

Lincoln University Digital Thesis

Copyright Statement

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand).

This thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- you will use the copy only for the purposes of research or private study
- you will recognise the author's right to be identified as the author of the thesis and due acknowledgement will be made to the author where appropriate
- you will obtain the author's permission before publishing any material from the thesis.

**An Empirical Analysis of House Price Bubble: A Case
Study of Beijing Housing Market**

A thesis
submitted in partial fulfillment
of the requirements for the Degree of
Master of Commerce and Management

at
Lincoln University

By
Dong (Ryan) Chen

Lincoln University, Canterbury, New Zealand
2012

Abstract

Abstract of a thesis submitted in partial fulfillment of the requirements of the Degree
of M. C. M

An Empirical Analysis of House Price Bubble: A Case Study of Beijing Housing Market

By Dong (Ryan) Chen

The dramatic increase in China's house prices creates house prices bubble spurring the Chinese economy (Derger & Zhang, 2010). From the U.S. sub-prime loan crisis, however, it is evidenced how severely the fluctuation of house prices can potentially endanger the stability of the real economy, especially for a large housing market such as the US, the European Zone and China. Following the burst of the US house price bubble, the global financial market has been extremely volatile in terms of the debt issues in both the US and countries in the Europe Zone such as Greece, Italy, Portugal and Ireland. Similarly, it is impossible for China to dodge the impact of the global financial and economic crisis because China is over-dependent on exports to stimulate its economic growth.

Beijing, the capital city of China, is the biggest city of China in terms of both population and land area; it has the largest commercial housing market. This study

investigates whether a house price bubble exists in Beijing housing market in the period from 1999 to 2009. This study examines the efficiency of Beijing housing market and provides appropriate risk management techniques to manage housing bubble crisis in Beijing. In this study, income, inflation, interest rate and construction cost have been using to model the Beijing house price dynamics; the result suggests a house price bubble exists in Beijing housing market.

Keywords: House price bubble, China, risk, housing loan

Acknowledgement

First of all, I would like to express my most heartfelt appreciation to my supervisors:

Dr Christopher Gan and Dr Baiding Hu. I would like to thank Dr Christopher Gan who consistently assisted my thesis work, without his invaluable feedbacks and guidance I would not be able to complete this thesis. I also would like to thank Dr Baiding Hu for his time in helping me through the statistical models and results. My sincere appreciate for their patience, valuable guidance and knowledge through the research.

I would like to dedicate this thesis to my family members for their support both financially and emotionally. My journey wouldn't be possible without their supports. I also want to say thank you to my friends, who supported me, encouraged me and helped me during the completion of this thesis.

Last, but not least, I would like to give my best wishes to Christchurch city and the people. After the earthquake, I hope Christchurch will be stronger and a better city in the future.

Table of Contents

ABSTRACT.....	ii
ACKNOWLEDGE.....	iv
CHAPTER ONE: INTRODUCTION.....	1
1.1 Introduction.....	1
1.2 Background.....	3
1.3 Research Problem Statement.....	4
1.4 Research Objectives.....	6
1.5 Structure of the Thesis.....	6
CHAPTER TWO: LITERATURE REVIEW.....	7
2.1 Housing Bubble Studies in the US.....	7
2.2 Housing Bubble Studies in Other Western Countries.....	9
2.3 Housing Bubble Studies in Asian Countries.....	10
2.4 Housing Bubble Studies in China.....	12
2.5 Conclusion.....	13
CHAPTER THREE: CHINESE LAND SYSTEM AND HOUSING MARKET.....	14
3.1 Land System in China.....	14
3.2 Overview of Chinese Housing Market.....	15
3.3 Housing Policy in China.....	17
3.3.1 Protecting Low Income Household.....	17
3.3.2 Stabilizing House Prices.....	18
3.4 Conclusion.....	19

Chapter Four: Methodology and Data.....	20
4.1 Model.....	20
4.2 Data.....	24
4.3 Conclusion.....	26
CHAPTER FIVE: DISCUSSION OF EMPIRICAL FINDINGS AND RESULTS.....	27
5.1 Results of Long Run Regression Model.....	27
5.1.1 Income Variable.....	27
5.1.2 Inflation Variable.....	28
5.1.3 Interest Rate.....	29
5.1.4 Cost of Supply.....	31
5.2 Results of Short Run Regression Model.....	33
5.2.1 Income Variable.....	33
5.2.2 Inflation Variable.....	34
5.2.3 Interest Rate.....	35
5.2.4 Cost of Supply.....	38
5.3 Comparing the Long Run and Short Run Models.....	39
5.4 Housing Bubbles in Beijing Housing Market.....	42
5.4.1 Evidence of Housing Bubbles.....	42
5.4.2 Changes in Beijing House Prices versus its Equilibrium Prices.....	46
5.4.3 Model Specification Test.....	49
5.4.3.1 Durbin-Watson Test.....	49
5.4.3.2 Goodness of Fit.....	51

5.4.3.3 Reason of Housing Bubbles.....	51
5.5 Conclusion.....	56
CHAPTER SIX: SUMMARY AND CONCLUSION.....	59
6.1 Overview of the Study.....	59
6.2 Implications.....	63
6.2.1 Results of Research Objective One and its Implications.....	63
6.2.2 Results of Research Objective Two and its Implications.....	66
6.2.3 Results of Research Objective Three and its Implications.....	70
6.3 Limitations.....	72
6.4 Recommendations for Future Study.....	75
6.5 Conclusion.....	77
REFERENCES.....	80
APPENDIX ONE: RESULT OF LONG RUN MODEL.....	89
APPENDIX TWO: RESULT OF SHORT RUN MODEL.....	90
APPENDIX THREE: DURBIN-WATSON CRITICAL VALUE (SHORT-RUN AND LONG-RUN MODELS).....	91

List of Tables

Table 1.1 Real Economic Growth Rate Forecasts of East Asian Countries.....	4
Table 1.2 Changes in House Prices in Beijing Real Estate Market from 1998 to 2009.....	5
Table 5.1 Beijing House Prices (1998 to 2010).....	32
Table 5.2 Changes in Beijing Population.....	35
Table 5.3 Comparison between Beijing House Prices and its Equilibrium Prices based on the Long Run Model (Equation 5.1).....	46
Table 5.4 Beijing House Price in 2012.....	49
Table 5.5 Durbin-Watson Test Results (for Equation 5.1).....	50
Table 5.6 Durbin-Watson Test Results (for Equation 5.2).....	50
Table 5.7 Changes in Beijing House Rent.....	55

List of Figures

Figure 1.1 Real House Prices Boom in OECD Countries.....	1
Figure 1.2 US House Price Index and Sales.....	2
Figure 3.1 Income and House Prices in Beijing.....	16
Figure 3.2 Income and House Prices in Shanghai.....	16
Figure 5.1 Long Run HPI (House Price Index) and Equilibrium HPI in Beijing (Equation 5.1).....	42
Figure 5.2 Short Run HPI and Equilibrium HPI in Beijing (Equation 5.2).....	43
Figure 5.3 Foreign Directly Investment (FDI) in China.....	52
Figure 6.1 Beijing (City Area) Average House Prices from 1998 to 2010.....	61

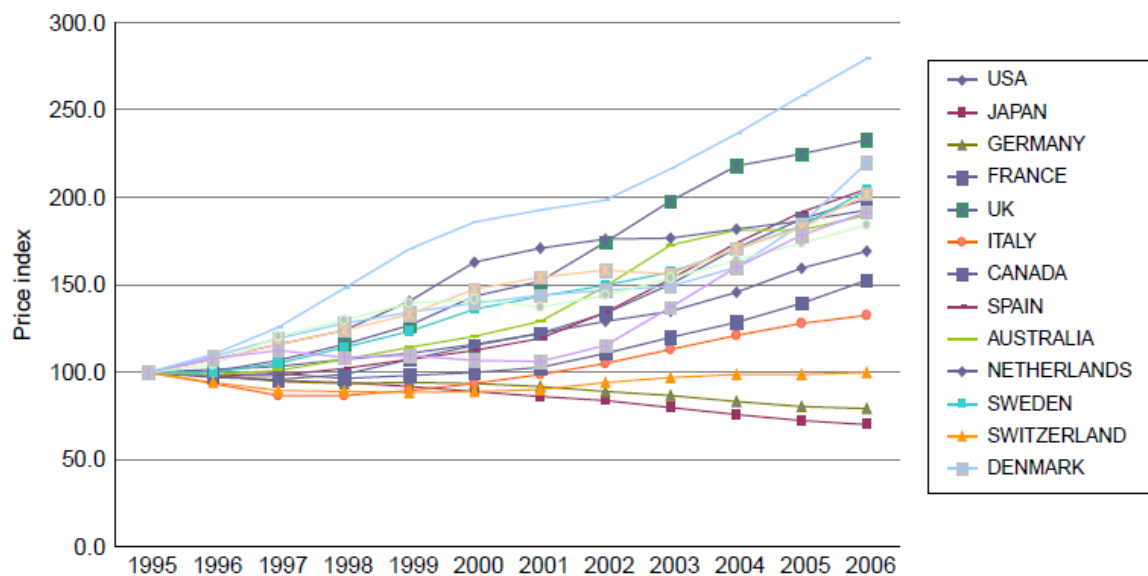
Chapter One

Introduction

1.1 Introduction

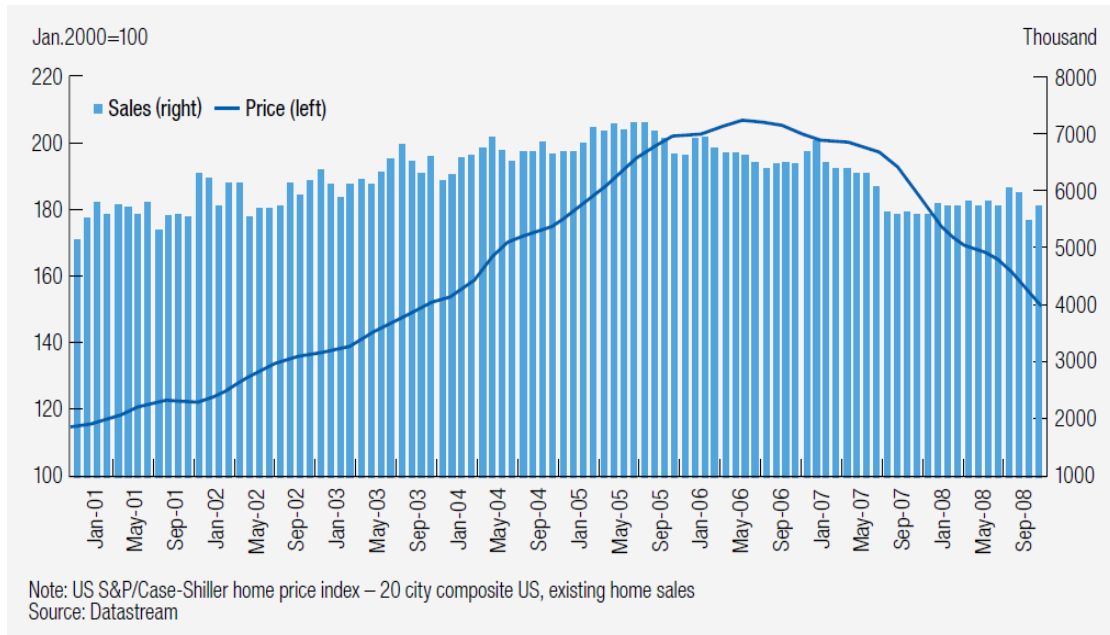
There is a dramatic increase in house price globally in recent years (see Figure 1.1). For instance, house prices in Australia, Sweden, Spain, Ireland and Britain before the U.S. sub-prime loan crisis was more than double of that in the early of 1990s (Todd, 2008). The U.S. housing market also increased by more than 70 percent during the period from January 2001 to the peak of May 2006, leading to the current global financial crisis (see Figure 1.2)

Figure 1.1 Real House Prices Boom in OECD Countries



Source: Bank of International Settlements, 2007

Figure 1.2 US House Price Index and Sales



Source: DataStream, 2009

Increase in house prices can lead to higher house price volatility which is a significant determinant of the default and prepayment of housing loans (Miles, 2008). Many researchers believe that the significant growth of house price potentially can generate a house price bubble (Roche, 2000 & Hou, 2009). Once the bubble burst it will endanger the stability of the country's real economy. For example, Reinhart and Rogoff (cited in Hayford & Malliaris, 2010) found that asset price bubble is one of the main risks of systemic banking crisis occurs in terms of the credit over expansion during the asset boom.

Minsky (1986) clearly explained how asset price bubbles and burst occurred in five steps such as displacement, boom, euphoria, profit taking and panic. When there is a

boom in the housing market, the increase in house price can lead to an increase in expected future price of house (Hayford & Malliaris, 2010). This is how a house price bubble occurs.

1.2 Background

The current global financial crisis clearly shows how a burst in a housing bubble can seriously drag down the real economy globally. Since the middle of 1990s, the house prices in the U.S. increased strongly, it continued to increase sharply even during the recession time in 2001 (McCarthy & Peach, 2004). This rapid increased in house price perpetuated a big house price bubble which burst in 2007 where Fannie Mae and Freddie Mac were the first two big mortgage companies that got into financial troubles. Following this, over a couple of months, mortgage-backed securities (MBS) and collateralized debt obligation (CDO) were reported to experience increasing losses (Kim & Kim, 2009). These started a bank crisis in the U.S.

As the rapid withdrawal of foreign capital takes place, the contagion of the sub-prime leading crisis spreads from the U.S. to many other emerging countries such as the East Asian countries and the Euro Zone countries such as Greek, Italy, Portugal and Ireland (Kim & Kim, 2009). For example, three of the main East Asian countries including China, Japan and Korea reported a significant fall in GDP growth forecast in 2008 to 2009 period (see Table 1.1).

Table 1.1 Real Economic Growth Rate Forecasts of East Asian Countries

	2008					2009		
	Q1	Q2	Q3	Q4	Annual	1 st Half	2 nd Half	Annual
Korea	5.5	4.3	3.1	-3.4	2.2	-3.9	-1.0	-2.4
China	10.6	10.1	9.0	6.8	9.0	7.5	8.7	8.1
Japan	1.5	0.7	-0.2	-4.3	-0.6	-3.6	-1.8	-2.7

Source: Samsung Economic Research Institute, 2007

Following China opening up to the outside markets in 1978, China began to play a more important role in the global financial market in terms of both international trade and investment. As a result, the stability of China's economy can seriously impacted by the global financial market. A burst of a house price bubble can endanger the stability of China's real economy. Moreover, a burst of house price bubble in China's housing market potentially can also bring down the recovery of the global economy.

1.3 Research problem statement

Beijing, the capital city of China, is the biggest city in China in terms of both population and land area; it has the largest commercial housing market. The historical data of Beijing real estate market shows that the house price in Beijing has been increasing every year especially for the last twelve years (see Table 1.2).

Therefore, a housing bubble could potentially exist in Beijing housing market and leading to potential problem such as financial crisis.

**Table 1.2 Changes in House Prices in Beijing Real Estate Market
(1998 to 2009)**
(House price in 1998 = 100%)

Year	House prices (%)
1998	100
1999	100.4
2000	200.2
2001	266.7
2002	291.5
2003	330.5
2004	351.7
2005	362.6
2006	378.5
2007	391.4
2008	400.8
2009	396.0

Source: Beijing Municipal Bureau of Statistics, 2010

This study investigates whether a house price bubble exists in Beijing housing market.

1.4 Research objectives

The research objectives of this study are:

- To investigate whether a bubble exists in the Beijing housing market from 1998 to 2010 using economic fundamentals (interest rates, inflation, income and cost of supply)
- To examine the effect of macroeconomic fundamentals on house price changes in Beijing housing market
- To identify appropriate risk management techniques to manage housing bubble crisis in Beijing

1.5 Structure of the Thesis

There are six chapters in this thesis. Chapter One introduces the overview of the research problem statement and objectives. Chapter Two reviews the literature on the housing market in the U.S., European countries, other Western countries and Asian countries. Chapter Three provides an overview of Chinese land system and housing market. Chapter Four discusses the data and research methodology of this study. Chapter Five contains the empirical results and findings. Chapter Six presents a conclusion of the research findings, policy implications, limitations and recommendations for future study.

Chapter Two

Literature Review

Case and Shiller (2003) explained an asset bubble as a price increase that cannot be explained by the underlying economic fundamentals such as income, inflation and interest rates. Indeed, a housing bubble can help the development of an economy during a booming time (Dreger & Zhang, 2010). However, when the housing bubble burst, it can also cause panic sale which will negatively impact the real economy deeply.

The increase in house prices depend on two parts: economic fundamentals and speculations (Hu et al., 2006). The speculation part is the key reason why asset price bubbles has been studied by many researchers such as Case and Shiller (1989), Levin and Wright (1997), Muellbauer and Murphy (1997) and Roche (2000), since Minsky published his book about economic instability hypothesis which explained how asset price bubbles and burst in 1986.

2.1 Housing bubble studies in the U.S.

Researchers have been intrigue in whether a house price bubble exists in the U.S. housing market before the current global financial crisis which took place in 2007 (see Hastings, 2004; McCarthy & Peach, 2004, 2005; McKnight, 2005; Clithero & Pealer, 2005). For example, McCarthy and Peach (2004, 2005) used ratio analysis to

test the house price bubble in the U.S. housing market twice in 2004 and 2005. However, they failed to observe a bubble in the U.S. housing market and they conclude that the rapid increase in house prices is attributed to the rising in income and decline in interest rate.

Clithero and Pealer (2005), on the other hand, found an existing house price bubble in Irvine, California. They used economic fundamentals similar to McCarthy and Peach (2004) study such as CPI (Consumer Price Index), income, and repeat-sales (OFHEO) index in the country level. In their results, they observed a house price bubble spans during the period from 1996 to 2003 documenting over 50 percent increase in house price to income ratio and the decline in rent to house price ratio.

Goodman and Thibodeau (2008) provided strong evidences to support the findings of Clithero and Pealer's study. They tested the house price bubble in 84 Metropolitan Statistical Areas (MSA) of America in the period from 2000 to 2005. In their results, nearly half of these MSA including California showed the high speculation rate over 90%, meaning only less than 10 percent of the sale units are for living, which drives the increase in nominal house price doubled than its rational expectation.

By studying the house prices in 62 MSA in the U.S., Capozza et al. (2004) found that it is speculation or other reasons that pushes up the U.S. house prices rather than driven by economic fundamentals. Most of the researchers (Clithero & Pealer, 2005; Goodman & Thibodeau, 2008; Capozza et al., 2004) firmly believe that the rapid

increase in U.S. house prices cannot be explained by the changes in fundamentals such as income and inflation and as a consequence, this increase in house price indeed is a bubble that cause by irrational expectations.

2.2 Housing bubble studies in other Western countries

Many researchers have reported house price bubbles exist in the European countries. For example, Levin and Wright (1997) tested the existence of house price bubbles in London, England. The result support that the volatility of house prices in London city and many other parts of U.K. is caused by speculation.

Similarly, Roehner (1999) also reported a speculative house price bubble exists in Paris, France. By testing twenty districts in Paris, the author found a strong link between house price and speculation especially for the higher price area such as the southwest part of Paris, where the house price elasticity on speculation is greater than 1.3.

Roche (2000) also examined the house price bubble in Dublin, Ireland. Based on regime-switching models, the author's result showed evidences suggesting the existence of a speculative bubble on house price in Dublin using the likelihood ratio test in their bubbles model.

Many other Western countries outside the Euro Zone also reported to experience a house price bubble during the booming period. For instance, Fraser, Hoesli and McAlevey (2008) have found an overvaluation on house prices in New Zealand which caused by price dynamics rather than an overreaction to economic fundamentals. In their study, the authors tested the difference between the real house price and the equilibrium price and their result showed that the real house price exceed the fundamental real house value by 25%. Australia also reported to have a mortgage speculative bubble by using ratio analysis especially in the major cities such as Sydney (Hatzi & Otto, 2008). For the variation of price to rent ratio, only a quarter of that can be explained by the economic fundamentals changes such as rent growth and real interest rates increase, which suggested a speculative bubble exist in housing market (also see Bourassa & Hendershott, 1995; Bodman & Crosby, 2004).

2.3 Housing bubble studies in Asian countries

Before the 1997 Asian financial crisis, signals already showed in historical high price to rent ratio and the increasing in gap of supply exceed demand in Malaysia housing market (Quigley, 1999). The author attributed the over booming of real estate market as a major reason that cause the 1997 Asian financial crisis. As a consequence, the study on house price bubbles and speculative behavior in the real estate market is extensive. For example, Calhoun (2003) employed the house price index (HPI) from 1992 to 2000 as a major input in their house valuation model to explain the 1997 Asian financial crisis. The author found a strong link between the

HPI of Bangkok, Thailand and the real economy around the crisis period (1992-2000); they tend to move in the same trend (upward trend during pre-crisis period and downward trend during post-crisis period).

Kim and Suh (1993) provided empirical evidences of the existence of growing bubbles in the mortgage market in South Korea. By using ratio analysis, the authors found that the price to value ratio is very large and keep increasing over time in both Korean and Japan, especially for the smaller apartment. Several years later, Kim (2004) adopted a linear regression model to test the time series data in South Korean mortgage market from the last quarter of 1988 to the last quarter of 2003 and his result also suggests that the house price bubble exists since the second quarter of 2002.

In the Japanese housing market, researchers suggest that the booming of asset prices before 1989 can be attributed to the movement of economy fundamentals such as income, interest rate and inflation; however, even when these fundamentals decreased, the increase trend in asset prices especially for the land price remained during the early of 1990s which cannot be explained by rational expectation and economic fundamental factors (see Ito & Iwaisako, 1995; Kim & Suh, 1993).

Chan et al. (2001) adopted Durlauf and Hooker's (1994) model using the flow and stock test to investigate the misspecification error and rational bubble. The results of the tests suggest a house price bubble exist in Hong Kong housing market. Xiao and

Tan (2007) employed the present-value model to test the price bubble in different types of property in Hong Kong housing market. More than 60 percent of the variation in the price index of the flatted factories and the retail premises cannot be explained by fundamentals or rational expectation leading to a conclusion of a housing bubble.

2.4 Housing bubble studies in China

China has experienced a strong increase in house price especially for the big cities such as Beijing, Shanghai, Shenzhen and Guangzhou since China opened to the outside market in 1978. The dramatic increase in house prices could potentially inflate a house price bubble in China's housing market. Shen, Hui and Liu. (2005) examined the house price bubble in Beijing and Shanghai mortgage market, and found strong evidences to support the existence of house price bubble in Shanghai real estate market. The authors adopted Granger causality test found that the house price exceeded the equilibrium price by 22% in 2003 in the Shanghai housing market.

Hou (2009) provided strong evidences to support the existence of house price bubble in Shanghai house market during the period from 2003 to 2004. The author suggested that the house price in Beijing is likely to form a bubble since 2005 where the average house price growth is more than the fundamental variation by 31.7%. Following this Dreger and Zhang (2010) studied time series data of 35 major cities

in China. By using the ratio analysis, they also found a house price bubble in China's real estate market and their conclusion has been supported by Leung and Wang (2007) in their qualitative study on house price bubbles in China's mortgage market. Leung and Wang (2007) employed the DiPasquale-Wheaton model to study dual-class house price which are small units (less than 90 square meters) and large units; qualitatively and confirmed a bubble exist in the housing market. Hui and Shen (2006) compared the housing market in Beijing, Shanghai and Hong Kong, and concluded that there is an existing housing bubble in Shanghai.

However, not all researchers arrived at the same conclusion. According to Hu et al.'s (2006) study, they used quarterly data from 1990 to 2005 and concluded that although speculation component indeed exists, the main engine of the increase in house prices in the national level are driven by economic fundamentals including income and interest rates (also see Ahuja et al., 2010). Moreover, Hui and Shen (2006) claimed that there may be no such housing bubble in Beijing before 2005.

2.5 Conclusion

Chapter Two reviews the literature on housing market. We discusses the literatures studying the housing bubble in the U.S., European countries (such as UK, France and Ireland), other Western countries (including New Zealand and Australia) and Asian countries (for example China, Japan, Korea and Hong Kong). The following Chapter will detail the land system and housing market in China.

Chapter Three

Chinese Land System and Housing Market

3.1 Land system in China

In economy, the land system can be explained as the ownership and right to use of the land. Differentiate from the land system of many other countries such as U.S.; the land in China is not buyable under the socialist system (generally every land is owned by public). In other words, land in China is publicly owned and a person can only have the rights to use the land but not own it (Lin & Ho, 2005).

The property ownership is defined as the right or control over properties. There are two forms of property ownership: freehold (means the right of property) and leasehold (means the right to use property in a certain period). Some countries such as Malaysia have both form of property ownership. Some countries like New Zealand only have freehold ownership. In China, however, under the publicly owned land system, freehold ownership does not exist. People can only hold a house for as long as 70 years. After the lease period expires, the ownership of the land returns to the state authorities.

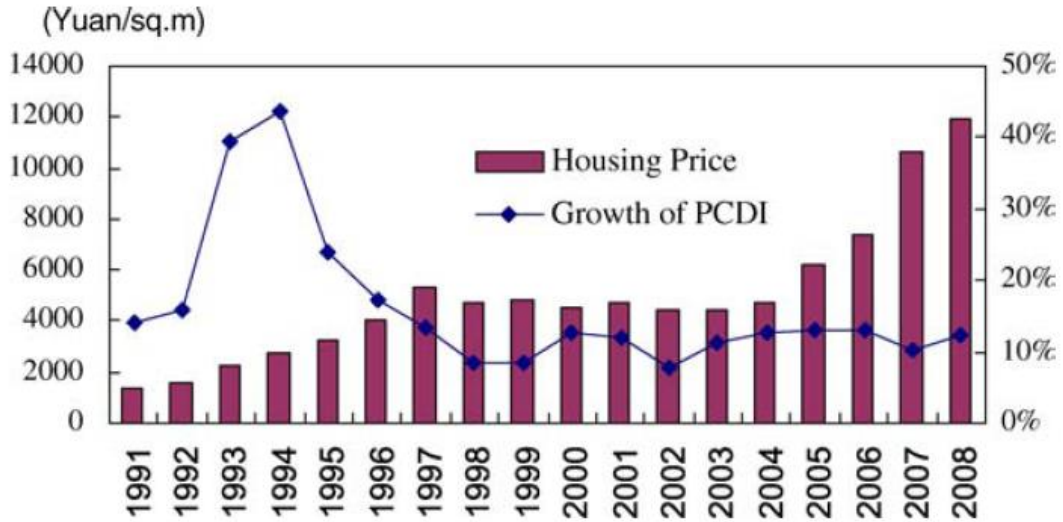
3.2 Overview of Chinese housing market

A bubble in the housing market spurs the Chinese economy in terms of the fiscal stimulus package and massive credit expansion (see Dreger & Zhang, 2010). The stock of loans rises by over a half since 2008. According to Kim and Kim (2009) report, the over lend of property loans is one of the main reasons of current global financial crisis. Therefore, the uncontrolled credit expansion is a big hazard to the real economy of China. Property industry becomes a major industry in China since the late of 1990s. Similarly, after the 1997 Asian financial crisis, instead of buying stocks Chinese households began to purchase house as investments which contributed to expanding the domestic demand in China's housing market (Hou, 2009). For example, the real estate investment and construction occupies more than 10% of China's GDP in 2011.

Following the 1997 Asian crisis, more Chinese people have begun to purchase houses as an investment similar to gold and silver investment. This expands the domestic demand for housing and causes significant increase in house prices in the metropolitan areas in China such as Beijing and Shanghai (see Figures 3.1 & 3.2). As a result, due to the high house price and increasing population in the big cities such as Beijing and Shanghai, a large number of people cannot afford to purchase a house leading the booming in rental market (Wang, 2003). This stimulated the speculation activities that invest houses in big cities and rent them out hoping future

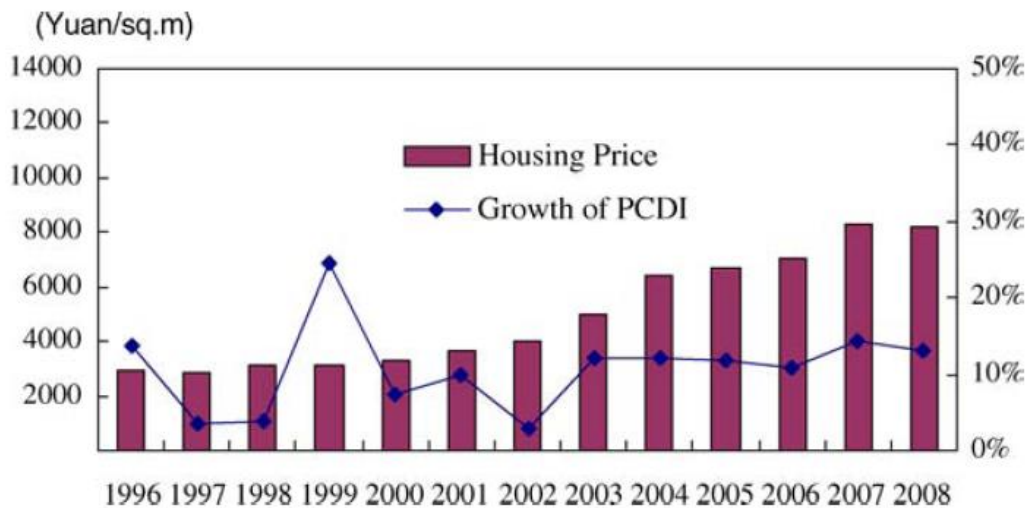
profit when the house price climbs up.

Figure 3.1 Income and House Prices in Beijing



Source: Nation Bureau of Statistics of China, 2009

Figure 3.2 Income and House Prices in Shanghai



Source: Nation Bureau of Statistics of China, 2009

PCDI stand for Per Capital Disposable Income in Figure 3.1 & 3.2

3.3 Housing policy in China

China's house price index has risen by at least 70% since 2000, and in some cities such as Beijing, Shanghai and Shenzhen house prices have increase by around 10% every year (Rapoza, 2011). According to Capital (2011), the increase in China's housing market is similar to the house bubbles that formed in Japan (1982 to 1991) and in the U.S. (1996 to 2006). Such bubbles generate great volatility in the financial market such as the 2007 subprime loan crisis in the U.S. and the lost decade in Japan. The situation in China's housing market is different from that of U.S. because of China's strong GDP growth, the incomplete urbanization, the limited investment alternative and the strong households' balance sheet (Capital, 2011). However, China's housing market still risk of being volatile after a more than ten years of growth in house prices. Therefore, the Chinese governments have already taken precautionary measures to cool down the housing market (see Section 4.3.2). Chinese housing policies include two parts: protecting low income household and stabilizing house prices.

3.3.1 Protecting low income household

As a consequence of increase in house prices, low income families and part of medium income families cannot afford to purchase a house. To address this issue, the Chinese Government put forth a housing policy framework to control the house prices increase in the cities. This housing policy framework includes two major

programs: (1) the economical and comfortable housing (ECH) program; (2) the cheap rental housing (CRH) program (Deng, Shen & Wang, 2009).

Different from commercial properties, the ECH program caters for low income families to enable them to buy a house. ECH units were built by for-profit real estate developers. In order to make the house cheap, the local government provided development subsidies such as free or low-cost land and lower or zero taxes to the developer (Deng, Shen & Wang, 2011). Moreover, the profit margin of the ECH units is always less than 3 percent which is regulated by local governments. These ECH units can be only sold to eligible families and cannot be sold within a five years period.

Under the CRH program, the government provided houses for rent at a low price than market rent price to eligible families. This program is for the disability group of people and extremely low income households (Deng, Shen & Wang, 2011)

3.3.2 Stabilizing house prices

In the beginning of 2011, because of the increasing house prices in big cities such as Beijing and Shanghai, the Chinese central government decided to set up two restrictions on property investment to stabilize house prices such as decreasing in the credit available on buying a second house and impose strict restrictions on the buyers' side of the housing transactions. The former implies that if a family already

has a house to live in, the down payment rate increases when applying for credit to purchase another house. This implies that the initial cost of buying a house increases while the number of houses that the family hold increase too. For example, if the down payment rate of buying the first property is 20 percent, a family buying the second house, the down payment will be greater than 20 percent. The implementation of this policy will help to curb the surging increase in the house demand in order to make the house price control effective. The Chinese government is planning to implement this policy before 2012. The latter policy aims to directly decrease the housing demand by putting strict conditions on people buying houses in the housing market of 43 cities in China. For example, the Beijing Government has decided to impose regulations on the Beijing housing market such as a family in Beijing cannot buy more than two houses and a family from other provinces can only buy one house in Beijing since the February of 2011.

3.4 Conclusion

Chapter Three provides an overview of Chinese land system and housing market. We present a comparison of the land system between China and Western countries (such as the U.S. and New Zealand); discusses the land system and property ownership in China. Furthermore, the housing market and housing policy in China are discussed in this Chapter.

Chapter Four

Methodology and Data

4.1 Model

There is no consensus as to which method is the best to estimate house price bubbles.

Some researchers used ratio approach (see McCarthy & Peach, 2004, 2005); some used user cost approach (asset-market approach) model (see Levin & Wright, 1997) and others used Vector error correction model (VECM) (see Case & Shiller, 1989; Quigley, 1999; Sing et al., 2006).

Ratio approach is the most common method in studying house price bubbles. In general, the method includes two different ratios which are price to rent ratio and price to income ratio. For example, Himmelberg et al. (2005) tested the price to income ratio in 46 Metropolitan Area in the U.S. housing market and concluded that the changes in long-term interest rate are the main engine of the increase in house prices in the U.S. Dreger and Zhang (2010) also used the ratio approach to test the existence of house bubbles in 35 major cities in China and found that the real house price exceed the equilibrium house value by 25% in the housing market. However, according to Cameron et al. (2006), the ratio approach focuses only on income and wealth factors but ignore the changes in other fundamentals such as demographic

changes.

The user cost approach model is another common method when testing house price bubbles. In the user cost approach model, the house price is a function of the quantity of housing service demanded and the real estate user cost of housing service (Poterba, 1984). Poterba (1984) employed a dynamic model of the user cost approach to test the inflation impact on tax subsidies to owner occupied housing in the U.S. housing market. The author found that the tax provision for real estate interest deductibility drive up the U.S. house price by 30 percent. Meen (1990) also examined the mortgage rationing (which is the difference between the demand for real estate and effective supply) impact on U.K. housing market by using the user cost approach. Meen's study successfully explained the mortgage rationing (1978 to 1980) and the absence of mortgage rationing (1981 to 1987) in U.K. housing market. The disadvantage in this approach is that the supply restriction and regulation are ignored to have impact on house prices and rents.

The VECM model is developed to estimate house prices relationship in both short run and long run. It has been widely used by researchers to examine house price bubble (see Sing et al., 2006; Gallin, 2006). Sing et al. (2006) employed the VECM model to test the long-run relationship between house price dynamic and household mobility in the Singapore public resale and private housing market. The authors found that the error term and lagged house price in VECM model can significantly explained the house price dynamics in Singapore housing market. Gallin (2006)

examined the relationship between house prices and interest rates from 1978 to 2000 in 300 metropolitan areas in the U.S. housing market by using the VECM model. The author found a weak co-integration between the house price dynamics and interest rate in the U.S. housing market. The limitation of the VECM is the variables used in VECM have to be co-integrated variables (Tuluca et al., 2000). Insignificant results will be created while the data series uses in VECM are not co-integrated.

In order to estimate both long term trend and short term dynamics of the house price in Beijing, this study adopts Coleman et al.'s (2008) model which based on the VECM. The model consists of the housing demand and housing supply equations.

$$Q_{Dt} = \alpha_t + \beta_{1t}P_t + \beta_{2t}Inc_t + \beta_{3t}Intr_t + \beta_{4t}Inf_t + \epsilon_{Dt} \dots\dots\dots (1)$$

$$Q_{St} = a_t + b_{1t}P_t + b_{2t}C_t + \epsilon_{St} \dots\dots\dots (2)$$

Where:

Q_{Dt} = quantity of housing demand in period t

Q_{St} = quantity of housing supply in period t

α_t and a_t = intercepts

β_n and b_n = coefficients

P_t = housing prices

Inc_t = income

$Intr_t$ = short-term interest rate

Inf_t = inflation

C_t = cost for housing supply

ϵ_{Dt} and ϵ_{St} = error terms

From equations 1 and 2, in equilibrium condition: $Q_{Dt} = Q_{St}$, a house price equation can be defined as a reduced form equation with house price as the main endogenous variable as follows:

$$P_t = \alpha_t + \beta_{1t}Inc_t + \beta_{2t}Intr_t + \beta_{3t}Inf_t + \beta_{4t}C_t + \epsilon_t \dots\dots\dots (3)$$

Where:

α_t = intercept

ϵ_t = error terms

Others are same as equations 1 & 2

Equation 3 is the model used to study the long term trend from 1998 to 2010 and also the short-run dynamics from 2005Q1 to 2010Q4 in this study.

In regards to economic theory, asset prices should be determined by both demand and supply factors. As Levin and Wright (1997) suggest, the most common demand factors used to study house prices in the literatures are income, inflation and interest rate. When studying the house price in the short run, researchers tend to ignore the impact of supply factors on house price dynamics because of the assumption that house supply does not move in a short period. For example, using quarterly data,

Black, Fraser & Hoesli (2006) test the actual house prices relative to the fundamental house value in U.K. using only demand factors (income, inflation and interest rate). Some researchers use only inflation to capture the cost of supply (for example Coleman et al., 2008). However, in reality, not only the cost of supply in China's housing market changes over time, but the inflation factor alone cannot capture the supply factors perfectly. Because inflation is calculated by the changes in a basket of goods that cannot well estimate the supply costs (such as material and labor costs) dynamics. Thus, this study employs both demand factors (income, inflation and interest rate) and supply factors to capture the house price movement in Beijing.

4.2 Data

According to Levin and Wright (1997), housing demand factors such as income, inflation and interest rate are used in most house prices study. In addition, many researchers also treated construction cost as an important variable of the supply side in studying house prices (see Case & Shiller, 2003; Meen, 1990; Malpezzi et al., 1998). Meen (1990) successfully used construction cost, interest rate, income, inflation and after tax interest rate in his empirical model to explain the mortgage rationing impact on U.K. housing market in both mortgage rationing period (1978 to 1980) and the absence of mortgage rationing period (1981 to 1987). Malpezzi et al. (1998) also identified construction cost as a major determinant of house prices in their study on house price index determination of 272 U.S. metropolitan areas. Nevertheless, Case and Shiller (2003) treated construction cost as an important

element in studying house price bubbles in four states in the U.S.

This study will use Beijing house price index to measure the change in house prices; Beijing GDP as income variable; consumer price index (CPI) as inflation variable; construction cost as cost of supply. These four series data is obtained from the Beijing Municipal Bureau of Statistics. The interest rate variable will be obtained from the Bank of China website.

Based on many existing researches on house prices, GDP could be a good measurement of income. For example, Green (1997) tested the relationship between GDP and house price and the author point out that GDP is a good prediction of the residential investment. Similarly, Gauger and Synder (2003) examined the relationship between residential investment, money supply, interest rate and GDP by using a VECM model in both pre-regulation (1959-1979) and post-regulation (1982-1999) sub-period. The authors found a positive correlation between residential investment and GDP in their result. The GDP in Beijing maintains a high growth rate around 10 percent which is approximately the same as trend of house price growth. In economic theory, GDP will positively correlate with house price (Pillay & Rangel, 2005). Therefore, this study uses GDP as the income variable.

Data used in this study are secondary data. Yearly data from 1998 to 2010 will be used in studying long-run; quarterly data from 2005Q1 to 2010Q4 will be used to study short-run.

4.3 Conclusion

Chapter Four discussed the data and methodology used in this study. We generally discussed three approaches, which have been widely used in housing market studies, and their limitations. Moreover, this chapter discussed the research models are used in this study and the data of each variable in the models.

Chapter Five

Discussion of Empirical Findings and Results

5.1 Results of long run regression model

The estimated results of the long run regression model (5.1) are presented in the Appendix 1.

$$HPI = 41.9827 + 20.0417 \text{Log}(\text{GDP growth}) + 44.1619 \text{DLog}(\text{CPI}) + 3.1275 \text{IR} + 0.0013 \text{Supply cost}$$

(0.0279) (0.1146) (0.0569) (0.0036)

..... (5.1)

All variables in the long run model showed positive coefficients. These positive relationships except interest rate have the hypothesized signs and are consistent with the results of Chen and Patel (1998) and Coleman et al (2008).

5.1.1 Income variable

In the long run model (Equation 5.1), the log of GDP growth is statistically significant and has a positive (20.0417) effect on the house price index of Beijing. This implies that if the speed of GDP growth goes up by 1%, it will push up the Beijing house prices by 20%. As an income variable, GDP growth in the model captures the ability of the consumers' house purchasing (which is known as housing

affordability). According to Kennedy and Anderson (1994), house expenditure and stable income have nearly perfect elasticity which is known as cointegration. Therefore, when income goes up, the demand for mortgage will follow pushing up the house prices. Gallin's (2003) explanation also supported our results. The author theoretically explained that, the house price and income is linked in the long run via housing affordability; they tend to return to their long run equilibrium relationship, although in the short period such relationship may drift away due to speculations or other fundamentals such as easy credit (caused by interest rate and policies). Furthermore, Linneman and Megbolugbe (1992) analyzed the U.S. housing market and found that the housing affordability is one of the important determinations of housing expenditures. The authors reported a positive relationship between household income and house price which support our model findings. Gallin (2006) investigated the long-run relationship between income and house prices in U.S. housing market and concluded that there is a positive relationship between income and house prices in the nation level of U.S.

5.1.2 Inflation variable

The estimated coefficient for the log CPI is 44.1619, which means that when the CPI goes up by 1% (logCPI minus last year logCPI) the Beijing house price index will increase by nearly 0.44%. CPI is an index to measure the inflation rate which is mainly composed by food prices, house prices, transport costs, education costs and

medical expenditures. In addition, according to NBSC (National Bureau of Statistic of China), house prices occupy 14% of China's CPI which ranked the second after food prices. Therefore, it is not surprising that our results showed a positive link between CPI and Beijing HPI (house price index).

However, the t-test result of CPI in the long run model shows the inflation variable is not statistically significant even at 10% significant level. This result is consistent with Ji and Wang's (2011) study. The authors compared the CPI, PPI with HPI during the period from 2000 to 2010, and they firmly believed that in the long run, CPI and HPI do not have strict one-to-one correspondence. They only link together though the other factors of production such as the price of labor and the price of raw materials. In their study, they pointed out that the HPI and CPI affect each other by creating "cost-driven upward pressure", but this channel is not stable; therefore, there is no certain significant link between HPI and CPI in the long run.

5.1.3 Interest rate

Previous studies have documented a negative relationship between interest rate and house price (see for example Kau & Keenan, 1980; Reichert, 1989; Levin & Pryce, 2007). This is because in general, most consumers cannot afford to pay cash for a house as it is too expensive; most of them will prefer to use housing loans. Therefore, an increase in interest rate will increase the borrowing cost, which in turn decreases the house demand.

However, some researchers also reported opposite conclusion such as Yun, Wang and Seabrook (2003) whose study showed a positive relationship between house price and interest rate, which is known as the “Gibson paradox” by Keynesian in 1930, in the Hong Kong housing market. The same conclusion also appears in Ayuso, Blanco and Restoy’s study in Spain (2006), and McQuinn and O’Reilly’s research in Ireland (2006). In China housing market, most researchers (for example Gao & Wang, 2009; Wang & Zhao, 2010) found a positive relationship between house price and interest rate. Our research also showed similar results in the long run model (the coefficient of interest rate is 3.1275 which is statistically significant at the 10% significant level). This is because the interest rate variable not only negatively impact the house price by increasing the borrowing cost of buyers but also positively affect the house price via the growth of the borrowing cost of the developers (Huang & Wang, 2007).

Urbanization in China is incomplete, and every year thousands of people move to cities especially the big cities such as Beijing and Shanghai. Majority of them are from the age group between 20 to 40 years old. They include graduate students from university and wealthy families looking for good education for their children. For the students, after they graduate from university, most of them will buy a house after their marriage which is an important Chinese traditional practice (Chovanec, 2009; Zha, 2009). Under the law, children cannot study and participate in the universities’ entrance examination in Beijing unless they are registered residence of Beijing. Therefore, for wealthy families, they buy a house in Beijing city in order to become

registered residence. This population growth in the cities creates a great demand in the Beijing housing market.

Following the 1997 Asian financial crisis, the confidence of stock market in China was somewhat depressed, and because of the limited investment alternatives, investors began to demand and speculate mortgage. As a result, increase in interest rate will impact the housing consumption in the long run, but demand in Beijing housing market did not change during our study period. Therefore, giving a certain amount of house supply, the developers are more sensitive about the changes in the interest rate. When interest rate goes up, the extent of the upward pressure from the house developer is greater than that of the downward pressure from the house buyers. Thus the interest rate variable exhibits a positive relationship in our long run model.

5.1.4 Cost of supply

The impact of supply cost on Beijing house prices is 0.0013 and is statistically significant at the 5% significant level in the long run. This result implies that a unit (Chinese RMB) change in the cost of supply will affect Beijing house prices by 0.0013%. Table 5.1 shows the house prices in Beijing during our study period from 1998 to 2010. On average, Beijing house prices is 8117.5 RMB per square meter, when supply cost increases by 1 RMB per square meter, Beijing house prices will increase by 0.11 RMB per square meter. The findings of Lv (2011) and Guo and Duan (2008) have supported our results. Lv (2011) analyzed the house prices

dynamics using income and cost of supply as the variables, and Guo and Duan (2008) model the house prices using cost of supply and demand- supply relationship. Both of them reported a positive relationship between supply cost and house prices.

Table 5.1 Beijing House Prices

Year	House Price (RMB/m²)
1998	5239.49
1999	5648.42
2000	4919.01
2001	5061.41
2002	4763.80
2003	4736.79
2004	5052.99
2005	6274.26
2006	8279.57
2007	11553.11
2008	12418.00
2009	13798.84
2010	17782.25
Average	8117.53

Source: Beijing Municipal Bureau of Statistics, 2011

5.2 Results of short run regression model

The estimated results of the short run regression model (Equation 5.2) are presented in the Appendix 2.

$$HPI = 69.8901 + 14.2145 \text{Log}(\text{GDPgrowth}) + 45.8414 \text{DLog}(\text{CPI}, 0, 4) + 1.4658 \text{IR} + 0.00006 \text{Supplycost}$$

(0.0003) (0.0233) (0.1817) (0.6979)

..... (5.2)

DLog(CPI,0,4) means the difference between the log CPI and the log CPI in the same quarter last year.

Similar to the results in the long run model, the variables in the short run model also exhibited positive relationships.

5.2.1 Income variable

The coefficient of GDP growth is positive (14.2145) and is statistically significant at the 1% significant level in the short run model. In the short run, a 1% increase in the speed of GDP growth rate will increase the Beijing house price index by 14.2%. The growth of income will increase the housing affordability to positively impact the house demand. This is the main channel showing how income variable affect Beijing house prices. For example, Yang and Shen (2008) investigated the Beijing housing market from 1990 to 2005. The authors reported that income variable is one of the

most important determinations of the housing affordability in Beijing housing market. The authors also found that the impact of income on housing affordability is huge especially for the first-time house buyers. Stone (2006) examined the fundamentals of the housing affordability concept in the U.S. housing market and confirmed that income variable has significant impact on house prices since it is an important determinant of housing affordability. The author reported that the family gross income determines how large a property loan repayment the buyer can afford and this significantly impact the housing affordability.

5.2.2 Inflation variable

Similar to the long run model, the coefficient of inflation variable (45.8414) is statistically significant. CPI can measure the price of other factors that affect on house price such as price of raw material and labor. Therefore, there should be a positive relationship between house prices and CPI both in the long run and short run. For example, Qiu (2011) examined the relationship between house prices dynamics and CPI in China using autoregressive distributed lag model during the period from 2004 to 2010. The author has reported a significant positive link between CPI and house prices.

5.2.3 Interest rate

In the short run model, interest rate is positive (1.4658) but insignificant. Due to the incomplete urbanization in China, the dramatic increase of population in Beijing (see Table 5.2) generates a huge demand in Beijing housing market. As a result, in Beijing housing market, the housing developers are more sensitive about the change in the interest rate and leading that interest rate will affect the housing developers more than housing buyers which due to the strong demand leading house buyers ignore the change in interest rate (McQuinn & O'Reilly, 2006);. Therefore, the positive coefficient comes mainly from the borrowing cost of housing developers.

Table 5.2 Changes in Beijing Population

Year	Population (million)	Settlements (million)
2006	15.8	3.8
2007	16.3	4.2
2008	17.0	4.7
2009	17.6	5.1
2010	19.6	7.0

Source: Beijing Municipal Bureau of Statistics, 2011

According to Hu and Guan's research (2011), changes in interest rate can hurt the confidence of real estate market and the demand for house sales in the short run. This makes interest rate statistically insignificant in the housing transaction. Due to

the total costs of housing supply and mark up, the housing developer will try their best to hold the house price at a higher level by hold (not sale) many of their residential properties, even though the amount of house sales may decrease in the short term in order to preserve their profits. Mak, Choy and Ho (2007) reported that the average housing vacancy rate in the major cities in China is about 30%, and many of them are unsold residential properties. According to the authors, investment in house development in Shanghai in 2004 was 117.55 billion (RMB) which increased by 30.4% more than that in 2003. Such investment occupied 38.1% of the total investment in Shanghai. This overbuilding in China's housing market created large housing supply and to decrease housing supply, real estate developers delay their housing sales hoping for higher profits when the house price rises (Dreger & Zhang, 2010). This resulted in high housing vacancy rate in the major cities in China. Painter and Redfearn (2002) investigated the role of interest rates in influencing homeownership rates in U.S. housing market from 1965 to 1999 and reported an inverse relationship between interest rates and homeownership. This suggested an increase in interest rate can decrease the willingness of families to own houses leading to increase in housing vacancy rate. Evidences for the increase in interest rates leading higher housing vacancy rate can be found in Beijing housing market in 2008, while the housing sales decreased by 39%, the house price and housing vacancy rate increased by 850 RMB and 44%, respectively. This means that housing developers hold many houses not for sale. They try to suppress the house supply in Beijing housing market to keep the house price in Beijing at a higher level in order

to preserve their mark up in each unit (commercial houses). According to Tsatsaronis and Zhu (2004), floating rate mortgage loans are more widely used in issuing housing loans; the increase in interest rate increases the price of bank credit. The authors explained that in order to minimize the risk of interest rate changes, commercial banks tend to issue more floating rate mortgage loans. This floating rate is relative to the market interest rate; therefore, an increase in interest rate will cause the repayment interest rate of floating rate mortgage loans to increase which increases the repayment of bank credit. McQuinn and O'Reilly (2006) also explained that higher interest rate have significant impact on new house buyers since they will be more highly leveraged. Therefore, the frequent increase in the interest rate in China dramatically increases the cost of housing loans. The authors also reported the increase in the interest rate lead to an expectation of decrease in house price, which makes the house buyer delay their plan of buying houses. These discourage house buyers to involve in the housing market immediately. Housing buyers may delay their plan of buying a house in the short term, since they expect the interest rate will drop back or the house price will decrease in the future. As a result, the amount of successful housing transaction could be in a very low level during the period of interest rate changes. For example, the Chinese government has changed the one-year deposit interest rate 11 times during the end of 2006 to the end of 2008, increasing from 2.25% to 4.14% at the beginning of 2008 and drop to 2.25% again at the last quarter. The housing sales decreased from 26.07 to 13.35 million meter square. The housing sales in 2008 were only 51% and 61% of that in 2006 and 2007,

respectively. However, the house prices in Beijing did not change dramatically (around 12000 RMB per square meter) during the beginning of 2007 to the end of 2008. This suggests that in the short term, the increase in the interest rate dramatically decrease the amount of housing sales but may not have significant impact on the overall house prices in Beijing. Therefore, the interest rate changes will only negatively affect housing sales in the short or middle term, and the housing market confidence will recover in the long run which makes the interest rate significant again in the long run (Hu & Guan, 2011).

5.2.4 Cost of supply

The coefficient of supply cost in the short run model is insignificant. Generally, building a residential area include several procedures such as land purchase, house design, build and sale. This implies the housing developers require a longer time period to complete a housing area development (from land purchase to housing sale). For example in China, to build a commercial housing area (a series houses or apartments that housing developers built on the land they purchased) normally takes 10 to 14 months. Therefore, the changes in supply cost such as the labor and raw material price will not impact the construction cost of the house currently sold in the short run, especially the pre-sale house since the developers do not know the actual construction costs and only know the forecasted construction costs when they sell the house; however, this forecasted construction costs is prediction by using the

previous construction costs data times the CPI. This may makes CPI may take place the role of cost of supply in explain the house price in the short term; as a result the cost of supply is insignificant in our short run model.

5.3 Comparing the long run and short run models

In terms of the long run and short run model (Equation 5.1 and 5.2), the inflation variable is significant in the short run model but insignificant in the long run model. In addition, both interest rate and supply cost are insignificant in the short term (Equation 5.2) but significant in the long run (Equation 5.1). Interestingly, among the three variables (CPI, Interest rate and Supply cost), CPI is significant in the short run model while the other two variables (interest rate and supply cost) are insignificant; CPI is insignificant in the long run model while the other two variables are significant. These can be supported by the following explanations.

For the three variables (CPI, interest rate and supply cost), we treat them as a group that capture the supply side of the housing transaction. As discussed in Section 5.1.3, the dramatic increase in the population of Beijing creates a huge demand in the Beijing housing market. This huge demand makes the housing developers more sensitive to the changes in the interest rate than the housing buyers. According to McQuinn and O'Reilly (2006), when there is a strong demand in the housing market, the housing market could generate future capital gains and this expectation makes many house buyers ignore the impact of the interest rate on repayment of housing

loans. The authors explained that because most of the housing loans are floating rate mortgage loans, many house buyers tend to stretch the mortgage loan repayment term over a longer time period for example 40 years; this is due to the large amount of loan repayment every month. Furthermore, this long repayment term period makes the effect of current interest rate changes on house buyers is small, because the total cost of property loans determined by the average interest rate during the whole loan period. As a result, in Beijing housing market, interest rate mainly captures the borrowing cost of the housing developers. Supply cost is a variable that measures the housing developers' construction and operating costs. Therefore, interest rate and cost of supply are important to house developers since these factors directly determine the total costs of housing supply. CPI is also an estimator of the cost of housing supply. For example, Coleman et al. (2008) used CPI to model the changes of construction cost in their VECM model. In the authors' model, in addition to controlling for inflation, CPI was also been treated as a basic proxy for the cost of supply housing. The authors reported a positive relationship between house prices and CPI index (which is a proxy for the construction cost index in the model).

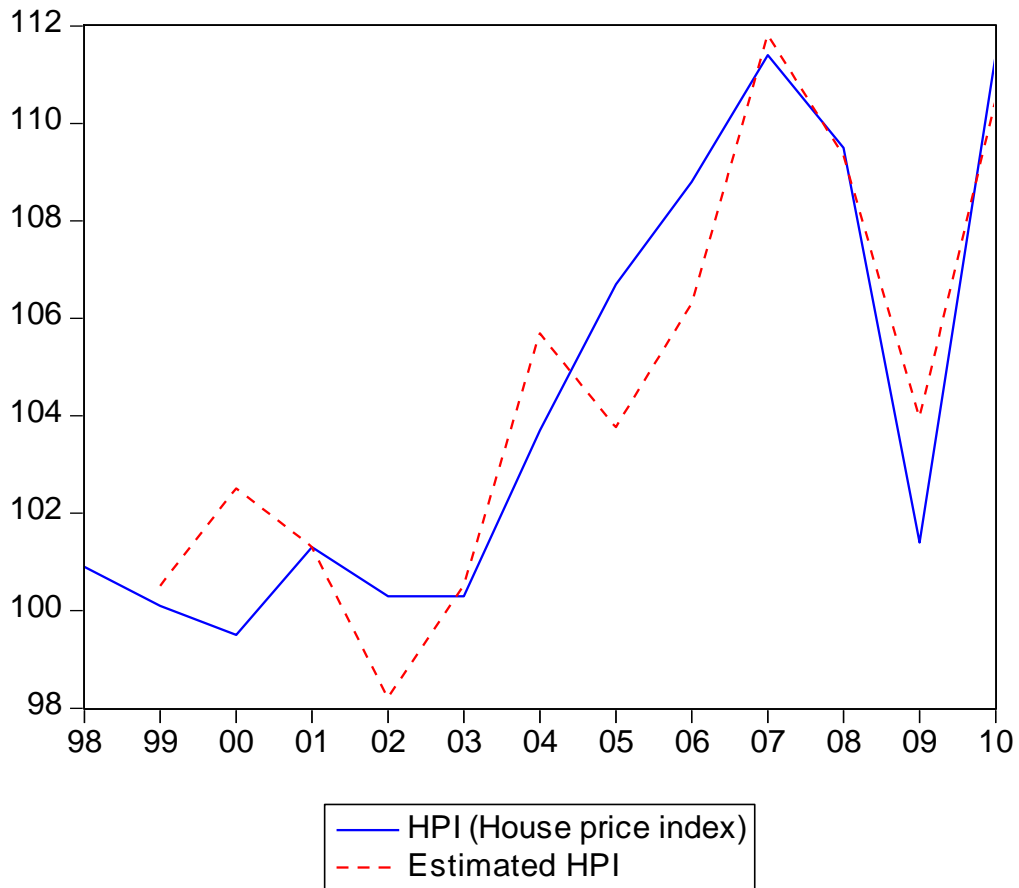
Because of the lagged effect of supply cost and interest rate (the current change in fundamental did not capture the real costs of houses currently being sold), housing developers tend to use CPI to estimate the total costs of housing supply in the short run (based on quarterly data). However, in the long run (based on yearly data),

housing developers already know their actual total costs of housing supply; therefore, they tend to focus on the interest rate (borrowing costs) and supply cost (construction and operating costs) to make their decision about house supply and house prices. In general, housing developers make decisions based on profits which is the house prices minus the total costs of housing supply; therefore, given a certain mark up, the house supply side is dependent on the total costs of housing supply. As a result, the costs of capital (depend on interest rate) and construction and operating costs (depend on supply cost) significantly impact the house price in the long run. However, in the short run, due to the incomplete information of total house supply costs (for example, most of the houses are sold before they are completely built), housing developers can only use CPI as a proxy of the total costs of supply housing to estimate their total costs. Therefore, CPI is more effective in explaining the house price in the short run.

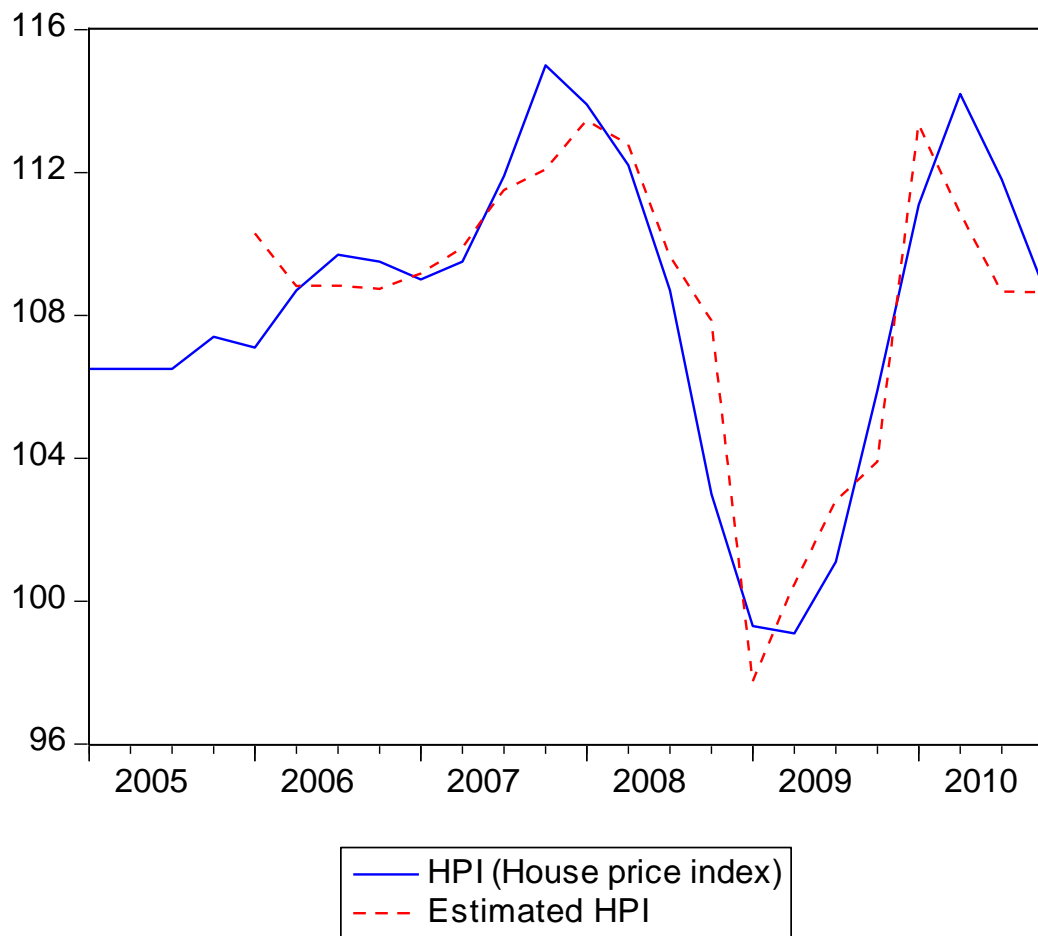
5.4 Housing bubbles in Beijing housing market

5.4.1 Evidence of housing bubbles

**Figure 5.1 Long Run HPI (House Price Index) and Equilibrium HPI in Beijing
(Based on Equation 5.1)**



**Figure 5.2 Short Run HPI and Equilibrium HPI in Beijing
(Based on Equation 5.2)**



Hott and Monnin (2008) suggest that to test the existence of a housing bubble is to address the gap between the real house price and its fundamental prices. Therefore, in order to provide descriptive evidence of the existence of housing bubbles in Beijing housing market, we compared the movement between house price index and equilibrium house price index based on the macroeconomic fundamental variables from our statistical model. Figures 5.1 and 5.2 show the movements of real house price index and equilibrium house price index from the long run (Equation 5.1) and

short run (Equation 5.2) models, respectively.

In the short run model (Figure 5.2), the dotted line represents the equilibrium house price index in Beijing housing market based on other economic fundamental variables such as income, inflation, interest rate and construction cost of house supply. Our results show two similar trends, the only significant differences appears in the last three quarter of 2006, in the second half year of 2007 and 2010. Theoretically, a house price bubble exists when the real house price index is greater than the equilibrium house price index for a non-short period. Therefore, the result of the short run model shows a housing bubble may exist in Beijing housing market until 2007.

This conclusion from Figure 5.2 can be supported by the result of the long run model (Equation 5.1). The larger gap between the house price and its long-run fundamental prices suggest the possibility of a house price bubble exists in the real estate market. In Figure 5.1, the house price index in 2005, 2006 and 2007 are certainly greater than the equilibrium house price index, which suggests the existence of a house price bubble in Beijing housing market. These results are consistent with the findings of Hou (2009) where the house price in Beijing is likely to form a bubble since 2005. Hou analyzed the relationship among house prices, income and house rents. In his results, the price to income ratio (P-I ratio) in Beijing housing market increased from 7.6 to 17.1 during the period from 2004 to 2007; while in the same period, the price to rent ratio (P-R ratio) in Beijing housing market also increased to 32 in 2007 from

15 in 2004. The author explained that the P-I ratio in Beijing housing market is more than 50% higher than the average P-I ratio of the eastern part of China (developed regions). In general, the P-R ratio moves between 9 and 18. When the ratio above 18 implied a potential price bubble could be exist in the housing market. The P-R ratio of Beijing rose over 18 since 2005. Therefore, the author concluded the existence of house price bubble in the Beijing housing market.

Also, Wu, Gyourko and Deng (2012) reported a historic high P-I and P-R ratio level in Beijing especially for the P-R ratio which experienced a nearly 70% increase since 2007. Similarly, Chovanec (2009) and Xu (2009) reported an extremely high P-I ratio in the China's housing market in their studies. Their studies are further supported the findings of Hou (2009). Hou (2009) studied both P-I and P-R ratios in Beijing and Shanghai housing market from 1991 to 2008 and concluded that extremely high ratios suggested the existence of a house price bubble in China. As a result, we can conclude the existence of house price bubble in China (at least in the big cities such as Beijing, Shanghai, Guangzhou and Shenzhen).

5.4.2 Changes in Beijing house prices versus its equilibrium prices

Table 5.3 Comparison between Beijing House Prices and its Equilibrium Prices based on the Long Run Model (Equation 5.1)

Period	Beijing Housing Market Condition
1999 to 2001	HPI lower than fundamental based HPI
2001 to 2003	HPI greater than fundamental based HPI
2003 to 2004	HPI lower than fundamental based HPI
2004 to 2007	HPI greater than fundamental based HPI
2007 to 2008	nearly equal
2008 to 2009	HPI lower than fundamental based HPI
2010	tend to be greater in the future

In China, housing market was controlled by the government before the liberalization of China's housing market in 1998. In fact, before 1998, most of the house under a person's name was not his or her bought from others; houses were given from the enterprise of collective ownership and national owned company (before the early of 1990s, majority of companies in China are under collective ownership or national ownership) as a reward for loyalty and hard working (Wu, 1996). For the house owners, the house was nearly free because they did not have to pay any real cash for the house. When the housing market was liberalized in 1998, many people who had more than one house sell their house at a very low price for cash. Because these houses were given by the companies as a reward (for loyalty and hardworking)

(Chinese government, 1998), the house is treated as zero cost by the owner. As a result, they sell the house at a very low price and can still make a large amount of profit from the housing transaction. Therefore, most the house owners tend to sell the house as quick as possible at a low price instead of waiting for a long time for a good price. This low price in the used housing market drove down the Beijing house price under the equilibrium price until 2001. The reason that house owners sell the house at a low price rather than waiting a long time for a good price is that they believe that the liberalized housing market is unstable. According to *Deregulation and the financial crisis* (2007), the economic liberalization may lead to the deregulation in the bank system that may cause the credit to over expand in the housing loan market; this may lead to potential problem in both the housing market and overall economy such as the U.S. sub-prime loan crisis. For example Kim and Kim (2009) analyzed the U.S. subprime loan crisis and reported the economic liberalization leading to the deregulation in housing market and the bank system have major attribution on this global financial crisis. Sundararajan and Balino (1991) also pointed out that economic liberalization is one of the most important contributions of financial crisis in Chile and Uruguay in 1980s.

According to Zhang and Fung's (2006) study, there is a negative relationship between the stock market and the housing market in China due to the flow of funds such as bank capital, private savings and foreign hot money; when the stock market depressed during the depression, money tend to go into the housing market looking

for profit. For example the authors reported a large amount of money goes into the housing market from China's stock market as a result of the depression in the stock market in 2001 leading to the increase in house prices. This hot money pushed up the Beijing house prices greater than its fundamental price. The Chinese government tried to decrease the money supply (increase the interest rate and money reserve) in order to control the increase in house prices; this caused the Beijing HPI in 2004 to be lower than its fundamental HPI. However, this monetary policy was ineffective. The foreign exchange market in China has been liberalized in 2005, due to the expectation of the appreciation of RMB; international funds flow into Chinese housing market and stock market which create a large demand in the housing market (Song & Gao, 2007). As a result, during 2005 to 2007, Beijing housing market was motivated by high expectations of investors and speculators (Hou, 2009).

Beijing housing market went into an adjustment period from 2007 to 2010. The HPI is lower than its equilibrium value during the whole period (from 2008 to 2010). Because the current sub-prime loan crisis (started at the beginning 2008) and the frequent increase in interest rate (see Section 5.2.3) among hurt the market confidence; furthermore, dramatically decrease the housing demand in Beijing housing market. China's central government also announced some strict restrictions will be implemented in the future in order to control the house price increase to avoid the potential risk of China's housing bubble crisis. For example, Beijing governments have implemented two policies to limit home purchases and high down

payments for the real estate loan in 2011 (Kurtenbach, 2011). These policies successfully stopped the increase in Beijing house prices (see Table 5.4), the house price index in Beijing housing market in the first half of 2012 decreased slightly by 0.3%.

Table 5.4 Beijing House Price in 2012
(House price in January = 100%)

Month	House Price Index
January	100.0
February	99.9
March	99.5
April	99.4
May	99.4
June	99.7

Source: Nation Bureau of Statistics of China, 2012

5.4.3 Model specification test

5.4.3.1 Durbin-Watson test

The Durbin-Watson (D-W) statistic tests if the model has first-order autocorrelation in the error term. The D-W statistic ranges between 0 and 4; a model does not suffer from autocorrelation when the D-W statistic is close to 2. This study used time series data; therefore, it is important to test for autocorrelation. According to Ostrom

(1978), non-autocorrelation is one of the assumptions of ordinary least squares (OLS) regression; and time series data routinely lead to violation of such assumption.

Table 5.5 Durbin-Watson Test Results (for Equation 5.1)

R-squared	0.835461	Mean dependent variable	104.5333
Adjusted R-squared	0.741439	S.D. dependent variable	4.706540
S.E. of regression	2.393222	Akaike info criterion	4.877495
Sum squared residual	40.09258	Schwarz criterion	5.079539
Log likelihood	-24.26497	Hannan-Quinn criterion.	4.802691
F-statistic	8.885801	Durbin-Watson statistic	2.032336
Probability(F-statistic)	0.007091		

Table 5.6 Durbin-Watson Test Results (for Equation 5.2)

R-squared	0.802037	Mean dependent variable	108.4750
Adjusted R-squared	0.749247	S.D. dependent variable	4.686922
S.E. of regression	2.346986	Akaike info criterion	4.756459
Sum squared residual	82.62517	Schwarz criterion	5.005392
Log likelihood	-42.56459	Hannan-Quinn criterion.	4.805053
F-statistic	15.19296	Durbin-Watson statistic	1.961852
Probability(F-statistic)	0.000037		

Tables 5.5 and 5.6 show the Durbin-Watson values are 2.03 and 1.96 for the equation 5.1 and 5.2, respectively. The critical value of D-W statistics (dU) is 2.17 in equation 5.1 (see Appendix 3) which shows the model does not have autocorrelation issues. Similarly, equation 5.2 has no autocorrelation since the D-W statistics is 1.96 which is in the middle of 1.82 and 2.18 (dU is 1.82). Autocorrelation occurs in a time series data when the model is misspecified which means that some independent variables can explain the dependent variable but are not included in the model (Ostrom, 1978). The results showed our models are not misspecified.

5.4.3.2 Goodness of fit

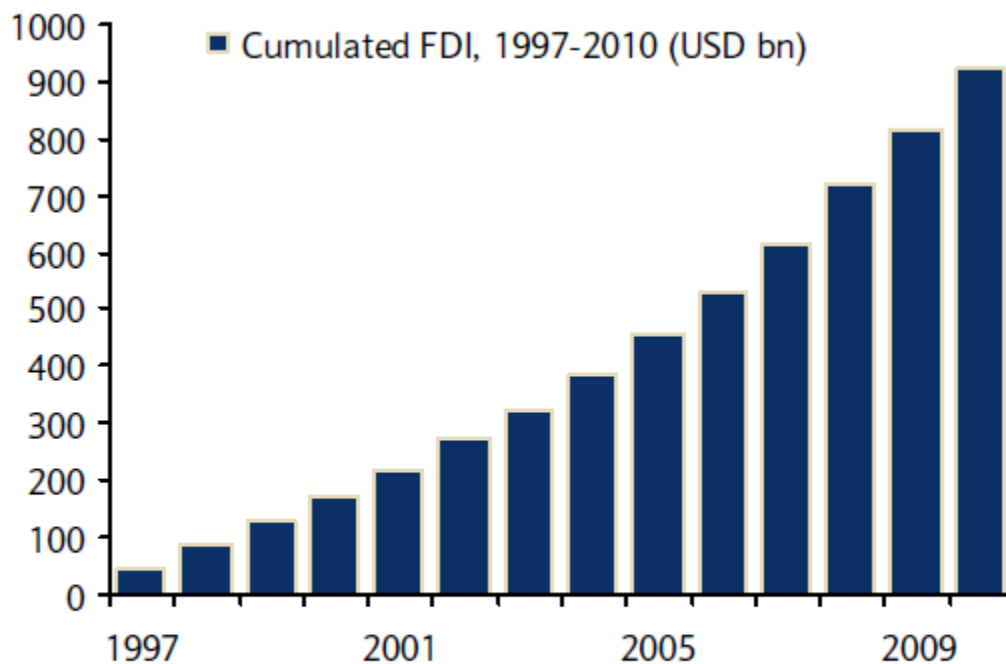
The adjusted R-squared of the two models (see Appendix 1 & 2) is 0.74 and 0.75, respectively. This suggests that only three quarters of the house price dynamics in Beijing housing market can be explained by the changes of the underlying economic fundamentals (income, inflation, interest rate & construction cost). The D-W test results showed both models are not misspecified. Therefore, the other 25% of Beijing house price dynamics that the models cannot explain could be due to the irrational expectations (that is investment and speculation).

5.4.3.3 Reason of housing bubbles

Investments and speculations are the main reason for asset bubbles. Investors and speculators buy houses not for living but to profit in the future via speculation.

Thomsett and Kahr (2007) firmly believe this expectation of future increase in house prices is the main reason that house price bubbled. This expectation is not rational and is not based on the underlying fundamentals. Dowall (1989) studied the speculation activities in Thailand (Bangkok) and concluded that the speculation behavior is the main engine that pushes up the house price. The author believed that if there are no speculation and investment; the house price will be held down to the total costs and reasonable profit for the house developers.

Figure 5.3 Foreign Directly Investment (FDI) in China



Source: CEIC Data, 2011 (cited in Zhang & Fung, 2006)

Hot money is a profit orientated capital that seeks for higher returns. According to Liang (2012), the dramatic increase in house prices in China formed a housing

bubble and this bubble is attributed to the hot money. The author explained that the hot money in China's housing market includes both foreign and domestic hot money. According to Figure 5.3, the foreign directly investment (FDI) in China has significantly increased, for example the FDI in 2010 is more than five times of that in 2000. Those foreign funds flow into China to seek for the future profit on the appreciation of RMB, and they mainly flow into the housing market and stock market due to the limited investment alternatives (Song & Gao, 2007). Zhang and Fung (2006) also found that the international fund is one of the important reasons leading to the increase of house prices in China. Liang (2012) also pointed out that domestic investments are attributed to the house price increase. According to Xin and Miles (2010), the new loans issued by commercial banks of China in 2009 valued 10 trillion RMB; and one-sixth of them went into the China's property market. These investments and speculations boomed the Beijing housing market.

The large demand in Beijing housing market not only increases the house prices but also caused a boom in the house rental market (see Table 5.7). This boom in Beijing house rental and housing market significantly encourages investors to invest in houses and rent them out in order to use rents to repay the housing loan every month especially in Beijing, Shanghai and Guangzhou (Wang & Luo, 2006). The house buyer expects that the house can be successfully rent out and the rents will be enough to repay the housing loan. Wang (2003) analyzed the impact of "refunding loan by rent" (use rents to repay the property loans) on China's housing market. The

author reported that theoretically, when there are no significant changes in other conditions such as rent, interest rate, rental market, using rent to repay housing loans can decrease the default risk of housing loans. However, this default risk of housing loans can increase dramatically when the total housing loans (repay housing loans by rents) increases. As a result of the boom in Beijing housing market, the author concluded that investors who used rent to repay loans will create a high potential default risk when there is a big decrease in rents or house prices.

Table 5.7 Changes in Beijing House Rent

	Beijing
	Rent in 1998=100%
1998	100.0
1999	98.5
2000	164.1
2001	205.9
2002	221.6
2003	240.4
2004	248.6
2005	254.6
2006	262.0
2007	269.0
2008	273.9
2009	270.9

Source: Beijing Municipal Bureau of Statistics, 2010

The speculators' situation is worse. According to Wang and Luo (2006) in big cities such as Beijing and Shanghai, many speculators use the only house they owned as the collateral of housing loan in order to borrow money from bank to buy another house; moreover, use the house they just bought as another housing loan's collateral to get money and invest in the housing market again. The authors explained that

because of the adverse selection, this type of the speculation can successfully use the asymmetric information to obtain money from banks. However, this kind of housing loan is very risky; it could lead to a high default rate and a decrease in house prices. The speculators involve in a large amount of risky debt and expect the house price in Beijing will keep climbing up in order to receive higher profit in the future to repay the debt. This is exactly a Ponzi Financing that Minsky explained in 1986 (Minsky, 1986).

5.5 Conclusion

From descriptions of Beijing house price dynamics and our long and short run models' results (Equation 5.1 & 5.2); we can conclude that there is a house price bubble exists in Beijing housing market during the period from 2004 to 2007. The bubble is caused by the investment and speculation behavior.

The results of the two models revealed that the Beijing house price index is significantly larger than the equilibrium value based on the relative economic fundamentals (income, inflation, interest rate and construction cost) during 2004 to 2007. This result is similar with the findings of Hou (2009) as explained in Section 5.4.1. As discussed in Section 5.4.3.2, nearly 75 percent of the changes in Beijing house price can be explained by the variables used in the models; as a result, we found that there is around 25% of the Beijing house price dynamics cannot be explained by the models. We believed the change in the house price of Beijing that

cannot be explained by the underlying fundamentals could due to the irrational expectations from the investment and speculation behavior. This finding is consistent with the findings of Hou (2009) and Dreger and Zhang (2010). Hou (2009) investigated the existence of housing bubble in Beijing and Shanghai, and found strong evidences of a speculative house price bubble in Beijing (from 2005) and Shanghai (from 2003) (see Section 5.4.1). Dreger and Zhang (2010) adopted ratio analysis to study the house price dynamics in 35 major cities of China. The authors found that the large demand in the China's housing market stimulated speculation behaviors which formed a housing bubble.

The housing bubble in Beijing housing market is fueled by speculative behavior such as Ponzi financing and large investments. For example, Dreger and Zhang (2010) reported that in some cities including Beijing, house buyers are "picked up by the seller through lottery". This means that compare with the large amount of house buyers who willing to buy houses, seller only provide a small amount of houses to sell in a short period even though they hold a large number of houses. These houses are sold to the "lucky person" though a lottery system (which is a random system). In doing so, the seller try to provide false information to the public that houses are in great demand so as to attract more house buyers. This created a false alarm of limited housing supply which nourishes exuberant expectations and speculations. As a result, the authors concluded that the investment and speculation stimulated an already existing housing boom. These speculative activities seriously endanger

China's economy via the commercial banking system. According to Wang (2003), most of housing investors expect to repay the housing loans by rents which potentially increase the default risk of the housing loans. Similarly, Wang and Luo (2006) also reported that due to the adverse selection, speculators are able to obtain credits from banks by providing false information and invest in the housing market. This makes both the speculators and commercial banks involved in a large amount of risky debts, which can crush the commercial banking system in China during the recession period of housing market.

Chapter Six

Summary and Conclusion

6.1 Overview of the study

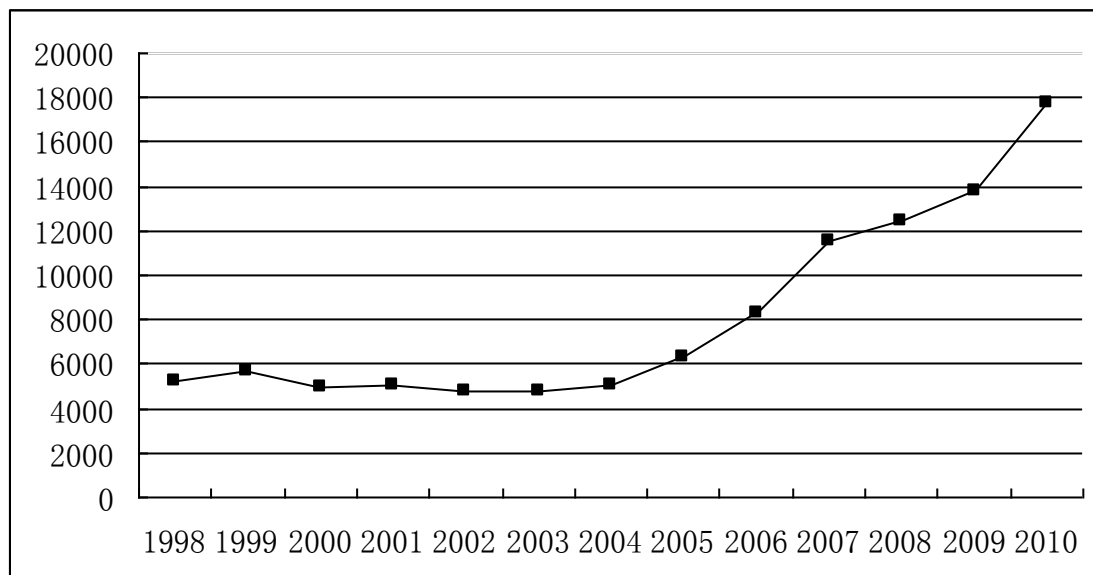
The dramatic increase in house prices created a large housing bubble in the U.S. housing market, leading to the current global financial crisis. This crisis has clearly showed how a burst in a housing bubble can seriously drag down the real economy globally. Both the debt issue in Euro Zone countries such as Greece and the decrease in GDP growth of East Asian countries such as Japan and Korea can be attributed to the U.S. sub-prime loan crisis. Hayford and Malliaris (2010) also reported that house price bubble is one of the main risks of systemic banking crisis occurs in terms of the credit over expansion during the booming time. For example, the authors explained the current U.S. sub-prime loan crisis that the over credit expansion on the housing loan generates a high default risk in the U.S. housing loan market. Kim and Kim (2009) reported that sub-prime mortgage loans with high default risk were sold into the secondary market (securities market) because of the financial innovation. In addition, the house prices in the U.S. decreased dramatically in 2006; this large decrease in house prices lead to a large amount of non-performing sub-prime property loans. The authors believed that those non-performing loans spread to the U.S. bank system including to financial market around the world, because of the securitization processes such as MBS (mortgage-back securities) and CDO (collateralized debt obligations).

Many researchers have studied house price bubble in different housing market globally. For example, Hastings (2004), McCarthy and Peach (2004, 2005), McKnight (2005) and Clithero and Pealer (2005) reported the existence of house price bubbles in the U.S. housing market before the current global financial crisis which took place in 2007. Levin and Wright (1997), Roehner (1999) and Roche (2000) also reported house price bubbles in the European countries. Australian and New Zealand housing markets were tested by Hatzi and Otto (2008) and Fraser, Hoesli and McAlevey (2008), respectively. The authors also discovered housing bubbles in the relative housing market. The housing market of East Asia and Southeast Asian countries such as Japan, Korea, Malaysia and Thailand has been reported to exhibit house price bubbles by many researchers (see Ito & Iwaisako, 1995; Kim & Suh, 1993; Kim, 2004; Quigley, 1999; Calhoun, 2003). Furthermore, Chan et al. (2001) and Xiao and Tan (2007) investigated housing bubbles in Hong Kong housing market and confirmed the existence of housing bubble created by the speculation behaviors.

China housing market has also experienced a dramatic increase in the house price started at the end of 1990s. For example, the house price in Beijing has increased dramatically since the liberalization of China's housing market in 1998 especially after 2004 (see Figure 6.1). The significant growths of Beijing house price potentially can generate a house price bubble, endangering the Beijing housing market and the overall economy. Roche (2000) tested the house price bubble in

Dublin from 1976 to 1998, and found a housing bubble when the house price increased from 1996 to 1998. The author concluded that the rapid rise or historical high house price tend to generate a big house price bubble. Similarly, Hou (2009) investigated the house price in Beijing and Shanghai, and reported the speculation behavior dramatically increase in house prices in Beijing and Shanghai that created a house price bubble in Beijing (since 2005) and Shanghai (since 2003).

Figure 6.1 Beijing (City Area) Average House Prices (1998 to 2010)



Source: Beijing Municipal Bureau of Statistics, 2011

However, only a few studies focus on China's housing market bubble (see Shen, Hui & Liu, 2005; Hu et al., 2006; Leung & Wang, 2007; Hou, 2009; Dreger & Zhang, 2010). For example, Dreger and Zhang (2010) concluded a housing bubble in China by using ratio analysis. Leung and Wang (2007) employed the DiPasquale-Wheaton model to test the house price dynamics in China and confirmed the existence of a

house price bubble. Similarly, Hou (2009) found empirical evidences to support a house price bubble exist in Beijing and Shanghai housing market. However, these researchers have not arrived at the same conclusion on the existence of China's house price bubble. However, some studies believed there is no such housing bubble in China. For example, Hu et al. (2006) believed that the main engine of the increase in house prices is driven by economic fundamentals including income and interest rates. Shen, Hui and Liu. (2005) tested the house price bubble in Beijing and Shanghai by comparing the market house price with the underlying fundamental based house price, and the authors found a house bubble in Shanghai; however, in the Beijing housing market, the authors believed the increase in house price is due to the economic fundamentals. These findings have been supported by Hui and Shen (2006). The authors compared the housing market in Beijing, Shanghai and Hong Kong, and concluded that there are no such house price bubbles in the Beijing housing market (see Section 2.4).

The existing literatures in China's housing market mostly focus on a few fundamental variables such as income and interest rate. For example, Hu et al. (2006) used interest rate and income to model the house price dynamics. Similarly, Hou (2009) used interest rate, income and rents to capture the changes in house prices in China. However, there are limited studies which test the house price by including house supply factors such as construction cost which impacts the house price. Because the construction cost directly affects the total housing supply costs of house

developers. In addition, the existing literatures study China's house market before 2006 while our study extends the data period to 2010.

In this study, we adopted Coleman et al. (2008) model to estimate both the long term trend and short term dynamics of the house price in Beijing using a wide range of variables including income, inflation, interest rate and construction cost. We use the data period from 1998 to 2010.

The long run model used yearly data from 1998 to 2010, while the short run model used quarterly data from 2005Q1 to 2010Q4. The data is collected from the Beijing Municipal Bureau of Statistics and Bank of China.

6.2 Implications

6.2.1 Results of research objective one and its implications

- Research objective one : To investigate whether a bubble exists in the Beijing housing market from 1998 to 2010 using economic fundamentals (interest rates, inflation, income and cost of supply)

Consistent with some researches in China's housing market (for example: Hou, 2009; Glindro et al, 2008; Wu et al., 2012; Chovanec, 2009), our results support the existence of house price bubbles in Beijing housing market during the period 2004 to 2007. For example, Figures 5.1 and 5.2 showed significant difference between

Beijing house price index and its fundamental based equilibrium price during 2004 to 2007 due to the investment and speculation as discussed in Sections 5.4.1 and Section 5.4.3.3. Thomsett and Kahr (2007) theoretically analyzed the current sub-prime loan crisis in the U.S. and suggested that the larger gap between the house price and its equilibrium price is an important signal of the existence of house price bubbles. The authors believed this gap is caused by investment and speculation via irrational expectations. The authors announced that there are three types of housing market including demand-and-supply market, rental market and financing market; and the financing market (this is highly related due to speculation and investment while in financing real estate market, people buy houses hoping to profit when house prices rises in the future) in real estate has main effects on housing bubbles. Statistically, about 25 percent of Beijing house price dynamics cannot be explained by macroeconomic fundamentals such as income, inflation, interest rate and supply cost. This part of the house price changes could be due to investments and speculation behaviors. Dowall (1989) have discussed that in spite of the speculation and investment, house prices is made up by the total costs and reasonable mark up of the housing developer. Those total costs and profits for the developers can be determined by the economic fundamentals such as income, inflation, interest rate and construction cost. This suggests that the house price which cannot be explained by the fundamentals could explain by the investment and speculation. Dreger and Zhang (2010) believed the large demand and increase in house prices in Beijing stimulate speculative activities. The authors reported that in some cities of China

especially in Beijing, Shanghai and Guangzhou, the housing market have boomed since 2001, and may be overheated in 2008 and 2009. The authors further pointed out that some real estate developers delayed their housing sales hoping for higher profits when the house price rises further; this decreased the amount of housing supply and encouraged the speculators to enter into the housing market stimulated an already existing housing boom. Wang (2003) and Wang and Luo (2006) also reported investments and speculative activities in the big cities such as Beijing and Shanghai lead credit over expansion in the housing loan market, which due to the adverse selection. As discussed in Section 3.2, Wang (2003) reported that due to the high house price and increasing population in the big cities, a large number of people can not afford a house; as a result, rental market boomed in the big cities such as Beijing and Shanghai. According to the author's analysis, the boom in the rental market stimulated investors and speculators to borrow large amount money from banks and invest in houses and rent them out hoping to use the rents to repay the housing loans. Wang and Luo (2006) claimed that such activities leading to the credit over expansion in the property loan; furthermore, those loans (use rents to repay loans) have higher default risk which can endanger the bank system.

A burst of house price bubbles such as the 2008 sub-prime loan crisis in US and Japanese real estate crisis in 1989 can endanger the stability and growth of the overall economy. The experience of those housing bubble crises should make governments to pay more attention on house price bubbles. The results of our study

support the existence of the house price bubble in Beijing housing market, which suggest that some policies should be implemented by the Chinese government to avoid a potential financial crisis cause by the housing bubble. Some policies have been implemented by the Beijing government in 2011 to curb the housing bubble. The policy includes decreasing the credit availability on buying a second house and imposing strict restrictions on the buyers' side of the housing transactions (see Section 3.3.2) in terms of the investments and speculation in the housing market. These policies seem to be efficient so far; for example in the first half of 2012, the Beijing house price index maintains (see Table 5.4). According to Dowall (1989), without the impact of investments and speculations, house prices will hold down to the costs of houses build plus a reasonable profit to the developers, which are determined by the underlying economic fundamentals. Therefore, under the strict restrictions (see Section 3.3.2), the investors and speculators hardly invest in Beijing housing market, which may drive down the house price to its equilibrium price.

6.2.2 Results of research objective two and its implications

- Research objective two: To examine the effect of macroeconomic fundamentals on house price changes in Beijing housing market

Theoretically, income, inflation and construction cost have positive effects on house prices; while interest rate negatively impact house prices. Kennedy and Anderson (1994) suggested that there is a near perfect elasticity between house expenditure

and stable income. This is due to the growth in income increases the house affordability (ability of the consumers' house purchasing). Therefore, the income variable positively impacts the house price via increase house affordability. According to Ji and Wang (2011), CPI (consumer price index) and HPI (house price index) indirectly impact each other via the other factors of production such as the price of labor and the price of raw materials. Both factors exhibit a positive relationship on labor prices and raw material prices. The authors reported that CPI is a general price which includes service prices, food prices, and house prices which are positively relative with labor prices and raw materials; and labor and raw material prices are two important determinants of the house developer's costs, which in turn positively impact the costs of house supply and house price. Construction cost is one of the most important costs for housing developers; it directly affects the total costs of house supply. As a result, a positive relationship between house prices and construction cost has been identified by many researchers (for example: Lv, 2011; Guo & Duan, 2008; Chen & Patel, 1998). The interest rate is the main determinant of the repayment (cost) of housing loans; therefore, increase in interest rate will decrease the housing demand via increase in the costs of housing loans. For example, Kau and Keenan (1980) based on utility maximization, mathematically analyzed the impact of interest rate on house prices and found a negative relationship between interest rate and house prices. Harris (1989) studied the U.S. housing market from 1970 to 1985 and found that the interest rate significantly (negatively) impacted the house price in U.S. especially in the mid-1970s.

However, not all researchers arrived at the same conclusion especially for the interest rate. As early as 1930, Keynesian has already described the positive relationship between interest rate and house price where these two variable change in the same way known as the “Gibson Paradox”. The “Gibson Paradox” is a long term positive relationship between interest rate and price named by Keynes in 1930 (Sargent, 1973). Similarly, Yun, Wang and Seabrook (2003) investigated the relationship between interest rate and house price in Hong Kong housing market from 1981 to 2001, and reported a positive relationship between Hong Kong house prices and interest rate. McQuinn and O’Reilly (2006) tested the house price dynamics in Irish housing market using income and interest rate variables, and their result exhibited a long-run positive relationship between house prices and interest rate. In terms of China’s housing market, most researchers (for example: Gao & Wang, 2009; Wang & Zhao, 2010; Lv, Li & Cao, 2010; Dong & Li, 2011) found a positive relationship between house price and interest rate. For example, Gao and Wang (2009) adopted the Vector Auto-Regression (VAR) model to study the relationship between interest rate and house prices in China from 2000 to 2007; the authors found a positive relationship between interest rate and house prices in China. Wang and Zhao (2010) used panel analysis to test the impact of interest rate on house prices in China and concluded a positive relationship between interest rate and house prices.

Similarly, the results of our two models also showed positive relationships between

interest rate and house prices in Beijing housing market (see Section 5.1.3). And this finding (positive relationship between house prices and interest rate) may be important for the Chinese governments since interest rate as a monetary policy is important for the government to control the housing market.

Kim and Kim (2009) discussed the impact of interest rate on U.S. housing market as the low interest rate stimulated the booming in U.S. housing market since 2000. The U.S. government used monetary policy (increase in interest rate) successfully to decrease the house price in the U.S. housing market. The authors reported that when the interest rate started to increase in 2005, the house price dramatically decreased. Based on the experience of the U.S., the Chinese government used traditional monetary policies (increase interest rate and deposit reserves) to control the house price which might not be effective in China's housing market. Dong and Li (2011) investigated the impact of monetary policies (increase the interest rate) on house prices in China and concluded that the impact of monetary policy (using interest rate changes to control house prices) during 1998 to 2009 is not significant especially from 1998 to 2006 due to the large demand in China's housing market. The incomplete urbanization cause the population to increase substantially (see Table 5.2) leading a large demand in the housing market. This rise in house demand increase house prices which attract investors and speculators into the housing market (see Section 5.4.3.3). Evidences for the effectiveness of the monetary policy can be seen in the Beijing housing market during the period 2006 to 2008. During 2006 to 2008,

the Chinese government increased the benchmark interest rate from 2.25% to 4.14% to control the increase in house prices; however, the house price in Beijing increased from 8280 to 12418 RMB per square meter. This positive movement between interest rate and house prices in Beijing suggests that the monetary policy may have little impact on the housing market. The Chinese government should find other ways to control the house price such as the policies discussed in Section 3.3.2.

6.2.3 Results of research objective three and its implications

- Research objective three: To identify appropriate risk management techniques to manage housing bubble crisis in Beijing

Many different methods have been used to address the house price bubbles, such as the ratio approach including house price to rent ratio and house price to income ratio (see McCarthy & Peach, 2004; McCarthy & Peach, 2005); asset-market approach (see Levin & Wright, 1997) and vector error correction (VECM) approach (see Case & Shiller, 1989; Quigley, 1999; Sing et al. 2006). Each of this approach has its limitations (see Section 4.1). Our study followed Coleman et al. (2008) method to study Beijing house price dynamics both in the long run and short run.

The two models results showed income variable mainly determines the house demand in Beijing housing market. As discussed in Section 5.3, because of the lagged effect of supply cost and interest rate, the house developers usually can only use CPI as a proxy to predict the total costs of house supply in the short term. In the

long run, the complete information of total supply costs (interest rate and supply cost data) is available, house developers use real costs of house supply instead of CPI to predict the cost. Therefore, in the short term, house supply is determined by inflation rate; and in the long run, house supply is more likely to be explained by interest rate and construction cost.

Based on our model results (see Section 5.3), the house price in Beijing depends on different variables: income, interest rate and construction cost is significant in the long run while income and inflation is significant in the short run. Therefore, when policymakers make decisions to curb house bubble crisis and when financial institutions and house buyers using underlying variables to forecast the future house price changes, they may need to concentrate on different variables in the different time period. For example, they may need to concentrate on income, interest rate and construction cost to forecast future Beijing house price in the long run, and concentrate on income and inflation for the short run forecasting. The Chinese government should pay more attention to the gap between the real house price and its underlying equilibrium price based on fundamentals to decrease the risk of housing bubble crisis instead of only looking at the house price itself. According to Hott and Monnin (2008), to test the existence of housing bubble is to address the gap between the real house price and the fundamental based price. Thomsett and Kahr (2007) suggested that the larger gap between the house price and the fundamental based equilibrium price is an important signal of the existence of house price

bubbles. The increase in house prices may be due to the economic fundamentals; however, the large gap between house prices and the fundamental based price suggests the existence of house price bubbles.

6.3 Limitations

The first limitation of this study is that the study did not include regulations in Beijing housing market as an independent variable. The regulations can significantly impact the house price. For example, Beijing government implemented strict restrictions in the Beijing housing market in 2011. These restrictions included: (1) increase the down payment rate of owning the second house. In Beijing housing loans market, the down payment rate is 20% for owning the first house. However, under the new regulation, if someone, who already has mortgage loans, wants to apply another housing loan to buy a second house, the down payment rate will increase to 60%; (2) families who hold Beijing registered residence can only buy two houses; families who hold the Beijing temporary residence permit and have lived in Beijing for more than 5 years can only buy one house; other families can only rent houses (Kuetenbach, 2011). After these restrictions have been implemented, the house price in Beijing stopped to increase and slightly decreases during the first half of 2012 (see Table 6.1). However, there is no such index or measurement for the regulation in China created by previous studies or governments; as a result, due to the time limitation, this variable was not included in the study.

Second, a complete real estate cycle is about 18 years, for example, the U.S. house prices reach the bottom at 1974, 1992 and 2010. Harrison (2005) explained a complete real estate cycle in four stages: a seven-year slow increase (recovery for the last recession), a 5-year rapid increase (a short time decrease may occur before this stage), winner's curse (a 2-year madness increase in house price) and a four-year collapse in the housing market. However, the liberalization of housing market in China only started in 1998 and the official house prices' data (from the Chinese government) before 1998 is not available. As discussed in Section 5.4.2, before 1998 the Chinese government controlled the housing market via housing allocation; and we believe this house price is not a market price. Therefore, due to data availability and quality, this study used the data from the Nation Bureau of Statistics of China; a 13-years study (from 1998 to 2010) which is not long enough to capture house prices movement in a complete real estate cycle.

Third, based on previous studies and data availability, our research only studied the new dwelling price and did not include second-hand (used) house prices. For the low income and middle income families (income under 500,000RMB per year according to the Nation Bureau of Statistics of China), second-hand (used) houses are important complement of new houses especially when the house price is high. For example, Cao and Yang (2008) compared the price of new houses and used houses in Wuhan housing market. The authors reported that the increase in new house prices will increase the price of used houses; and when the used house prices increase close

to the new house prices, most people tend to buy new houses and pushes up the property prices. Fitzpatrick and McQuinn's (2007) estimated both new house and second-hand house price dynamics in their model. The authors found that those two types of house prices tend to move in the similar way in the Irish housing market. Therefore, the authors concluded a positive link between second-hand house (used house) and new commercial real estate. Ji, Xiao and Chen (2004) studied the housing market in Shanghai from 2000 to 2003 and reported that there is a direct positive link between used house and new dwelling prices, and the high price of new properties cause the increase in the used house price in Shanghai housing market during the study period.

Fourth, because of time constraint, this study only used Beijing housing market as a case; which may not be representable of whole China, because the variables exhibiting relationships with house price may vary slightly in each city. In order to adequately capture the house price in China, at least 32 metropolitan areas (28 provincial capitals plus 4 municipalities) should be included in the study. House price dynamics are different in different provinces of China due to the different demand, income, labor, material costs and traditional practices (in some part of China, a big family tend to live together and pass the house to next generation). Therefore, to study the house price bubble at the national level, the dataset should include as many provinces as possible to capture those dynamics trend in China's housing market. For example, Himmelberg et al. (2005) used a dataset of 46

Metropolitan Area in 48 states of U.S. (excluding Hawaii and Alaska) to test the price to income ratio in the U.S. housing market; and successfully forecast the burst of the housing bubble. The authors concluded that the house price is expected to decrease significantly when the interest rate increases. The authors explained that the more metropolitan areas include in the study the better to investigate the house price at the national level. Dreger and Zhang (2010) used a dataset of 35 major cities in China to study China's housing bubbles. Similar to Himmelberg et al. (2005) suggestion, Dreger and Zhang also pointed out that to explore the existence of a house price bubble in China's housing market, the analysis of the four big cities such as Beijing, Shanghai, Guangzhou and Shenzhen is inadequate. Therefore, data selection from a wide range of metropolitan area is suggested, since housing markets vary a lot across different cities in China (Hu et al., 2006). This difference in housing markets includes different demand, income, labor, material costs and cultures.

6.4 Recommendations for future study

The recommendations for future study are as follows:

- Due to the limitations of our study, to further improve the research result, the impact of government regulations and policies on house prices especially the restrictions be implemented by the Beijing government in 2011 should be tested. As discussed in Section 6.2, the two main restrictions (limits on the number of house purchased and increased in down payment rate) have significant impact

on house prices in Beijing especially in the first half of 2012 (see Table 5.1). A combination of new and second-hand (used) house prices can be used to study the house price bubble in Beijing.

- In order to adequately capture the house price bubble in China, future studies should study more housing markets of metropolitan areas beside the four top tier cities (Beijing, Shanghai, Shenzhen and Guangzhou) and include provincial capitals such as Nanjing, Hangzhou, Fuzhou etc.
- We also recommend future studies to compare China's housing market with other areas housing market such as Japan and Korea using similar variables. Some of the researchers tend to use other housing market as a test case to compare with their targets. For example, Kim and Suh (1993) selected the Japanese housing market as a case using same model and variables to study the house price in both South Korea and Japan. The authors confirmed a housing bubble in South Korea due to the experience of the previous housing bubble crisis in Japan in 1980s. Hui and Shen (2006) found housing bubbles in Beijing and Shanghai housing market by comparing the house price dynamics in Hong Kong. The authors explained that to compare the house price dynamics between different areas (test case and target) can help to understand the housing bubble and its impact on the overall economy, especially when the test case has experienced a housing bubble and burst in the past.

6.5 Conclusions

The strong increase in house prices could potentially create a bubble in the housing market. The burst of a house price bubble could endanger the countries economy as a whole. For example, a house price bubble burst can lead to a large amount of non-performing loans which negatively impact the banking system; residences can lower spending which may drive down the country's overall economy as evident in the U.S. sub-prime loan crisis. It can also lead to re-allocation of capital which can significantly impact the exchange rate, international capital flow and world economy (McKibbin & Stoeckel, 2006). Previous housing bubble crises (such as U.S. and Japan) have documented the dramatic impact of a house bubble burst on the domestic economy at large.

After the 2008 subprime loan crisis in the U.S., house prices in Beijing kept increasing which made many people concern about a potential housing bubble in China and (if so) will it burst? For example, Hou (2009) analyzed the relationship among house prices, income and house rents in Beijing and Shanghai housing market and reported a speculation bubble in both cities. Dreger and Zhang (2010) investigated the price to income and price to rent ratio in 35 metropolitan areas of China, and found empirical evidences to support existence of a speculative housing bubble in China's housing market.

Differ from previous literatures in China's housing market, this study employed

economic fundamentals of both supply and demand in housing transactions such as income, inflation, interest rate and construction cost to investigate the house price dynamics in Beijing housing market. Previous studies of China's housing market only used income and interest rate as independent variables (see for example: Shen, Hui & Liu, 2005; Hu et al, 2006; Hou, 2009). In addition, our study period is from 1998 to 2010. Previous studies on China's housing market investigated the house price before 2006 (for example: She, Hui & Liu, 2005; Hu et al., 2006; Hui & Shen, 2006); however, we extended the study period to 2010. The results of our study showed an existing housing bubble in Beijing housing market caused by speculation activities (see Section 5.4.3.3). The strict restrictions (limits on house purchases and increase down payment rate) have been implemented in 2011 to control the speculation behavior. These restrictions effectively stopped the increase in Beijing house prices in the first half of 2012. The impact of interest rate on house price is estimated to positive in our study (see Sections 5.1.3 & 5.2.3). This is because the large demand in Beijing housing market is due to the dramatic increase in population (see Table 5.2), investments and speculations (see Section 5.4.3.3). Our finding explains the effectiveness of monetary policy (increase interest rate) in China's housing market from 1998 to 2009 as discussed in section 6.2.2 (also see Dong & Li, 2011). Moreover, the results of the models show that in the short term, house supply is determined by inflation rate while in the long run, house supply is more likely to be explained by interest rate and construction cost (see Section 6.2.3).

In conclusion, the current global financial crisis has a significant negative impact on almost every country including China. It is impossible for China to insulate from the impact of the global financial crisis. As economic growth slows down, the Chinese government has begun to relax the tight credit policies meant to cool inflation previously. Some have argued that such action would intensify the real estate bubble. However, most critics do not see a meltdown similar to the U.S. sub-prime loan crisis that led to the global crisis because most Chinese homeowners hold relatively modest mortgages, and demand in the long run will be sustained (Kurtenbach, 2011). The sustained demand is due to: (1) the incomplete urbanization in China increase the population in cities (for example a forecast of Economist Intelligence Unit shows a 26.1% increase in urban population (over 160 million people) between 2011 and 2020 in China); (2) the increasingly affluent families caused by the strong economic growth seeking more spacious properties (Kurtenbach, 2011). Furthermore, the government has taken proactive measures to control the real estate market such as limits on home purchases (such as banned on second home purchase), high down payments to qualify for mortgages in some cities such as Beijing, Shanghai and Guangzhou (Kurtenbach, 2011). This helps to mitigate any possible massive mortgage default in the real estate sector.

References

- Ahuja, A., Cheung, L., Han, G., Porter, N., & Zhang, W. (2010). Are house prices rising too fast in China? *International Money Fund working paper*
- Ayuso, J., Blanco, R., & Restoy, F. (2006). House prices and real interest rate in Spain. *Banco de Espana Research Paper No. OP-0608*
- Bank of China. (from 1912 to present). Retrieved from <http://www.boc.cn/en/index.html>
- Bank of International Settlements. (2007). Retrieved from <http://www.bis.org/statistics/index.htm>
- Beijing Municipal Bureau of Statistics. (from 2004 to present). Retrieved from <http://www.bjstats.gov.cn/esite/>
- Bodman, P., & Crosby, M. (2004). Can macroeconomic factors explain high house prices in Australia? *Australian Property Journal*, 38(3), 174-179
- Bourassa, S., & Hendershott, P. (1995). Australian capital city real house prices 1979-1993. *Australian Economic Review*, 111, 16-26
- Black, A., Fraser, P., & Hoesli, M. (2006). House prices, fundamentals and bubbles. *Journal of Business Finance and Accounting*, 33(9), 1535-1555
- Calhoun, C. A. (2003). Property valuation models and house price indexes for the provinces of Thailand: 1992-2000. *Housing Finance International*, 17, 31-41
- Cameron, G., Muellbauer, J., & Murphy, A. (2006). Was there a British house price bubble? Evidence from a regional panel. *Centre for economic policy research discussion paper No. 5619*.
- Cao, G., & Yang, Q. F. (2008). 对二手房市场价格影响因素及其健康发展的思考: 以武汉二手房房地产市场为例. (The used house prices influencing factors: A case study based on the used housing market in Wuhan). *China Collective Economy*, 8, 75-76
- Capital, B. (2011). China beyond the miracle. Part 3: Bubble deflation, Chinese style. *Economic Research*. Nov 8, 2011

-
- Capozza, D. R., Hendershott, P. H., & Mack, C. (2004). An anatomy of price dynamics in illiquid markets: Analysis and evidence from local housing market. *Real Estate Economics*, 32, 1-32
- Case, K. E., & Shiller, R. J. (1989). The efficiency of the market for single-family homes. *American Economic Review*, 79, 137-152
- Case, K., & Shiller, R. (2003). Is there a bubble in the housing market? *Brookings Papers on Economic Activity*, 2, 299-362.
- CEIC Data. (from 1992 to present). Retrieved from <http://www.ceicdata.com/>
- Chan, H. L., Lee, S. K., & Woo, K. Y. (2001). Detecting rational bubbles in the residential housing markets of Hong Kong. *Economic Modeling*, 18(1), 61-73
- Chen, M. C., & Patel, K. (1998). House price dynamics and granger causality: An analysis of Taipei new dwelling market. *Journal of the Asian Real Estate Society*, 1(1), 101-126
- Chinese government (1998). 国务院关于进一步深化城镇住房制度加快住房建设的通知. (Further deepening the urban housing system to speed up housing construction). Chinese government documents number [1998]23
- Chovanec, P. (2009). China's real estate riddle. *Far East Economic Review*. June 2009
- Clithero, J., & Pealer, N. (2005). Is there a housing bubble in Irvine, California? A repeat-sale analysis using a new data set. *International Real Estate Review*, 8(1), 110-127
- Coleman, M., LaCour-Little, M., & Vandell, K. D. (2008). Subprime lending and the housing bubble; Tail wags dog? *Journal of Housing Economics*, 17, 272-290
- Deng, L., Shen, Q., & Wang, L. (2009). Housing policy and finance in China: A literature review. *Prepared for U.S. Department of Housing and Urban Development, November, 2009*
- Deng, L., Shen, Q., & Wang, L. (2011). The emerging housing policy framework in China. *Journal of Planning Literature*, 26(2), 168-183
- Deregulation and financial crisis. (2007). *Multinational Monitor*, 28(3), 6-7
- Dong, F., & Li, Z. L. (2011). Empirical study on the effect of interest rate policy on house price: 1998-2009. *Journal of Chongqing University of Technology*

(*Social Science*), 25(1), 61-71

- Dowall, D. E. (1989). Bangkok: A Profile of an Efficiently Performing Housing Market. *Urban Studies*, 1989(26), 327-339
- Dreger, C., & Zhang, Y. (2010). Is there a bubble in Chinese housing market? *DIW Berlin Discussion Paper No. 1081*
- Fitzpatrick, T., & McQuinn, K. (2007). House prices and mortgage credit: Empirical evidence for Ireland. *The Manchester School*, 75(1), 82-103
- Fraser, P., Hoesli, M., McAleve, L. (2008). House prices and bubbles in New Zealand. *Journal of Real Estate Finance and Economics*, 37, 71-91
- Gallin, J. (2006). The long run relationship between house price and income: Evidence from local housing markets. *Real Estate Economics*, 34(3), 417-438
- Gallin, J. (2003). The long-run relationship between house prices and rentals. Washington: Federal Reserve.
- Gao, B., & Wang, X. Z. (2009). 中国房地产市场货币政策传导机制的有效性分析：2000-2007. (Analysis of the effectiveness of the monetary policy transmission mechanism in China's real estate market: 2000-2007). *Finance and Trade Economics*, 2009(3), 129-135
- Gauger, J., & Synder, T. C. (2003). Residential fixed investment and the macro economy: Has deregulation altered key relationships? *Journal of Real Estate Finance and Economics*, 27, 335-354
- Glindro, E.I., Subhanij, T., Szeto, J., & Zhu, H. (2008). Determinants of house prices in nine Asia-Pacific economies, *Bank of International Settlements Working Papers*, No. 263, October.
- Goodman, A. C., & Thibodeau, T. G. (2008). Where are the speculative bubbles in US housing market. *Journal of Housing Economics*, 17, 117-137
- Green, R. (1997). Follow the leader: How changes in residential and non-residential investment predict changes in GDP. *Real Estate Economics*, 25, 253-270
- Guo, Y. Q., & Duan, D. D. (2008). 基于房地产市场供求关系和产品成本的房价决定模型. (A house prices determined model based on demand-supply relationship and supply costs). *兰州学刊*, (*Journal of Lanzhou Studies*). 52, 31-33

-
- Harris, J. C. (1989). The effect of real rates of interest on housing prices. *Journal of Real Estate Finance and Economics*, 2, 47-60
- Harrison, F. (2005). *Boom Bust: House Prices, Banking and the Depression of 2010*. Shephard-Walwyn Ltd. London. ISBN-13: 978-0-85683-254-3
- Hastings, R. (2004). Bubble, bubble housing trouble. *Collections and Credit Risk*, 9(6), 62-63
- Hatzi, E., & Otto, G. (2008). Price, rents and rational speculative bubbles in the Sydney housing market. *The Economic Record*, 81, 96-103
- Hayford, M. D., & Malliaris, A. G. (2010). Asset prices and financial crisis of 2007-09; A overview of theories and policies. *Forum for Social Economics*, 39(3), 279-286
- Himmelberg, C., Mayer, C., & Sinai, T. (2005). Assessing high house price: Bubbles, fundamentals and misperceptions. *Journal of Economic Perspectives*, 19(4), 67-92
- Hott, C., & Monnin, P. (2008). Fundamental real estate price: An empirical estimation with international data. *The Journal of Real Estate Finance and Economics*, 36(4), 427-450
- Hou, Y. (2009). House price bubbles in Beijing and Shanghai? A multi-indicator analysis. *International Journal of Housing Markets and Analysis*, 3(1), 17-37
- Hu, J., Su, L., Jin, S., & Jiang, W. (2006). The rise in house prices in China: Bubbles or fundamentals? *Economic Bulletin*, 3(7), 1-8
- Hu, J. Y., & Guan, Y. Z. (2011). 利率变动及居民收入支出对消费者购房信心的影响分析. (Analysis the impact of interest rate changes, income and CPI on the confidence of house buyers). *Business Times*, 2011(19), 14-15
- Huang, H., & Wang, B. (2007). 银行利率变动对房地产市场的影响. (The impact of interest rate changes on housing market). *Price: Theory and Practice*, 2007. 51-52
- Hui, E. C. M., & Shen, Y. (2006). Housing price bubbles in Hong Kong, Beijing and Shanghai: A comparative study. *The Journal of Real Estate Finance and Economics*, 33(4), 299-327
- Ito, T., & Iwaisako, T. (1995). Explaining asset bubbles in Japan. *NBER Working Paper No 5358*

-
- Ji, B. L., Xiao, J. J., & Chen, J. (2004). Impact on price of commodity apartment of second-hand house. *Journal of Chang'an University*, 21(2), 59-61
- Ji, M., & Wang, Y. (2011). The real estate market and the inflationary transmission mechanism. *China Money*, 8, 4-8
- Kau, J. B., & Keenan, D. (1980). The theory of housing and interest rate. *Journal of Financial and Quantitative Analysis*, 15(4).
- Kennedy, N., & Anderson, P. (1994). Household saving and real house prices: An international perspective. *BIS Working Paper* n.20
- Kim, K. H., & Suh, S. H. (1993). Speculation and price bubbles in the Korean and Japanese real estate markets. *Journal of Real Estate Finance and Economics*, 6, 73-87.
- Kim, K. H. (2004). Housing and the Korean economy. *Journal of Housing Economics*, 13(4), 321-341
- Kim, K. W., & Kim, H. N. (2009). Global financial crisis overview. *SERI Quarterly*, April, 13-21.
- Kurtenbach, E (2011). China's thin Margin for Error in Property Policies. Retrieved 17, August 2012 from <http://news.yahoo.com/chinas-thin-margin-error-property-policies-055328642.html>
- Leung, C. K. U., & Wang, W. (2007). An examination of the Chinese housing market through the lens of the DiPasquale-Wheaton model: A graphical attempt. *International Real Estate Review*, 10(2), 131-165
- Levin, E. J., & Wright, R. E. (1997). The impact of speculation on house prices in the United Kingdom. *Economic Modeling*, 14(4), 567-585
- Levin, E. J., and Pryce, G. (2007). A Statistical Explanation for Extreme Bids in the House Market, *Urban Studies*, 44(11), 2339-2355
- Liang, P. (2012). Uniqueness of speculative capital flows and monetary policy responses in China (2007-2010). Retrieved from <http://www.aabri.com/LV11Manuscripts/LV11006.pdf>
- Lin, G. C. S., & Ho, S. P. S. (2008). The state, land system, and land development processes in contemporary China. *Annals of the Association of American Geographers*, 95(2), 411-436

-
- Linneman, P. D., & Megbolugbe, I. F. (1992). Housing affordability: Myth or reality? *Urban Studies*, 29(3-4), 369-392
- Lv, H. B., Li, P., & Cao, J. B. (2010). 货币政策调控房价有效性的实证研究: 基于 VAR 模型. (Empirical analysis the effectiveness of monetary policy on controlling house prices: based on VAR model). *Chinese Housing Finance*, 2010(5), 15-18
- Lv, P. (2011). 我国住房生产成本对房价的影响分析. (The impact of the cost of house supply on house prices). *Price: Theory and Practice*, 2010, 62-63
- Mak, S. W. K., Choy, L. H. T., & Ho, W. K. O. (2007). Privatization, housing conditions and affordability in the People's Republic of China. *Habitat International*, 31(2), 177-192
- Malpezzi, S., & Chun, G. H., & Richard, K. G., (1998). New place-to-place housing price indexes for U.S. metropolitan areas, and their determinants. *Real Estate Economics*, 26(2), 235-274
- McCarthy, J., & Peach, R. W. (2004). Are house prices the next “bubble”? *Economy Policy Review – Federal Reserve Bank of New York*, 10(3), 1-17
- McCarthy, J., & Peach, R. W. (2005). Is there a “bubble” in the housing market now? *Network Financial Instrument*, 2005-PB-01
- McKibbin, W., & Stoeckel, A. (2006). Bursting of the US housing bubble. Essential Economic Analysis for Strategic Thinkers, Issue 14, Retrieved from Economic Scenarios.com
http://www.economicscenarios.com/public/pdfredir_sample.asp?issueNo=14
- McKnight, T. K. (2005). Bubbles. *Marine Corps Gazette*, 89(9), 52-53
- McQuinn, K., & O'Reilly, G. (2006). Assessing the role of income and interest rates in determining house prices. *Economic Modeling*, 25. 377-390
- Meen, G. P. (1990). The removal of mortgage market constraints and the implications for econometric modeling of UK house prices. *Oxford Bulletin of Economic and Statistic*, 52(1), 1-23.
- Miles, W. (2008). Boom-bust cycles and the forecasting performance of linear and non-linear models of house prices. *The Journal of Real Estate Finance and Economics*, 36, 249-264

-
- Minsky, H. (1986). *Stabilizing an unstable economy*. New Haven: Yale University Press
- Muellbauer, J., & Murphy, A. (1997). Booms and busts in the UK housing market. *Economic Journal*, 107(445), 1701-1727
- National Bureau of Statistics of China. (2009). China Statistical Yearbook 2009. Retrieved from <http://www.stats.gov.cn/>
- National Bureau of Statistics of China. (2010). China Statistical Yearbook 2010. Retrieved from <http://www.stats.gov.cn/>
- National Bureau of Statistics of China. (2012). China Statistical Yearbook 2012. Retrieved from <http://www.stats.gov.cn/>
- Ostrom, C. W. (1978). *Time series analysis*. Sage University Papers Series on Quantitative Applications in the Social Science, 07-009. Thousand Oaks, CA: Sage.
- Painter, G., & Redfearn, C. L. (2002). The role of Interest Rates in Influencing Long-run Homeownership Rates. *Journal of Real Estate Finance and Economics*, 25(2-3), 243-267
- Pillay, S., & Rangel, Gary. (2005). Evidence and Determinants of Real Estate Bubbles: The Case of Singapore. *The 16th Asian Finance Association Conference Proceedings, Paper No. 37*
- Poterba, J. M. (1984). Tax subsidies to owner-occupied housing: An asset-market approach. *Quarterly Journal of Economics*, 99, 729-752
- Qiu, Y. (2011). 房价波动与 CPI 关系的计量分析. (Analysis the relationship between house price dynamics and CPI). 教育部人文社会科学研究项目 (Ministry of Education, Humanities and Social Science Project) (10YJA790271), 26(1), 43-46
- Quigley, J. M. (1999). Real estate prices and economic cycles. *International Real Estate Review*, 2(1), 1-20
- Rapoza, K. (2011). China's housing bubble past, ant its future. Forbes, Nov 8, 2011
- Reichert, A. K. (1989). The impact of interest rates, income and employment upon regional housing prices. *Journal of Real Estate Finance and Economics*, 3.

-
- Roche, M. J. (2000). The rise in house prices in Dublin; bubble, fad or just fundamentals. *Economic Modeling*, 18, 281-295
- Roehner. (1999). Spatial analysis of real estate bubbles: Paris 1984-1993. *Regional Science and Urban Economics*, 29, 73-88
- Samsun Economic Research Institution. (2007). Retrieved form <http://www.seriworld.org/>
- Sargent, T. J. (1973). Interest rates and prices in the long run: a study of the Gibson paradox. *Journal of Money, Credit and Banking*, 5(1), 385-449
- Shen, Y., Hui, E. C., & Liu, H. (2005). Housing price bubble in Beijing and Shanghai. *Management Decision*, 43(4), 611-627
- Sing, T. B., I.C., T., & Chen, M. C. (2006). Price dynamics in public and private housing markets in Singapore. *Journal of Housing Economics*, 15, 305-320. DOI:10.1016/j.jhe.2006.09.006
- Song, B., & Gao, B. (2007). Influence of international capital flow on housing and land price: Positive test based on the data in China (1998-2006). *Research on Financial and Economic Issues*, 2007(3), DOI:CNKI:ISSN:1000-176X.0.2007-03-007
- Stone, M. E. (2006). What is housing affordability? The case for the residual income approach. *Housing Policy Debate*, 17(1), 151-184
- Sundararajan, V., & Balino, T. J. T. (1991). *Banking Crisis: Cases and Issues*. International Monetary Fund, Washington D. C.
- Thomsett, M. C., & Kahr, J. (2007). *Beyond the Bubble*. New York, Amacon.
- Todd, A. K. (2008). *Modern Financial Macroeconomic, Panics, Crashes and Crisis*. Singapore; Blackwell Publishing
- Tsatsaronis, K., & Zhu, H. (2004). What drives housing price dynamics: Cross-country evidence. *BIS Quarterly Review*, March 2004
- Tuluca, S., Myer, F., & Webb, F. (2000). Dynamics of private and public real estate markets, *Journal of Real Estate Finance and Economics*, 21(3), 279-296
- Wang, J. F. (2003). Adverse selection behavior of loaners and risks of commercial banks: A theoretical model and empirical analysis of effect of refunding loan by rent on the asset risk of housing loans of commercial banks. *Journal of*

- Wang, J. K., & Luo, L. J. (2006). 居民个人住房贷款风险分析与对策. (Individual housing loans risk analysis and countermeasures). *Special Zone Economy*, 2006(12), 263-264
- Wang, X. Z., & Zhao, F. J. (2010). 房地产市场货币政策效应—基于我国 35 个大中型城市的实证分析. (The impact of the monetary policy on housing market: A case study based on 35 cities in China). *Economic Structural Reform*, 3, 157-161
- Wu, F. L. (1996). Changes in the structure of public housing provision in urban China. *Urban Studies*, 33(9): 1601-1627.
- Wu, H. L. (2011). 中国中小型企业面临倒闭潮. (Chinese small-sized and middle-sized firms facing bankrupt). *Apple daily*
- Wu, J., Gyouko, J., & Deng, Y. H. (2012). Evaluation conditions in major Chinese housing markets. *Regional Science and Urban Economics*. 42(3). 531-543
- Xiao, Q., & Tan, G. (2007). Signal extraction with Kalman Filter: A study of the Hong Kong property price bubbles. *Urban Studies*, 44(4), 865-888
- Xin, Z., & Miles, T. (2010). China vows to keep “hot money” out of property market. *Reuters*. Retrieved from <http://www.reuters.com/article/>
- Xu S. L. (2009). An affordable home for every family, Chongqing official promises. *Global Times*. Spetember 2009, Retrieved from <http://www.china.org.cn/>
- Yang, Z., & Shen, Y. (2008). The affordability of owner occupied housing in Beijing. *Journal of Housing and Built Environment*, 23, 317-335
- Yun, T., Wang, J., Hui, C. M. E., & Seabrook, W. (2003). The impact of interest rates upon housing prices: an empirical study of Hong Kong’s market. *Journal of Property Management*, 15(2). 153-170
- Zha, M. J. (2009). Pitching a tent and a message. *Shanghai Daily*. 9. December. 2009
- Zhang, G. Y., & Fung, H. G. (2006). On the imbalance between the real estate market and the stock markets in China. *Chinese Economy*, 39(2), 26-39

Appendix 1: Result of long run model

Dependent Variable: HPI				
Method: Least Squares				
Sample (adjusted): 1999-2010				
Included observations: 12 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	41.98271	19.74111	2.126664	0.0710
LOG(GDPGROWTH)	20.04172	7.246538	2.765696	0.0279
DLOG(CPI)	44.16191	24.51272	1.801592	0.1146
IR	3.127505	1.373268	2.277418	0.0569
SUPPLYCOST	0.001269	0.000296	4.288998	0.0036
R-squared	0.835461	Mean dependent variable		104.5333
Adjusted R-squared	0.741439	S.D. dependent variable		4.706540
S.E. of regression	2.393222	Akaike info criterion		4.877495
Sum squared residual	40.09258	Schwarz criterion		5.079539
Log likelihood	-24.26497	Hannan-Quinn criterion.		4.802691
F-statistic	8.885801	Durbin-Watson statistic		2.032336
Probability(F-statistic)	0.007091			

Appendix 2: Result of short run model

Dependent Variable: HPI				
Method: Least Squares				
Sample (adjusted): 2006Q1 2010Q4				
Included observations: 20 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	69.89013	8.890478	7.861234	0.0000
LOG(GDPGROWTH)	14.21448	3.020554	4.705919	0.0003
DLOG(CPI,0,4)	45.84141	18.14815	2.525955	0.0233
IR	1.465816	1.046576	1.400583	0.1817
SUPPLYCOST	5.78E-05	0.000146	0.395731	0.6979
R-squared	0.802037	Mean dependent variable		108.4750
Adjusted R-squared	0.749247	S.D. dependent variable		4.686922
S.E. of regression	2.346986	Akaike info criterion		4.756459
Sum squared residual	82.62517	Schwarz criterion		5.005392
Log likelihood	-42.56459	Hannan-Quinn criterion.		4.805053
F-statistic	15.19296	Durbin-Watson stat		1.961852
Probability(F-statistic)	0.000037			

Appendix 3: Durbin-Watson critical value (short-run and long-run model)

Critical Values for the Durbin-Watson Test: 5% Significance Level

T=6 to 100, K=2 to 21 (K ≤ T-4)

Long-run model T=12; Short-run model T=20

K includes intercept

T	K	dL	dU
12	5	0.51198	2.17662
20	5	0.89425	1.82828