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Policy-Driven Housing Cycle: The Hong Kong Case of Supply Intervention

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This paper builds on the literature that shows policy often plays a key role in housing cycles. Using the cointegration approach which focuses on the supply and demand dynamics of the housing market, and with explicit consideration of housing price expectations proxied by the price-earning ratio in financial markets, this paper identifies two cointegrating relations: a long run demand-side relation that involves housing property price, interest rate, price expectation and income; and a supply-side relation that involves private housing completion, property price, interest rate, and building and land costs. Based on Hong Kong data from 1990 – 2012, which covers big cycles in the housing market, this paper suggests that policies to augment or restrain housing supply in the attempt to stabilize housing prices have been counterproductive.

Keywords

Housing Prices, Housing Cycle, Demand and Supply, Government Intervention

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1. Introduction

By now few people would doubt the role of policy in contributing to the overheating of the American housing market before it turned south in 2005-2006, thus triggering the subprime crisis and then the global financial tsunami. Hong Kong, long known as the world's most free economy, presents another case study which demonstrates that fluctuations in housing markets often have their origins in policy. There is no shortage of evidence that wild fluctuations in housing markets are often home-made. Agnello and Schuknecht (2011) study the housing markets of 18 industrialized countries over the period of 1980 – 2007, and find that changes in domestic credit and interest rates have a significant role in housing cycles. Although they recognize that international capital flows can contribute to housing booms and busts in significant ways, they also find that financial market deregulation, which has been a dominant policy theme since the 1980s, can compound problems. However, Coleman et al. (2008) take a cautious stance by saying that the emergence of a housing price bubble might not be attributed to the policy-driven availability of subprime mortgages. Still they maintain that “political and regulatory actions and economic conditions...permitted the spread not only of new private-issue instrument designs and ABS products, but also of weaker underwriting standards to flow in great volumes into the void” (p.289), thus eventually aggravating adverse trends that beset the housing and mortgage markets. Ho and Wong (2008) demonstrate, by using the Chow Test and a timing test, that the public housing privatization scheme in Hong Kong announced in December 1997 disrupted the flow of funds from aspiring homebuyers from among the public housing tenants into the private market, and triggered a dramatic plunge in housing prices independent of the Asian Financial Crisis. They find evidence that the sale of public housing units to sitting tenants at deep discounts effectively siphoned off the demand for the Home Ownership Scheme and private housing, and by implication, triggered a major decline in the housing market and a collapse in housing transactions. Ho and Wong (2009), moreover, demonstrate the important role of public rental housing in contributing to savings accumulation for first time homebuyers and the continued housing price increases prior to 1998.

Although Hong Kong has been rated as the most free economy in the world, the Hong Kong government has been deeply involved in housing development as the primary supplier of Home Ownership Scheme housing and public rental housing.¹ Against this background, the climb of housing prices to the peak of 1997, the dramatic decline that followed, as well as the subsequent rally making new highs deserve close study.² Rather than focusing on any specific policy

¹ A small portion of these housing supplies come from the Hong Kong Housing Society, a non governmental organization (NGO) that has been developing both public rental housing and assisted ownership housing with the help of the government.

² According to the Demographia International Housing Affordability Survey (2015), Hong Kong is now rated as the city with the world's highest housing costs. Median

initiative, this paper goes back to the basics. This study is motivated by the cyclical shifts in housing supply policy. By studying the supply and demand dynamics of the private housing market in Hong Kong, we discover that policy-driven supply changes have played a significant role in driving the direction of the housing cycle.

In this exercise, we borrow the concept of the price-earning (PE) ratio in stock market analysis to model expectations about future price movements. The paper is divided into five sections. Section 2 reviews the major changes in the housing and land supply policies in Hong Kong pre-1997 and post-1997. Section 3 develops the model used in this paper to explain the demand and supply adjustments of the private housing market in Hong Kong. The empirical findings are reported in Section 4. Finally, Section 5 offers conclusions.

2. Private Housing Supply in Hong Kong

In retrospect, the Hong Kong government intervened in the housing market on the supply side four times, i.e. in 1997, 1999, 2002 and 2013, each time with the view to stabilizing the housing market. For many years before 1997, the disposal of government land was done mainly through periodic active land auctions. As the Hong Kong government has always been the largest landowner of the territory, this land supply mechanism is basically a supply-led model by which the Hong Kong government has the power to control when and how much new land should be placed on the market in order to achieve various policy objectives. Peng and Wheaton (1994) argue that the restriction of annual land sales to no more than 50 hectares as provided in the Annex to the Sino-British Joint Declaration would lead to higher housing price. However, Ho and Wong (2008) show that the housing market was more or less in balance during the run-up to 1997. If anything, the physical shortage as evident in the early 1980s was sharply reduced in 1997.³ There was no clear evidence that the housing market was in shortage due to the annual cap on land sales to 50 hectares under the Sino-British Declaration. Housing prices appeared to be rising in a moving equilibrium in which both supply and demand changed in response to market fundamentals and more or less being equalized. The fact that housing price rose sharply was not surprising because of the strong economic growth.

The post-1997 period is worth a closer look because of the large swing in the housing price and a paradigm shift in the housing policies, particularly in

housing prices now represent 17 times the median household income—the highest record anywhere in all 11 years of the survey.

³ Readers are advised to compare actual households with actual dwelling units as presented in the figures shown in Richard Wong's article herein, as quality and quantity of housing units are not substitutable in terms of satisfying the needs of households for a dwelling unit. <http://www.hkcer.hku.hk/Letters/v42/wong.htm>

housing supply management. After the handover of sovereignty, the Hong Kong government introduced a housing production target of 85,000 units a year, which is roughly twice the annual supply in prior years. This soon led to large increases well above trend. This supply side policy initiative added to the gloom following the Asian Financial Crisis and the fallout from the Tenant Purchase Scheme (TPS), a public housing privation scheme that allowed sitting tenants to buy their units at deep discounts.

In view of the continuing weakness of the housing market—a close to 70% decline in housing prices through to 2003 from their peak in 1997, the government gradually reversed its policy of increasing supply and selling public housing cheaply. In 1999, the government introduced the *application list system*. Under this system, developers who are interested in a land parcel on the list submit their proposed price to the government. If this proposed price is no less than 80 percent of the fixed undisclosed price, then a public auction would consequently result for the land parcel of interest.⁴ Since there is a cost involved for this process but no guarantee that the applicant would successfully obtain the land parcel, motivation to apply for sites to be put on auction was low. As a result, the supply of land and *inter alia* that of private housing significantly dropped below the long run average for many years. Li et al. (2016) examine the causal relation between government land supply and housing prices in Hong Kong and find that there is no causality between the two variables from 1987 to 2002. They do find however, a one-way causal relation that runs from price to supply after 2002, thus suggesting that land supply did respond to housing price increases after the government completely stopped initiating land auctions. Li et al. (2016), however, do not test for causality with a model that simultaneously involves both demand and supply relations.

In view of the rising concern over the surge in housing prices, Leung Chun-ying, who became Chief Executive of the Hong Kong Special Administrative Region in 2012, adopted a more proactive approach to increasing land supply. Rather than boosting supply well above historical trends as was the case with Tung Chee-hwa⁵, the Leung government announced a long term housing production target of 480,000 units for a ten-year period from fiscal year 2015/16 to 2024/25 (60:40 public-private split in new housing production). In his 2013-2014 budget speech, Financial Secretary John Tsang also stated that the “Government’s aim is to maintain on average the provision of land for building about 20,000 (private) residential units each year” (Government of the Hong Kong Special Administrative Region, 2013, p.38). The production target is based on the projection of the long term housing demand based on

⁴ Periodic land sale auctions and the application list system co-existed from 1999 to 2002.

⁵ Tung was the first Chief Executive of the Hong Kong Special Administrative Region and assumed office in 1997. He is renowned for his housing production target of 85,000 units a year.

considerations such as household formation, which is less influenced by economic cycles.

3. Theoretical Considerations

Understanding how demand and supply interact in both the short and the long run is essential to addressing housing market problems. In a free market, the price is acceptable to both the buyer and the seller. However, market clearance for units transacted does not imply equilibrium in terms of longer term demand and supply. The market price for each transaction adds to market information, and both potential buyers and sellers will respond. Thus, a momentary “equilibrium” is typically only a transitional state. There are several features of the housing market which lead to delayed responses from both the supply and the demand side. Quality heterogeneity compounds the imperfect information problem. Potential buyers and sellers may keep revising their bid and ask prices as the search goes on.

Given the uniqueness of each housing unit, price discovery is not as efficient as might be thought. In other words, it is very difficult and time consuming for owners to obtain a fair market price for their property. Sellers weigh their perceived marginal cost of search against the expected marginal benefit in deciding if they would accept an offer. Developers typically have many units to sell and can thus easily notice any changes in the rate at which their units are selling, but most other sellers would only have one or two units to sell and tend to take a longer time to realize a change in market sentiments and respond with a change in the asking price.

Novy-Marx (2009) points out that price is not the only variable that adjusts to clear markets; behavioral changes are also part of the adjustment process. Behavioral adjustments involve learning and can take considerable time. Riddel (2004) finds that the housing market is often characterized by sustained periods of disequilibrium. Recent studies have also found that supply instability plays an important role in housing price dynamics (Bahadir and Myhaylova, 2014 and Glaeser et al., 2008).

In this study, we identify both the demand and supply side relations of the private housing market in Hong Kong. In the short run, the housing stock is fixed. In the market place, a unit sold is a unit bought. Thus “turnover supply” and “turnover demand” which mean observable housing transactions are always equal. Berkovec and Goodman (1996) look at turnover and how it can be a measure of housing demand. They find that changes in turnover are positively related to changes in housing demand and develop a search model to explain for the linkage. Oikarinen (2012) finds that turnover is superior to price as an indicator of change in housing demand.

The total demand for private housing stock in this study is defined as the sum of “turnover demand” and “reservation demand”. We define the stock of housing minus units sold at any given period as “reservation demand”. Reservation demand is the sum of owner-occupied housing, owner-leased housing, and vacant housing that have not changed hands within the period of interest. All of these units may be voluntarily or involuntarily held. The possibility of involuntarily held housing implies the possibility of disequilibrium as the existing owners seek to dispose the units at the best price that they can find which is acceptable to buyers. Reservation demand can be turned into effective “flow supply” at a certain price and certainly is related to expectations on the part of existing homeowners.

The long-run supply of housing responds to additions to the housing stock and will rise with price. DiPasquale and Wheaton (1994, 1996) cite the traditional stock-flow model that defines the equilibrium of the housing stock to be the result of a stock demand function based on housing price, home financing cost, and the cost of renting, which interact with the supply of the given housing stock at the time. They note that if supply is understood as units of housing, then the demand function for the stock equation should include household formation and tenure choice considerations. They see increase in housing supply as a flow and function of housing price, factor price, and interest rate. The flow supply adds to the stock and will affect the stock equilibrium in the next period. The authors thus dispute the traditional stock-flow model which assumes instantaneous market clearing. Observing that the housing market may exhibit significant disequilibrium, they conclude that “the connection between housing construction and the various factor markets remains largely elusive” (DiPasquale and Wheaton, 1994, p.5).

Let us start with their stock demand function in their Equation (1), which is:

$$D(X_1, P, U, R) = S \quad (1)$$

where X_1 is a vector of exogenous factors such as demographics and permanent income, P is the housing price, U is the annual user cost of home purchase financing, and R is the alternative cost of renting. We propose first to see stock demand as comprising turnover demand and reservation demand. While turnover demand is largely driven by income, financing and rental costs, and expectations, reservation demand is especially driven by expectations. In line with the analysis of DiPasquale and Wheaton (1994), the momentary “equilibrium price” is not an equilibrium price in the sense of being stable without external disturbance. It is tentative, and will be adjusted as market participants continue to digest the information and change their behaviors.

We propose to write the housing stock demand (D) as dependent on the housing price ($\ln PPI$), prime interest rate (PR), logarithm of the nominal gross domestic product ($\ln GDP$), and housing price expectation ($EXPVERSE$). $EXPVERSE$ is defined so that if its value goes up, housing prices are

expected to fall. D is the total demand including “turnover demand” and the “reservation demand” of potential sellers for the total private housing stock. Following DiPasquale and Wheaton (1994, 1996), the housing stock at the end of period t is the housing stock at the beginning of the period plus housing completions minus housing demolitions in this period of time. In general, the quantity of housing demanded is negatively related to housing price and the interest rate⁶ because a higher interest rate increases the cost of buying a home (increase in mortgage interest cost). In addition, income level would have a positive effect on housing demand. Substituting Equation [2] into Equation [1], and transposing, we obtain Equation [3]. Current or short term housing stock S is measured by the total stock of private housing units. Supply over the longer term, however, is responsive to price increases, thus reflecting the profit-maximizing behavior of developers and increases subject to a time lag.

$$D_t = \alpha_0 + \alpha_1 P_t + \alpha_2 GDP_t + \alpha_3 PR_t + \alpha_4 EXPREVERSE_t \quad (2)$$

$(\alpha_1 < 0, \alpha_2 > 0, \alpha_3 < 0 \text{ and } \alpha_4 < 0)$

$$P_t = \frac{\alpha_0}{\alpha_1} + \frac{\alpha_2}{\alpha_1} PGD_t + \frac{\alpha_3}{\alpha_1} PG_t + \frac{\alpha_4}{\alpha_1} EXPREVERSE_t - \frac{1}{\alpha_1} S_t \quad (3)$$

Equation [3] shows housing price as a function of per capita GDP, prime rate, expectations, and housing stock. However, as Equation [3] stands, P is not really a long run equilibrium price, since supply is still subject to delayed adjustment. Following DiPasquale and Wheaton (1994, 1996), new housing supply follows a differential equation (see Equation [4]) and is equal to new construction C minus depreciation δS where stock S depreciates at rate δ . Construction C depends on housing price P , and other cost variables X_2 such as land, interest, and building material cost. On the supply side, given that the demolition rate in Hong Kong during the last decade is just around 0.5% (Hong Kong Property Review, various years) and relatively stable, we assume δ to be zero for simplicity. Then the supply of new private housing at any time will be equal to housing completion, i.e. $\Delta S = C(P, X_2)$. The supply side relations can be summarized by using Equation [5]. New housing supply as measured by private housing completion ($LnCOMP$) is positively related to price with a lag so that the supply curve is upward sloping and $LnCOMP$ is negatively related to other cost variables X_2 . In this study, costs are represented by land and building costs and the prime interest rate. After testing, C in Equation [5] is defined to lag 6 quarters ($t+6$) following the supply side determinants at time t , therefore, any change in the independent variables will affect future housing completion by around 1.5 years.⁷ In estimating the cointegration relations with

⁶ In Hong Kong, the mortgage lending rate is often anchored on the prime interest rate.

⁷ A one and half year lag may be considered to be too short. However, this statistical result is obtained empirically and it may make sense considering the fact that developers generally have some room for shifting the completion date of ongoing projects backward or forward given market conditions.

supply dynamics and demand interacting in a vector error correction model (VECM) framework (Table 3), we will present the long term equilibrium structure in the next section.

$$\Delta S_t = C_t - \delta S_t \quad (4)$$

$$C_{t+6} = \beta_0 + \beta_1 P_t + \beta_2 PR_t + \beta_3 BCOST_t + \beta_4 LAND_t \quad (5)$$

$(\beta_1 > 0, \beta_2 < 0, \beta_3 < 0 \text{ and } \beta_4 < 0)$

4. Data and Empirical Results

4.1 Data and Methodology

Many past studies indicate that price expectations play an important role in explaining housing price movement. Once prices have increased for a period of time, there is the tendency to believe that the upward trend will continue for some time in the foreseeable future (adaptive expectations approach). Studies by Philips (1988) and Brown et al. (1997) assume that price expectations are formed by observing past and current values of different variables, including inflation and interest rates. DiPasquale and Wheaton (1994) observe that the use of recent past price data as a proxy for future price expectation is problematic as they are highly correlated with the current price and therefore would lead to serial correlation.

In this study, we borrow the concept of the PE ratio in stock market analysis. Stocks with a higher PE ratio are generally expected to rise faster, thus reflecting stronger future profit growth (e.g. IT or new technology companies during IT bubbles), than companies with a low PE ratio (e.g. public utility companies). The “PE ratios” in the housing market are calculated as follows: average property price per square meter to average rental income per square meter per year (E) (data obtained from Hong Kong Property Review, various years). Figure 1 shows the PE ratio of the Hong Kong housing market. As can be seen, the PE ratio peaked at 27 in 1997 and then dropped to about 16 in 2003. Since people are willing to accept a lower rental return in the property market when deposit interest rates are lower, so we calculate the premium (i.e., the positive difference) of the rental yield over the Hong Kong 3-month bank deposit rate. Based on this alternative measure, Figure 2 indicates a different pattern for picturing housing price expectations. We can see that the yield (net return) fell to negative territory, around -1.3%, in 1997 which means that people were willing to accept a negative return from rental income, thus indicating they must have been very optimistic about future price appreciation. To very bullish speculators, short term negative rental returns are immaterial compared to expected capital gains. Indeed, housing units as an illiquid asset should enjoy a higher return than holding cash. In 2009, even though Hong Kong property prices had risen over 30% from the bottom during the financial tsunami in late 2008, the net yield was still a positive 3.84% in 2009Q4 which is still higher

than the 22 year average (2.92%). The net yield variable, EXPREVERSE, is somewhat like the inverse of the PE ratio in stock market analysis; its rise portends price declines. We expect that EXPREVERSE and property prices should be negatively related.

Figure 1 Price Expectation Proxied by Gross “PE” Ratio of Homes (1990Q1-2012Q4)

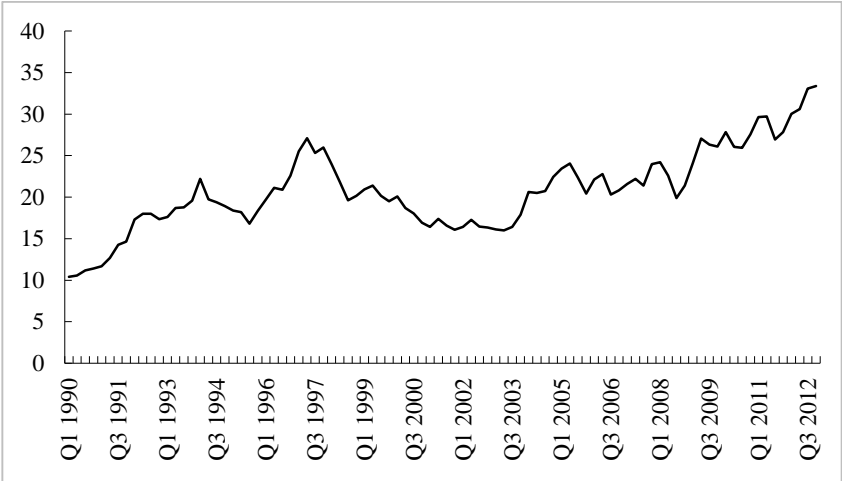
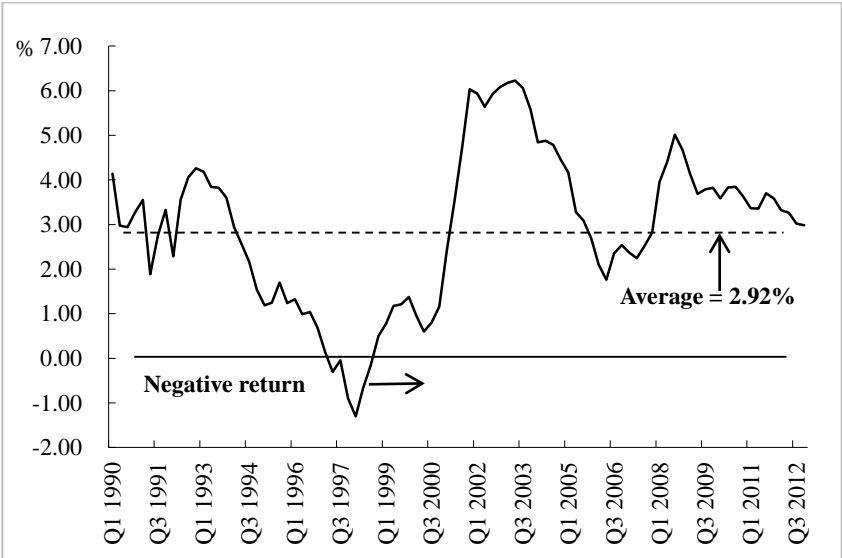


Figure 2 Price Expectation Proxied by Net Rental Yields (1990-2012Q4)

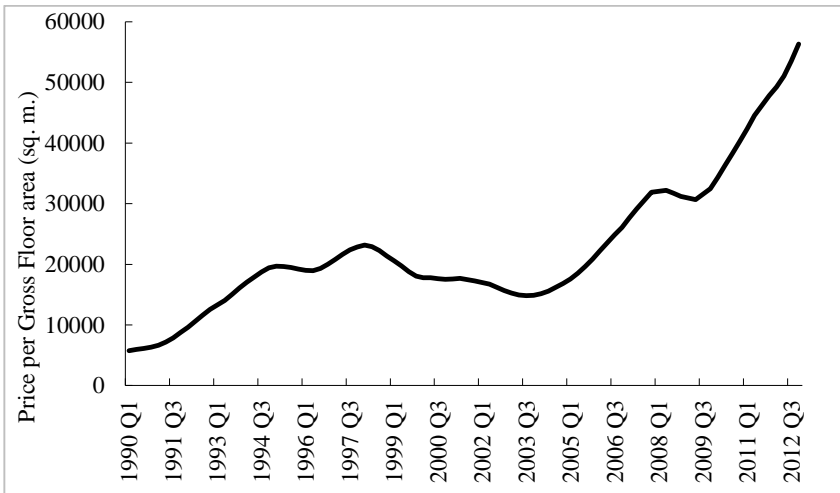
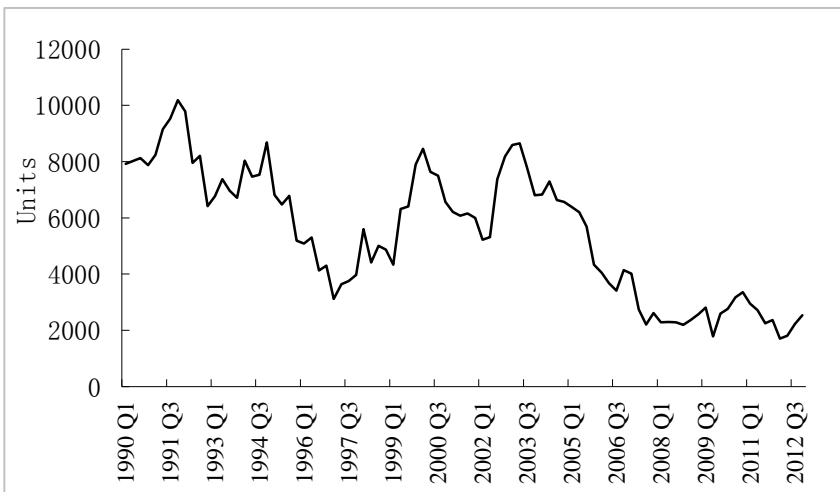


For the sources and definitions of the other variables that are analyzed, please refer to Table 1. Figures 1 – 5 show the movement of the key variables. This study employs quarterly data from 1990 to 2012⁸. This is a period with a stable monetary regime as well as relative political stability after the signing of the Sino-British Joint Declaration which removed much of the uncertainty about Hong Kong's future. This study basically follows the work of DiPasquale and Wheaton (1994) and Yong (2004) in using the cointegration approach which can help to identify any short-run and long run relations among variables and investigate the demand/supply dynamics.

Table 1 List of Variables and Their Definitions

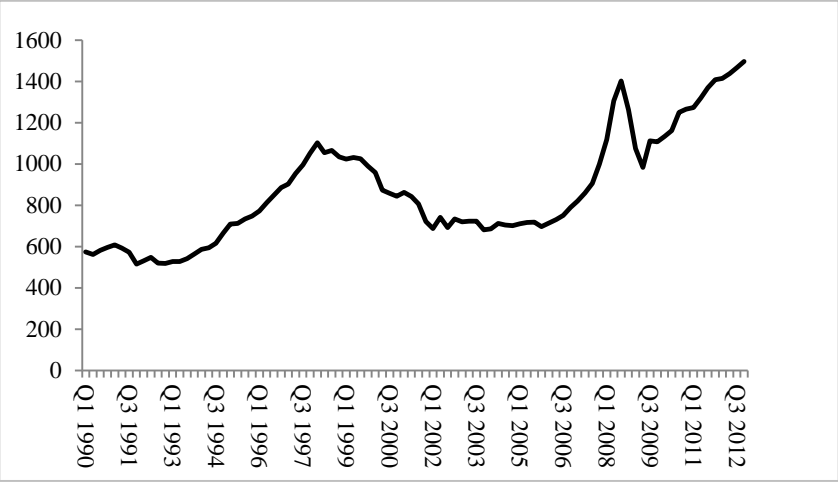
Short Form	Description	Data Source(s)
<i>LnPPI</i>	Log property price index (overall private domestic housing market 1999=100)	Hong Kong Property Review, Rating and Valuation Dept HKSAR Government
<i>LnCOMP</i>	Log Private Residential Completion (seasonally adjusted)	Hong Kong Monthly Digest of Statistics, Hong Kong Census and Statistics Dept, HKSAR Government
<i>LnFCOMP</i>	Log of Future Private Residential Completion (total completion in the next two years)	Hong Kong Monthly Digest of Statistics, Hong Kong Census and Statistics Dept, HKSAR Government
<i>LnPSTOCK</i>	Log Private Housing Stock (No. of units)	Hong Kong Monthly Digest of Statistics, Hong Kong Census and Statistics Dept, HKSAR Government
<i>LnPGDP</i>	Log Gross Domestic Product, per capita (Current price, seasonally adjusted)	Hong Kong Census and Statistics Dept, HKSAR Government
<i>LnBCOST</i>	Log Building Works Tender Price Index	Architectural Services Department, HKSAR Government
<i>LnLAND</i>	Log Estimated Land Price per GFA sq. m (Current price)	Unpublished statistics provided by Census and Statistics Dept, HKSAR Government
<i>EXPVERSE</i>	Housing price expectation: Rental yield minus Hong Kong 3-month deposit rate (in percentage) When EXPVERSE goes up, housing prices are expected to fall.	Hong Kong Property Review, various years, Rating and Valuation Dept and Monthly Statistical Bulletin, various issues, HKMA
<i>PR</i>	Prime Rate (in percentage)	Monthly Statistical Bulletin, various issues, HKMA

⁸ The land price data are only available up to 2012.

Figure 3 Estimated Land Price per GFA sq. m.⁹ (1990Q1-2012Q4)**Figure 4** Private Housing Completions (1990-2012Q4)

⁹ The land cost variable is an unpublished statistics provided by the Census and Statistics Department. All property developers (excluding very small ones) in Hong Kong report their estimated land values for the first and fourth quarters including projects under construction and land reserve. We assume that land value in Q2 = Q1 value + average increase (Q4-Q1)/3, and land value in Q3=Q2 value + average increase (Q4-Q1)/3. Data on land price are only available starting from 1990 to 2012Q4.

Figure 5 Building Works Tender Price Index¹⁰ (1990-2012Q4)



4.2 Empirical Results

4.2.1 Disequilibrium of Housing Demand and Supply

Prior to applying the Johansen procedure, we need to examine the order of integration of all variables in the model by using augmented Dickey-Fuller (ADF) tests for unit root. The variables are found to be of order one $I(1)$.¹¹ The next step is to carry out co-integration analyses of the variables with Equations [3] and [5]. We choose the lag structure by using the Akaike information criterion (AIC) and Schwarz information criterion (SIC), which determine 1 lag in the VECM. The cointegration test results are presented in Table 2. The number of co-integrating vectors r is determined by referring to the λ_{\max} and the trace statistics. As can be seen, the trace statistics indicate that there are two cointegrating vectors ($r = 2$) while the λ_{\max} statistics indicate that there is no cointegration among the eight variables. The results are generally consistent with previous discussions and we will proceed to the analysis with two cointegrating vectors.

Having determined that the number of cointegrating vectors $r = 2$, the next step is to identify the cointegrating vectors and test if the restrictions suggested by our theoretical model (i.e. including the demand side variables in the first

¹⁰ The Building Works Tender Price Index (BWTPI) is a quarterly index compiled by the Architectural Services Department as an aid for adjusting building cost data for estimation purposes. It also provides an indication of the level of tender prices for new building works undertaken by the Architectural Services Department. It is computed in a similar way as that by the Building Cost Information Service of the Royal Institution of Chartered Surveyors in the United Kingdom.

¹¹ The results are not reported here for space consideration, but available upon request.

cointegrating equation, and the supply side variables in the second cointegrating equation) are statistically acceptable. The estimated cointegrating equations and the results of the test of restrictions are reported in Table 3. The LR χ^2 statistic for the restrictions (i.e. $H_0 = \beta_{14} = \beta_{15} = \beta_{16} = 0$ and $\beta_{22} = \beta_{27} = \beta_{28} = 0$) is 7.84. The restrictions are accepted and so our prior hypotheses are not rejected at the 5% level of significance.

Table 2 **Johansen Cointegrating Test Result (1990 to 2012)**

Variable(s)	Null Hypothesis	Alternative Hypothesis	Test Statistics
LnPPI, LnPGDP, PR, LnCOMP, LnLAND, LnBCOST, EXPREVERSE, LnPSTOCK	Trace tests:		Trace Value
	$r = 0$	$r > 0$	192.22***
	$r \leq 1$	$r > 1$	141.41**
	$r \leq 2$	$r > 2$	95.52
	λ max tests:		λ max Value
	$r = 0$	$r = 1$	50.81
	$r = 1$	$r = 2$	45.90
	$r = 2$	$r = 3$	39.47

Notes: 1. *** and ** denote 1% and 5% significant levels respectively

2. r indicates number of cointegrating vectors.

3. Lag interval = 2, determined by AIC criterion.

4. 98Q1 dummy is treated as exogenous variable¹²

The coefficients of all of the variables in the cointegrating equations (Equations 1 and 2) carry the expected signs. Except for the building cost variable, all other coefficients are significant. The first cointegrating vector (demand side) suggests there is a negative relation between prime rate, private housing stock, expectation (more negative = higher expectations) and property price. The housing demand is positively related to the *GDP per capita*. The second vector (supply side) suggests that private housing completion is positively related to the property price, and negatively related to the cost variables: prime rate, building cost and land price. The housing completion variable now lags 6 quarters (1.5 years) behind those that determine completion, which shows that both housing price and cost variables affect housing completion with a considerable time lag.

We have thus identified two long run relations among the six variables, i.e. for the 1) demand side: $\text{LnPPI} = 1.64 * \text{LnPGDP} - 0.16 * \text{PR} - 0.16 * \text{EXPVERSE} - 4.30 * \text{LnPSTOCK} + 58.04$ and 2) supply side: $\text{LnCOMP}(t+6) = 2.24 * \text{LnPPI}$

¹² The 98Q1 dummy captures the effect of the TPS on the housing market. “0” to the quarters prior to December 1997 and assigned the value of “1” for quarters from Q1 1998 onwards. The policy is “switched off” by the end of 2002Q4. For a thorough analysis of the TPS, see Ho and Wong (2006, 2008 and 2009).

$-0.07*PR - 2.62*\text{Ln}LAND - 0.45*\text{Ln}BCOST + 26.80$. Figure 6 shows the two restricted cointegrating vectors. Both vectors appear to be stationary throughout the study period and are mean-reverting. The deviations of the vectors from their long run values can be regarded as short term disequilibrium or shocks in the housing demand and supply.

Table 3 Normalized Long-run Cointegrating Coefficients & Test of Restrictions

Variable	CointEq 1 (Demand Model) $\text{Ln}PPI$	CointEq 2 (Supply Model) $\text{Ln}COMP$
$\text{Ln}PPI$	1	-2.24 (-5.04)***
$\text{Ln}PGDP$	-1.64 (-11.44)***	0
PR	0.16 (11.07)***	0.07 (2.34)**
$\text{Ln}COMP(t+6)$	0	1
$\text{Ln}LAND$	0	2.63 (6.08)***
$\text{Ln}BCOST$	0	0.45 (1.47)
$EXPVERSE$	0.16 (10.64)***	0
$\text{Ln}PSTOCK$	4.3 (13.98)***	0
Constant	-58.04	-26.8
Test of cointegration restrictions: $H_0 = \beta_{14} = \beta_{15} = \beta_{16} = 0$ and $\beta_{22} = \beta_{27} = \beta_{28} = 0$ LR Test: $\chi^2 = 7.84$, $p\text{-value} = 0.0976$		

Notes: 1. ** and *** denote significance at 10% and 5% levels respectively.

2. Numbers in parentheses are t-statistics.

3. Negative coefficients signal positive effects.

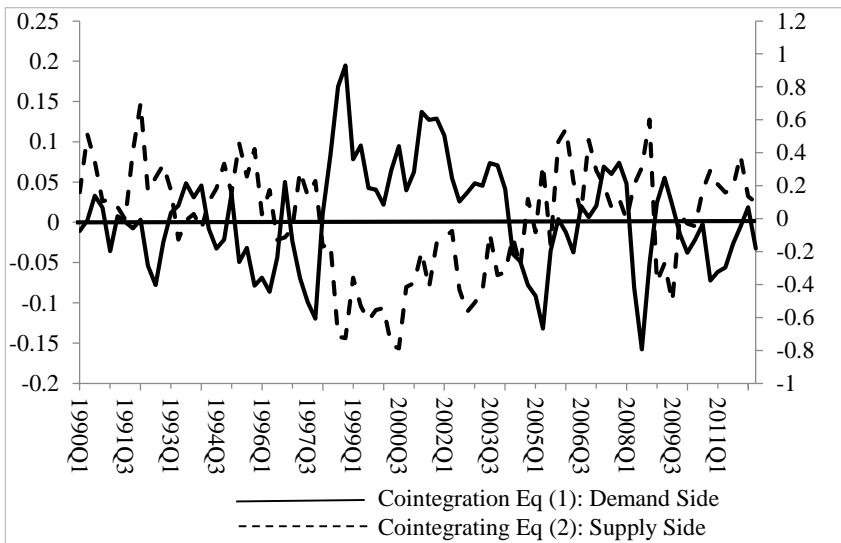
4. β_{14} , β_{15} and β_{16} denote fourth, fifth and sixth variables in first cointegrating equation.

5. β_{22} , β_{27} and β_{28} denote the, seventh and eighth variables in second cointegrating equation.

As can be seen in Figure 6, the demand for housing stock experienced an obvious decline from 1997 to 2003. This period includes both the Asian Financial Crisis and the TPS - the public housing privatization program of the

Housing Authority. Ho and Wong (2006, 2008 and 2009) and Ho et al. (2008) provide strong evidence that the effect of TPS on the demand for housing is significantly larger than that of the Asian Financial Crisis. In 1996 and 1997, close to 10,000 public housing households gave up their units each year and purchased HOS or private homes. After 1997, the demand for private and HOE units by existing public housing tenants virtually disappeared with the availability of a very attractive scheme to buy their own public housing units. The price of private housing units, which had largely depended on HOS owners to trade up, also plummeted. We should therefore expect that the housing price should decrease in order to ensure that the housing demand would adjust upward to its long run level. The adjustment continued for a few years and until the government announced that the TPS was to be terminated. The announcement was made on November 2002¹³ and a strong rebound of the housing market started in the summer of 2003 after the SARS epidemic subsided. However, the global financial tsunami of 2008 brought about another major shock to demand but this was much shorter.

Figure 6 Residuals from Cointegrating Relation: Demand & Supply Sides (1990-2012)



On the supply side, as can be seen in Figure 6, the supply of private housing in general appears to fluctuate significantly during the study period. Such supply-

¹³ Termination of the TPS was announced by Housing Secretary Michael Suen among his “nine measures” to stabilize the market in late 2002. Ho and Wong (2006, 2008) present evidence that support their conclusion that the end of the TPS played a key role in the subsequent housing market rebound.

side fluctuations are mostly policy-driven, though admittedly, also partly due to movement in the housing price, land and building costs, and interest rate. In 1996, LnCOMP was obviously below its desired level significantly. This could be the outcome of the anti-speculation measures announced in June 1994. The property price had been falling for nearly 2 years following these measures. Since the building of new units requires several years for completion, the supply response would be very slow (inelastic) in the short run. Therefore, the supply gap emerged 2 years later following the introduction of anti-speculation measures and policy uncertainty. If our analysis is correct, this supply side shortfall has origins in demand management policy.

After the handover of sovereignty, the Hong Kong government under the first Chief Executive Tung Chee-hwa introduced an unprecedented housing production target of 85,000 units a year, and this policy led to substantial increases within a few years that were well above the long run level. This was clear for the 1999–2003 period (Figure 6). This supply side policy initiative added to the gloom following the Asian Financial Crisis and the fallout from the TPS policy.

In view of the continuing weakness of the housing market, the government essentially reversed its earlier policy of increasing supply and selling public housing cheaply. From then until 2013, the government began to control land supply through the *application list system* for land sales. Afterwards, the supply of private housing dropped below the long run equilibrium for many years. In retrospect, the Hong Kong government intervened three times in the housing market with significant supply side effects, i.e. in 1994, 1997 and 2002. The intervention each time, however, only resulted in housing excess or shortage for a few years afterwards, thus undermining the ability of the market to restore equilibrium.

In Figure 6, we plot the residuals from the two cointegrating relations. Interestingly these residuals appear to move in exactly opposite directions. Thus when the completion of private housing units was below its long-run equilibrium value, the housing price would be above its long-run equilibrium value and vice versa. This clearly indicates that supply deviations from the long term trend are a key driver of fluctuations in housing prices.

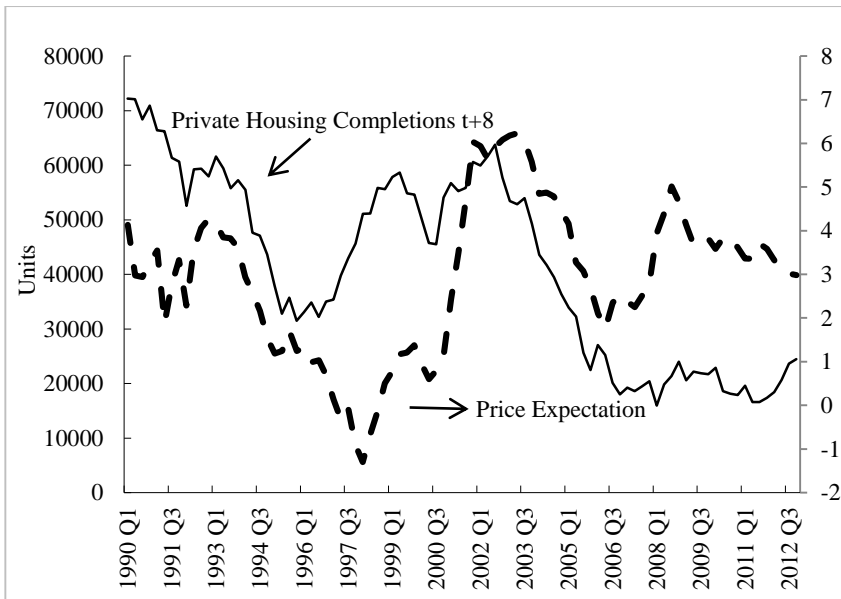
4.2.2 Price Expectation and Supply Dynamics

As mentioned above, government intervention often results in a supply surplus or shortage. Given that any plan to increase supply will not affect actual supply after at least three or four years, trying to adjust the supply to offset rapid demand fluctuations is clearly unrealistic. In Hong Kong, there is the widespread belief that with the supply of housing remaining at historically low levels in recent years, housing prices should continue to go up further in the foreseeable future. Instead of trying to adjust supply to meet fluctuating demand, a more pragmatic approach would be to set up an annual production target, with

reference to the 10 year average take up rate of housing units and household formation or other demographic data. In this section, we will investigate the relation between future private housing production (actual total completion for the coming two years) and price expectation.

Figure 7 plots private housing completion ($t+8$, future 2 years supply) against the price expectation which is proxied by the net yield variable. These two variables are found to move closely over time. The cointegration test is used to further investigate their relation in the long-run. The results are presented in Table 4. The number of co-integrating vectors r is determined by referring to the λ_{\max} and the trace statistics. As can be seen, both the λ_{\max} and the trace statistics show that there is one cointegrating vector between the two variables at the 5% level of significance.

Figure 7 Private Housing Completions ($t+8$, Future 2 Years Total) and Price Expectation (1990-2012)



The estimated cointegrating equation is reported in Table 5. The completion of private housing units for $t + 8$ (2 years) is positively related to *EXPVERSE* at time t . The coefficient is significant with the expected sign. That is, lower levels of completion of private units in the coming two years mean higher expectations for a price increase today, which would then translate into greater demand and therefore housing price. Hong Kong's experience tells us that government intervention in the market is often badly timed and a more stable policy would have been much better.

Table 4 Johansen Cointegrating Test Result (1990 to 2012)

Variables	Null Hypothesis	Alternative Hypothesis	Test Statistics
<i>EXPVERSE</i> and <i>LnFCOMP</i>	Trace tests:		Trace Value
	$r = 0$	$r > 0$	25.75**
	$r \leq 1$	$r > 1$	5.67
	λ max tests:		λ max Value
	$r = 0$	$r = 1$	20.08**
	$r = 1$	$r = 2$	5.67

- Notes:** 1. ** denotes 5 % significant level.
 2. Test assumption: Linear deterministic trend in data.
 3. r indicates number of cointegrating vectors.
 4. Lag interval = 1, determined by AIC criterion.

Table 5 Normalized Cointegrating Coefficients Using Johansen Procedure

Cointegrating equation: <i>EXPVERSE</i> = $f(\text{LnFCOMP})$	Coefficient	<i>t</i> -statistic
<i>EXPVERSE</i>	1	
<i>LnFCOMP</i>	-3.99	2.49**

- Notes:** 1. ** denotes significance at 5% level
 2. optimal lags are determined by AIC criterion.

5. Policy Implications and Concluding Remarks

The evidence presented in this study shows that attempts to stabilize prices by using supply or demand side measures actually aggravate the instability of the housing market in Hong Kong. The housing supply decline in 1996-97 was largely a market response and can be traced back to demand management policies in 1994. The 1999-2002 glut was a result of a supply side intervention policy initiated in 1997, while the shortage in 2003-2012 was due to a policy overreaction to the previous over supply. All of these policy initiatives have wholly neglected the disequilibrium dynamics of the private housing market in Hong Kong. By using a cointegration approach, this paper has identified two cointegrating relations, i.e., a long run demand side relation that involves property price, prime rate, income, price expectation, and private housing stock, and a supply side relation that involves private housing completion, property price, prime rate, and building and land costs. The residuals from the cointegrating relations, which capture the short run disequilibrium dynamics in the demand and supply of private housing during 1990 – 2012, are found to be the driving force for short term price fluctuations, and policy changes play a

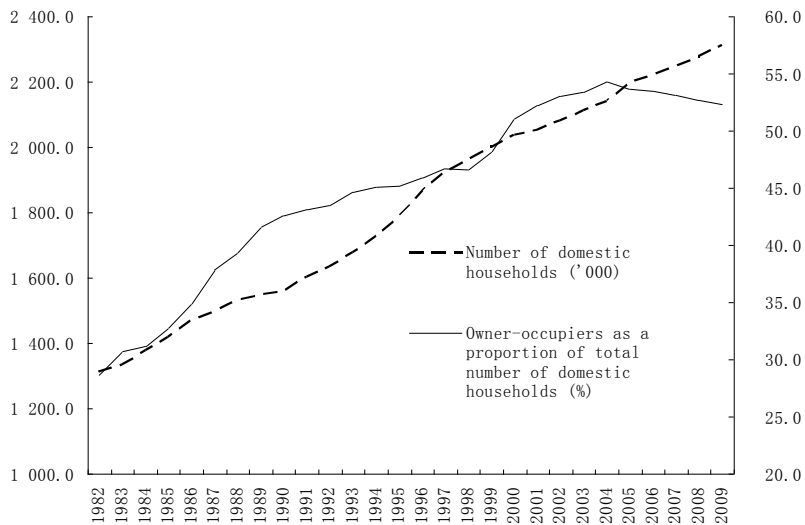
significant role in these fluctuations. Moreover, housing completion clearly plays a role in the formation of price expectations, which in turn, play a key role in housing demand. Hong Kong's experience suggests that supply instability is one of the main reasons for fluctuations in housing prices.

In addition to boosting supply and trying to hold long term supply closer to long term demand, the Leung administration has introduced demand side measures in the form of a special stamp duty and other new and targeted stamp duties to put a check on speculative demand, investment demand, and demand from foreign buyers, in the belief that demand management is more effective in the short term. Yet there is no evidence that these measures are working to slow down price increases.¹⁴ Still, the HKSAR government appears to have learnt from its past mistakes and has adopted a policy of stable housing supply in line with market fundamentals. The Long Term Housing Strategy Consultation Document (2013) states that “.... over-estimating the projected housing demand may lead to over production. A significant supply glut could have huge negative ramifications on the housing market as witnessed in the aftermath of the Asian financial crisis in 1997. Equally, an under-estimation of demand could lead to insufficient supply in the private residential market, which would result in rises in flat prices, making flats unaffordable to prospective home buyers”. Instead of setting a short term annual production target, the government has accepted a recommendation from the consultation committee to adopt a long term housing production target.

Just as Poole (2001) observed, it is very important that the central bank does not take a position on the level of prices in asset markets. “It is very easy to be wrong about the appropriate level; the judgment ought to be left to the market.” For a small open economy blessed with low tax rates, respect for the rule of law, excellent infrastructure and market institutions, a well-educated labor force, an efficient civil service, and laissez faire policy, housing and office prices are likely to be high because these favorable factors tend to attract capital. But this in itself is not a cause for concern. Market prices are a natural outcome of market forces and serve important functions. Thus, it will not be desirable to artificially boost housing prices by limiting supply or cool down the market by boosting supply. The supply should be set at levels that commensurate with the needs of the community as suggested by long term demographic trends and economic projections. The government can set up a production target based on past take-up rates over an extended period and household formation data (e.g. Figure 8). The price expectations of potential home buyers would be more accurate if future supply is known and stable.

¹⁴ Ho (2015) argues that the measures actually worsened the situation especially for entry-level homes. See: Housing policy urgently needs to be revamped, *China Daily*, March 3, 2015. http://www.chinadaily.com.cn/hkedition/2015-03/03/content_19698231.htm

Figure 8 Number of Domestic Households ('000) and Owner-Occupiers % 1982-2009



Notes: Owner occupied including private housing and subsidized sales flats.

Source: Quarterly Report on General Household Survey, Census and Statistics Department of HKSAR

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