Factors Associated with the Recovery of Housing Prices in Hong Kong

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ABSTRACT

In the period 1999 – 2004 housing prices in Hong Kong sunk to a low point in mid 2003 and then rose again. This paper investigates which factors are associated with those price movements.

The paper starts by reviewing literature on housing prices including both price determinants and research methodology. Data published by the Hong Kong Government is used for the study. The housing price variables are grouped together as macro economic factors, demographic factors, housing related factors and housing supply factors. The 2-Stage Least Square (2SLS) Method of regression analysis is used in order to reduce the bi-direction effects between dependent and independent variables. Results show that economic conditions are the most important external influencers of housing prices. The model developed can be used to predict the trend of housing prices.

Key words: housing prices, multiple regression models, 2-stage least square, Hong Kong

1.0 Introduction

In the 80s and early 90s, real estate property in Hong Kong was considered to be the most attractive, profitable investment, such that everyone wished to participate in the market. Housing prices rose steeply. However, after the Asian Financial Crisis in 1997 and the global economic downturn in the late 90's, the pattern changed and the property market is no longer "the Investor's Heaven". In the period 1999 to 2004, housing prices in Hong Kong dropped to a low point in mid 2003 and then rose through to 2004. This paper investigates the main factors that influenced those market changes. The paper is divided into three sections. The first section briefly reviews literature on housing price determinants and research methodology. Model development which includes source of data, development procedure, and the 2-Stage least square method are introduced in the second section. Results of the modeling and discussions are presented in the final section.

2.0 Literature on housing price determinants and research methods

2.1 Review of housing price determinants

Studying the factors which explain boom and bust in housing markets is an interesting research area (Tse et al., 1999) because the performance of the housing market has significant impacts on the social and economic conditions of the population. In addition to demand for accommodation and investment, speculative activities also influences demand for the property particularly when housing prices are expected to rise due to an imbalance between buyers and sellers. This can cause a self-fulfilling speculative price bubble (Levin & Wright, 1997). Housing has a number of special characteristics: durability, spatial fixity, heterogeneity, and the extensive involvement of governments in housing and related input markets (Arnott et al., 1996; Bayer et al., 2003; Cruz & Morais, 2000). Housing demand can be influenced by house prices, household incomes, and demographic features such as age, race, household size, and marital status (Megbolugbe & Cho, 1993). Maclennan and Pryce (1996) suggest that housing systems are significantly shaped by economic change. The effect of globalization of financial markets on real estate markets has been studied by Renaud

(1997), who suggests that a large number of countries experienced strong real estate booms that peaked around 1989 followed by severe asset price deflation during the period 1985 to 1994. Hong Kong was one of the regions in Asia which had this type of price pattern. In term of housing supply, Topel and Rosen (1988) suggest that housing investment decisions are determined by comparing current asset prices with the current marginal costs of production. DiPasquale (1999) argues that production of new units and the existing stocks owned by householders are the main determinants. Barlow (1993) argues that the planned use of land might cause the land supply to be insufficiently responsive to actual changing demand. On the other hand, Tse (1998) suggests that there is no causal relationship between land supply and housing prices and that land sales and land banking behaviors are likely to be determined by the current economic conditions.

2.2 Review of research methods for housing prices

The stock-flow model that is widely used in macroeconomic studies of the housing market was motivated by a concern with business cycles and forecasting. In the model, it is assumed there is a perfectly inelastic short-term supply of stock or services. Muellbauer and Murphy (1997) derived an equation for real house prices in the form of an inverted housing demand function. The theory of housing demand was examined in an inter-temporal context, taking into account expectations, credit constraints, lumpy transaction costs, and uncertainty. An error-correction estimation methodology was employed by Nellis and Longbottom (1981) to carry out an empirical analysis of the determination of housing prices. DiPasquale and Wheaton (1994) developed a structural model of the single family market, their forecast suggested that the nation's changing demographics will impact on the demand for housing. Mayer and Somerville (1997) derived the amount of new housing construction as a function of house price changes and lagged house price changes. Their approach was consistent with urban spatial theory but different from DiPasquale and Wheaton, who introduced lagged stock.

3.0 Development of a housing price model

The objective of this section is to develop a housing price model by studying the data during the period of 1999 to 2004 in Hong Kong. The purpose of the modeling is to identify the main factors that influenced housing price changes; and to investigate their causal relationships. The housing price model developed is based on the reduced-form equation 2SLS regression are employed for the study.

3.1 A reduced-form equation

The literature review suggests an extensive list of determinants that contribute to housing supply and demand, and therefore housing prices. One example is Reichert (1990), who used a reduced-form equation to derive a regional housing price model. He found that mortgage rates, population shifts, employment, and income trend each have an influence on housing prices. The housing price is derived from the supply and demand function under an equilibrium assumption (DiPasquale & Wheaton, 1994). The determinants of demand for housing can be summarized from the literature review as demographic factors, housing-related elements, and macroeconomic variables. Thus, the demand equation can be denoted as follows:

$$Q_d = f(G, H, D, t) \quad (t = 1, 2, 3, \dots n) \tag{1}$$

$$G = g(x_1, x_i, \dots x_m, t) \quad (i = 1, 2, 3, \dots m) \tag{2}$$

$$H = h(y_1, y_i, \dots y_m, t) \tag{3}$$

$$D = d(z_1, z_i, \dots z_m, t) \tag{4}$$

therefore, $\quad Q_d = f(x_i, y_i, z_i, t) \tag{5}$

where

Q_d = aggregated quantity demand for new housing during period t

G = macroeconomic variables

H = housing-related variables

D = demographic variables

x_i = macroeconomic variables such as GDP, interest rates, household income, unemployment rate, and the Hang Seng Index

y_i = housing-related variables such as unit transaction volume

z_i = demographic variables such as population, number of marriages, and birth rates.

The quantity-of-supply equation can be denoted as follows:

$$Q_s = f(S, t) \qquad\qquad (t = 1, 2, 3, \ldots n) \tag{6}$$

$$S = s(v_1, v_i, \ldots v_m, t) \quad (i = 1, 2, 3, \ldots m) \tag{7}$$

$$Q_s = f(v_i, t) \tag{8}$$

where

Q_s = aggregated quantity of new supply during period t

S = supply variables

v_i = variables such as housing price, construction cost, and land supply.

Under an assumption of supply-demand equilibrium within the given period, i.e., $Q_d = Q_s$, the functions (5) and (8) give a reduced-form price function:

$$P = f(Q_d, Q_s, t) \qquad (t = 1, 2, 3, \ldots n) \tag{9}$$

$$P = f(x_i, y_i, z_i, v_i, t) \qquad (i = 1, 2, 3, \ldots m) \tag{10}$$

where

P = the price of new housing units sold during period t as a dependent variable.

x_i, y_i, z_i, v_i are the independent variables.

Assuming a generalized functional form with a multiplicative relationship gives:

$$P_t = \beta_0 x_{it}^{\beta_1} \cdot y_{it}^{\beta_2} \cdot z_{it}^{\beta_3} \cdot v_{it}^{\beta_4} \tag{11}$$

The functional form in (Equation 11) can be converted into a linear equation suitable for estimation by standard multiple regression techniques expressed in logarithmic form. A one-period lagged autoregressive error term P_{t-1} is applied to the model. Thus, the multiple regression equation for housing price becomes:

$$\ln P_t = \beta_0 + \beta_1 \ln x_{it} + \beta_2 \ln y_{it} + \beta_3 \ln z_{it} + \beta_4 \ln v_{it} + \beta_5 \ln P_{t-1} + \varepsilon_t \tag{12}$$

where

$\beta_0 \ldots \beta_5$ represent the intercepts and the regression coefficients (or elasticities)

associated with the respective explanatory variables

ln = the natural log of continuous variables

e_t = a disturbance term for quarter t, where $e_t \sim$ WN $(0, s^2)$.

3.2 Ordinary Least Square (OLS) and 2-Stage Least Square (2SLS) Methods

The assumption for applying 2SLS is that the disturbance term of the dependent variable is correlated with the cause of the independent variables. The complex interrelationship between variables may make some of the predictor variables correlate with the errors, however, 2SLS regression uses instrumental variables that are uncorrelated with the error terms to compute the estimated value of the problematic predictors (the first stage of 2SLS), it then uses those computed values to estimate a linear regression model of the dependent variable (the second stage of 2SLS). Since the computed values are based on variables that are uncorrelated with the errors, the results of the 2-stages model are optimal. 2SLS is considered to be a satisfactory way to deal with the problem of predictor variables thought to be correlated with the error term.

The main difference between OLS and 2SLS could be distinguished from the figures below:
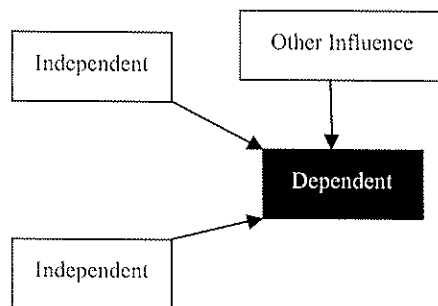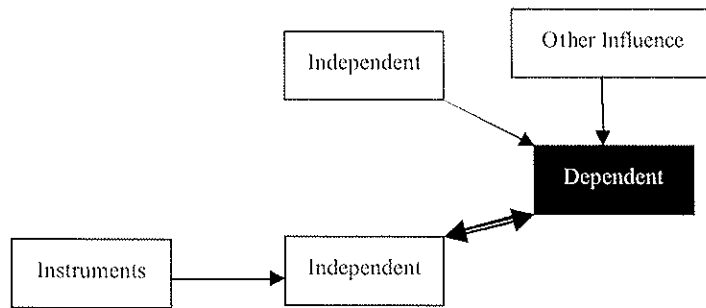

Figure 1: Path diagram for OLS

Figure 2: Path diagram for 2SLS

If there are feedback relationships from the dependent variable to the independent variable which produce correlations between the error terms and the independent variable, such relationships are not considered in the OLS regression and the model will be biased. In 2SLS, there are instrumental variables, or simply instruments, that are not influenced by other variables in the model but that do influence those variables. These instruments are employed to be the control variables for the endogenous variables (that is causally dependent on the other variables in the model). Norusis (1998) suggested that the instruments must fulfill the following criteria to take effect:

- highly correlated with the endogenous variables.
- not correlated with the error terms.

3.3 Source of data

Monthly data was collected from the Hong Kong Monthly Digest of Statistics published by the Census and Statistics Department of Hong Kong. Moving averages have been used to smooth out the seasonal effect. The data consists of macro economics, land supply, demographic and housing related factors

Housing Price

The Housing Price Index (1999=100) which is composed on a monthly basis by Rating and Valuation Department of Hong Kong was used (Peng & Wheaton, 1994; Fu, et al., 1993) to give an overall image of housing market prices. A downward trend

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could be observed before June 2003, which is considered as the rebound point of housing prices, after which the inclining trend revealed that housing prices are recovering (Figure 3).
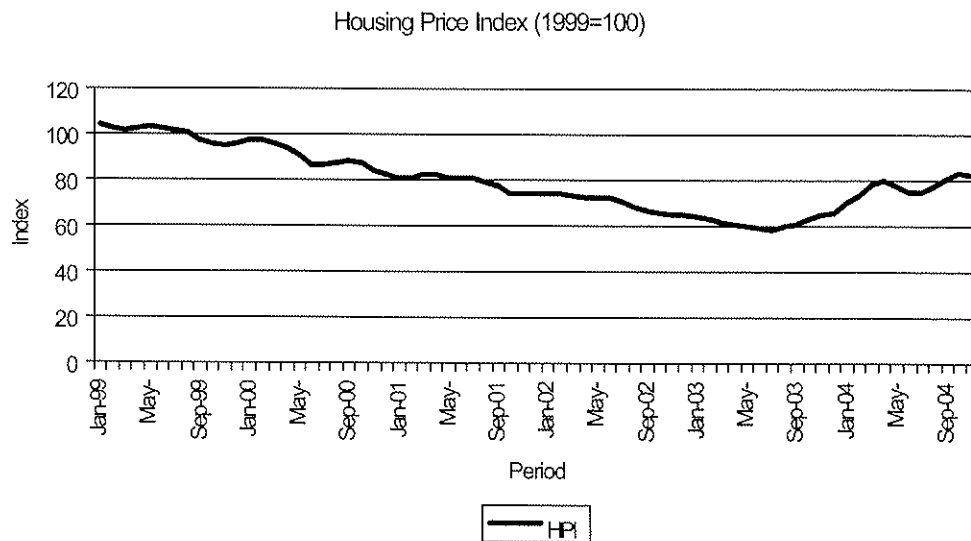
Housing Price Index (1999=100)

Figure 3: Housing price index (Source: Rating and Valuation Department in Hong Kong)

Economic factors

In examining the economic conditions, several indicators were used. Gross Domestic Product (GDP) is one of the most common indicators used by commentators in representing economic conditions (Maclennan & Pryce 1996). GDP is considered because it links macroeconomic activity to residential expenditure (Wheeler & Chowdhury, 1993). Stock market indices, such as the Hang Seng Index, consumer price indicies and interest rate are also widely used. The Hang Seng Index and Interest Rate reflect the financial status, whereas the Consumer Price Index indicates general inflation and consumer spending activity. Interest rates and mortgage rates work together to effect the cost of owning property. The interest rate in Hong Kong experienced a significant drop in the past few years and has stayed at a very low rate since 2002.

Speculation

Speculative activity was not factored into the analysis as statistics are not available.

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As the market was falling from 1999 to mid 2003 it is unlikely to have been an influence during that period. It is possible that speculative activity may have accelerated the recovery from mid 2003 onwards however it is unlikely to have been a principal factor in the market recovery.

Land Supply

The total number of residential units completed and number of consents to commence residential building works were employed to represent the land supply in Hong Kong in order to detect the effect of land supply on housing price, since such figures reflect the actual quantity of land supplied for residential purpose (Ho & Ganesan, 1998).

Demographic and Income Factors

Demographic factors employed in this study include the total number of population, total number of population of age group 30-60, total number of domestic households and median household income (Green & Hendershott, 1996; Horioka, 1988). Total number of population reflects growth, whilst the age grouped data examines the profile of the population which has the most purchasing power. In the long term view an increase in population will increase the demand for housing and hence the price. As this study is focused on short term, the factor is not expected to be significant in the model. The number of households could be another measure of the demand for housing.

The real income of households directly reflects their ability to spend. Median household income was collected from Census and Statistics Department.

3.4 Estimation Procedure and Empirical results

The model was built by analyzing the past relationships between housing prices and independent determinants. Figure 4 depicts the estimation procedures used for modeling. A reduced-form model was built using the collected data. Then ordinary least square regression and 2-stages least square methods were applied to generate the

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results. The 2-stages regression helps to reduce the correlation effects between the errors of dependent variable and independent variables, so that a more accurate result is obtained.
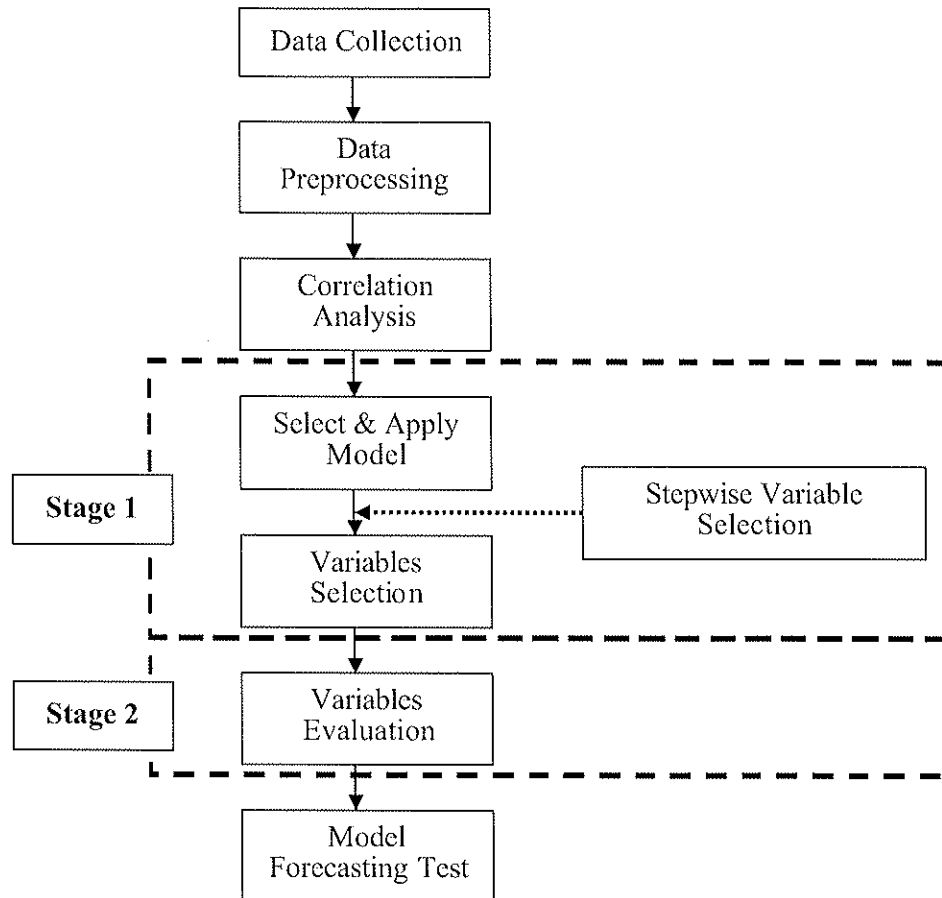

Figure 4: Summary of Estimation Procedures

The final model has been derived as follow (refer to Appendix):

$$LnHPI = -24.155 - 0.0559(LnIR) + 5.144(LnCPI) + 0.5283(LnHSI) \tag{13}$$

Where LnHPI = Residential housing price index, LnIR = Interest rate, LnCPI = Consumer price index, LnHSI = Hengsang index

In the model, the coefficients reflect the relationship between housing prices and the determinants. The model indicates that Interest Rates, Hang Seng Index and Consumer Price Index are the main factors contributing to housing price changes for

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the period. Both the Consumer Price Index and the Hang Seng Index have positive effects on housing prices and interest rates negative effects.

The higher the adjusted R^2, the better the model value. At the significance level 0.05, the adjusted R^2 of 86% shows that the total fluctuation in housing prices can be explained by differences in interest rates, the Hang Seng Index and the Consumer Price index in the studied period, after adjusting for the number of explanatory variables and sample size. Therefore, the model is considered to be a good fit to explain housing price fluctuations. A one percent decrease in interest rate is associated with 0.06 percent increase in housing prices. A one percent increase in the Consumer Price Index is associated with a 5.14 percent increase in housing prices and a one percent increase in the Hang Seng Index is associated with a 0.53 percent increase in housing prices during the studied period.

4.0 Discussion and Conclusion
The economic indicators rather than demographic and income factors are shown to be statistically significant in the model. The results demonstrate the significance of economic change to the housing system. Maclennan and Pryce (1996) also found the same result.

Interest rate changes have a small but statistically significant effect in the model. In Hong Kong, interest rates have been gradually decreased since year 2000 in order to stimulate the economy. The saving deposit rate was only 0.5% for deposits less than HK$100,000 in May 2004 (HKSAR). The model suggests that the adjustment of interest rates through monetary policy has only a limited short term effect on housing prices.

A significant link was found between the Hang Seng Index and residential property prices. This supports previous findings that in Hong Kong, the stock market leads the property market in price changes (Fu et al., 1993; Cheung et al., 1995). A similar

effect has been found in Singapore (Ong, 1994).

The strong positive correlation between the CPI and housing price movements is hard to explain. Particularly why housing prices should increase at a rate that is over five times faster than the CPI. Increases in CPI may not only indicate inflation driven by increases in production costs, but also demand pressure arising from increased consumers' confidence in the economic conditions and hence their willingness to spend rather than save. This same demand pressure arising from increased confidence may have a greater influence on the housing market than on consumer activity as a whole. However further research is necessary to clarify this. It does however suggest that it is difficult for governments to influence the housing market independently of the economy in general.

The results show that housing prices are not statistically significantly influenced by land supply factors for the studied period. This is different from the effects suggested by Neutze (1987) that land supply is a good variable for housing price determination. On the other hand, the result further consolidates Tse's (1998) argument that there is no causal relationship between land supply and housing prices. The results may indicate that in the study period land supply kept pace with the overall increase in demand.

Demographic factors have previously been demonstrated as important variables for housing price determination in the long term (Meen, 1998; Ho & Ganesan, 1998). However, demographic factors do not show statistical significance in this study. Tse, et al. (1999) showed that population change was one of the variables in their reduced-form model. However in this study its impact on housing prices is weak, i.e., a percentage change of population is associated with a 0.0012 percent increase in housing prices, using yearly data. This study is a short-term housing price model, the long-term variable may not be embodied in the short term model. Demographic variables play a subsidiary role in the short run as they change only gradually (in the study period the total population increased steadily from 6.5 to 6.8 million. It may

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also be an indication that supply kept pace with demand during the study period.

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Appendix

Notes

Dependent variable:	Residential housing price index (LnHPI)
Explanatory:	Interest rate (LnIR), Consumer price index (LnCPI) Hengsang index (LnHSI)
Instruments :	Population of age group 30-60 (LnPOP_A), Total population (LnTPOP), Total number of residential unit obtained consent to commence (LnRCC), Total number of residential unit completed (LnRNC), Total number of domestic household (lnNDH), Interest rate (LnIR), Consumer price index (LnCPI), Median household income (LnMHI), Gross Domestic Product (LnGDP)

Listwise Deletion of Missing Data

Multiple R	:	.93070
R Square	:	.86620
Adjusted R Square	:	.85972
Standard Error	:	.06757

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	3	1.8324776	.61082586
Residuals	62	.2830628	.00456553

F =   133.79080   Signif F = .0000

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
LnHSI	.528266	.070656	.583701	7.477	.0000
LnIR	-.055860	.008898	-.746375	-6.277	.0000
LnCPI	5.144495	.405195	1.309477	12.696	.0000
(Constant)	-24.155115	2.103723		-11.482	.0000