

THE DRIVING FORCES BEHIND THE RECENT HOUSING MARKET
DEVELOPMENT IN HONG KONG: FUNDAMENTALS? BUBBLES? POLICY?

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by

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ABSTRACT

The Driving Forces Behind The Recent Housing Market Development In Hong Kong:
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By examining the driving forces behind the recent housing market development in Hong Kong, this thesis offers an explanation for the effects of the “Capital Investment Entrant Scheme” and the movements in the exchange rate between HKD and RMB on the housing prices of the overall market and two sub-markets. Induced by record-low mortgage rates and decreasing amount of new dwelling units completion, housing prices in Hong Kong surged to a record high level recently. To test the equilibrium price of housing, cointegration tests will be used to identify whether there is overvaluation in recent property market. At the end of 2010, result shows that there is no overvaluation of the overall market and two sub-markets. Besides, by using the vector error-correction model, result suggests that the “Capital Investment Entrant Scheme” and appreciation of RMB against HKD have positive impact on the overall market and smaller units only. The last section will discuss current policies to curb speculation and to check housing price inflation. The discussion will focus on effectiveness of the special stamp duty and whether housing prices index futures would be a good alternative to the special stamp duty to curb speculation.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

(LO Ki Chiu)

September, 2011

CERTIFICATE OF APPROVAL OF THESIS

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This thesis is dedicated to my beloved mummy and memorable daddy.

Chapter 1 Introduction

Hong Kong's housing prices have increased significantly after the financial tsunami in 2008. Housing prices rose by about 50 percent in nominal terms from the end of 2008 to the end of 2010. Hong Kong people have perceived year 1997 as the pinnacle of the "housing bubble" period. Because of the Asian Financial Crisis and misguided housing policy, the "housing bubble" bursted, and the extent of the price decline, some 66 percent from the peak to the trough in 2003, was both unprecedented and a big surprise (HKMA, 2001). Fluctuations in housing prices certainly have big effects on the real economy, as well as financial well-being of flat-owners and businesses. Since the start of the significant decline of housing prices in 1997, Hong Kong's economy suffered from general price deflation and negative economic growth (HKMA, 2002). Not only did many corporations fail, but many home-owners also went "under water" and saw their homes going into negative-equity territory. Some owners even chose to commit suicide at that time. Therefore, it is important to maintain a stable growth in the housing market development. Currently, housing prices are approaching the 1997 record-high level and speculative activities, cash flow from mainland China and the problematic government policy all take blame for creating such situation.

This thesis looks at the fundamental determinants of housing prices development in Hong Kong. An econometric model is used to compute the long-run equilibrium prices of housing so as to perform an assessment on the deviation from the equilibrium prices. Besides, the assessment of the effect of "China factor" will be embedded in the vector

error-correction model. The effect of “Capital Investment Entrance Scheme” and the exchange rate of Renmenbi (RMB) against Hong Kong Dollar (HKD) on the Hong Kong’s housing market will also be examined.

In addition, the Special Stamp Duty (SSD), a recent housing policy aimed at curbing speculation will also be studied. Observations suggest that the SSD has successfully curbed short-term speculative activities a few months after its introduction, but its social cost is likely to be much bigger than the benefits. On the other hand, there is another policy tool that aims not so much at curbing speculation but as at channeling it to another market so that speculators’ demand need not compete with users’ demand. That is creating in market in housing price index futures (Ho, 1991). The merits of the housing prices index futures proposal will be further discussed in the discussion part below.

This thesis further examines the long-run relationship between housing prices of different classes and fundamental variables. Comparison will be made between the market housing prices with the computed long-run equilibrium housing prices to determine whether there is over-valuation or under-valuation to the long-run equilibrium prices of the housing market in Hong Kong. Besides, evidence will also be presented to show that the Capital Investment Entrant Scheme only affects the large units but not the general housing market. Furthermore, statistical test will be used to explore the effect of

the exchange rate of RMB against HKD on the overall housing market as well as the two sub-markets, the small-to-medium size units and large size units.

The remainder of the thesis is organized as follows. Section II presents the background of the housing market in Hong Kong from 1990 to 2010. Section III reviews the earlier studies. Section IV describes the data and methodology. In section V, econometrics models will be carried out to examine the long-run relationship among housing prices and fundamental determinants as well as to evaluate the effect of Capital Investment Entrant Scheme and exchange rate of RMB on housing prices. Section VI provides a conclusion and comments on recent housing policy.

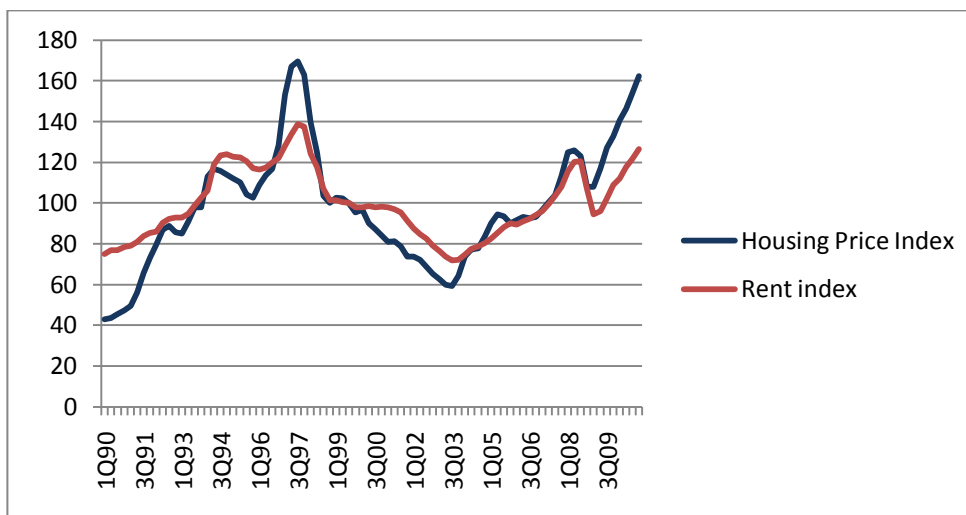
Chapter 2 Background

2.1 Background on Hong Kong's Housing Market

During the early 1990s, housing prices in Hong Kong were volatile. According to the Rating and Valuation Department, the housing prices index (overall) in Hong Kong surged from 42.8 in 1Q1990 to 162.8 in 4Q1997 indicating that housing prices went up by 280 percent in this eight-year period. Concurrently, the rents index increased by 83 percent from 74.9 to 137.4. The rising housing prices were supported by strong demand for occupation and investment which reflecting booming economic activities and higher income of citizens. In 1990, the annual per-capita income was HKD105000 (in nominal term) which doubled to HKD210000 (in nominal term) in 1997. The trends of housing prices and rents and housing prices and per-capita income between 1Q1990 and 4Q2010 are shown in Figure 1 and Figure 2.

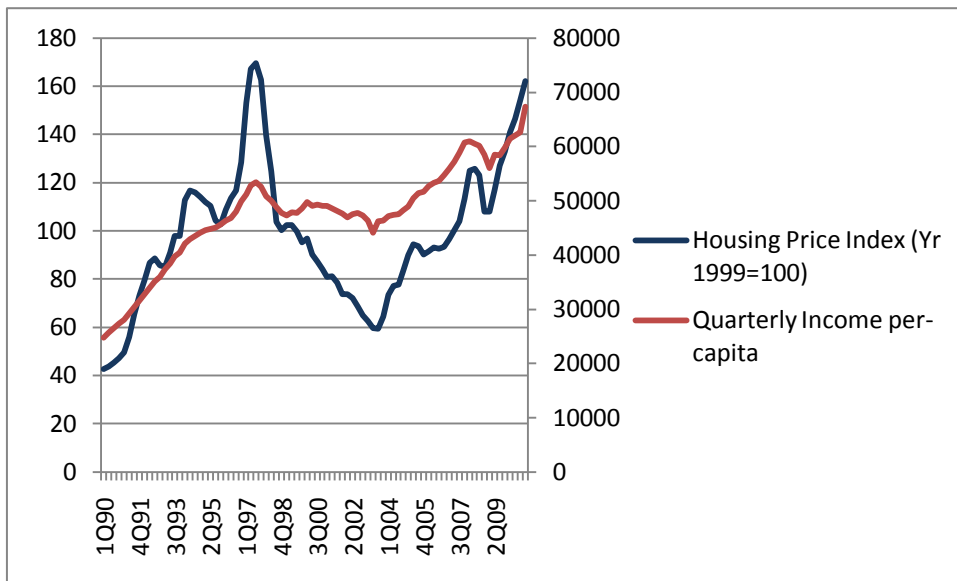
Figure 1 Housing Prices Index (Overall) and Rents Index (Overall)

(Period: 1Q1990 – 4Q2010, Yr 1999=100)



Source: Hong Kong Property Review 1989-2011, Rating and Valuation Department

**Figure 2 Housing Prices Index (Overall) and Quarterly Income Per-capita
(Period: 1Q1990 – 4Q2010)**



Source: Hong Kong Property Review 1989-2011, Rating and Valuation Department, Hong Kong Monthly Digest Jan 1990 – Dec 2010, Census and Statistics Department

After the outbreak of the Asian Financial Crisis (AFC) in 1997, economic activities contracted and unemployment rate increased drastically. The crisis started in Thailand and spread to most of the Southeast Asian countries. Hong Kong’s economy was also deeply hurt a lot by the slump even through the government successfully protected the currency and maintained the linked exchange rate system. Together with the failure of housing policy at that time, property prices continued to go down until 2003. On December 8 1997, the Housing Authority announced the “Tenants Purchase Scheme”¹ (TPS) which allowed sitting tenants in selected public housing estates to purchase their rental flats at up to 88 percent discount from the estimated market prices.

¹ For details of TPS program please refer to Hong Kong Year Book 1997 and <http://www.housingauthority.gov.hk/b5/aboutus/news/pressrelease/0,,2-0-1739,00.html>

With the deep discount, which would apply to tenants who committed to buying within 12 months of the “for sale” announcement of their estates, the effective selling prices of the public housing are less than HKD300,000 per unit. The TPS program changed the structure of the Hong Kong housing market since existing public housing tenants no longer have the incentive to buy private residential units as the program allowed them to buy their rental flats at a much lower price. At the same time, the government announced a target housing production of 85000 units per year, including public housing, subsidized housing and private housing in the coming years². The expectation of high housing supply in the near future made people believe the housing prices would be lower later on and the potential homebuyers thus stopped their purchase plan of private units.

Housing prices actually continued to climb after the outbreak of the Asian Financial Crisis³ on July 2 1997, not peaking until October of the year, when it started to decline. However, a truly precipitous decline started in January 1998, driven by sharp markdowns of new housing prices by developers. These markdowns led to a strange phenomenon of existing homes selling at higher prices than new homes. Ho’s (2006) explanation was that developers were much better aware of developments in the market because they had many units to sell, while existing home sellers typically had just one unit to sell. When few buyers appeared, the home sellers’ reaction would typically be: “the market is quiet; I have to wait.” Developers on the other hand quickly noticed if

^{2 3} For details of production target in 1997 and Asian Financial Crisis please refer to Hong Kong Year Book 1997

their units were not selling. The sharp price declines in fact did stimulate sales. Total market turnover in 1998 was actually not bad at all, though turnover in existing homes fell to a trickle. (Ho & Wong, 2006, 2008) According to the Rating and Valuation Department, the housing prices index (overall) dropped by more than 55 percent from 162.8 in 4Q1997 to 72.2 in 2Q2002.

Writing in Mingpao monthly (February 2002), Lok Sang Ho made the prediction that the housing market would only recover after abolition of the Tenants Purchase Scheme, and suggested that even if the TPS were to be terminated immediately, the economy might need 2 to 3 years before truly recovering. Several of his articles, jointly written with Gary Wong, demonstrated that the TPS had much to do with the degree of decline of the housing market and the economic collapse after 1997. (Ho & Wong, 2006, 2008, 2009)

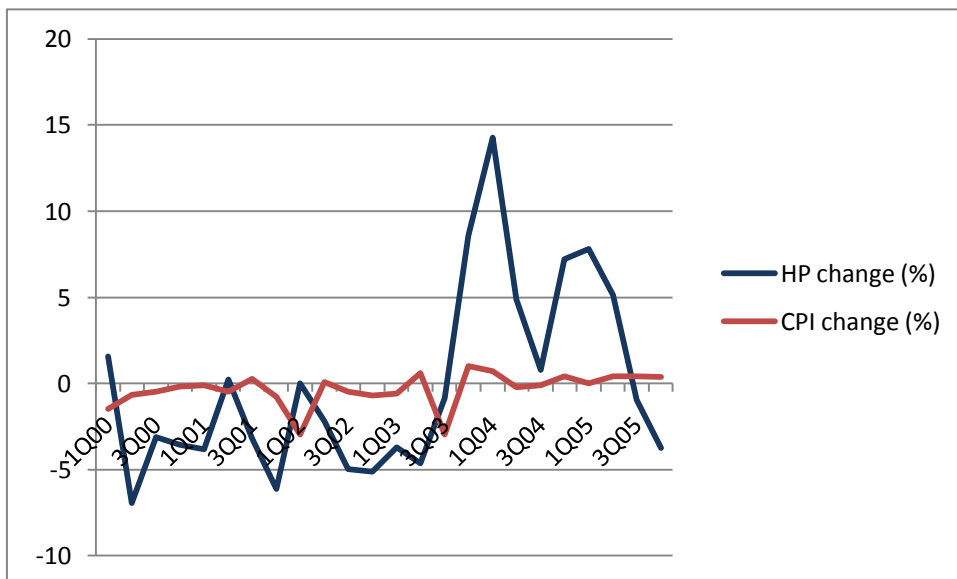
Secretary for Transport and Housing Department of Hong Kong Special Administrative Region government, Michael Suen, announced a nine-point strategy⁴ to revive the housing market in November 2002. At the same time, however, the Severe Acute Respiratory Syndrome (SARS) epidemic broke out. Still, Ho (2002) predicted that the housing market was on the verge of a recovery. Even through housing prices continued to sag, falling another 17% to 59.3 in the third quarter of 2003, but as soon as

⁴ For the detail of Michael Suen nine-point strategy may refer to Hong Kong Year Book 2002 and <http://www.info.gov.hk/gia/general/200211/13/1113269.htm>

SARS receded in the summer of 2003, the housing market started a sustainable recovery, for the first time since the AFC.

The sharp decline in housing prices in those few years had contributed to general prices deflation and economic contraction. The weak market sentiment also affected the fiscal balance through declines in land sale revenue and stamp duties from housing transactions. The decline in housing prices not only had negative effects on fiscal balance, but also affected the economy through the wealth effect and the investment effect. According to the Hong Kong Monetary Authority (1999), the decline in property prices reduced private consumption by 3.5% in 1998 while the decline in private investment reduced the real GDP growth rate by 1 percentage point out of an overall contraction of around 6 percent.

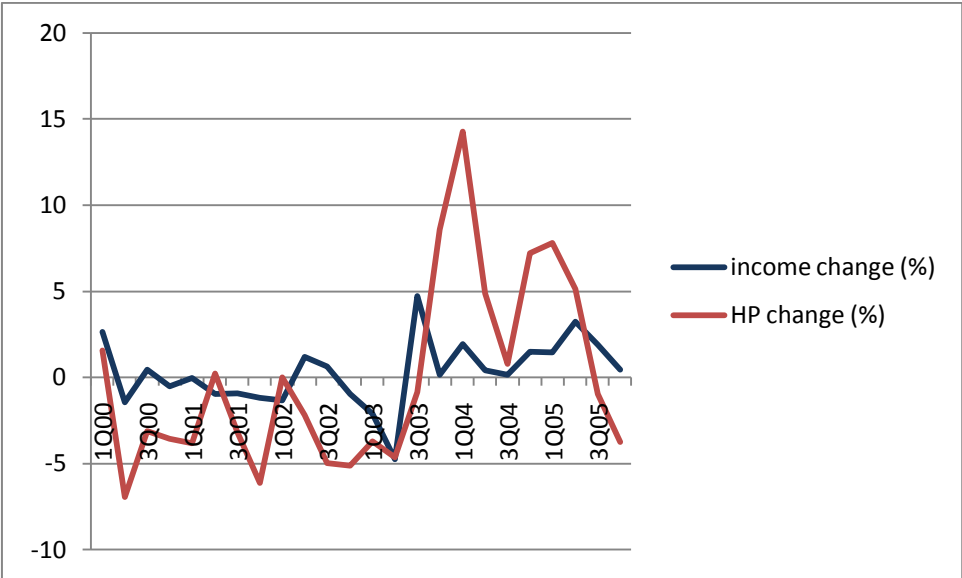
Figure 3 Change in Housing Prices and the Composite CPI (Period: 1Q00 – 4Q10)



Source: Hong Kong Property Review 1989-2011, Rating and Valuation Department, Hong Kong Monthly Digest Jan 1990 – Dec 2010, Census and Statistics Department

The Hong Kong economy started to recover after 2003. From 3Q2003 to 2Q2008, the annual rise of housing prices averaged 16%. The strong increase of housing prices after SARS was a reflection of a combination of factors including recovering economy, relatively low mortgage rates and moderate growth in private housing supply. Figures 3 and 4 show the change in housing prices with respect to change in composite CPI and income between 1Q2000 and 4Q2010.

Figure 4 Change in Housing Prices and Income (Period: 1Q00 – 4Q10)



Source: Hong Kong Property Review 1989-2011, Rating and Valuation Department, Hong Kong Monthly Digest Jan 1990 – Dec 2010, Census and Statistics Department

After a period of recovery, housing prices dropped again by about 15% during the global financial crisis in 2007 and global financial tsunami in 2008. According to BBC News, the financial tsunami⁵ started with a housing bubble in the United States.

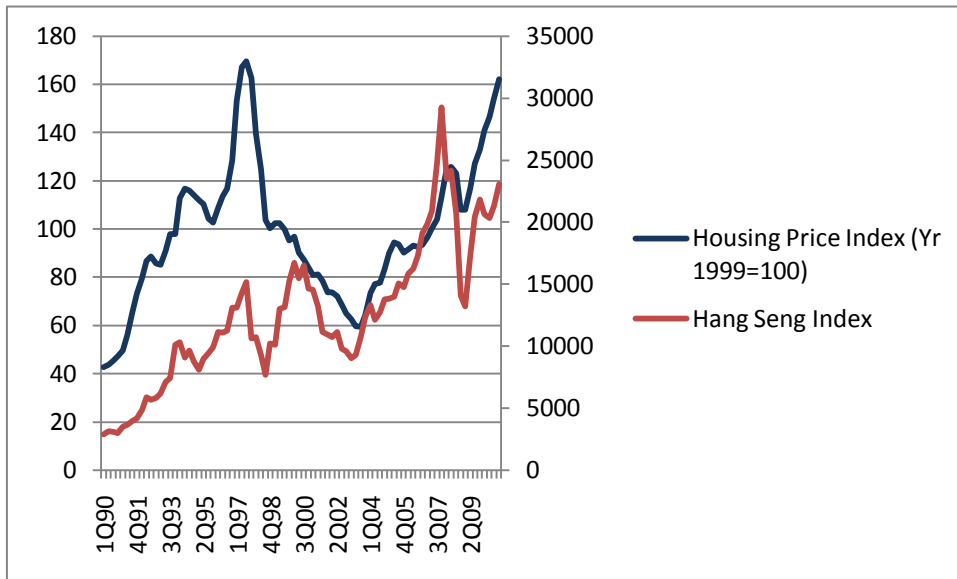
With the bursting of the housing bubble, many home owners in the US were falling behind in their mortgage payments and thus the delinquency rate rose sharply. Many financial institutions suffered from a high loss since over-leveraging was very common in the United States. The financial tsunami hurt the real economy of the United States and the European countries deeply. To save their economy, the Federal Reserve of the US and the Central Bank of Europe adopted the quantitative easing policy⁶, which enlarged the monetary bases of the central banks and provided abundant money supply and thus boost up the asset prices. During the financial tsunami, the Hong Kong Hang Seng Index dropped by more than 60 percent, whereas housing prices dropped by about 15%. The stock market and housing market performance between 1Q1990 and 4Q2010 are shown in Figure 5.

Under the linked exchange rate system, Hong Kong has to by and large follow the interest rate movements in the United States. According to the HKMA, the mortgage rate in Hong Kong dropped to about 2% in 2009 and 2010. In 2009 and 2010, the housing prices in Hong Kong rose by 23.1% and 22% respectively. Many citizens were concerned about the formation of housing bubble and unaffordable private housing units. In late 2010, the government announced an increase of land supply and introduced the

5 For the details of financial tsunami may refer to <http://news.bbc.co.uk/2/hi/business/7687101.stm>

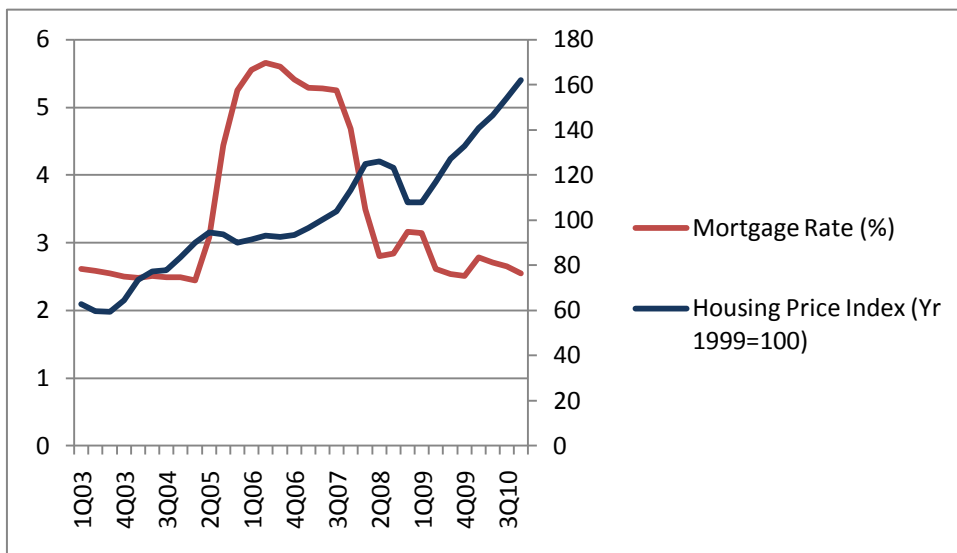
6 Quantitative easing policy is an unconventional expansionary monetary policy target at stimulate the economy by creating new money electronically. When the Federal Reserve lowered the interest rate to 0% -0.25%, it is no room for further rate cut. The central bank buys the financial assets from banks and other financial institutions, which would increase the prices of financial assets and lower their yields. For the detail of quantitative easing policy may refer to http://www.hangseng.com/hsb/eng/user/try/pdf/mktf_e.pdf

Figure 5 Housing Prices Index (Overall) and Hang Seng Index(Period:1Q90 – 4Q10)



Source: Hong Kong Property Review 1989-2011, Rating and Valuation Department, Hong Kong Monthly Digest Jan 1990 – Dec 2010, Census and Statistics Department

**Figure 6 Effective Mortgage Rate and Housing Prices Index (Overall)
(Period: 1Q00 – 4Q10)**



Source: Hong Kong Property Review 2002-2011, Rating and Valuation Department, HKMA Annual Report 2002-2011, HKMA

Special Stamp Duty to curb speculative activities. The trend of effective mortgage rate and housing prices index from year 2000 to 2010 is shown in Figure 6.

Many economists and property analysts have pointed out that Hong Kong’s property market is overvalued at the end of 2010. In April 2011, the International Monetary Fund (IMF) noted that the risk of housing bubble in Hong Kong was developing, and the government is taking proactive policy steps to resist this prospect. If the bubble were allowed to occur, the future correction will be painful. According to the Demographia International Housing Affordability Survey 2011, Hong Kong is the least affordable market among Australia, Canada, Ireland, New Zealand, United Kingdom and United States. The survey used the “median multiple” (median housing prices divided by the gross annual median household income) to assess the housing affordability. A median multiple rating of below 3, means that housing is affordable. As shown in Figure 7, the median multiple of Hong Kong was 11.4 in 2010 which means the housing in Hong Kong is severely unaffordable.

Figure 7: Housing Affordability of Major Metropolitan Market in 2010 (Top 5)

Ranking	Metropolitan Market	Median Multiple
1	Hong Kong, China	11.4
2	Sydney, Australia	9.6
3	Vancouver, Canada	9.5
4	Melbourne, Australia	9.0
5	Plymouth, U.K.	7.5

Source: 7th Annual Demographia International Housing Affordability Survey 2011

2.2 Capital Investment Entrant Scheme

The Capital Investment Entrant Scheme⁷ (CIES) started from 27 October 2003. The objective of the scheme is to allow the entry for residence by capital investment entrants. The entrant is allowed to make his choice of investments amongst permissible assets including real estates, securities, bonds, certificate of deposits, subordinated debts and eligible collective investment scheme without the need to establish or join in a business. The minimum investment of the CIES is HKD6.5 million. However, the threshold of investment was raised to HKD10 million and real estate investment has been temporarily suspended from the permissible investment assets starting from 14 October 2010. In the eight year period up to March 2011, there were 9708 out of 17186 applications were approved, bringing a total of HKD69 billion of investments to Hong Kong of which HKD24 billion is related to real estate investment.

⁷ For the details of the Capital Investment Entrant Scheme, please refer to Hong Kong Year Book 2003 and http://www.immd.gov.hk/ehhtml/hkvisas_13.htm

Chapter 3 Review of Literature

3.1 Theory of Housing Price Determination

Housing is a special type of asset in that it has a dual role of consumption and investment good (Glindro, Subhanij, Szeto, & Zhu, 2007). If you owned a flat and were living in it, you would be exposed to the risk of housing price fluctuation. When housing exists as a pure investment asset, its fundamental value can be determined by the classical asset pricing model. However, it is not easy to determine its intrinsic value due to the consumption function provided by housing. Besides, since every single property unit is unique, for example, having different view and different interior decoration, it is difficult to determine the intrinsic value of a property.

To determine the intrinsic value of a property, the most frequently used method is to compare the housing prices and the economic fundamentals. The fundamentals can be classified into two categories: fundamental value and market fundamentals (Hui & Yue, 2006).

Based on the present value asset pricing formula, the fundamental value of an asset is measured by the cash flow over time, the terminal value of the asset and the discount rate to be used to convert future value into current value (Stiglitz, 1990). However, Flood and Hodrick (1990) mentioned that it is difficult to specify the fundamental value as determined by these three determinants since the data cannot be

extended to indefinite future. Therefore, this concept is used in theoretical analysis rather than empirical analysis.

Many studies were done focusing on the linkages between property prices and economic conditions, beginning with Gottlieb (1976), who suggested that the long swings in construction and price development were synchronized with long swings in aggregate economic activity. Modern models attempt to generate patterns of price change over time in response to the changing conditions in economic fundamentals and economic shocks (Quigley, 1999). These studies range from explaining effect of the economic fundamentals on the housing price trends (DiPasquale & Wheaton, 1994), and exploratory research on specific regions (Case & Mayer, 1995; Clapp & Giaccotto, 1994).

Given the difficulties in calculating the fundamental value of a property, different authors used different approaches. One is inferring the fundamental value with exogenous macroeconomic variables (Hui & Yue, 2006). Case and Shiller (1990) used time-series cross-section regressions to test the prices and excess returns using a number of independent variables including the ratio of construction costs to price, change in adult population and real per-capita income. All of these were positively related to excess returns and price changes over the period 1Q1970 to 3Q1986. More recently, Hofmann (2003) examined the housing price determination in a number of industrialized economies and results showed that economic growth, inflation, interest rates, bank

lending and equity prices had significant explanatory power in determining the housing prices, while Egert and Mihaljet (2007) compared the determinants of housing prices in 27 OECD and European countries, and found that the housing prices were determined by the macroeconomics factors, institutional factors and housing finance systems. Other possible methods include the reduced-form demand-supply model by Quigley (1999), which was used to determine the housing prices for owner-occupied, single-detached housing in the 41 metropolitan areas from 1986 to 1994, a VAR model used by Sutton (2002) for a group of industrial countries, which concluded that Canada's housing market was not overvalued in the period 1Q1995 to 2Q2002 and a cointegration analysis and error-correction model by Tsounta(2009) who found possible overvaluation in western- Canada in mid-2008.

In the Hong Kong property market, Hui & Yue (2006) used the reduced-form demand-supply model to estimate the long-run equilibrium prices of housing in Hong Kong between 1990 and 2003, while Ho & Wong (2008) employed the autoregressive distributed lag (ARDL) approach and cointegration test and found that exports and interest rate were two key variables that could explain the movement of housing prices over a long period in Hong Kong, while Leung, Chow and Han (2008) used cointegration analysis to examine the long-run determinants of property prices in Hong Kong, and concluded that long-run determinants include GDP per-capita, real interest rate, land supply, and the residential investment deflator.

Housing price risk has attracted much attention in recent year after the global financial tsunami in the United States. Public and policymakers should monitor closely changes in housing prices (Cocco, 2004), as suggested by Tsounta (2009) evaluating whether house prices are overvalued or undervalued could have important economic and financial implications. The change in housing prices would not only affect the housing market outlook, but also the economy's growth outlook and the prospects for the financial sector. A sharp decline in housing prices can lead to serious problems of negative equity loans and higher risk of default, which have the potential to unleash systemic risks (Glindro, Subhanij, Szeto, & Zhu, 2007). Residential properties tend to have bigger wealth effect compared to other financial assets (Case, Quigley & Shiller, 2005), and thus, when housing prices are higher, consumption growth will increase. This has been confirmed by Girouard and Blondal (2001), who explored the wealth effect in a number of OECD countries and found that booming housing markets have a significant and positive effect on household consumption. Trichet (2003) also concluded that the macro-economy can be influenced by fluctuations in housing prices through wealth and balance-sheet effects on consumption and investment, while Peng, Yiu & Tam (2005) suggested that housing prices change can affect households' consumption spending through the wealth effect, as higher housing prices may signal faster growth of the economy and reduce households' financing constraints. Ho & Wong (2008) shared similar views, showing that housing prices drive domestic demand that consist of consumption and private investment.

Recently, the bubble development in the housing market has become a hot topic. However, high housing prices do not necessarily indicate the development of housing price bubbles. It is important to distinguish between housing price overvaluation and housing price bubbles. According to Glindro, Subhanij, Szeto, & Zhu (2007), housing prices overvaluation refers to the fact that current housing prices are substantially above their fundamental values. On the other hand, housing price bubbles refers to housing prices increase driven by overly optimistic expectation of future housing prices movement and cannot be explained by serial correlation and mean reversion of housing price dynamics. They argued that housing prices could rise above their fundamental values in the short run due to frictions in the housing market. Brunnermeier & Julliard (2008) also mentioned that when the deviation of housing prices from its fundamentals could not be explained by the short-term dynamics, it can be labeled as bubble and most likely this deviation was driven by overly optimistic expectation of future housing prices appreciation.

3.2 Housing Price and Income

Case & Shiller (1990) uses the quarterly microdata of existing single family home to estimate excess returns and housing prices for Atlanta, Chicago, Dallas and San Francisco from 1Q1970 to 3Q1986, and found that housing price and excess returns were positively related to per-capita income. At the same time, Peng, Yiu & Tam (2005) concluded that there is a two-way linkage between real GDP and property prices growth in China property market. Specifically, the development of the China's property market

is supported by population's higher real income, and the property prices growth have positive effect on local GDP mainly through the investment channel. Leung, Chow & Han (2008) in their investigation of the Hong Kong property market, discovered that given the improved economic fundamentals, the steady growth in household income has increased the long run equilibrium value of residential housing since 2003. Milne (1991) used the cointegration test and found that a positive long-run relationship exists between housing prices and income. Hui and Gu (2009) mentioned that household income, which represents affordability, was an important indicator of housing market demand, and concluded that household income was a key factor affecting housing price level in Guangzhou between 2004 and 2007. Case & Shiller (2003) examined the relationship between personal income per-capita and housing prices by using quarterly data from 1Q1985 to 3Q2003 in the United States, and showed that income alone could completely explain the increase in housing prices in most of the states. Quigley (1999) used the reduced-form demand-supply model and concluded that from 1986 to 1994, ten percent increase in household income was associated with a two percent increase in the prices of owner-occupied housing.

3.3 Housing Price and Vacancy Rate

Hui & Yue (2006) mentioned that a large vacant stock indicated an oversupply in the market and thus could lead to a decline in the average selling price of housing. However, an increase in housing prices may undermine housing affordability and may result in an increase in vacant dwellings. Peng & Hudson-Wilson (2002) regressed the

prices of Tokyo office market over the period of 1977 to 1999 against variables including net operating income, office vacancy rate, price index and general economic indicators, and found that there was an inverse relationship between office prices and vacancy rates. When there is higher office prices, vacancy rates tend to be lower, suggesting that a tight market is associated with higher prices.

3.4 Housing Price and Mortgage Rate

Mortgage rate is the interest rate for the money borrowed from banks by people in order to buy houses. Therefore, mortgage rate is the cost of acquiring a flat. Follain (1982) concluded that at high interest rates, the households' liquidity problems would tend to dampen housing demand and hence lower housing prices. As a result, housing demand can be driven by capital availability. Kau & Keenan (1980) also agreed with this view that starting an inverse relationship between interest rates and the immediate demand for consumer durables. In the local market, Wong, Hui & Seabrooke (2003) demonstrated that an inverse relationship existed between interest rates and housing prices from 1989 to 1997. However, during the deflationary period from 1998 to 2001, lower interest rates were accompanied with lower housing prices. They explained that positive interest rate effect during deflationary period had been negated by anticipated capital losses, therefore, falling interest rates may not be able to stimulate housing prices. By using a dynamic model, Otto (2007) examined the effect of fundamentals on housing price fluctuation in Australia and concluded that a 25 basis point rise in the mortgage rate reduced the long-run quarterly growth rate of real house prices by about 1

percentage point in Sydney and 0.4 percentage point in Adelaide. It is believed that there is an inverse relationship between mortgage rates and housing prices. However, Case and Shiller (2003) mentioned that mortgage rate may have an insignificant coefficient in the housing prices function as low mortgage rates can stimulate the housing market, but low rates may also be caused by the Federal Reserve easing in response to a weak economy and housing market.

3.5 Housing Price and Housing Supply

It is believed that higher housing stock will lower the prices of housing. Van der Vlist, Czamanski & Folmer (2010) used the autoregressive distributed lag (ARDL) model to examine the housing market dynamics in Haifa, Israel. The result showed that housing stock and home prices were significantly and negatively related between January 1989 and June 1999. Glindro, Subhanij, Szeto, & Zhu (2007) mentioned that increase in land supply tends to bring down housing prices on the supply side, in the long run, while Peng & Wheaton (1994) using the econometric method, found out that there is a negative relationship between housing prices and land supply. The authors argued that reduction in land supply would lead to expectation of higher future housing rents which would be capitalized into higher current housing prices. The supply of land for private houses by the government was also found to have a significant dampening effect on private housing prices (Lum, 2002).

3.6 Housing Ladder Effect

The housing market is a continuum with a full range of qualities and prices. Homeowners will move up to a better quality when they have accumulated sufficient equity in their existing homes (Ho & Wong, 2006). The households' mobility decision in trading smaller and lower-quality flats for bigger and higher-quality flats is dependent on housing wealth accumulated (Stein, 1995; Ortalo-Magne & Rady, 2004). The housing price changes will create self-reinforcing effects that run from down payment to demand and to the housing prices (Stein, 1995), and there will be a chain reaction vertically across different housing segments on the property ladder (Ortalo-Magne & Rady, 2004). If the price of existing homes increase, the credit constrained flat owners will trade up their existing homes for a new home when they can cover outstanding mortgage balances and down payments of the new homes (Sing, Tsai & Chen, 2006).

In Hong Kong, public housing has played an important role in local housing market because low rents allow for the accumulation of household savings (Ho & Wong, 2006). A major public housing construction program was launched by then-Hong Kong Governor Murray Maclehoze in October 1972. In 1978, the government further launched the Home Ownership Scheme (HOS) and offering opportunities for those not qualified to apply for public rental housing to buy subsidized flats, and public housing tenants to upgrade their housing conditions. The prices of Home Ownership Scheme housing units were much lower than the private housing units. Besides, public housing tenants were given a more favorable quota in the lottery of new Home Ownership

Scheme flats than other applicants. However, public rental housing applicants who bought the Home Ownership Scheme flats, were required to give up their current rental home. On 1 April 1987, a new “Housing Subsidy Policy” (HSP) took effect. It aimed at reducing housing subsidy to public housing tenants who are no longer in need of it. Under the HSP, households who have been living in public rental housing for ten years or more are required to declare household income biennially. This policy has increased the incentive for the rich public housing tenants to consider buying Home Ownership Scheme⁸ flats. Since the owners of the Home Ownership Scheme flats are also protected from rent increases, they could also accumulate savings, and given that the demand for housing is income-elastic, HOS owners will have the incentive to move up to better private units when they are ready.

In December 1997, the government announced a privatization of public housing program known as “Tenants Purchase Scheme” (TPS). Under the scheme, public housing tenants in selected housing estates could buy their existing rental flats with a discount of up to 88 percent off the estimated market value, though they were prohibited from reselling their units within the first two years of purchase. The discounted prices were normally less than HKD300000 per unit depending on the size and location of the flats, making Home Ownership Scheme flats unattractive and leading to a reduction in transaction of such flats. Privatizing of public housing cheaply could reduce the equity values and spread throughout the housing market along the housing ladder (Stein, 1995; Ortalo-Magne & Rady, 2004). At the same time, the government announced a policy to supply 85000 units of new flats annually. In 1998 and 1999, the government continue to

use every means within its control to boost housing supply (Ho & Wong, 2008). The prices of housing market continued to decline until 2003, in an attempt to revive the housing market, the government suspended the building of Home Ownership Scheme housing, the suspension of the building Home Ownership Scheme housing disrupted the housing ladder as it became more difficult for the public housing tenants to climb up the ladder. As a result, interested the public housing tenants could only buy the Home Ownership Scheme housing units in the second-hand market. However, there are very few second-hand Home Ownership Scheme units available on the market. In October 2010, the government announced a new policy 'My Home Purchase Plan'. Under the plan, the government would build a number of flats and rent to the eligible applicants at market rent. After five years of rental, tenants could get back 50 percent of their rents and use that as down-payment to buy their existing rental flat or buy a flat in the private residential market. However, the number of My Home Purchase Plan units is very small compared to the number Home Ownership Scheme houses.

8 9 The TPS and HOS housing are the under subsidized home ownership scheme by the Hong Kong Housing Authority to assist low-income families to acquire home ownership, for detail may refer to <http://www.housingauthority.gov.hk/en/residential/shos/0,,1-0-0-0,00.html>

Chapter 4 Data and Methodology

4.1 Data

In this study, quarterly data from 1990 to 2010 will be used. The quarterly housing prices index (overall) which measures the price changes of housing of constant quality. To ensure the quality is kept constant, the new rateable values are matched with the old ones which follow the General Revaluation of rateable values. The quarterly index with a base point of 100 in 1999 is the average of the monthly index in respect of the relevant period. The composite index of housing prices of overall market (HP) is compiled by calculating the weighted average of the component indices. There are five component indices classified according to the floor area as follows:

Class A – saleable area of less than 40m²

Class B – saleable area of 40m² to 69.9m²

Class C – saleable area of 70m² to 99.9m²

Class D – saleable area of 100m² to 159.9m²

Class E – saleable area of 160m² or above

In this analysis, Class A, Class B, and Class C are grouped together as small-to-medium size units (HPABC), and Class D and Class E are grouped together as large units (HPDE)¹⁰. Table 1 reports the housing prices index and two sub-indices in Hong Kong from 1990 to 2010. It can be seen that the trend of HP and HPABC is very similar and they are more volatile than HPDE.

¹⁰ The classification of small-to-medium size and large size unit is according to the Rating and Valuation Department, the Government of HKSAR

Apart from the housing prices index, change in the vacancy rate (VR) of the overall private residential units is another important variable that may reflect the balance of demand and supply of the housing market, and thus whether the housing market is in equilibrium. The vacancy rate can reflect the balance of demand and supply of the housing market. When the new demand is greater than the supply of new dwellings, the excess new demand will be absorbed by domestic units in the secondary housing market. It is believed that the vacancy rate is quite stable in the short term, so the single moving average method is used to compute the value of first to third quarter. In addition to the vacancy rate, housing stocks (HS) is an important variable on the supply side, while per-capita GDP (IPC) and effective mortgage rate (MR) are variables that can affect the affordability of individuals buying domestic units. Higher per-capita income and lower mortgage rate can enhance the affordability of purchasing private units. Besides, there is an increasing number of buyers of housing units coming from mainland China from 2003 to 2010. Exchange rate of RMB (CNY) is a factor influencing their purchase decision, as when RMB appreciates against Hong Kong Dollar, the housing units in Hong Kong in terms of Hong Kong Dollar will become cheaper. Furthermore, the introduction of “Capital Investment Entrant Scheme” (CIES) in October 2003 is another influential factor that increase the incentive for foreign households especially purchasing power from China, to invest in Hong Kong’s property market. Long-term equilibrium housing prices will be measured by housing stocks, vacancy rate, mortgage rate and per-capita GDP. Short-run housing prices dynamics, however, will be examined by the exchange rate of RMB against HKD and the introduction of “Capital Investment Entrant Scheme”. Table 1 shows the summary of the descriptive statistics of variables.

Table 1 Descriptive Statistics of Variables (Period: 1Q90 – 4Q10)

Variables	Maximum	Minimum	Average	Standard Deviation
Housing Price Index (Overall)	169.50	42.80	98.19	28.99
Housing Price Index (Class A,B,C)	169.20	43.10	97.70	28.70
Housing Price Index (Class D,E)	203.40	34.00	108.91	40.82
Quarterly Per-capita GDP (\$HK)	67310.92	23372.75	47460.30	9453.31
Effective Mortgage Rate (%)	11.31	2.44	6.32	2.95
Vacancy Rate (%)	6.80	3.50	4.96	0.94
Housing Stocks (thousand units)	1102.90	741.96	968.54	107.18
Exchange rate of RMB/HKD	1.65	0.89	1.07	0.21

*Quarterly Per-capita GDP is seasonally adjusted by seasonally exponential smoothing method

Source: Hong Kong Property Review 1989-2011, Rating and Valuation Department, Hong Kong Monthly Digest Jan 1990 – Dec 2010, Census and Statistics Department

4.2 Methodology

To examine the long-run relationship between housing prices and market fundamentals, including per-capita GDP, effective mortgage rate, vacancy rate and housing stocks, the cointegration test will be used. Following the cointegration approach used by DiPasquale & Wheaton (1994), the test will be applied to two submarkets, namely the small-to-medium size market and the large size market.

As for the introduction of “Capital Investment Entrant Scheme” in October 2003 and the increasing number of mainlanders purchasing housing units in Hong Kong as RMB continues to appreciate against HKD, these two factors will be used as the exogenous variables, and their short-run effects on housing prices will be analyzed. To find out the short-run effect on housing prices of these two factors, this study will follow the vector error-correction model used by Malpezzi (1998).

Chapter 5 Empirical Results

5.1 Price Dynamics on the Overall Housing Market

5.1.1 Test Result for Unit Roots

By testing the stationary properties of variables, the Augmented Dickey-Fuller (ADF) unit root tests (Dickey & Fuller, 1981) will be used. The following equation is estimated for each of the time series:

$$\Delta X_t = \alpha_0 + \alpha_1 t + \beta X_{t-1} + \sum_{i=1}^k \delta_{t-i} \times \Delta X_{t-i} + \varepsilon_t$$

Where Δ is the first difference operator, t is the time trend, k is the optimal lag to be used as chosen by Akaike Information Criterion (AIC), and ε is the error term. The null hypothesis that series X is non-stationary and has a unit root can be rejected if β is significantly negative.

Table 2 shows the test statistics for all the series in level form and in first differences respectively. The result shows that the null hypothesis of unit root cannot be rejected when the series are in level but it can be rejected when the series are in first differences. This indicates that all the series are integrated of order one, and therefore no further unit root tests are needed.¹¹

¹¹ When the series are in second difference, which is the same as testing the linear combination of two stationary series and it must be also stationary.

Table 2 The ADF Test of Unit Root (Period: 1Q90 to 4Q10) – Overall Market

Variable Name	Test on	No Trend	Trend	Conclusion
LnHP	Level	-2.5055	-2.5412	I(1)
	1 st diff	-4.1911***	-4.1697***	
LnHS	Level	-2.3398	-1.5846	I(1)
	1 st diff	-2.6492*	-3.2500*	
LnVR	Level	-2.0484	-2.1849	I(1)
	1 st diff	-3.3830**	-3.3179*	
LnMR	Level	-1.1386	-2.7311	I(1)
	1 st diff	-5.0610***	-5.0337***	
LnIPC	Level	-2.9137*	-2.8379	I(1)
	1 st diff	-5.2685***	-5.5221***	

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.
2. The number of lags in the unit root tests is determined by the AIC.

5.1.2 Test Results for Cointegration

If the series are non-stationary in level form but stationary after the first difference, the series are defined as being integrated of order one I(1). The result of ADF Unit Root test indeed shows that the variables of the series are integrated of order one I(1). Therefore, cointegration analyses can be carried out to identify the long-run relationship among logarithm(log) of housing prices index (LnHP), housing stocks (LnHS), vacancy rate (LnVR), mortgage rate (LnMR) and per-capita income (LnIPC). It is hypothesized that the housing stocks and the vacancy rate would both reflect supply side conditions and carry negative coefficients, while mortgage rates would dampen demand and per-capita income would heighten demand. In the vector error-correction model, the logarithm of exchange rate of RMB against HKD (LnCNY) and dummy

variable “Capital Investment Entrant Scheme” (CIES) are treated as exogenous I(0)variables.

The number of co-integrating vectors r is determined by the trace statistics and λ max value as shown in Table 3. Besides, the lag specification for the Johansen test is determined by the Akaike’s Information Criterion (AIC). The result shows that the HP, HS, VR, IPC and MR are cointegrated with only one cointegrating vector.

Table 3 Testing Cointegration Using the Johansen Procedure – Overall Market

Cointegrating Relation	Hypothesized No. of CE(s)	Test Statistics	Probability
LnHP =f(LnHS, LnVR, LnIPC, LnMR)	None	Trace Value 82.8733**	0.0032
With exogenous variables LnCNY and dummy CIES	At most 1	46.4873	0.0668
		λ max value	
	None	36.3860*	0.0246
	At most 1	20.9393	0.2799

Note:

1. * and ** indicates 5% and 1% significance level respectively.
2. Lag interval = 2 is determined by the AIC.

5.1.3 Identifying Long Run Relations

Cointegration test is used to investigate the long-run relationships between non-stationary variables. Table 4 shows the long-run cointegrating coefficients of the variables when LnHP is treated as the dependent variable. The estimated long-run

coefficients on all variables are shown with the expected signs. When the housing stocks or vacancy rate increases, the supply of second-hand property units available for sale will increase, thus driving down housing prices. Income per capita, on the other hand, is positively related to housing prices, as higher income tends to indicate higher purchasing power, and thus boosting the demand for residential units and housing prices. In addition, the mortgage rate is negatively related with housing prices. When the effective mortgage rate is higher, the cost of buying a flat will increase and thus discourage purchase of residential unit.

Table 4 Estimated Long-Run Coefficients (Dependent Variable: LnHP)

Regressors	Coefficient (t-ratio)
Intercept	5.2430
LnHS	-1.6891(-2.5688)**
LnVR	-0.6221(-3.5922)***
LnIPC	2.2071(7.3187)***
LnMR	-0.0951(-1.7691)*

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.
2. The number of lags in the unit root tests is determined by the AIC.
3. With exogenous variables LnCNY and dummy CIES.

5.1.4 Long-Run Equilibrium Price

Based on the long-run coefficients of independent variables, the “long-run” equilibrium price of housing can be determined. By “long-run equilibrium” means the level that the price should settle down given the exogenous variables being unchanged for a sufficiently long time. Since the exogenous variables themselves do change, sometimes quite significantly, big movements can be noticed in the long-run equilibrium prices. The trends of fitted value of housing prices index and the market prices index are

shown in Figure 8. Any deviation of the actual value from the long-run equilibrium value indicates an over-valuation or an under-valuation. Figure 9 shows the trend of the deviations between actual value and long-run equilibrium value of housing price index. Prices in 1997 were often perceived to be excessive, and indeed the housing market peaked in the second half of 1997. The decline in part reflected the effect of the Asian Financial Crisis and in part reflected the impact of the TPS housing policy (Ho & Wong, 2006). According to the cointegration equation, in the fourth quarter of 1997, the housing price was over-valued by about 26%. After that, the housing prices continued to decline until 2003.¹² In 2008, the global financial tsunami interrupted the recovery in housing prices, and the housing price dropped by about 15% that year. In fact, an under-valuation to the long-term equilibrium can be observed after the global financial crisis. At the 1Q09, the market price was under-valued by 16% compared to the long-run equilibrium price. Since then, the housing prices have rebounded strongly, and by 4Q10, housing prices were more or less consistent with the long run equilibrium level.

¹² During the peak in 1997, the housing prices were overvalued by about 26%. The housing prices continued to fall in next six years. However, from 1998 to 2000, the housing prices were still above the equilibrium level. The reason is that the Asian Financial Crisis deteriorated the local economy and drove down the local GDP. Besides, Ho and Wong (2006) mentioned that the public housing privatization program launched in 1997 produced adverse effects on housing market and local economy. The declined in housing prices further induced unemployment and set off a vicious circle.

Figure 8 Long-Run Equilibrium and Market Value of Housing Prices Index (Overall) (Period: 1Q90- 4Q10, Yr 1999=100)

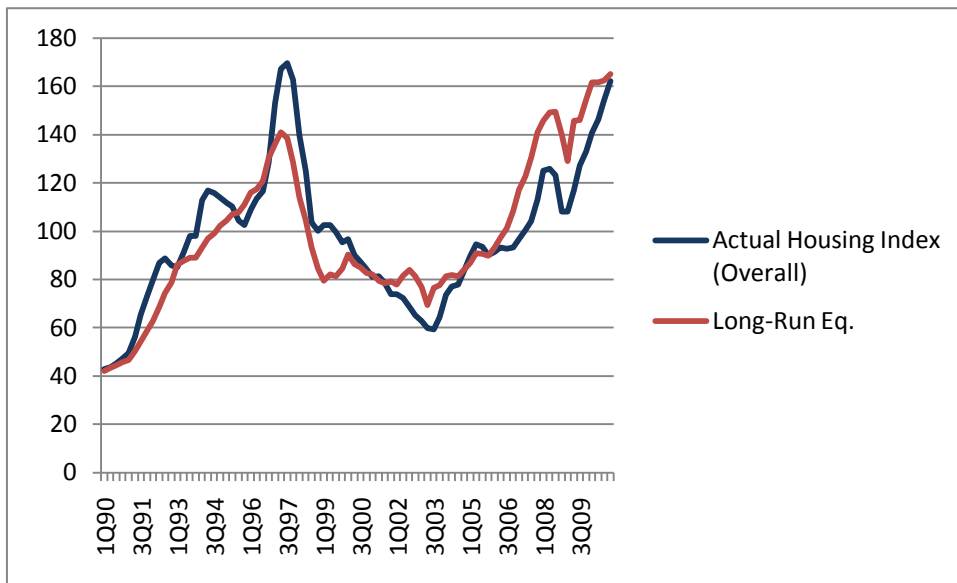
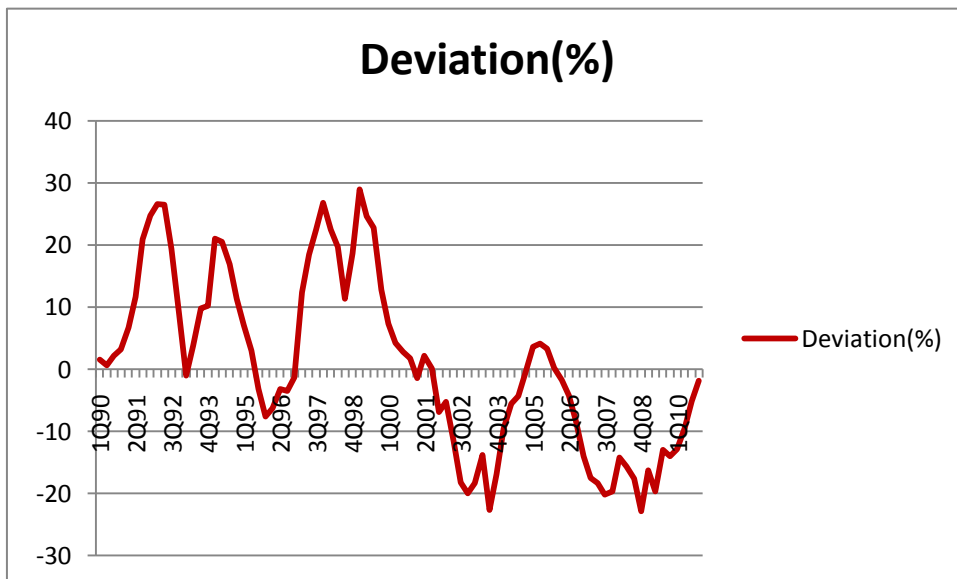


Figure 9 Deviation between Long-Run Equilibrium and Market Value of Housing Prices Index – Overall Market (Period: 1Q90- 4Q10)



5.1.5 Results for Granger Causality Tests

Granger causality is based on the predictability of the movement in one series, for example, x by prior movements in another series. If a series y contains information relevant to the prediction of x solely in the time series data of variables, then y is said to cause x . The test involves estimating the following equations:

$$x_t = \sum_{i=1}^n \alpha_i y_{t-i} + \sum_{j=1}^n \beta_j x_{t-j} + u_{1t}$$
$$y_t = \sum_{i=1}^n \lambda_i y_{t-i} + \sum_{j=1}^n \delta_j x_{t-j} + u_{2t}$$

where it assumed the error terms u_{1t} and u_{2t} are uncorrelated. The first equation postulates that x is related to past values of itself and that of y .

From Table 5, we cannot reject the null hypothesis of LnHP not Granger-causing LnIPC¹³ and that of LnVR not Granger-causing LnIPC. When the housing prices increase, land developers may find it more profitable to build new flat. As there are more residential units to be built, the derived demand for housing will increase and thus boost the per-capita income. Besides, when houses prices increase, the wealth of flat owners will also increase. And therefore the flat owners will consume more and in turn boost up the per-capita income. Another channel linking housing prices and per-capita income is that when housing prices increase, many small and medium enterprises whose owners

¹³ It is recognized that there may be an endogeneity problem in the cointegration test involving HP and IPC. For this reason Ho & Wong (2008) used exports rather than IPC in their cointegration tests. However, other authors have done this test with HP and IPC and the same procedures are followed in this study with a realization that this is not quite satisfactory and has room for improvement.

Table 5 Granger Causality Test Results among pairs of LnHP, LnHS, LnVR and LnIPC

Dependent Variable	Null Hypothesis	F-Statistic	p-value
LnHP	LnHS does not Granger Cause LnHP	0.5061	0.6048
LnHS	LnHP does not Granger Cause LnHS	0.3400	0.7128
LnHP	LnVR does not Granger Cause LnHP	2.3590	0.1013
LnVR	LnHP does not Granger Cause LnVR	1.9098	0.1551
LnHP	LnIPC does not Granger Cause LnHP	1.0492	0.3552
LnIPC	LnHP does not Granger Cause LnIPC	6.0388	0.0037***
LnHP	LnMR does not Granger Cause LnHP	0.0248	0.9755
LnMR	LnHP does not Granger Cause LnMR	1.3863	0.2562
LnHS	LnVR does not Granger Cause LnHS	0.2589	0.7726
LnVR	LnHS does not Granger Cause LnVR	1.3120	0.2752
LnHS	LnIPC does not Granger Cause LnHS	0.7900	0.4575
LnIPC	LnHS does not Granger Cause LnIPC	0.1048	0.9006
LnHS	LnMR does not Granger Cause LnHS	3.5044	0.0349**
LnMR	LnHS does not Granger Cause LnMR	1.6867	0.1919
LnVR	LnIPC does not Granger Cause LnVR	0.7073	0.4961
LnIPC	LnVR does not Granger Cause LnIPC	3.2724	0.0433**
LnVR	LnMR does not Granger Cause LnVR	0.3020	0.7402
LnMR	LnVR does not Granger Cause LnMR	0.5399	0.5850
LnIPC	LnMR does not Granger Cause LnIPC	0.5379	0.5862
LnMR	LnIPC does not Granger Cause LnMR	1.0598	0.3515

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.
2. The number of lags is determined by the AIC.

are also homeowners may borrow more money from banks for investment purpose on the collateral of their homes, and this will also increase the per-capita income. For the relationship between vacancy rate and per-capita income, when there is lower vacancy rate, land developers has a higher incentive to build new flat and thus drive up the derived demand of housing and the income per-capita. Besides, the null hypothesis of LnMR not Granger-causing LnHS could not be rejected. As low mortgage rate is associated with low interest rates in general, the cost of construction declines as land developers have to make less interest payment on the loans from the banks. Thus land

developers have a higher incentive to build more new flats in times of low interest rate, explaining the negative relationship between mortgage rate and housing stock.

5.2 Price Dynamics on the Two Sub- markets (Classes A, B, C and Classes D, E)

5.2.1 Test Result for Unit Root

The ADF test is again utilized to examine the stationarity properties of the variables LnHPABC and LnHPDE. From Table 6, it can be seen that the null hypothesis of unit root cannot be rejected when the series are in level but it can be rejected when the series are in first differences. This indicates that all the series are integrated of order one, and therefore no further unit root tests are needed.

Table 6 The ADF Test of Unit Root (Period: 1Q90 to 4Q10) – Two Sub-markets

Variable Name	Test on	No Trend	Trend	Conclusion
LnHPABC	Level	-2.5086	-2.5292	I(1)
	1 st diff	-4.1809***	-4.1590***	
LnHPDE	Level	-2.4535	-2.7687	I(1)
	1 st diff	-4.5112***	-4.5265***	
LnCNY	Level	-2.6586*	-1.9363	I(1)
	1 st diff.	-8.6203***	-9.1887***	

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.
2. The number of lags in the unit root test is determined by the AIC.

Since the series are non-stationary in level form but stationary after the first difference, the series are defined as being cointegrated of order one I(1). The result of ADF Unit Root test shows that the variables of the series are integrated of order one I(1), therefore cointegration analyses can be carried out to identify the long-run relationship among logarithm(log) of housing prices index of two sub-markets (LnHPABC / LnHPDE), housing stocks (LnHS), vacancy rate (LnVR), mortgage rate (LnMR) and per-capita income (LnIPC).

The number of cointegrating vectors r is determined by the trace statistics and λ max value as shown in Table 7. Besides, the lag specification for the Johansen test is determined by the Akaike's Information Criterion (AIC). The result shows that in both the small-to-medium size market and large size market, the HP, HS, VR, IPC and MR are cointegrated with only one cointegrating vector.

Table 7 Testing Cointegration Using the Johansen Procedure – Small-to-medium Size Flat

Cointegrating Relation	Hypothesized No. of CE(s)	Test Statistics	Probability
LnHPABC		Trace Value	
= f (LnHS, LnVR, LnIPC, LnMR)	None	82.2661**	0.0037
With exogenous variables LnCNY and dummy CIES	At most 1	45.9809	0.0742
		λ max value	
	None	36.2852*	0.0253
	At most 1	20.8168	0.2874

Note:

1. * and ** indicates 5% and 1% significance level respectively.
2. The number of lags is determined by the AIC.

Table 8 Testing Cointegration Using the Johansen Procedure – Large Size Flat

Cointegrating Relation	Hypothesized No. of CE(s)	Test Statistics	Probability
LnHPDE		Trace Value	
=f(LnHS, LnVR, LnIPC, LnMR)	None	98.5912**	0.0001
With exogenous variables LnCNY and dummy CIES	At most 1	51.4271*	0.0222
		λ max value	
	None	47.1641**	0.0008
	At most 1	20.9393	0.0878

Note:

1. * and ** indicates 5% and 1% significance level respectively.
2. The number of lags is determined by the AIC.

5.2.2 Identifying Long-Run Relations

The cointegration test is used to identify the long-run relationship between non-stationary variables. Table 9 and Table 10 show the long-run cointegrating coefficients of the variables, where LnHPABC and LnHPDE are treated as dependent variables in the two markets respectively. The estimated long-run coefficients on all variables in both the markets are statistically significant with expected signs from 1990 to 2010.

Table 9 Estimated Long-Run Coefficients (Dependent Variable: LnHPABC)

Regressors	Coefficient (t-ratio)
Intercept	4.6066
LnHS	-1.5666(-2.2308)**
LnVR	-0.6936(-3.7377)***
LnIPC	2.1215(6.5933)***
LnMR	-0.1078(-1.8831)*

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.
2. The number of lags is determined by the AIC.
3. With exogenous variables LnCNY and dummy CIES.

Table 10 Estimated Long-Run Coefficients (Dependent Variable: LnHPDE)

Regressors	Coefficient (t-ratio)
Intercept	-4.7804
LnHS	-1.3682(-3.5019)***
LnVR	-0.3982(-3.9466)***
LnIPC	2.6972(14.9186)***
LnMR	-0.0681(-3.9466)***

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.
2. The number of lags is determined by the AIC.
3. With exogenous variables LnCNY and dummy CIES.

5.2.3 Long-Run Equilibrium Price

Based on the long-run coefficients of independent variables, the long-run equilibrium prices of housing in the two sub-markets can be determined. The trends of fitted value of housing prices index and the market prices index in both markets are shown in Figure 10. When there is deviation between long-run equilibrium and actual value, there will be over-valuation or under-valuation to the long-run equilibrium. Figure 11, suggests that there is slightly under-valuation of the small-to-medium size units in 4Q10.

Figure 10 Long-Run Equilibrium and Market Value of Housing Prices Index of Small-to-Medium Size Unit (Period: 1Q90- 4Q10, Yr 1999=100)

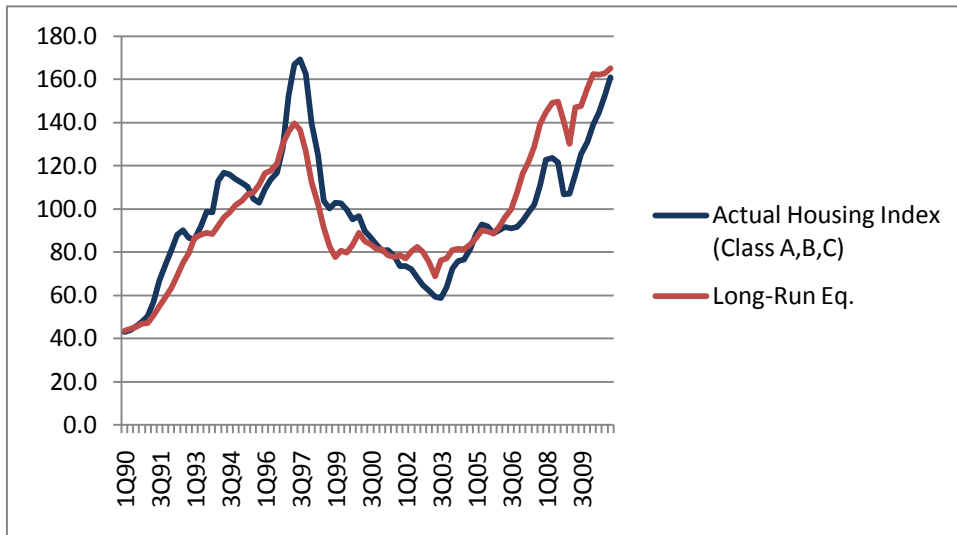


Figure 11 Deviation between Long-Run Equilibrium and Market Value of Housing Price Index of Small-to-Medium Size Units (Period: 1Q90- 4Q10)

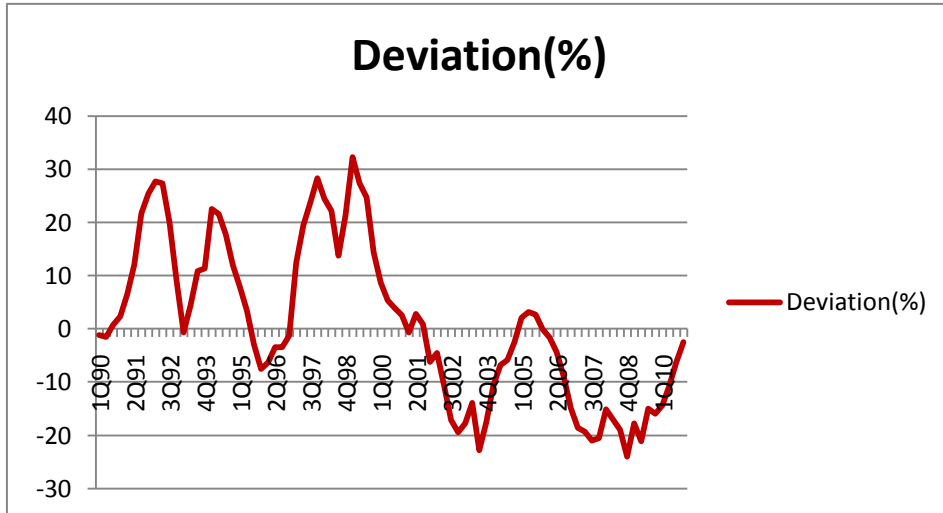


Figure 12 shows the long-run equilibrium and market value of the large size residential units from 1Q90 to 4Q10. It can be observed that the price volatility of large units is greater than the small-to-medium size units, that is, prices range of large units during boom and bust is bigger than the small-to-medium size units. For the deviation of

equilibrium value and market value, there is about 2 percent of under-valuation of the large units in 4Q10, as seen from Figure 13.

Figure 12 Long-Run Equilibrium and Market Value of Housing Prices Index of Large Size Units (Period: 1Q90- 4Q10, Yr 1999=100)

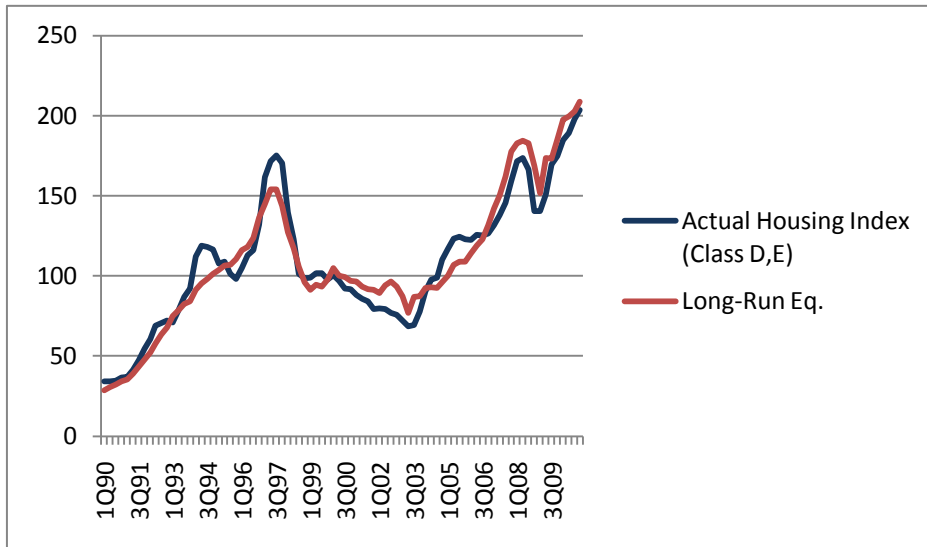
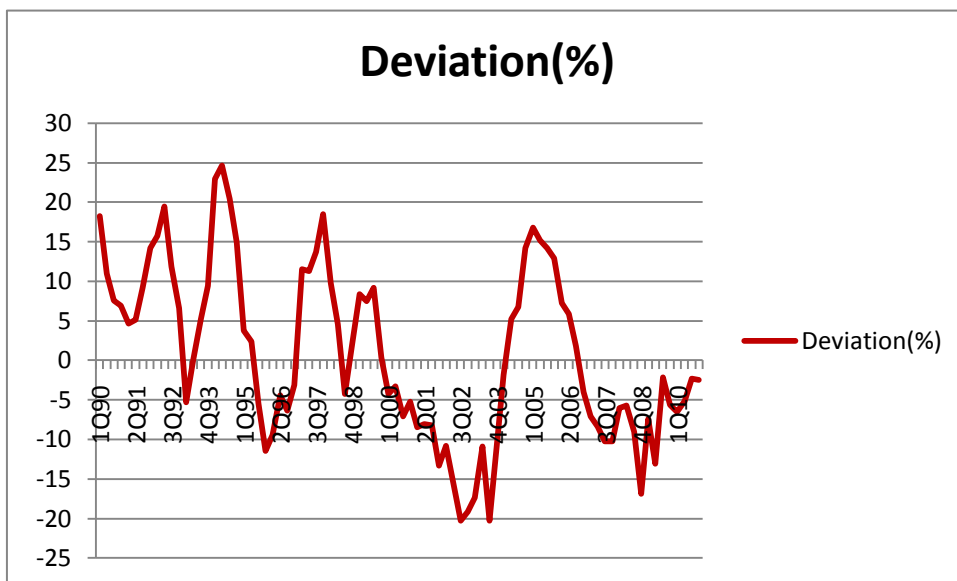


Figure 13 Deviation between Long-Run Equilibrium and Market Value of Housing Prices Index of Large Size Units (Period: 1Q90- 4Q10)



5.3 Vector Error-Correction Model (VECM)

In previous section, the cointegration test to identify the long-run relationship between housing prices and independent variables. Next, the deviations from the long-term relationship and the short-term dynamics of error-correct will be examined by using the vector error-correction model (VECM). Vector error-correction models are the basic VAR, with an error-correction term incorporated into the model (Johansen, 1991). The error-correction term measures any movement away from the long-run equilibrium. The equation of the vector error-correction model is as following:

$$\underset{5 \times 1}{\Delta Y'_t} = \underset{5 \times 1}{\beta Y'_{t-1}} + \sum_{j=1}^{k-1} \underset{5 \times 5}{\beta_j \Delta Y'_{t-j}} + \underset{5 \times 2}{\lambda X'_t} + \underset{5 \times 1}{V_t}$$

In this form, the equilibrium relationship, ΔY_t is a function of $\Delta H P$, $\Delta I P C$, $\Delta H S$, $\Delta A M R$ and $\Delta V R$. X_t is the CNY and CIES dummy, and β is a $D \times C'$, 5×5 matrix where D is an adjustment matrix and C' is a cointegrating matrix. Where β_j is a 5×5 VAR coefficient matrix and λ is a 5×2 exogenous variable coefficient matrix. The error term V_t is the i.i.d. residual vector. The result of vector error-correction model is listed in Table 11.

It can be seen that in the overall housing market and two sub-markets, the coefficient of ECM term is significantly negative, from which the existence of long-run relationship can be concluded. In the vector error-correction model, the Capital

Investment Entrant Scheme (CIES) dummy and ΔLnCNY are treated as exogenous variables, and their effect on the housing prices in short-run will be examined next.

Table 11 VEC Model (Exogenous Variable LnCNY in First Difference Form)

Regressors	ΔLnHP coefficient (t-ratio)	$\Delta\text{LnHPABC}$ coefficient (t-ratio)	ΔLnHPDE coefficient (t-ratio)
$\Delta\text{LnHP}(-1)$	0.5140(4.2065)***		
$\Delta\text{LnHP}(-2)$	-0.0685(-0.5376)		
$\Delta\text{LnHPABC}(-1)$		0.5011(4.1374)***	
$\Delta\text{LnHPABC}(-2)$		-0.0827(-0.6601)	
$\Delta\text{LnHPDE}(-1)$			0.4848(3.7231)***
$\Delta\text{LnHPDE}(-2)$			0.1403(1.0347)
$\Delta\text{LnHS}(-1)$	-0.1119(-0.0831)	-0.2058(-0.1552)	0.6981(0.4160)
$\Delta\text{LnHS}(-2)$	3.7759(2.9055)***	3.7977(2.9850)***	3.0347(1.8287)*
$\Delta\text{LnVR}(-1)$	-0.0512(-0.1921)	-0.0617(-0.2350)	-0.0934(-0.2848)
$\Delta\text{LnVR}(-2)$	0.5585(2.0015)**	0.5792(2.1001)**	0.5244(1.6317)
$\Delta\text{LnIPC}(-1)$	0.5933(1.6794)*	0.6104(1.7582)*	0.7979(1.8223)*
$\Delta\text{LnIPC}(-2)$	0.2458(0.6842)	0.2716(0.7690)	-0.0671(-0.1539)
$\Delta\text{LnMR}(-1)$	-0.0387(-0.5635)	-0.0366(-0.5408)	-0.0398(-0.4700)
$\Delta\text{LnMR}(-2)$	0.0880(1.2379)	0.0875(1.2485)	0.1334(1.5250)
CIES	-0.0058(-0.3936)	-0.00995(-1.3986)	0.0409(2.5160)**
ΔLnCNY	0.1889(1.6559)*	0.1922(1.7110)*	0.1069(0.7644)
Constant	-0.0162(-1.5193)	-0.0147(-1.3986)	-0.0311(-2.3611)**
ECMt-1	-0.2637(-4.7066)***	-0.2497(-4.8268)***	-0.3908(-4.2402)***
R-squared:	0.6289	0.6363	0.5655

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.

The result shows that the coefficients of CIES on the overall market and small-to-medium size market are not statistically significant, but it is positively significant for the large size market, suggesting that the Capital Investment Entrant Scheme, with a threshold investment of HKD6.5 million in Hong Kong, will only affect the large size market but not the small-to-medium size market. Large size units are perceived as the luxury market, so the CIES will only have positive impact on the luxury market but not the general market, and it should not be responsible for the recent surging of housing prices in the small-to-medium size housing market. However, it does contribute part to

the increase of housing prices of the large residential units. Besides, the effect of appreciation of RMB has positive impact on the housing market. The coefficients of Δ LnCNY are significantly positive in the overall market and small-to-medium size market. However, the effect of RMB on large size housing market is positive but not statistically significant.

In the vector error-correction model as laid out in Table 11, the exogenous variable LnCNY is in first difference form. However, in an alternative formulation, the vector error-correction model as estimated in Table 12, the exogenous variable LnCNY will be in level form. The previous results of ADF unit root test show that LnCNY in level form is non-stationary. However, when the stationary property of LnCNY is tested by using Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root test (Kwiatkowski, Phillips, Schmidt, & Shin 1992), the result shows that LnCNY has no unit root when the series are in level form. The LM-Stat. of LnCNY of no trend and trend are 0.384897 and 0.272689 respectively. The null hypothesis that LnCNY is stationary cannot be rejected at 5% significant level. The stationarity property of LnCNY is ambiguous, and therefore, LnCNY is treated as exogenous variable in both level form and in first difference when the vector error-correction model is performed.

From the results, the coefficients of CIES are significantly positive only on the large size market but they are not significant on the overall market or small-to-medium size market, a confirmation that CIES only has positive impact on the large size housing

market. For the effect of RMB, the coefficients of LnCNY are all positive but only statistically significant on the large size market. The result suggests that when RMB appreciates, the speed of change of the housing prices of large size housing market will increase.

Table 12 VEC Model (Exogenous Variable LnCNY in Level Form)

Regressors	Δ LnHP coefficient (t-ratio)	Δ LnHPABC coefficient (t-ratio)	Δ LnHPDE coefficient (t-ratio)
Δ LnHP(-1)	-0.5412(3.7268)***		
Δ LnHP(-2)	-0.1827(-1.2176)		
Δ LnHPABC(-1)		0.5106(3.5062)***	
Δ LnHPABC(-2)		-0.2264(-1.5189)	
Δ LnHPDE(-1)			0.5261(3.7888)***
Δ LnHPDE(-2)			0.1539(1.0530)
Δ LnHS(-1)	-0.9212(-0.6260)	-1.0823(-0.7413)	0.3483(0.2095)
Δ LnHS(-2)	2.7393(1.8047)*	2.4666(1.6552)*	2.9979(1.7524)*
Δ LnVR(-1)	-0.1177(-0.3871)	-0.1357(-0.4490)	-0.1151(-0.3412)
Δ LnVR(-2)	0.1832(0.5953)	0.1953(0.6366)	0.3814(1.0891)
Δ LnIPC(-1)	0.4944(1.1521)	0.5568(1.3088)	0.6128(1.2484)
Δ LnIPC(-2)	0.1505(0.3367)	0.2552(0.5754)	-0.3665(-0.7385)
Δ LnMR(-1)	-0.0659(-0.8262)	-0.0723(-0.9164)	-0.0269(-0.2988)
Δ LnMR(-2)	-0.0679(-0.8262)	0.0656(0.9120)	0.1384(1.5089)
CIES	0.0217(1.3907)	0.0249(1.6306)	0.0328(1.9273)*
LnCNY	0.0856(1.3594)	0.0548(0.8401)	0.1063(1.9369)*
Constant	-0.0162(-1.2889)	-0.0153(-1.2303)	-0.0250(-1.7626)*
ECMt-1	-0.0385(-0.5894)	0.0077(0.1387)	-0.3357(-3.4408)***
R-squared:	0.5158	0.5177	0.5357

Note:

1. *, ** and *** indicates 10%, 5% and 1% significance level respectively.

The two vector error-correction models confirm that CIES has positive impact only on the luxury market but not on the small-to-medium size market. Besides, there is positive relationship between exchange rate of RMB and the housing prices in overall market and small-to-medium size market, but no relationship between the exchange rate of RMB and the speed of change of the housing prices in the two markets. On the other

hand, there is no relationship between exchange rate of RMB and the housing prices of the large units. However, there is positive relationship between exchange rate of RMB and the speed of change of housing prices of the large units.

Chapter 6 Conclusion and Discussion

6.1 Conclusion

The empirical findings have shown that there is long-run relationship between housing prices and fundamental variables. Based on the cointegration analysis, the relationship between housing prices and per-capita income is positive, and the relationship between housing prices and vacancy rate, housing stocks and effective mortgage rate are negative. Besides, by using the long-run coefficients of variables to compute the long-run equilibrium price of housing, it was found that there was about 30 percent of over-valuation to the long-run equilibrium price in 1997, while the housing prices in 4Q10 were slightly below the long-run equilibrium level.

Besides, by using the vector error-correction model, the effect of Capital Investment Entrant Scheme and the exchange rate of RMB on the housing prices in Hong Kong was tested. The results show that CIES has positive impact only on the large units but not on the small-to-medium size market. Besides, there is a positive relationship between exchange rate of RMB and the housing prices in overall market and small-to-medium size market, while no relationship exists between the exchange rate of RMB and the speed of change of the housing prices in the two markets. On the other hand, there is no relationship between exchange rate of RMB and the housing prices of the large units. However, there is positive relationship between exchange rate of RMB and the speed of change of housing prices of the large units.

After the financial tsunami, housing prices in Hong Kong have surged by more than 50 percent in two years time. Many Hong Kong people claimed that they cannot afford a flat and blame speculative activities for the high housing prices, and many Legislative Council members put pressure on the government to curb the speculative activities of the housing market. In response to the request from the public to curb speculations, the government introduces the Special Stamp Duty (SSD) on 19 Nov 2010. In the final section of this thesis, some comments will be made on the recent housing policy.

6.2 Comments on Recent Housing Policy

6.2.1 The Special Stamp Duty (SSD)

When discussing on housing policy, the direction of the policy will depend on the trend of housing prices. In times of falling housing prices, public will urge the government to revive the housing market. When the housing prices are rising, public will put pressure on the government to curb speculations. Two years after the global financial tsunami, housing prices in Hong Kong have gone up by more than 50 percent. Many people, especially members of Legislative Council, lay blame on the speculative activities for the high housing price. The government is under huge pressure to suppress the rising housing price, and thus introduced new housing policies to curb the speculative activities. In theory, speculations exist in the housing market because speculators can find profit opportunity. To curb speculations effectively, the government has to increase the cost of speculations. The following are some potential or announced measures to curb speculations.

- 1) Impose higher stamp duty
- 2) Penalties on resale of flats within a specific period of time
- 3) Increase the down-payment for the mortgage / tightening financing
- 4) Prohibition of resale of uncompleted properties
- 5) Increase the land supply

The first four measures deal with the demand-side and these can increase the cost of speculation, whereas the last one is to lower the housing prices by increasing the housing supply. No matter what measures the government is going to take, it is hoped that the measure will not hurt the real buyers or disrupt the housing ladder.

Recent policy: Special Stamp Duty

On 19 November 2010, the government announced the introduction of the Special Stamp Duty (SSD) to curb speculative activities in the local property market. The SSD is based on the consideration paid or market value at the time of resale, and the regressive rates depend on the length of time the property was held. The SSD is payable irrespective of whether the property is sold at a gain or at a loss. The following is the regressive rates of the SSD:

- 15% - if the property is held for six months or less
- 10% - if held for more than 6 months, but for 12 months or less
- 5% - if held for more than 12 months but for 24 months or less

Limitations of the SSD

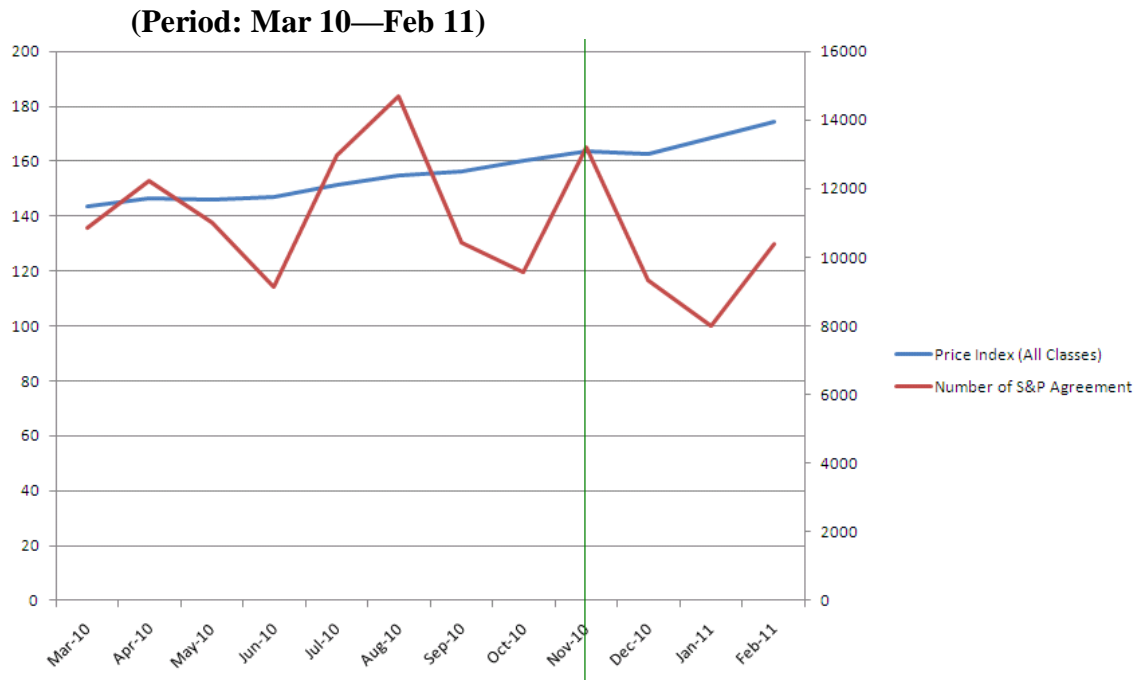
There are some limitations to the SSD. For example, it does not apply to a transfer of share. Therefore, fervent speculators may be able to escape from the SSD by setting up a Hong Kong or offshore company to own the property and then indirectly transfer the property through a transfer of share of the holding company. As a result, indirect transfer of property via a share transfer of “Shell Company” would provide an avenue for speculators to profit from speculation without being liable to the SSD.

Effects of SSD

After the introduction of SSD, the short-term speculative activities would be reduced as the cost of reselling within two years is very high. Since the SSD is payable irrespective of whether the speculators sold the property at a gain or at a loss within two years, this would reduce the liquidity of the property as well as increase the uncertainty of speculations. In addition, the number of transactions (especially the confirmor transactions) will decrease as the speculative activities will become inactive. However, the SSD policy will eventually hurt genuine users. Existing flat owners may consider carefully before trading up their existing homes for a new flat which will be liable to the SSD. In the short-run, the supply of second-hand properties will decline, resulting in the disruption of the housing ladder. Figure 14 shows the housing price and number of transactions before and after the introduction of the SSD. We can see that the housing prices have continued to rise after the imposition of the SSD even through the transaction volume has decline. The consequence is the same as the sellers’ stamp duty

in Singapore, a policy very similar to Hong Kong's except for the rate of stamp duty and the holding period of property which is liable to the stamp duty.

Figure 14 Housing Prices Index (Overall) and Transactions



Source: Hong Kong Property Review Monthly Supplement Jan 2010 – Mar 2011, Rating and Valuation Department

Note: Green line represents the start of implementation of the SSD

There are three phases in the implementation of seller's stamp duty in Singapore (Urban Redevelopment Authority of Singapore, 2011). The first phase started from 20 February 2010, sellers who buy residential properties and sell them within one year of acquisition has to pay the seller's stamp duty which is based on the same rates as the

buyer's stamp duty. On 30 August 2010, the government announced the seller's stamp duty will be extended to include properties sold within up to three years of acquisition. The amount of seller's stamp duty for holding period of one year is computed based on the same rate as the buyer's stamp duty, but is reduced to $\frac{2}{3}$ and $\frac{1}{3}$ of the amount of buyer's stamp duty for holding periods of 2 years and 3 years respectively, however, there is no evidence that housing prices in Singapore have cooled down. The Singapore government thus launched the third phase of seller's stamp duty on 14 January 2011, which extends the holding period for imposition of seller's stamp duty on residential properties from 3 years to 4 years based on new regressive rates. For holding period of one year or less, the rate will be 16 percent of price or market value, whichever is higher. For holding period of two years, three years and four years, the regressive rates will be 12 percent, 8 percent and 4 percent of price or market value respectively, whichever is high. However, even with the introduction of the seller's stamp duty in February 2010, housing prices in Singapore continue to soar. According to the Urban Redevelopment Authority of Singapore, housing prices in Singapore in 2010 increased by more than 10 percent after the introduction of seller's stamp duty, and it is estimated that housing prices in 1Q2011 will go up by 2.1% On the other hand, the transaction volume is in a downward trend after the introduction of seller's stamp duty. Figure 15 and Figure 16 show the trend of housing prices and transaction volume after the introduction of sellers' stamp duty in Singapore.

Figure 15 Property Prices Index in Singapore

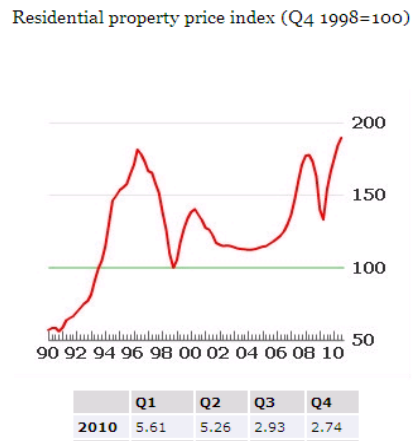
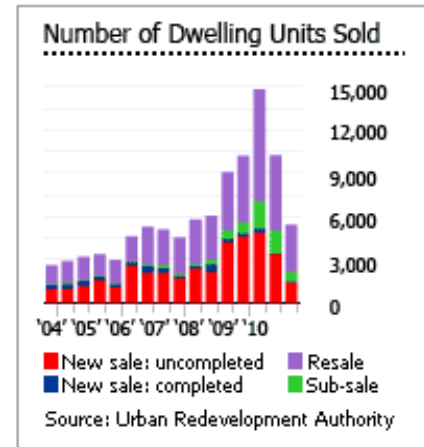


Figure 16 Number of Dwellings Units Sold in Singapore



Source: Property Market Information: Private Residential Properties (various issues), Urban Redevelopment Authority of Singapore

The aim of the SSD is to curb speculation. However, it also hurts the real buyers and disrupts the housing ladder. Is there any good substitute to the SSD?

6.2.2 Housing Prices Index Futures

Ho (1991) mentioned that speculative activities can boost housing prices and an abrupt end of a speculative boom can have disastrous effects on the economy. Innovation of the housing prices index futures is a good way to reduce speculations in the real property market, since investing in housing prices index futures involve lower transaction costs than investing in real property market. When the speculators expect a rise in housing prices, they can simply take a long position in the index futures.

Therefore, the housing prices index futures can channel off short-term speculators from the real property market and avoid disruption on real property market.

In addition to the function of speculations, housing prices index futures also provides a platform for individuals or institutions to hedge against housing prices risk (Case, Shiller & Weiss, 1993). For individuals or institutions, such as flat owners, land developers, and mortgage lenders, who want to pay off some of their housing investment risks, they can simply sell the index futures for protection against a fall in housing values. Besides, housing prices index futures can provide a function of portfolio diversification and price discovery (Jud, Wingler & Winkler, 2006).

There are real estate derivatives trading in other countries, for example, housing prices futures and options is started trading in Chicago Mercantile Exchange from mid-2006 and in Eurex from February 2009. However, the trading volume is not high for those markets. To determine the housing futures contract's success, three factors are very important: relevant measurement, sufficient demand and education (Jud & Winkler, 2009). For appropriate measurement in Hong Kong, this thesis proposes the use of Centa-City Leading Index¹⁴ constructed by the Centaline Property and City University of Hong Kong. The Centa-City Leading Index is a hedonic index- a quality-adjusted housing index that include three sub-indices according to districts—Hong Kong Island, Kowloon, and New Territories.

¹⁴ For the details of Centa-City Leading Index, please refer to <http://centadata.com/cci/cci.htm>

The housing transactions data of the index is calculated according to the Initial Purchase Agreements by the Centaline Property. The data of Initial Purchase Agreements is the most updated information in the market and can therefore avoid manipulation of the index futures. In addition to the first criteria determining success of housing futures contracts as discussed above, Hong Kong Stock Exchange (HKEx) plays an important role to ensure sufficient demand and education. To ensure a high demand of the index futures, HKEx has to promote and educate people to use this new product. Besides, HKEx can provide a platform for trading housing index futures. These are very important to in making certain the success of housing prices index futures development in Hong Kong.

List of Variables and their Definitions

Short Form	Descriptions	Data Sources
LnHP	Log Housing Price Index (Overall Private Domestic Housing Market, 1999=100)	Hong Kong Property Review, Rating and Valuation Department
LnHPABC	Log Housing Price Index (Class A,B,C of Private Domestic Housing Market, 1999=100)	Hong Kong Property Review, Rating and Valuation Department
LnHPDE	Log Housing Price Index (Class D, E of Private Domestic Housing Market, 1999=100)	Hong Kong Property Review, Rating and Valuation Department
LnHS	Log Private Housing Stock (No. of unit)	Hong Kong Property Review, Rating and Valuation Department
LnVR	Log Vacancy Rate of Private Domestic Housing Units	Hong Kong Property Review, Rating and Valuation Department
LnMR	Log Effective Mortgage Rate Prior to 1Q97, Prime Rate + 0.5% as a Proxy of Mortgage Rate	Hong Kong Census and Statistics Department
LnIPC	Log Per-capita GDP (Seasonally adjusted)	Monthly Statistical Bulletin and Unpublished Statistics, HKMA
LnCNY	Log Exchange Rate of RMB against HKD	Hong Kong Census and Statistics Department
CIES	Capital Investment Entrant Scheme Dummy, 0= prior to 3Q03, 1= starting from 3Q03	Immigration Department

Appendix I

Equilibrium Value and Market Value and of Housing Price Index (Overall) (Period: 1Q90 to 4Q10)

Quarter/Year	HP(Overall)	Equ. HP(Overall)	Deviation(%)
1Q90	42.80	42.15	1.54
2Q90	43.70	43.42	0.64
3Q90	45.30	44.34	2.16
4Q90	47.30	45.85	3.16
1Q91	49.60	46.48	6.71
2Q91	56.00	50.18	11.60
3Q91	65.50	54.16	20.94
4Q91	73.20	58.68	24.74
1Q92	79.60	62.87	26.61
2Q92	86.80	68.60	26.54
3Q92	88.70	74.32	19.36
4Q92	85.70	78.75	8.82
1Q93	85.10	85.96	-1.00
2Q93	91.00	87.66	3.81
3Q93	97.90	89.13	9.84
4Q93	98.00	88.89	10.25
1Q94	112.90	93.25	21.07
2Q94	116.80	96.91	20.52
3Q94	115.90	99.16	16.88
4Q94	114.00	102.36	11.37
1Q95	111.90	104.42	7.16
2Q95	110.30	107.14	2.95
3Q95	104.30	107.75	-3.20
4Q95	102.60	111.11	-7.66
1Q96	108.80	116.10	-6.29
2Q96	113.50	117.24	-3.19
3Q96	116.70	120.86	-3.44
4Q96	128.50	130.26	-1.35
1Q97	153.10	136.27	12.35
2Q97	167.10	141.03	18.48
3Q97	169.50	138.46	22.42
4Q97	162.80	128.42	26.77
1Q98	139.70	114.02	22.52
2Q98	124.80	104.26	19.70
3Q98	103.70	93.16	11.31

4Q98	100.20	84.42	18.69
1Q99	102.50	79.48	28.96
2Q99	102.40	82.16	24.63
3Q99	99.70	81.20	22.79
4Q99	95.30	84.53	12.74
1Q00	96.80	90.23	7.29
2Q00	90.10	86.43	4.25
3Q00	87.30	84.94	2.78
4Q00	84.20	82.70	1.81
1Q01	81.00	82.14	-1.39
2Q01	81.20	79.46	2.19
3Q01	78.60	78.49	0.14
4Q01	73.80	79.23	-6.86
1Q02	73.80	77.91	-5.27
2Q02	72.20	81.69	-11.62
3Q02	68.60	83.85	-18.19
4Q02	65.10	81.39	-20.01
1Q03	62.70	76.73	-18.29
2Q03	59.80	69.39	-13.81
3Q03	59.30	76.66	-22.65
4Q03	64.40	77.52	-16.93
1Q04	73.60	81.40	-9.59
2Q04	77.20	81.73	-5.54
3Q04	77.80	81.31	-4.31
4Q04	83.40	83.94	-0.65
1Q05	89.90	86.76	3.62
2Q05	94.50	90.78	4.10
3Q05	93.60	90.62	3.28
4Q05	90.10	89.91	0.22
1Q06	91.50	93.14	-1.76
2Q06	93.20	97.31	-4.22
3Q06	92.70	101.12	-8.33
4Q06	93.30	108.47	-13.98
1Q07	96.60	117.05	-17.47
2Q07	100.30	122.79	-18.32
3Q07	104.00	130.25	-20.15
4Q07	113.20	140.87	-19.64
1Q08	125.00	145.69	-14.20
2Q08	125.90	149.28	-15.66
3Q08	123.20	149.52	-17.60
4Q08	108.00	140.00	-22.85

1Q09	108.00	128.96	-16.25
2Q09	117.10	145.67	-19.61
3Q09	127.10	146.04	-12.97
4Q09	132.90	154.61	-14.04
1Q10	140.80	161.62	-12.88
2Q10	146.40	161.64	-9.43
3Q10	154.10	162.51	-5.17
4Q10	162.20	165.15	-1.79

Appendix II

Equilibrium Value and Market Value and of Housing Price Index (Class A,B,C)

(Period: 1Q90 to 4Q10)

Quarter/Year	HP(ClassA,B,C)	Equ. HP(ClassA,B,C)	Deviation(%)
1Q90	43.10	43.60	-1.14
2Q90	43.90	44.60	-1.57
3Q90	45.70	45.37	0.74
4Q90	47.80	46.71	2.33
1Q91	50.30	47.19	6.59
2Q91	56.90	50.80	12.02
3Q91	66.60	54.75	21.65
4Q91	74.30	59.23	25.44
1Q92	80.90	63.33	27.74
2Q92	88.00	69.11	27.34
3Q92	90.00	75.03	19.96
4Q92	86.70	79.50	9.05
1Q93	86.10	86.67	-0.66
2Q93	91.90	87.93	4.51
3Q93	98.70	89.01	10.89
4Q93	98.50	88.44	11.38
1Q94	113.00	92.26	22.48
2Q94	116.70	95.99	21.58
3Q94	115.80	98.41	17.67
4Q94	113.90	101.71	11.98
1Q95	112.10	103.90	7.90
2Q95	110.40	106.78	3.39
3Q95	104.50	107.71	-2.98
4Q95	102.80	111.25	-7.60
1Q96	109.10	116.47	-6.33
2Q96	113.50	117.57	-3.46
3Q96	116.80	121.05	-3.51
4Q96	128.30	130.03	-1.33
1Q97	152.50	135.72	12.36
2Q97	166.80	139.68	19.42
3Q97	169.20	136.72	23.75
4Q97	162.30	126.49	28.31
1Q98	139.70	112.22	24.48
2Q98	125.00	102.27	22.22
3Q98	103.80	91.26	13.74

4Q98	100.30	82.63	21.39
1Q99	102.80	77.71	32.29
2Q99	102.50	80.52	27.30
3Q99	99.60	79.84	24.75
4Q99	95.10	83.17	14.35
1Q00	96.50	88.80	8.67
2Q00	89.70	85.21	5.28
3Q00	87.00	83.73	3.90
4Q00	83.70	81.59	2.58
1Q01	80.60	81.16	-0.69
2Q01	80.90	78.65	2.86
3Q01	78.30	77.64	0.85
4Q01	73.60	78.45	-6.19
1Q02	73.50	76.99	-4.53
2Q02	71.90	80.45	-10.63
3Q02	68.30	82.39	-17.10
4Q02	64.50	80.10	-19.47
1Q03	62.20	75.68	-17.82
2Q03	59.30	68.88	-13.91
3Q03	58.70	76.04	-22.81
4Q03	63.60	77.08	-17.49
1Q04	72.40	81.01	-10.63
2Q04	75.80	81.39	-6.87
3Q04	76.40	81.10	-5.79
4Q04	81.60	83.71	-2.52
1Q05	88.30	86.52	2.06
2Q05	92.90	90.08	3.13
3Q05	91.90	89.46	2.72
4Q05	88.50	88.59	-0.10
1Q06	90.10	91.62	-1.66
2Q06	91.70	95.94	-4.42
3Q06	91.10	100.03	-8.93
4Q06	91.50	107.57	-14.94
1Q07	94.70	116.34	-18.60
2Q07	98.30	121.84	-19.32
3Q07	101.90	128.98	-21.00
4Q07	110.80	139.35	-20.49
1Q08	122.70	144.63	-15.16
2Q08	123.70	149.05	-17.01
3Q08	121.40	149.72	-18.91
4Q08	106.80	140.52	-24.00

1Q09	106.90	130.09	-17.82
2Q09	115.80	146.94	-21.19
3Q09	125.40	147.49	-14.98
4Q09	131.10	155.97	-15.94
1Q10	139.00	162.46	-14.44
2Q10	144.80	162.18	-10.72
3Q10	152.50	162.70	-6.27
4Q10	160.90	164.96	-2.46

Appendix III

Equilibrium Value and Market Value and of Housing Price Index (Class D,E)

(Period: 1Q90 to 4Q10)

Quarter/Year	HP(ClassD,E)	Equ. HP(ClassD,E)	Deviation(%)
1Q90	34.00	28.72	18.37
2Q90	34.00	30.61	11.09
3Q90	34.70	32.23	7.66
4Q90	36.60	34.20	7.01
1Q91	37.10	35.42	4.74
2Q91	41.20	39.14	5.27
3Q91	47.30	43.27	9.32
4Q91	54.60	47.75	14.35
1Q92	60.40	52.11	15.91
2Q92	68.90	57.59	19.63
3Q92	70.70	63.12	12.01
4Q92	72.10	67.58	6.69
1Q93	71.10	75.02	-5.22
2Q93	78.70	78.58	0.15
3Q93	86.80	82.42	5.32
4Q93	92.00	84.00	9.52
1Q94	112.00	91.01	23.06
2Q94	118.70	95.13	24.78
3Q94	118.10	97.94	20.59
4Q94	116.60	101.35	15.05
1Q95	107.50	103.45	3.92
2Q95	108.90	106.25	2.50
3Q95	101.20	106.96	-5.39
4Q95	98.00	110.52	-11.33
1Q96	105.00	115.81	-9.33
2Q96	112.90	117.96	-4.29
3Q96	115.90	123.64	-6.26
4Q96	132.10	136.21	-3.02
1Q97	161.60	144.74	11.64
2Q97	171.60	153.96	11.46
3Q97	175.10	153.80	13.85
4Q97	170.30	143.58	18.61
1Q98	139.60	127.03	9.90
2Q98	122.80	117.29	4.70
3Q98	101.30	105.64	-4.11

4Q98	98.50	96.10	2.50
1Q99	99.00	91.23	8.52
2Q99	101.60	94.44	7.58
3Q99	101.80	93.15	9.29
4Q99	97.90	97.45	0.46
1Q00	100.60	104.92	-4.11
2Q00	96.90	100.08	-3.18
3Q00	92.30	99.23	-6.98
4Q00	91.80	96.75	-5.12
1Q01	88.20	96.23	-8.34
2Q01	85.70	93.06	-7.91
3Q01	84.20	91.60	-8.07
4Q01	79.30	91.37	-13.21
1Q02	79.70	89.29	-10.74
2Q02	79.20	93.86	-15.62
3Q02	77.00	96.50	-20.21
4Q02	75.60	93.39	-19.05
1Q03	72.30	87.38	-17.26
2Q03	68.60	76.88	-10.77
3Q03	69.20	86.71	-20.20
4Q03	77.80	87.40	-10.98
1Q04	90.70	92.28	-1.71
2Q04	97.80	92.85	5.33
3Q04	98.90	92.52	6.90
4Q04	109.90	96.15	14.30
1Q05	116.90	99.95	16.96
2Q05	123.30	106.92	15.32
3Q05	124.50	108.92	14.30
4Q05	123.00	108.80	13.05
1Q06	122.40	113.96	7.40
2Q06	125.80	118.71	5.97
3Q06	125.10	122.75	1.91
4Q06	126.30	131.42	-3.90
1Q07	131.80	141.70	-6.99
2Q07	138.00	150.43	-8.26
3Q07	145.50	161.97	-10.17
4Q07	159.40	177.42	-10.16
1Q08	171.70	182.44	-5.89
2Q08	173.80	184.05	-5.57
3Q08	166.30	182.66	-8.96
4Q08	140.30	168.51	-16.74

1Q09	140.50	151.55	-7.29
2Q09	150.90	173.36	-12.96
3Q09	169.60	173.18	-2.07
4Q09	174.90	185.05	-5.48
1Q10	184.60	197.26	-6.42
2Q10	189.10	199.17	-5.06
3Q10	198.00	202.47	-2.21
4Q10	203.50	208.44	-2.37

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