

# Modeling Shanghai Real Estate Market

*Dynamic insight into the sustaining house price growth*

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***Abstract:** In this paper, I try to get insight into the abnormally sustaining house price growth, or so-called house market bubble in Shanghai real estate industry by the tool of system dynamic method which especially focuses on the systems with highly dynamic characteristics, and many feedbacks relationships involved, which is consistent with the real estate market system. The most fundamental purpose of this project is to see whether it is the speculators' intervention that causes the problem of unsuitable high price in Shanghai house market or not and to see what kind of impact both on the society and economic field will be after the trend of speculation is quenched. This paper mainly divides the system into 6 parts, population and economy sector, family house demand sector, speculators' demand sector, speculators' profitability sector, house price sector, and house construction and sale sector to analyze how these subsystem can directly or indirectly work on the whole real estate industry in Shanghai.*

**Key words:** System dynamic method; Feedbacks; Real estate industry; Speculation,

## 1. Introduction

### 1.1. General context

With China's opening up policy deepening, Shanghai, one of the China's economic powerhouses, its urban housing industry is also benefit from it. The implementation of the new policy in the real estate sets up and spurs the growth of market, which bit by bit accounted for the pretty significant part in the Chinese economic growth, and is

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gradually to be the mainstay industry. Statistics show that the added value of the city's real estate industry accounted for 6.4 percent of city's total gross domestic product in 2001, 7 percent in 2002, compared with only 1.4 percent in 1991. It's evident to see that Shanghai are now experiencing high speed growth, it attracts more and more people, and the city's own reconstruction accelerates. Like most large cities in the world, the improvement of living condition is always among those things to which people pay more attention. The recovery and development of the real estate market in Shanghai are mainly due to the quick growth of demand, which is triggered by the municipal reconstruction of the central part of the city, people's strong desire to improve living condition, increase of income, and the change of traditional conception which is accompanied by the trend of fewer and fewer family members in a household. Meantime, purchasing houses as investment becomes more and more attractive due to the high house unit area price growth rate. As these factors will exist for quite a long time and the impact is pretty enormous, it's very useful to approach the issues by system dynamic analysis.

I don't think the present situation is satisfying, so I would like to use what I've learned to get insight into the future market.

## **1.2. Problem descriptions and dynamic hypothesis**

*The most obvious problem is that potential non-investment oriented demands haven't been largely satisfied and most people complain about the high price*

Acknowledged, many exogenous and endogenous factors can finalize the house price, including the land price, demand and supply ratio etc. At the very beginning, the local citizens' houses are assigned by the government (*Fu Li Fen Fang*), also called *welfare housing allocation*, that is, government allocate the houses to people who move from one district to another because of some well-planned municipal reconstruction programs or some other spontaneous factors like eager to ameliorate their living condition. These years, however, there's no more cinch to seek a decent pad in shanghai, for the *welfare housing allocation* policy was abolished, instead, government has implemented and has been accelerating the capitalization process of

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housing distribution, that is, people get money consistent with the capita in their family, which make many unaffordable people flooded into the real estate market. Hence, Shanghai real estate market, is more and more commercialized with the market's playing the key roles, and people they have to repurchase through the market, which is lead to a very stark different opportunities and constraints for two kinds of people

1. **Speculators** who want to make a bundle in the immature real estate market through *batch purchasing*, and then drive up the price
2. The truly house-needed people can't afford the expenditure of the house because of the frenzy growth of the housing price

A clear duality of socioeconomic structure exists. The unusual high price remains an important watershed in the social and economic contours of these two types of people

The house supply in Shanghai with the unit price under 3000 Yuan (375 US dollars), which is appropriate for the common *income generation (Gong xin jie ceng)* who accounted for the majority of housing demanders compliant with municipal reconstruction programs to improve their house condition, is much less up to par (<60% of the total housing supply). According to the data from Shanghai real estate trade and exchange center, for example, the aggregate registered presale areas of commercial housing are 14,590,000 square meters during the first half year of 2004 consisted with the ratio of 22.6%, 31.7%, 32.1%, 13.6%, with the price below 3500 Yuan, 3500~6000 Yuan, 6000~9000 Yuan, and above 9000 Yuan respectively (54.3% of the housing supply is below 6000, up by 17.4% from 2003, yet still far to enough!) In another hand, The real estate corporations incline to construct the house with 100 square meters, which is according to the demand of most income generation, and the total expenditure is from 300,000 to 500,000 Yuan (37,500~61,000 US dollars), However, that kind of houses are also involved the most of speculation, which allure billions of the idle funds leading to the frenzy price growth

### 1.3. The purpose of this project

*The most fundamental purpose of this project is to see whether it is the speculators' intervention that causes the problem of unsuitable high price or not and to see what kind of result will be after the trend of speculation is quenched.*

## **2. Why System Dynamics is applied?**

System dynamics has been applied to issues ranging from corporate strategy to the dynamics of diabetes, from the cold war arms race between the US and USSR to the combat between HIV and the human immune system. System dynamics can be applied to any dynamic systems, with any time and spatial scale. [Sterman Business Dynamics]

Through the quotation above, it can be seen that system dynamics focuses on the systems with highly dynamic characteristics, and many feedbacks relationships involved. As known to all, real estate markets are among the most unstable and cyclic asset market, exhibiting large amplitude cycle of 10~20 years. Real estate constitutes a large fraction of total wealth in any economy, generates a significant fraction of banking activity and debt, and strongly affects the job market, consequently, real estate booms are often accompanied by periods of intense speculation involving expansion of credit and banking activity, stimulating the local and even national economy. When the bubble bursts, the resulting bad loans, defaults, and unemployment can throw an entire region into recession or even depression. Hence, real estate industry is just a highly dynamic system on which is appropriate to apply the system dynamic analysis.

Moreover, when we try to solve some problem, we usually just focus on the problem itself, which is quite related to the essence of system dynamics, which only model the problem, not the whole system. Here the problem is high price compared to income level in a certain period, and how the speculation can affect the house price. As to the price level, there are many factors influencing it. The most basic one is the price

adjustment mechanism by demand and supply. Besides this, investors' price setting, which is usually hard to quantify, is rather crucial in this case since the market is not so mature and regulated, and everything is determined by market itself. As summarized above, different factors make the price level in a highly dynamic state. Unlike other statistic methods, which are just recorded the trend of price, system dynamics will try to trace the price level by studying the cause of it.

The major characteristic of system dynamics is to research events by building models, which use stock and flow components. The use of stock and flow can grasp the feedback relationships quite well. Since any stock indicates a delay in the system, which is very reasonable and realistic in real system because no impact can be in action immediately after implementation, system dynamics models can portray the problem more veritably.

In a word, as to such a complicated, dynamic and highly interconnected system like real estate market in Shanghai, system dynamics is a suitable research methodology. Of course it doesn't mean that this method is perfect, for the system is so complex under different circumstances, it's hard to include everything.

## **3. Conceptual model**

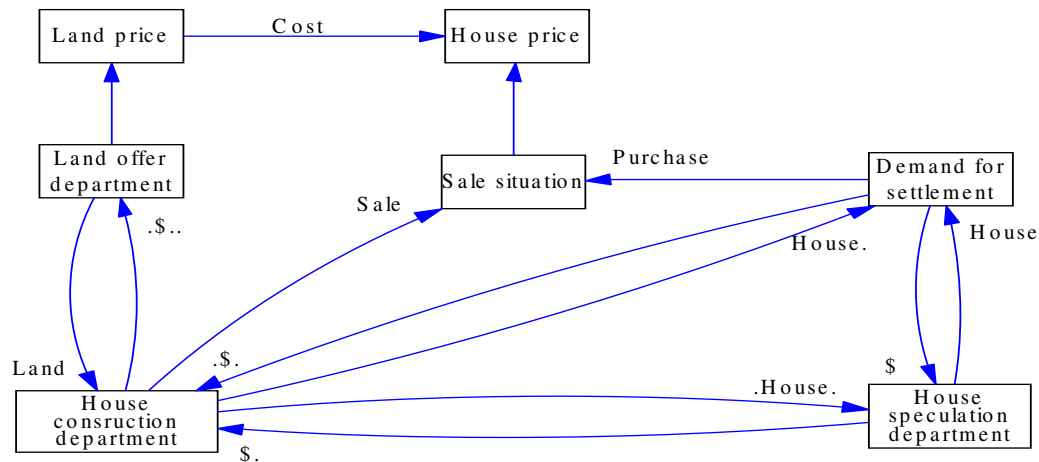
### **3.1. Verbal description**

The real estate industry has several characters:

1. Highly dynamic: there is some delay from the beginning of the construction to the completion, and through the market, people can purchase the houses for their settlement. After a long period of time (also a delay), houses can be demolished or descend to the secondhand market. It's obvious that these series of change is a dynamic course.
2. Complex interconnection: all the endogenous factors can affect each other, population can affect the demand, demand can affect the supply, demand and supply ratio can militate house price, and price can in turn influence the demand

and so on.

The real estate industry is not a single unit, it's a very complicated and highly dynamic system. There're several departments consisting of the whole real estate market. Their interconnections are showed as follows:



*Figure 3.1 The interconnection of the real estate industry*

### 3.2. Model boundary

When applying system dynamic to solve a problem, one should not try to model the system where the problem arises. One should try to model the problem itself, extract the information what is really needed to explain, and how a certain behavior arises from the structure. Therefore it is useful to make assumption and discuss what kind of variables should be considered as a endogenously (arising from interaction of the variables in the model itself) or exogenously, as an constant

Hence, it is useful to select what are included and what are excluded from model. A model boundary chart would summarize the scope and the elicitation process where variables that are related to the problems solving process, are chosen to be in the model.

<b>Endogenous</b>	<b>Exogenous</b>	<b>Excluded</b>
<ul style="list-style-type: none"> <li>● House unit area price</li> <li>● Price trend</li> <li>● Land availability</li> <li>● Annual sale rate</li> <li>● Speculators' demand</li> <li>● Family demand</li> <li>● Speculators' revenue</li> <li>● Affordable house price</li> <li>● Speculators' profitability</li> </ul>	<ul style="list-style-type: none"> <li>● GDP growth rate</li> <li>● Land offer</li> <li>● Average house area</li> <li>● Average land area per house</li> <li>● Interest rate</li> <li>● Tax rate</li> <li>● Construction time</li> <li>● Time to sell houses</li> <li>● Forced freezing time</li> <li>● House life</li> <li>● Loan fraction</li> <li>● House/family</li> <li>● Population growth</li> <li>● Household growth</li> <li>● Resale time</li> </ul>	<ul style="list-style-type: none"> <li>● Financial problem when house company are constructing housing</li> <li>● Second hand house market</li> <li>● Renting of Houses</li> <li>● Other factors which can affect the house purchase</li> </ul>

### 3.3. Time horizon

In this model the time horizon is set to be 22 years, from the beginning of 1998 when the new land policy was implemented at the start of 2020. Since there are many elements that influence the development of real estate market and they change regularly. In order to exhibit the large amplitude cycle of 10-20 years and capture the longest delay and indirect side effects, it's necessary for us to set the time horizon long enough.

### 3.4. Causal loop diagram

Before one sketches the stock and flow diagram, it's very necessary to draw the causal loop first, which can visually and clearly shows the interconnection and mutual effect

among the different variables. In this model, there are mainly 6 sub-models, which are:

1. Population and economy sector
2. Family house demand sector
3. Speculators' demand sector
4. Speculators' profitability sector
5. House price sector
6. House construction and sale sector.

The different sectors mentioned above will be drawn as causal loop diagrams specifically and separately as follows:

### 3.5. Overview of integrated CLD

Through the introductions of separate causal loop diagrams above, the integrated CLD will be presented as follows. We can easily find there are mainly 12 feedback loops inside, they are:

1. Current house price  $\rightarrow$  -real family demand  $\rightarrow$  +house sold to family  $\rightarrow$  +total house sale  $\rightarrow$  +demand and supply ratio  $\rightarrow$  + current house price **(B1)**

This is a balancing loop originated from the family demand, which can affect the house price. Increase of average family income make family house demand rise, which in turn increase the total sale, which increase the demand and supply ratio, result in the advancing of house price finally. This balancing loop mainly adjust the demand and supply between the family and house company.





2. Current house price  $\rightarrow$  +speculators' revenue  $\rightarrow$  + speculators' demand  $\rightarrow$   
 +house sold to speculators  $\rightarrow$  +total house sale  $\rightarrow$  +demand supply ratio  $\rightarrow$   
 +current house price (R1)

Compared to the common families, speculators usually have much stronger purchase power. They resell their house and the idle capital in turn accumulate, which can trigger more speculation in the real estate market, which increase the demand supply ratio, say business bubble, that is, the real house demand can't be filled, instead, most houses are bought scarily by the speculators.

3. Current house price  $\rightarrow$  +house resale profitability  $\rightarrow$  - house resale  $\rightarrow$   
 +vacant house  $\rightarrow$  -demand supply ratio  $\rightarrow$  + Current house price (R2)

This loop mainly represents the scenario after the burst of speculation in the real estate market. If speculators find the current house price lessen, that is the profitability is dwarfed, they will gradually begin to undersell their house in order to distract the invest financing to other more profitable industry, or just in case of losing more money when the total house cost begin to surpass the current total house price. Evidently, the result of speculators' house closing out will make the vacant houses spill over, and will in turn seriously decrease the house price. We can easily find there will be a big house price trough at that time.

4. Total house sale  $\rightarrow$  +demand and supply ratio  $\rightarrow$  + investment budget  $\rightarrow$  +new

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house construction → +vacant house → +house sold to family → +total house sale (R3)

More houses sold to family will increase the total house sale, which will thereby increase the demand and supply ratio, which can fill the investment budget and spurs more house construction, which increase the vacant house, make more family can buy the house.

5. Total house sale → +demand and supply ratio → +investment budget → +new house construction → +vacant house → +house sold to speculators → +total house sale (R4)

This reinforcing loop functions as the same responsibility as R3, which is from the aspect that how speculators' demand can spurs more house construction

6. House cost → -new house construction → -and availability → -land price → +house cost (B2)

7. Current house price → +house company's revenue → + investment budget → +new house construction → -land availability → -land price → +house cost → +current house price (R5)

The above two loops (B2, R5) have the same function on the adjustment of house construction.

B2 mainly adjusts the house construction from the limitation of house cost, that is, higher house price can lessen the house construction, and less house construction can increase the land availability, which can in turn decrease the land price, which decrease the house cost in the end. This loop demonstrates how the house cost can limit the house construction, that is, when the house price is very high, and the house sale is in the downturn, which is usually happened after the burst of speculation when speculator are not willing to purchase the house because of the negative price growth rate and families are not able to afford the high house price yet. There is a big sale vacuum existing.

R5 mainly adjusts the house price through the revenue aspect. The higher house price, the more revenue house company will get and therefore more investment budget are allowed to put into the new house construction, and further more decrease the land availability, finally make the house price up however, the price, here is very illusive. This loop usually dominants the system when the speculation are largely involved, which makes the real estate industry more fragile

8. Current house price  $\rightarrow$  -real family demand  $\rightarrow$  +house sold to family  $\rightarrow$  +total house sale  $\rightarrow$  +demand and supply ratio  $\rightarrow$  +investment budget  $\rightarrow$  +new house construction  $\rightarrow$  -land availability  $\rightarrow$  -land price  $\rightarrow$  +Current house price (B3)

While the increase of family demand can increase the house price from the aspect of

demand and supply ratio, it can also increase the house price through the increase of house cost, that is, more house need to be built, more land will be used, and less land availability will be, which leads to higher house price. Hence, the increase of family demand can spur the house price through two ways: one is market mechanism, which is supply and demand adjustment, another is the land limitation adjustment.

9. Current house price  $\rightarrow$  +speculators' revenue  $\rightarrow$  + speculators' demand  $\rightarrow$   
 +house sold to speculators  $\rightarrow$  +total house sale  $\rightarrow$  +demand supply ratio  $\rightarrow$  +  
 investment budget  $\rightarrow$  +new house construction  $\rightarrow$  -land availability  $\rightarrow$  -land  
 price  $\rightarrow$  +Current house price (R6)

Speculators' demand can not only make the house price up through the demand and supply mechanism, but also it can ascend the house price through the aspect of house cost, which is due to the land price increase, for more houses will be built. However, not like the family demand, speculators' demand will not shrink in face of the higher house price, instead, as long as the house growth rate is positive, speculators' demand will increase infinitely.

10. Speculators' revenue  $\rightarrow$  +speculators' demand  $\rightarrow$  +house sold to speculators  $\rightarrow$   
 +house resale  $\rightarrow$  +speculators' revenue (R7)

This reinforcing loop depicts how the house resale can fill speculators' revenue, and in turn speculators have stronger purchase power to purchase more commercial houses.

11. Speculators' revenue  $\rightarrow$  + speculators' demand  $\rightarrow$  +house sold to speculators  $\rightarrow$   
 -speculators' revenue (B4)

This small balancing loop represents how the house speculation investment can drain speculators' revenue

12. House sold to speculators → +house resale → +vacant house → +house sold to speculators (R8)

This is also a small balancing loop depicting the house resale can increase the house company's sale capacity and in turn speculators can get more house from market, however, this loop imposes really limited effect on the whole system, because when speculators dump their houses to the market, they will not repurchase the house again, for the house market is in slump, and when the profit is high, speculators will try to keep the houses for a longer time, expecting more profit in the future. Hence the market will not have extra houses sold to speculators in spite of the strong demand from speculators.

## 4. Simulation and behavior analysis

This chapter represents the result of model simulation under the following scenario

1. Ordinary real estate market 2. Real estate market with speculation involved

### 1 Ordinary real estate market

It is assumed no speculation involved, we are mainly to see how the market will go, whether it will develop with a healthy and positive state. We make that by adjusting the real interest rate big enough, say 30%, so that no speculators will invest the real estate industry for the high interest rate

Analysis:

Phase 1:

At the beginning of phase one, the initial total price of new houses is 349,800 Yuan and the suitable new house price is 155,999 Yuan so the Price Acceptability Ratio, which equals Real Price Paid for New Houses divided by New House Price Suitable, is relatively low though only 35% families can buy the house and hence demand for new houses can be largely satisfied. (From the graph it shows that the curve of new houses sold to family greatly increase.)

But at that time the total demand is so small compared to the supply available per year that the house unit area price goes down and almost reaches to 3100Yuan/m<sup>2</sup>, which is the lowest price that investors are willing to sell houses (land cost + normal profit). Due to too much otiose house, low price, and relative small sale, the construction start rate is very small even become decelerated, because investment shrinks dramatically, the land consumption is in turn also dwarfed, which makes the land availability increase leading to land price down, and gradually, new houses under construction gradually flow into the stock of new houses by construction. So we can see at this time period the whole market is under the low development phase and with the increase of total demand it will soon face a new phase.

Actually, this simulation is very close to the real scenario in Shanghai from year 1998 to year 2000. Because during the period of year 1995 and 1996, too much investment was put into the house market than needed. This over-investment generated a large number of houses in year 1998 due to the construction time delay. Though the demand has become to increase recently, the accumulation of the houses, which were built earlier, still needs time and a shot in the arm to digest. Hence, the whole market was in the downturn with much more supply than demand, the vacancy rate was also very high. (CP is the current total house price and AP is the affordable house total price )

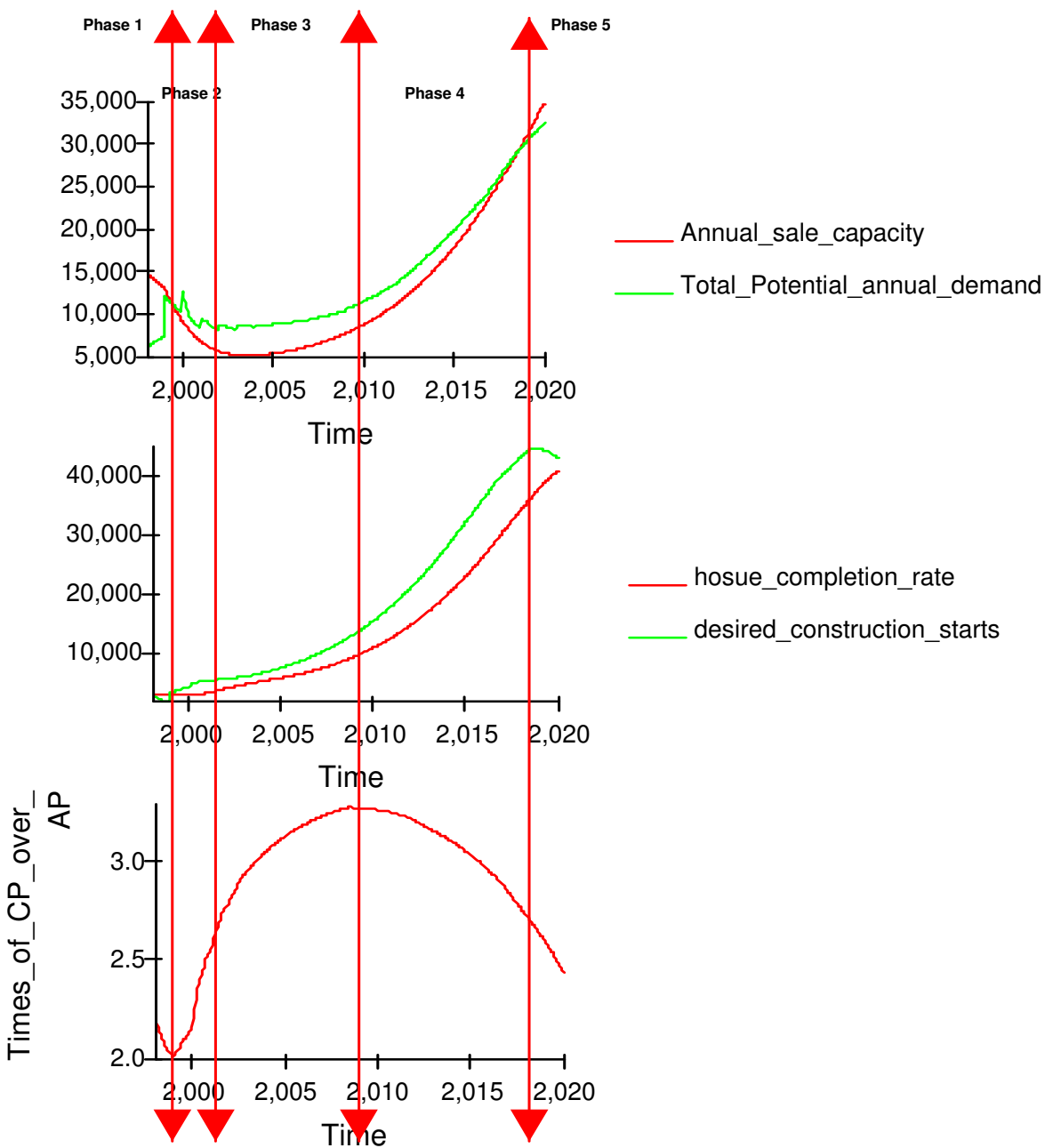


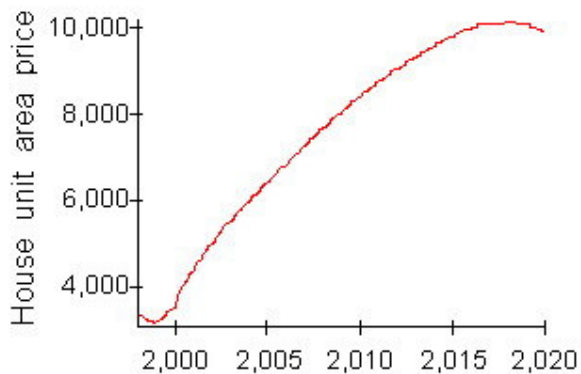
Figure 4.1.1

Phase 2:

On the other hand, if we trace back to the history, because of the house allotment policy and excess house supply, the house unit area price decreased from 1998 to the end of 1999, which was consistent with the price adjustment mechanism based on the



market itself. And then it began to rebound in year 1999 when large potential house demand flow into the house market and in turn consume the earlier excess houses. We can easily find from the graph (see phase 2) that because the house demands first time surpass the house inventory, and that's a shock to the house companies for which they haven't get ready. With the house sale become better and better while house company find the future boom market, they begin to construct new house. Although construction start rate begins to recover, but because of the construction delay, the amount of new houses doesn't increase immediately. Moreover, since in phase one nearly no investment has been made, the stock of new houses hereby start to be in the situation with negative net flow in phase 2. The increase of demand per year and the



decrease of supply per month make the new house demand supply ratio rise. Therefore at year 1999, price of new houses starts to increase in large scale.

Figure 4.1.2

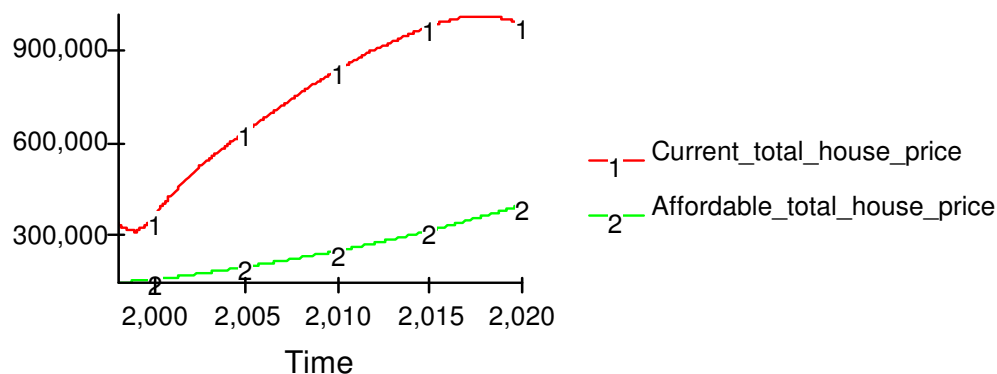


Figure 4.1.3

At the same time, with the increase of average income suitable new house price is increasing all the time. But it increases at a much lower rate than the price of new houses. So the discrepancy between these two prices becomes larger and larger and inevitably it affects the demand for new houses. So in spite of the increase of total demand, the sale rate of new houses decelerates.

### Phase 3:

After several years' construction, the investment put during phase two begins to produce new houses while the family house demand is still far more than the house supply. But this scenario with serious lack of vacant house seems to be alleviated, which can be seen from the figure 4.1.1 that the sale capacity begin to increase though still not enough. Meanwhile average income still keeps going up, however, its growth rate is still lower than the price growth rate, which makes the price gap between family affordable price and real house price bigger until year 2009. We can see from the graph below

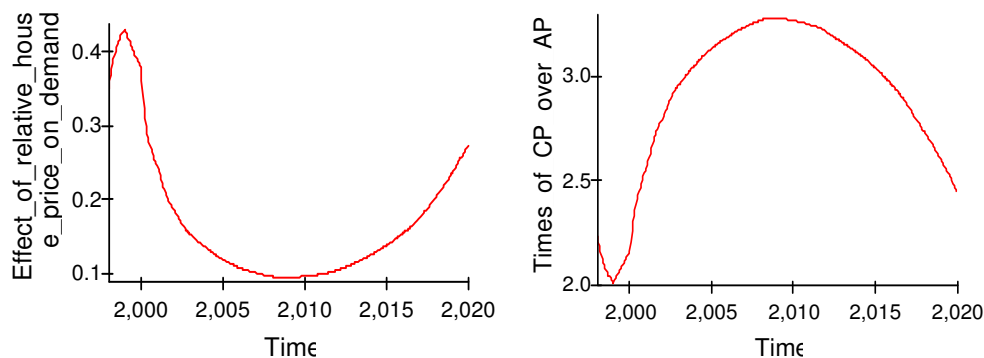


Figure 4.1.4

Because house companies have been accelerate the house construction and during phase 3, further more new completion houses flow into the new house market, which makes the demand and supply further more decrease, and in turn we can see a inflection point in figure 4.1.4 in around year 2009

#### Phase 4

In this phase, because the gap between house demand and supply is further smaller, and the “times of CP and AP” begin to decrease after the inflection point in 2009, which means more and more fractional people can purchase the house. We can see from the first graph of figure 4.1.1, that the family house demand exhibits somewhat pretty clearly exponential growth. At the same time, because the revenue is greatly filled by the prosperous market sale, house companies have more funding to invest the new house (also because the family house demand is still bigger than the house supply, which spurs house company have higher ratio of investment budget) On the other hand, we should notice that though the price is still increasing in the phase 4, but its growth begin to exhibit a kind of goal-seeking fashion at the end of phase 4, which is because the house supply is gradually close to the house demand

## **Phase 5**

The house supply finally surpasses the house demand. Because of the construction delay and earlier serious house shortage, house companies' new house construction overshoots the actual house demand. In this phase, we can see because the house inventory begins to exceed the real house demand, the house unit area price (Figure 4.1.2) begins to decrease from the stabilization and the desired construction start rate also begins to shrink, which is a new begin for the real estate's character of cyclic phenomena.

## **2. Real estate market with speculation involved**

The local media always covers a worry that active buying and selling in Shanghai's real estate market is overheated and may be a bubble. With the city development going at a ever highest, the booming future of Shanghai real estate industry, and especially the decrease of deposit interest rate of US dollars, billions of investment funding flows into Shanghai real estate market from abroad, which makes Shanghai the hottest house market and the place with the most centralized real industry speculation activity involved in China. In this part, I will mainly test the model with the condition of speculation involved (set the loan interest rate at a relative low level, say 2%), to see how the speculation can affect local people's purchase power and what will it be after the bubble burst.

Analysis:

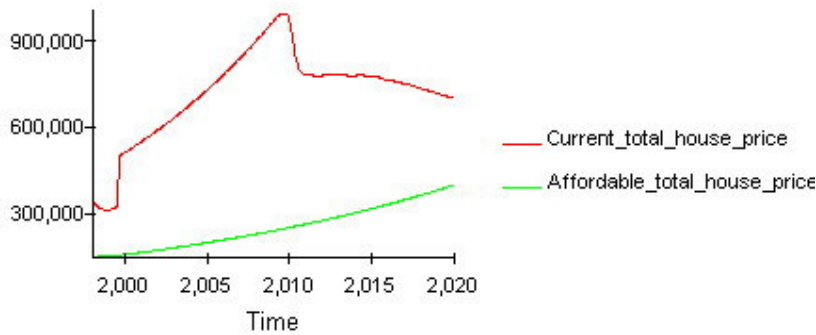
#### Phase 1

Like phase 1 of scenario 1, whole city's real estate industry is in the downturn, which originated from the over-investment in the earlier time. It still needs time for the market to digest these excess houses. As we know, speculators usually will not seek this kind of gloom house market. However, large amount of municipal reconstruction functions like a catalyst, which makes the Shanghai real estate a brilliant house market and also a ideal arena for the speculation definitely sooner or later. We can find that large scale of ordinary family was pushed into the house market in 1998 because of the abolishment of house allotment policy and accelerated city reconstructions. This huge potential ordinary family house demands wave efficiently assimilated the otiose houses built in the earlier year and awaken the Shanghai house market (we can see figure 4.2.1, that the house price rebounded in 1999 around triggered by the huge ordinary family house demands), which in addition also lured the attraction from speculators. From then on, the market exhibit a new behavior and we come to Phase 2.

#### Phase 2

Reap where one has not cultured, which is no better to describe the speculators. As the huge house demands in phase 1, the house unit area price was in turn dragged up (see the inflection point in figure 4.2.1), which is spotted by the speculators, and they began to step into this fecund house market. We can see that in phase 2, speculators

take advantage of advancing house price trend, and a great deal of idle money suddenly infused into the market. House demands for investment were so considerable at that time that the whole house market immediately dominated by speculators (they are usually very quick reacted and purchase more than one houses or



even monopoly

several floors and

whole building).

The great house

demands soon

made the house demand far more surpass the house supply, and because of the mechanism of supply and demand, house unit area price was suddenly driven up.

Although families' annual income is also increasing sustainable but the extremely abrupt house unit area price increase, a great number of families were coerced to quit from the house market, which is indicated by the dramatic downturn of annual house sold to families in the second graph.

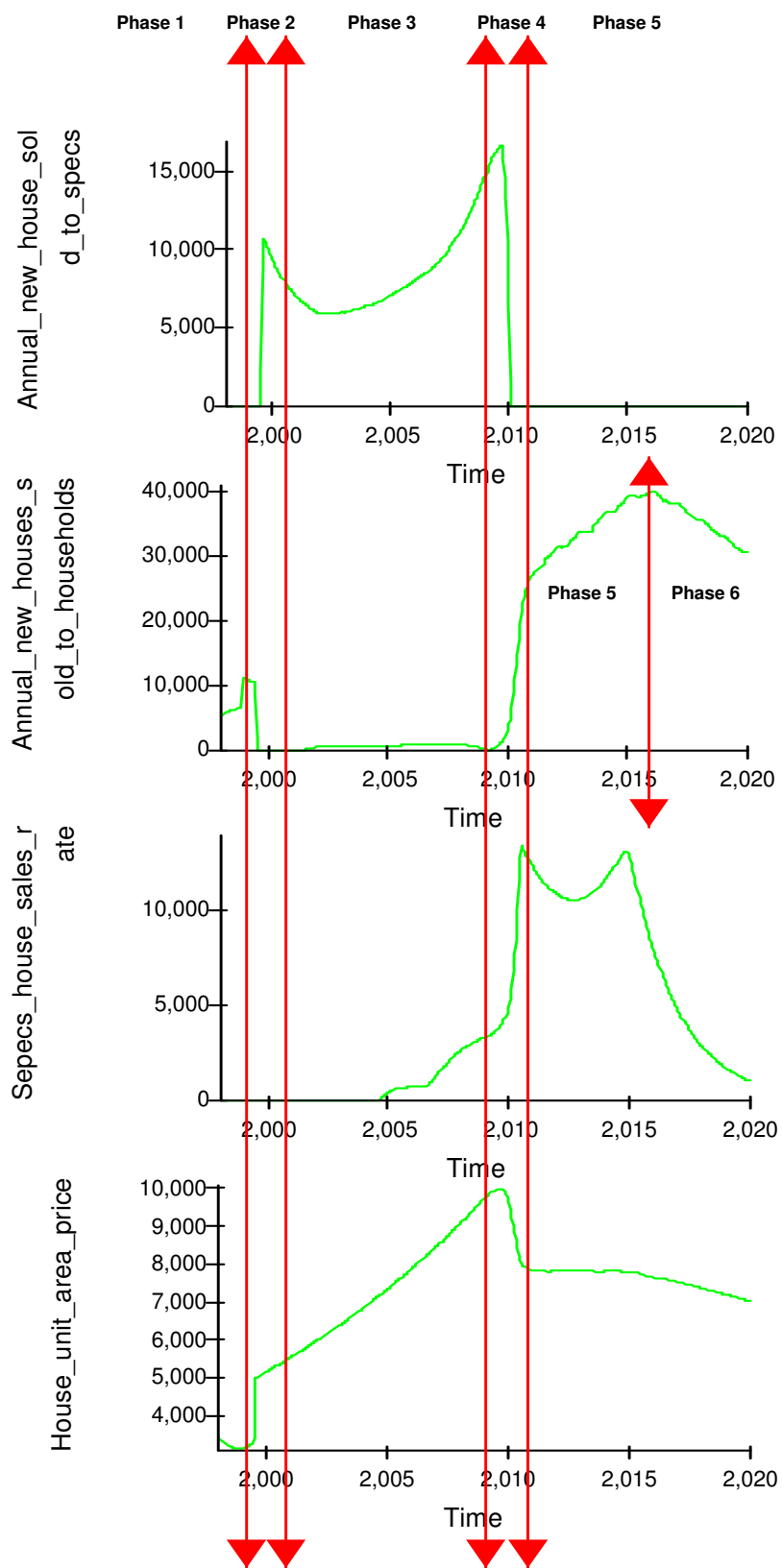
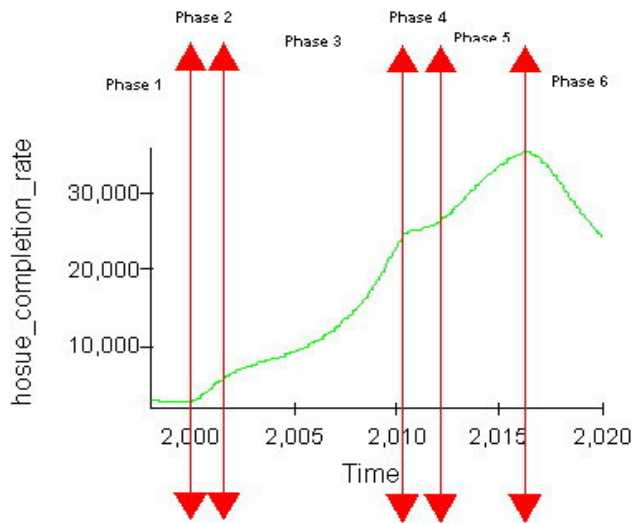


Figure 4.2.1

### Phase 3

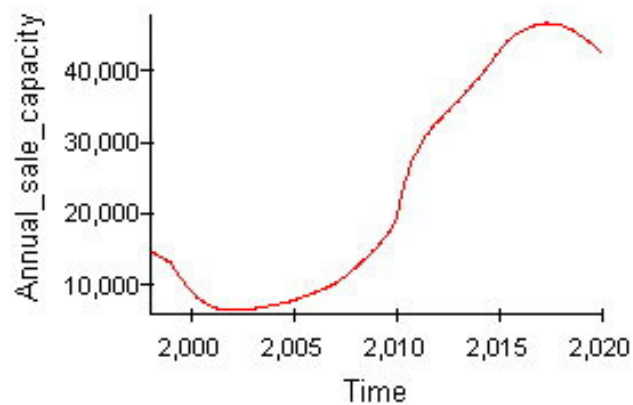
As the house demand for investment boomed in phase 2, the house inventory shortage



became serious, which indicated by the demand and supply ratio. House companies began to invest more new house construction with their revenue booming and strong market demand, but before completion,

there is a period of construction time delay. In phase 1, because of the otiose houses, new house construction kept at a low level. However, speculations' considerable house demand spurs house companies invested more, and in turn we can see the obvious upturn of new house completion from year 2000 to the mid of 2002 in phase 2 of graph above, which somewhat alleviated the house demand supply ratio but still far less than enough. Less or more, however, from the graph of annual sale

capacity(graph below), it began going up in the mid of 2002, which hereby make the house completion in the beginning of phase 3 also a little mild due to the mild



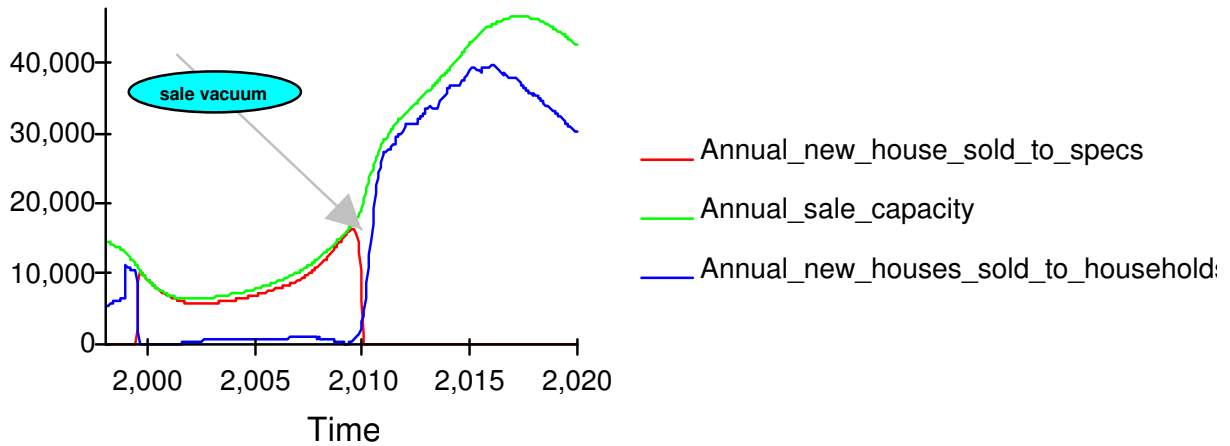
house construction start. We can easily find that the annual house sale capacity limited



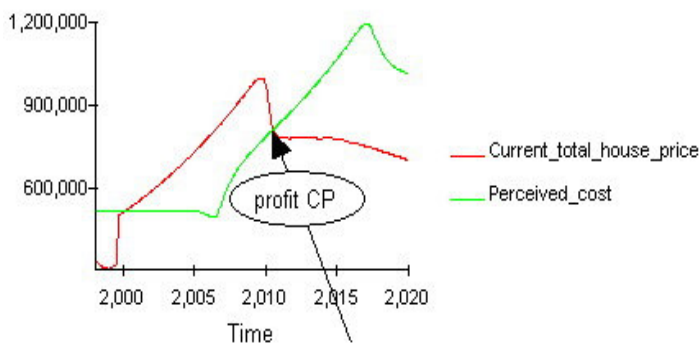
speculators' house demand, and the curve of house sold to speculators exhibits the same shape and almost the same value with the curve of annual house sale capacity (if total house demand > annual sale capacity, then the annual sale capacity = annual house sold to families + annual house sold to speculators, nevertheless, since the unusual sky-high house price and the sharp-set speculators' house demand, we can see in the phase 3 of the second graph of figure 4.2.1, there is almost no house sold to families, so approximately all the house were sold to speculators). With the up going of annual house sale capacity, more and more house demands for investment could be satisfied, this scenario can be indicated by the exponential growth of the curve of house sold to speculators, which is also because speculators' R1 loop was dominant this course. The house unit area price during this time was also growing with an exponential fashion.

#### **Phase 4**

After 5 years' forced freezing time, more and more houses from speculators begin to be resold to the house market, which associated with the large later-coming newly built houses, makes the house demand and supply ratio further close to the ordinary level, and great momentum of house price growth rate in turn began to be quenched and became gentler and gentler. In this time, speculators found there is no more house price growth and they begin stop the housing buying, which will elicit a horrible crisis in the real estate market. As we can see the graph below, because speculators retreat from the house market pretty quickly as they came in, there is a distinct house sale vacuum inside, that is because when the



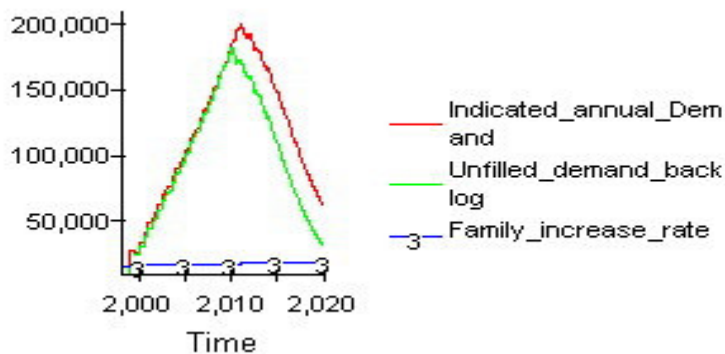
wave of speculation recedes, the sky-high house price also makes the ordinary people can't afford it. Hence, neither speculator nor ordinary families will buy the house. It is



this kind of sale vacuum without any subsequent sale supplement force makes the house unit area price dramatically decrease.

Moreover, speculators find their profit of house investment begin to shrink (see the graph above, profit=current total house price-perceived house cost), and you can see that the profit critical point, below which speculators will start to undersell their house.

Unfortunately, this nightmare happens. Year 2011 later, the profit for house investment



becomes negative, another wave of house undersell begins (see the third graph of figure 4.2.1), which generates

more vacant house and deteriorates the price decrease. We can also refer to the graph of annual house sale capacity, the house completion rate from 2011 to 2013 is relatively mild due to the house low house construction start during the time of sale vacuum. Gradually, with the price decrease and income continuing increase, more and more ordinary families again can buy the house. We can see a clearly uprising of curve of houses sold to families in the second graph of figure 4.2.1. We can also see the graph beside that the unfilled house demand backlog peaks and even begins to decrease in year 2010 when the house price begins to collapse, and in turn because not so much unfilled families join the group of annual new house demand, the annual house indicated demands also begin to decrease.

#### **Phase 5 & Phase 6**

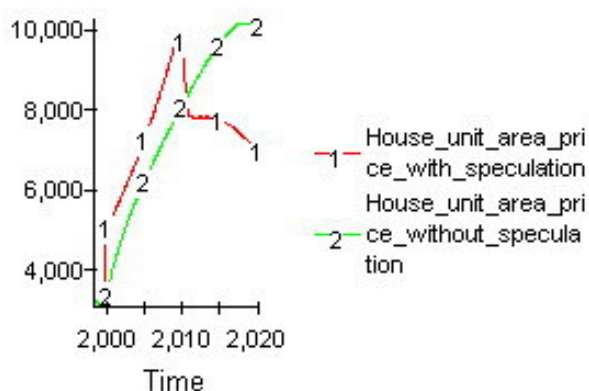
In phase 5, still no more speculation house purchase because of the downturn of house price due to the supply and demand mechanism, and ordinary families' house demand are greatly satisfied, excess houses are further assimilated by the market, and the new houses again begin to be built according to the growth rate of annual family house demand in order to fill the demand in the future (see the graph of annual house completion) Yet, because the decrease of annual indicated house demand, the house sold to ordinary families rate also becomes mild, finally in phase 6, it decreases since the large liquidation of house demand backlog, in turn the house construction start and completion are also decrease.

## 5. Conclusion

### 5.1 Major findings

After building this model and making different simulation tests, I think I get more insight into the real estate market of Shanghai. The following is several important outlines I want to point out and personally I think they are crucial to the development of the real estate market.

1. First of all, the engine for the development of the real estate market of Shanghai is nothing but the increases of demand. Fortunately, as discussed in the introduction, this increase of demand will still last for some time. So it is really a good opportunity to further develop and invest the real estate market in Shanghai.
2. How to develop is a big problem presenting in face of us. Too many interventions of government or unreasoning investment to get profit in the booming period will both do harm to the long-term development of the market. My point of view is that the present price level is somewhat abnormal because its growth rate is too high compared to the average income level. We can see the graph, acknowledged, with the city's infrastructures improvement and the amelioration of its investment environment, the increase of house price and boom of its real estate market are quite normal though there is always some people can't afford the house price. But

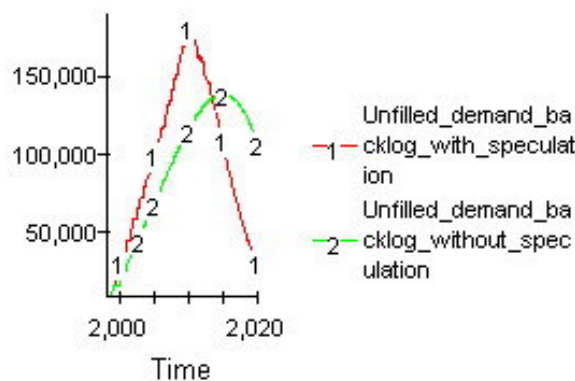


if there is too much speculation involved, we can easily find that the house price will increase in a fashion of frenzy (like exponential growth, see the red line from 2000 year to 2008 year), which is not

appropriate to its citizens' average income in some period of time, and will hugely increase the unfilled family (see the graph next page). I think that's why presently people are always complaining about the sky-high house price. Moreover, as long

as the visional boom bubble burst, who will foot the bill? For the time being, real estate industry has been accounted for more and more important position in nation's GDP growth from which also a great deal of municipal revenue come. Meanwhile, this kind of rampant real estate development incur a great wave of critics from local economist, as they believe that the nation's economy is being taken hostage by the industry while pointing out that the auctioning of land-use rights and tax of house sale have become the biggest source of revenue for local governments. If city's real estate industry someday breakdown like the collapse of house market in Hong Kong several years ago, which largely embroiled related finance organization to a financing crisis, that is, speculation transfer the risk ultimately to the local bank, the cost of illusive boom will be finally paid by the

local bank and relevant financial organization, and afterwards long-term stagnation of whole house market and the excess houses have to be assimilated by the city itself, which is quite heavy percussion to local



economic growth and will surely bring city to depression. Just as a local citizen said:" after making a down payment (on a property), I thought I could stop worrying about the city's ever-rising housing prices, only to find myself start worrying about them falling some day."

3. On the other hand, the high price is also somewhat normal, because the real estate market in Shanghai is not a local close market, instead, it's a kind of international market, not only will the Shanghai local people buy the houses, but also people from abroad surely purchase houses in this glamorous city with the fine combination of Chinese tradition and modern fashion, An increasing proportion of real-estate investment in the mainland's major cities doesn't come from the regular banking sources. A considerable amount is believed to have come from overseas.

According to the statistic, in 2003, 40 to 50 per cent of the buyers of new homes

in Shanghai were people holding overseas passports, as compared to around 25 per cent in 2002. Many of the purchasers then have no need to obtain mortgages through domestic lending institutions, and I think the mechanism of demand and supply can fundamentally adjust the price, as long as there is considerable potential demand, there is price going up, which is an inevitable step in the development in whatever market. The price is high because the stagnation earlier impedes investment and when a huge potential demand approaches the earlier built houses can't meet the style and quality people ask for now, so the supply of in-fashion houses is insufficient and then price goes up. Also after a long time's depression, when facing a promising future, investors are eager to raise the price. The simulation results also show that in the period of continuous developing the increase of price on the contrary becomes stable.

4. To avoid or at least alleviate the speculation activities in real estate industry, government, I think, should try to create more investment channels for the mainland's idle money, including boosting small shareholder participation in the domestic stock market.

## **5.2. Limitation and future work**

Acknowledged, all these conclusions are based on the model boundary and assumption, which have been discussed in part 3.2. Out of this boundary of the model, everything can change and new dynamics appear because many assumed exogenous variable can be also influenced by other exogenous factors and endogenous factors, which will surely introduce much more complicated scenario and much more dynamic simulation result. For example, what if the depression or boom in house market can affect the city's GDP and in turn affects families' income. What if there are other factors that affect people's purchase behavior? And in reality if the new house price is too high some people will choose to rent houses rather than to buy new houses. These dynamic complexity discussed above could all be considered inside of

this project in the future work, and with the more specific feedback loops and more variables' interaction network introduced, I think, it will be further contributable to develop the relevant judgmental policies.

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