In original time series, the base year is not fixed, and the index is calculated by taking last year as the benchmark.

Figure 6: The relationship between Gini coefficient and land price in China, 2006-2010.

accumulated in the hands of rich people (otherwise the Gini coefficient should show steady decrease by catching up effect). As high income people's wealth is piling up, it becomes profitable to serve those people with high set up cost houses and charging high price. Hence the seller investment more in housing market, the direct effect will be soaring up land price. It explains why the land price is increasing with Gini coefficient, it is straightforward to conclude the housing price in same period will increase, hence, we did not show this series in the graph.

After experiencing a dramatic increasing in property price from October, 2009, Chinese government try to cooling the hot housing market by using some policies including tightening restrictions on down pay request of land transactions and increasing the requirement of mortgage application. From our analysis, we can find that the first policy will increases the set up cost of sellers hence reduces the profit margin in serving both types of buyers, the market in favor of equilibrium 1 hence it will increase the property price. For the second policy, which aims to reduce speculative demand of high type buyers, will also decrease the disposable income of low type buyers, then sellers may find it is still profitable to serve high type buyers exclusively.

Because of the analysis of government policies in the previous and the related empirical evidence shown above, to maximize social welfare and provide houses to more buyers, a government should focus on reducing the relative income of buyers. As the inequality of buyers' income is decreasing, sellers will find that the profit margin of serving only one type of buyers is also reducing. They have more incentive to provide the median quality houses to all the buyers.

4 Conclusion

The paper provides us some interesting comparative static properties which allow us to do policy experiments. In our model, some re-distributive taxation policy will drive down the profit margin of sellers who choose to serve the high type buyers exclusively, the trade-offs is in favor of serving both types of buyers. Through, the final result depends on the set up cost for different type of houses but the asking price of sellers will be reduced. Second, we discussed the consequences of current housing market policies including tightening restrictions on down pay request of land transactions and increasing the requirement of mortgage application. Our model predicts that such policies will make few effect on sellers' product choice, even in some cases they may increase the property price.

From our analysis, we believe that the most efficient policies are those can reduce the inequality of buyers' income, for example re-distributive taxation policy.

References

[1] Acemoglu, Daron (1999), "Changes in unemployment and wage inequality: an alternative theory and some evidence", *The American Economic Review*, Vol. 89, No. 5 (Dec., 1999), pp. 1259-1278.

[2] Albrecht, James, Axel Anderson, Eric Smith and Susan Vroman (2007), "Opportunistic matching in the house market", *International Economic Review, No.* 48:2, pp. 641-664.

[3] Albrecht, James, Pieter A. Gautierz and Susan Vroman (2009), "Directed Search in the Housing Market", Working paper.

[4] Burdett, Kenneth and Melvyn G. Coles (1999), "Long-Term Partnership Formation: Marriage and Employment", *The Economic Journal*, Vol. 109, No. 456, Features (Jun., 1999), pp. F307-F334.

[5] Carrillo, Paul Ernesto(2006), "An equilibrium search model for buyers and sellers and an empirical application for the real estate market", Ph.D. Dissertation, University of Virginia, 2006, 95 pages, No. 3189336.

[6] Wheaton, William C. (1990), "Vacancy, Search, and Prices in a Housing Market Matching Model", *The Journal of Political Economy*, Vol. 98, No. 6 (Dec., 1990), pp. 1270-1292.