WHAT DRIVES PROPERTY PRICES IN HONG KONG?

Key Points :

- *This paper extends our earlier research by presenting an empirical model of the property price that combines the so-called fundamental variables with the concept of speculative bubbles. Our estimates suggest that about half of the swings in the property price since the early 1990s can be attributed to changes in the fundamental variables. The remainder was explained by the build-up of a bubble and its subsequent collapse.*

- *The "fair" value of property prices rose strongly in the early part of the 1990s, reflecting a combination of factors including booming economic activity, low real interest rates, strong increases in the number of households, and moderate growth in public housing supply. The fair value dropped in the wake of the Asian financial crisis, as economic activity contracted, real interest rates rose, and growth in the number of households slowed.*

- *Our results suggest that while interest rates played a role, they were only part of the demand-side factors that contributed to the property price swings. It is sometimes argued that a flexible exchange rate would have allowed the monetary authorities to tighten monetary conditions to prevent the building-up of the bubble. However, it is not at all clear whether this is feasible in practice, and there were many episodes of sharp property price swings in economies with an independent monetary policy.*

- *Property prices are estimated—at present—to be below their fair value. This implies that there are error-correction forces whereby fundamental demand and supply factors are providing support to property prices. Nevertheless, the model offers little guide for predicting property price movements, because the actual price could deviate from its fair value—by a significant magnitude and for a sustained period—in a downturn just as in an upturn.*

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I.   INTRODUCTION

The sharp decline in property prices in the past few years has contributed significantly to general price deflation and weak economic activity. It has also affected the fiscal balance through declines in land revenue and stamp duties from property sales transactions.[1] A recent paper by Gerlach and Peng (2002) examines in particular the relationship between bank lending, property price and output. The analysis suggests that the direction of influence was likely from property price to bank lending, and that proper prudential regulation and risk management by banks helped limit the banking sector's vulnerability to the sharp swings in property prices.

This paper extends the earlier empirical work by looking into the determination of residential property prices in Hong Kong. This issue is of interest for at least two reasons. First, it is often argued that the currency board arrangements has contributed importantly to the formation and subsequent burst of the bubble. Specifically, the very low (negative) real interest rate in the early part of the 1990s—due to a combination of relatively low nominal interest rate and high domestic inflation—was often viewed as a driving force behind the run-up in property prices. The high real interest rate in the wake of the Asian financial crisis also helped trigger the sharp set-back in the sector. This study examines the factors that may have influenced the property market and their relative importance. Second, it should shed light on the present situation in the property market. In particular, it is important to gauge whether the continued weakness reflect "fundamental" economic factors or weak investor sentiment towards the sector following the bursting of the bubble. The two sets of factors could have different implications for the outlook.

The rest of the paper is organised as follows. The next section reviews some stylised facts about the demand and supply-side factors of the property market, including government policies. Section III outlines an empirical model that combines a "fair" or "fundamental" value of the property price with the concept of speculative bubbles. Section IV presents empirical estimates and discuses their implications. The final section concludes.

II.   DEMAND AND SUPPLY FACTORS

Conceptually it is useful to think of the evolution of property prices as being determined by changes in the demand and supply-side factors, just as for prices of other goods and services. However, a number of special factors need to be kept in mind. First, housing goods have the dual function as both commodities—yielding a flow of consumer services—and also as an investment asset. For a homeowner, housing return is the sum of the value of rental services and investment return (capital gains or losses). The residential rental index was closely related to the property price index, notwithstanding a couple of significant divergences (Chart 1). Secondly, the supply of housing stock tends to adjust slowly to price movements, and shocks to demand are mostly borne by price changes in the short run. This is one of the factors that explain the observed high volatility in the property prices relative to prices of other goods and services. The situation is complicated further by the extensive involvement of the government in the sector. While

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[1] An earlier study reviews the impact of property price falls on other macroeconomic variables including consumption, investment, price, banking sector performance and the government fiscal position, see Peng, Cheung, Fan and Leung (2001).

the specifics of the government programs differ across economies, the level of involvement compared to other product markets is uniformly high.[2] Finally, the property market is susceptible to speculative bubbles due to potentially irrational behaviour by investors.[3] This section presents some stylised facts about these elements.

Demand-side factors

It is generally agreed that macroeconomic conditions—as reflected by income growth, unemployment rate, and interest rates, etc—have significant effects on property price movements. Strong income growth and low unemployment seem to have raised demand for residential properties and contributed to the booming property market in the second half of the 1980s and first part of the 1990s (Chart 2). The downturn in economic activity and the associated rise in unemployment have certainly impacted on the demand for housing service. Interest rates have also played a role (Chart 3). In particular, during the three episodes of sharp price declines in the past two decades, real interest rates were all at relatively high levels.

For a city economy with significant migration, demographic developments may also be an important factor on the demand side. Chart 4 shows that growth in the total number of households tended to have a lagged effect on property price changes.[4] A number of cycles in the growth of the number of households are worth noting. The number of households increased strongly in 1980-81, due to immigrants from the Mainland following its opening-up to the outside world. The growth slowed in the latter part of the 1980s—reflecting increased emigration—but returned to a higher level during much of the 1990s, as emigrants returned amid rising confidence in a smooth political transition. The growth rate slowed down sharply in 1997, as the cycle of returning emigrants ended, and rebounded in more recent years to a relatively low level by the standards of the 1990s.

Supply-side factors and government policy

As noted earlier, housing supply tends to adjust slowly to price shocks, as the number of new completions is very small relative to the total housing stock and is predetermined by the volume of construction in progress. In Hong Kong, government policies in the property sector have had important influence on the total supply of housing stock for two reasons. First, a limit of an annual total of 50 hectares was imposed on land sales from 1985, as provided under the Sino-British Joint Declaration. The limit was relaxed from 1994, and was lifted following the transfer of sovereignty on 1 July 1997. It is often argued that the restricted supply of land may have restrained the adjustment of private housing supply to increased demand, thereby reinforcing price increases in the booming period (Chart 5). Subsequently, the increased supply of land following the

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[2] Smith, Rosen and Fallis (1988) includes a comprehensive review of government involvement in the housing market in the industrial countries.

[3] Man Cho (1996) provides a survey of theoretical and empirical literature on efficient market hypothesis and models of speculative bubbles.

[4] There is a potential issue of endogeneity, as changes in property prices could also affect the formation of households. In Hong Kong, this concern probably is of less concern than in the US, for example, because of the difference in the way a household is defined. While the US definition measures households by structural units, the Hong Kong definition uses an economic unit (for example whether to share meals). Thus, a structural unit could accommodate more than one household in Hong Kong. The issue will be addressed in the empirical study by examining whether changes in the number of households have a lagged effect or some contemporaneous relationship with movements in property prices.

relaxation of the restriction appears to have resulted in an increase of housing units just when the market started a downturn.

Secondly, the government runs a large public housing programme, which provides accommodation for about half of Hong Kong's population. The main elements of the program are public rental units, and subsidised home ownership schemes, with the former accounting for about two-thirds of the total. It was designed to provide a minimum standard of housing for all residents. As conditions of public housing have improved over the years, it could have some substitution effect at the lower end of the private housing market. An increase in public housing supply could thus have a negative effect on property prices by affecting demand for private residential units. Chart 6 shows that growth in the supply of public housing units slowed in the 1990s. This, combined with the strong increase in the number of households in much of the 1990s, should have raised demand for private housing.

Speculative activity

Excess movements in property prices—relative to fundamental demand and supply-side influences—are sometimes attributed to speculative activity.[5] An asset bubble is generally said to exist if its price is influenced in an important way by pure demand for future capital gain. In Hong Kong, a long period of sustained price increases before the mid-1990s should have provided incentives for investors/speculators to buy properties on expectations that the price of housing will continue to rise. Several indicators support this argument. One is affordability, of which the simplest measure is the house price to income ratio. The ratio of the property price index to nominal GDP rose strongly in the early part of the 1990s, and reached a peak in 1997 (Chart 7). The scale of the subsequent drop was unprecedented, taking the ratio back to its level in 1990. The speculative demand around 1997 was also evidenced by the significant rise in the number of confirmer transactions (Chart 8).[6]

III. MODELLING METHOD

The above review of the stylized facts suggests that both macroeconomic conditions and other demand and supply-side factors have probably affected property price movements in Hong Kong. Nevertheless, it may not be sufficient to use these fundamental variables in modeling property price. Indeed, testing for co-integration using the Johansen method (Johansen, 1991, 1995) failed to find a long-run stable relationship between real property prices, and macroeconomic and other demand and supply variables. The empirical analysis thus follows the IMF study by modeling property prices as determined by some fundamental factors and a bubble builder and burster term. The model was originally developed by Abraham and Hendershott (1996) in their study of metropolitan housing markets in the US.

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[5] A number of studies test for speculative behaviour in property markets including an IMF study of the Hong Kong experience. The IMF working paper by Kalra, Mihaljek and Duenwald (2000) presents an empirical model of the Hong Kong property price that includes a speculative element. It also provides references to similar studies of other economies' experiences.

[6] If an uncompleted flat is re-sold to sub-purchasers before the legal completion of the original sale, all sub-vendors will sign in the capacity as "confirmors" in the Assignment. The legal interests in the flat will pass from the developer direct to the sub-purchaser at the end of the chain. Confirmors are therefore, buyers with a view to obtain short-term gains before completion of the sale of the property.

The starting point of the model is to express growth in the fundamental or fair real property price (Δp^*) as a linear function of a set of demand and supply variables such as change in the unemployment rate (Δu), real interest rate (r), and growth in the real rental index ($\Delta rent$), in the potential demand—i.e. the number of households adjusted for public housing stock—(Δh), and in the private housing stock (Δs):[7]

$$\Delta p^*_t = \alpha_0 + \alpha_1 \Delta u_t + \alpha_2 r_t + \alpha_3 \Delta rent_t + \alpha_4 \Delta h_t + \alpha_5 \Delta s_t + \ldots + \text{lagged variables} \qquad (1)$$

The actual growth in property price is this fundamental value plus an error term:

$$\Delta p_t = \Delta p^*_t + \theta_t \qquad (2)$$

The error term is specified as:

$$\theta_t = \lambda_0 + \lambda_1 \Delta p_{t-1} + \lambda_2 (p_{t-1} - p^*_{t-1}) + \phi_t \qquad (3)$$

where p^*_{t-1} and p_{t-1} are the fundamental and actual real prices, respectively, in the previous period, and ϕ_t is a random error. For $\lambda_1 > 0$, Δp_{t-1} acts to perpetuate growth, generating a price bubble. For $\lambda_2 < 0$, $(p_{t-1} - p^*_{t-1})$ captures the tendency of the bubble to eventually burst when the actual price level exceeds the fundamental level. Substituting equations (1) and (3) into (2) gives the following:

$$\Delta p_t = (\alpha_0 + \lambda_0) + \alpha_1 \Delta u_t + \alpha_2 r_t + \alpha_3 \Delta rent_t + \alpha_4 \Delta h_t + \alpha_5 \Delta s_t + \ldots + \lambda_1 \Delta p_{t-1} + \lambda_2 (p_{t-1} - p^*_{t-1}) + \phi_t \qquad (4)$$

The econometric difficulty in estimating equation (4) is that p^* itself depends upon on the estimates from the equation. Following the other studies mentioned earlier, the problem is solved by first estimating equation (4) without the λ_2 term. Based on the preliminary estimates, Δp^* is computed, and cumulated over time to obtain a first-pass time series on p^*. We then add $(p_{t-1} - p^*_{t-1})$ to equation (4) for re-estimation. The process is repeated until the coefficient estimates stabilize, implying that $(p_{t-1} - p^*_{t-1})$, p_{t-1}, the determinants of Δp^* are uncorrelated and that Δp^* and p^* estimates are consistent.

It should be noted that the above framework is a joint test of the existence of a bubble and model specification. Results that are thought to be bubbles could equally well be produced by misspecification of fundamentals. Nevertheless, to the extent that strong priors exist about the fundamental variables and the excess movement in the actual property price (such as the run-up in 1996-97 before the collapse), the concept of a bubble is a useful device for understanding observed market behaviour.

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[7] Throughout the paper, lower-case letters denote logarithms of the respective variables, except the unemployment rate and interest rate.

IV.   EMPIRICAL ESTIMATES AND IMPLICATIONS

Quarterly data for the period 1981-2002 were used in the estimation. The consumer price index used for deflating nominal variables was the composite CPI excluding the rental component. Thus, the real property price is a measure of property prices relative to prices of other goods and (non-housing) services.[8] The real mortgage rate is measured as the nominal rate minus annualized log-change in the CPI during the quarter. Seasonal adjustments were made to the variables with stable seasonal patterns such as real GDP, employment and the number of households. Unit root tests suggest that all log differences and change in the unemployment rate are stationary (Annex Table 1). The real interest rate is on the borderline with an ADF statistics being significant only at slightly above 10% level. Nevertheless, we used the level of the real interest rate in the empirical model, as it worked better than its changes. We employed a set of diagnostic tests to check whether this posed problems for the residuals of the empirical equation (see below).

In estimating equation (4), we started by regressing log-changes in real property prices against its own lags and a set of potential demand and supply variables and their lags. Using a general-to-specific approach, a parsimonious equation was derived (Table 1). A number of observations are worth noting. First, changes in the unemployment rate seem to perform better than real GDP as an indicator of macroeconomic conditions for the current purpose, probably because it affects consumer sentiment about future income growth more. Secondly, as expected, the real mortgage rate and growth in the rental index enter the equation significantly with expected signs.[9] Thirdly, demographic developments and public housing supply also play a role. Specifically, changes in the "potential" demand for private housing, as measured by the difference between the number of households and public housing units, have a positive (lagged) effect.

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[8]   The rental component of the CCPI lags market rents because of typical 1 to 2-year rental contracts. Thus, in terms of measuring economic effects of general price changes (rather than solely from consumers' cost of living perspective), the CCPI may be a distorted indicator in the period of significant changes in market rents.

[9]   Given a high correlation between changes in the property and rental prices, the estimate might be subject to a simultaneity bias. We followed Davidson and Mackinnon (1989, 1993) and employed a Hausman test to see whether this was indeed a concern. To this end, we first ran an auxiliary regression of Δrent against a set of instrumental variables that were likely correlated with Δrent but not the error term of the equation for Δp. In this case, the natural choice was to use the predetermined variables plus others such as real GDP growth. The residuals from the auxiliary regression were then included in the regression of the equation for Δp. The residuals were found to be insignificantly different from zero with a p-value of 0.74, suggesting that the OLS estimates were consistent.

Table 1. A Preliminary Model of Property Price Changes
(1981:3 - 2002:1)

$\Delta p_t = + 0.276*\Delta p_{t-1} + 0.038 - 0.032*\Delta u_t - 0.317*(0.5r_t + 0.5r_{t-1}) + 0.552*(0.5\Delta rent_t + 0.5\Delta rent_{t-1})$
(SE) (0.133)   (0.017) (0.013)   (0.157)   (0.285)
    $+ 0.964*\Delta h_{t-2} - 2.707*\Delta s_{t-2}$
     (0.533)   (1.300)

$R^2 = 0.46$; DW = 1.88

Diagnostic tests for the residuals:

AR 1-5 test   : F(5,71) = 1.05 [0.40]
ARCH 1-4 test : F(4,68) = 2.23 [0.08]
Normality test : $\chi^2(2)$ = 1.39 [0.50]
hetero test   : F(12,63) = 2.46 [0.01]
hetero-X test   : F(27,48) = 1.60 [0.08]
RESET test   : F(1,75) = 0.23 [0.63]

Sources: HKMA Research Department staff estimates.

Based on the estimates, Δp* was derived and cumulated to obtain a first-pass estimate of p* by assuming that real property prices were in equilibrium in the early 1990s. The latter assumption followed the IMF study and was based on the considerations that output was estimated at potential in the early 1990s and that real property prices were stable for a sustained period around that time. This first-pass estimate of p* was used to estimate the full version of equation (4), and the estimates were used to obtain a new estimate of p*. The process continued until the estimated coefficients stabilized and Δp* and p* were consistent.

The final estimates of equation (4) are presented in Table 2. A number of observations are highlighted.

- All the coefficients are of correct signs and significant, and the diagnostic tests suggest that the residuals are well behaved. The model performs reasonably well in explaining property price changes, close to half of the variation in the quarter-on-quarter growth in real property prices (Chart 9). Diagnostic tests for residuals and stability tests are all satisfactory. However, recursive estimates suggest some instability in the early part of the sample period (Annex Chart 1).[10]

- In terms of individual variables, the real interest rate accounted for about 7% of the total variation of real property prices in the sample period, and changes in the unemployment rate explained 6%, and those in the rental index about 5%. Thus, while the low real interest rates in the earlier part of the 1990s and the subsequent rise contributed to the swings in property prices, its overall effect was not disproportionately high, when compared with that of the general macroeconomic conditions as captured by changes in unemployment.

[10] It may be related to the selection of the base period in the early 1990s. Dummy variables were tried to capture the breaks, but not very successful.

- Δh explained about 6% of the variation, and Δs about 8%. This confirms the notion from the stylized facts that demographic changes and public housing program have influenced the demand for private residential properties. Also, changes in the supply of private units seemed to have a lagged effect on property price movements.

- While the IMF study used only general macroeconomic variables such as GDP growth, real interest rate and real effective exchange rate, our model suggests that a combination of macroeconomic and monetary conditions, and demographic developments, government policy and supply-side variables have contributed to changes in property prices.

Table 2. A Speculative Bubble Model of the Real Property Prices
(1981:3 - 2002:1)

Variable	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0.047	0.017	2.750	0.007	0.092
$0.5\Delta rent_t + 0.5\Delta rent_{t-1}$	0.573	0.281	2.040	0.045	0.053
$0.5r_t + 0.5r_{t-1}$	-0.384	0.158	-2.420	0.018	0.073
Δu_t	-0.028	0.013	-2.180	0.032	0.060
Δh_{t-2}	1.172	0.534	2.190	0.031	0.060
Δs_{t-2}	-3.241	1.306	-2.480	0.015	0.076
λ_1	0.324	0.133	2.440	0.017	0.074
λ_2	-0.060	0.031	-1.960	0.054	0.049

$R^2 = 0.48$; DW = 1.98

Diagnostic tests for the residuals:

AR 1-5 test	:	$F(5,70) = 0.78 [0.57]$
ARCH 1-4 test	:	$F(4,67) = 1.95 [0.11]$
Normality test	:	$\chi^2(2) = 2.07 [0.36]$
hetero test	:	$F(14,60) = 1.78 [0.06]$
hetero-X test	:	$F(35,39) = 1.10 [0.38]$
RESET test	:	$F(1,74) = 0.01 [0.91]$

Instability tests:

variance	0.172
joint	1.375
Constant	0.197
Δu_t	0.174
$0.5r_t + 0.5r_{t-1}$	0.185
$0.5\Delta rent_t + 0.5\Delta rent_{t-1}$	0.066
Δh_{t-2}	0.183
Δs_{t-2}	0.272
λ_1	0.046
λ_2	0.081

Sources: HKMA Research Department staff estimates.

The estimates suggest that property price movements were likely subject to speculative activities. The estimated bubble builder (0.32) and burster (0.06) were close to the estimates by the IMF study and within the ranges reported in Abraham and Hendershott for US cities. A fair or fundamental value of the real property price and the deviation of the actual price from that fair value were shown in Chart 10. The former

grew strongly in the earlier part of the 1990s, reflecting a combination of factors including booming economic activity, low real interest rate, strong increase in the number of households, and moderated growth in public housing supply. The fair value slid in the wake of the Asian financial crisis, as economic activity contracted, real interest rate rose, and growth in the number of households slowed sharply.

During the last upswing that peaked in mid-1997, property prices were estimated to be over 30% above levels suggested by the fundamental variables (Table 3). It is interesting to note that in the early 1990s, real property prices are estimated to have been above its fair value by a greater extent. While prices declined in 1992 and particularly in 1994-95, the magnitudes of the falls were much smaller than the collapse in the wake of the Asian financial crisis. The important difference seems to be that in the earlier period, the gap was narrowed through both declines in the actual price and strong increases in the fundamental value. In the recent episode, the fundamental value dropped along with the actual price in the crisis period.

Table 3. Explanation of the Real Property Price Swings

Cumulative change in logarithms	1990:1 - 1997:2	1997:3 - 2002:1
Actual real property price	0.85	-0.77
Fundamental value	0.51	-0.32
Disequilibrium at end-period	0.34	-0.11

Sources: HKMA Research Department staff estimates.

The estimates suggest that property prices are at present moderately below their fair values, as the former continued to decline and the latter appear to have stabilized in the past few years. This suggests that the fundamental developments such as declines in the interest rate are providing support to the property sector. However, caution is required in interpreting these estimates, particularly for assessing the near-term outlook of property prices. The actual prices could deviate from their fair values by a large magnitude in a downturn just as in an upturn. For example, in the downturn around the mid-1980s, the actual prices were estimated to be below trend by about 30%, although the sharp decline at that time was in part attributable to the political uncertainty prior to the Sino-British agreement on the transfer of sovereignty. This highlights an important caveat of the bubble model for modeling asset prices. That is, while it helps to model the large swings in property prices, it offers little in explaining the mechanism through which the build-up and subsequent burst of the bubble take place. Therefore, it does not help much with predicting future price movements.

V. CONCLUDING REMARKS

This paper presents an empirical model of property prices by combining fundamental variables with the concept of speculative bubbles. Our estimates suggest that a combination of factors including macroeconomic and monetary conditions, demographic developments, government housing policy and supply changes have influenced movements in property prices. In particular, strong growth in the number of households in

much of the 1990s (in part due to returnees from abroad), combined with slower growth in public housing supply should have raised demand for the private residential units.
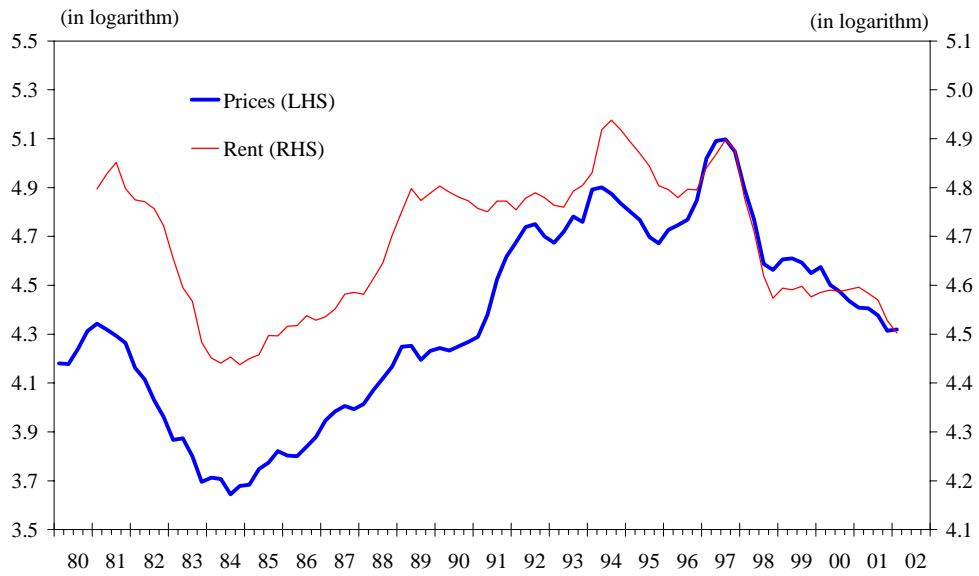
The loose monetary conditions in the earlier part of the 1990s—as reflected in the low and negative real interest rate—helped boost the demand for properties. The subsequent increase in the real interest rate has also contributed to the price decline. Nevertheless, our estimates suggest that changes in monetary conditions were probably not the single most important factor contributing to the property price swings, as argued by some commentators. Thus, there is not much evidence for blaming the currency board per se for the asset price bubble in the 1990s. It might be argued that with a flexible exchange rate system, the monetary authority might have been able to take pre-emptive actions to prevent the build-up of the bubble by tightening monetary conditions. However, it is doubtful whether this was feasible in practice. Indeed, there were many episodes of excessive property price swings in other economies with flexible exchange rates.

Our estimates indicate that the current levels of property prices are supported by improved fundamentals including relatively low interest rates, moderated growth in public housing supply, and increased rental yield. Nevertheless, it should be noted that these estimates offer little help in predicting property prices. For one thing, the actual price may undershoot in a downturn for a sustained period. Secondly, the economic growth outlook remains uncertain, notwithstanding some improvements due to the rebound in external trade. In particular, the unemployment rate is likely to remain high in the near term.
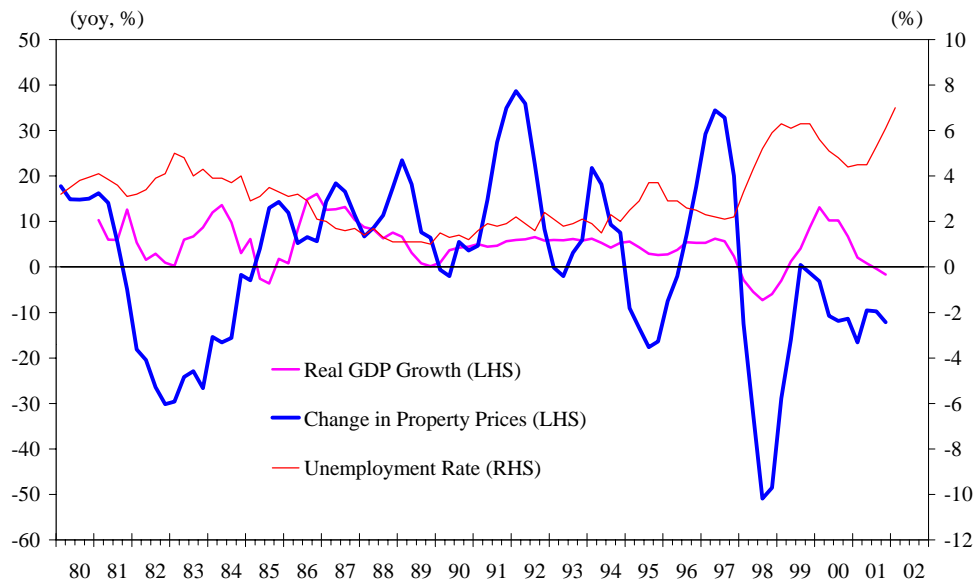
REFERENCES

Abraham, J M and P H Hendershott (1996): "Bubbles in metropolitan housing markets", *Journal of Housing Research*, *Volume 7, Issue 2.*

Cho, M (1996): "House price dynamics: A survey of theoretical and empirical issues", *Journal of Housing Research, Volume 7, Issue 2.*

Davidson, R and J G MacKinnon (1989): "Testing for consistency using artificial regressions", *Econometric Theory*, 5, pp 363-84.

Davidson, R and J G MacKinnon (1993): "Estimation and inference in econometrics", Oxford University Press.

Gerlach, S and WS Peng (2002): "Bank lending and property prices in Hong Kong", paper presented at the Bank of Finland/CEPR Annual Workshop on Asset Markets and Monetary Policy in Helsinki, 25 & 26 April 2002.

Johansen, S (1991): "Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models", *Econometrica*, 59, pp 1551-81.

Johansen, S (1995): "Likelihood-based inference in cointegrated vector autoregressive models", Oxford University Press.

Kalra, S, D Mihaljek and C Duenwald (2000): "Property prices and speculative bubbles: Evidence from Hong Kong SAR", *IMF Working Paper,* WP/00/2.

Peng, WS, L, Cheung, K Fan and C Leung (2001): "The property market and the macro-economy", *HKMA Research Memorandum 02/2001, March 2001.*

Smith, L B, K T, Rosen and G Fallis (1988): "Recent developments in economic models of housing markets", *Journal of Economic Literature, Volume 26,* pp 29-64, *March 1988.*

# Chart 1. Real Residential Property Prices and Rent

(in logarithm)　　　　　　　　　　　　　　　　　　　(in logarithm)

Prices (LHS)

Rent (RHS)

80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02

Chart 2. Real GDP Growth, Unemployment Rate and Change in Real Property Prices

(yoy, %)　　　　　　　　　　　　　　　　　　　　　　(%)

Real GDP Growth (LHS)

Change in Property Prices (LHS)

Unemployment Rate (RHS)

80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02

Chart 3. Real Mortgage Rate and Changes in Real Property Prices

Change in Real Property Prices (LHS)

Real Mortgage Rate (RHS)
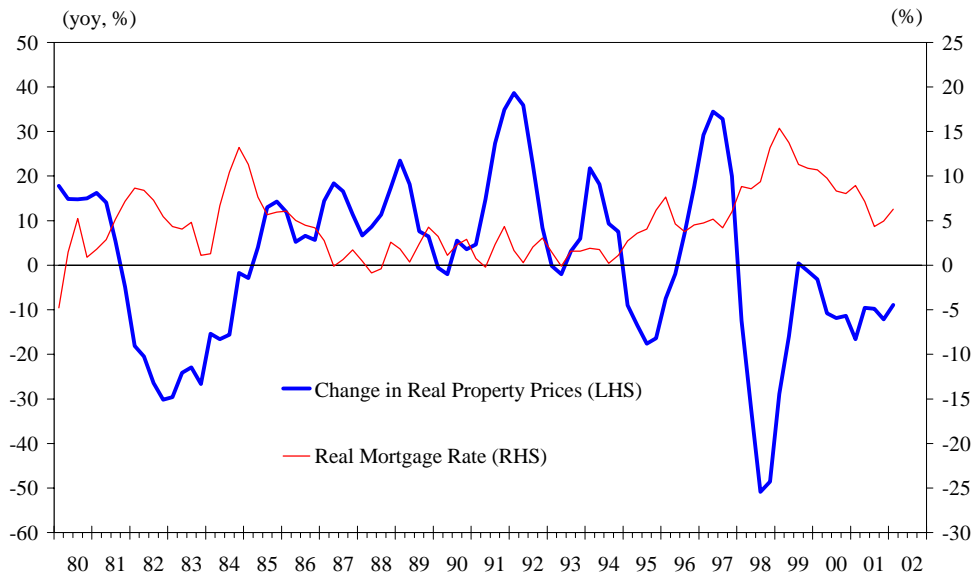
Chart 4. Demographic changes and Property Price Movements
(year-on-year)

Change in Real Property Prices (LHS)

Household Growth (RHS)
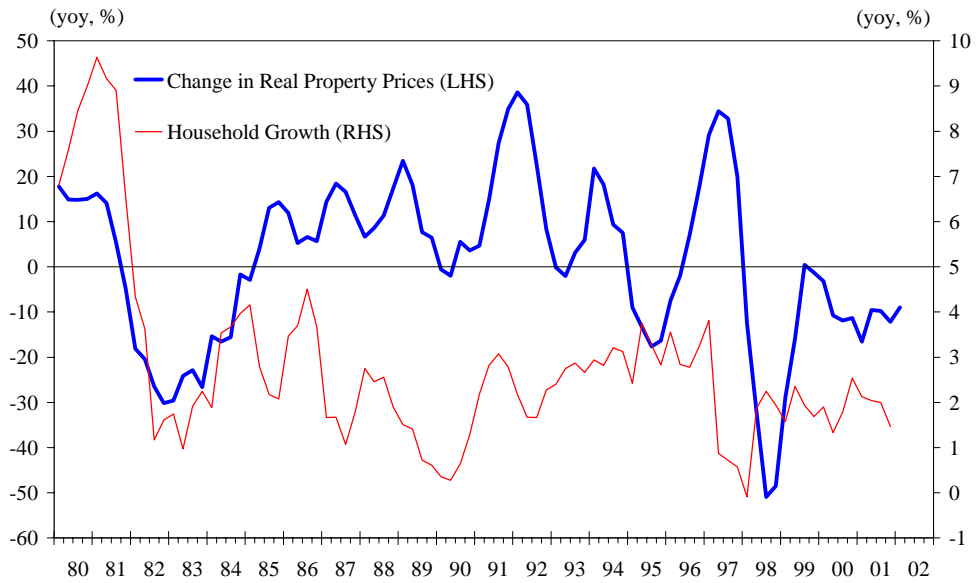
Chart 5. Land Sales and New Completion of Private Residential Units

(hectares)   (thousand units)

- Residential Land Disposal (Fiscal year) (LHS)
- Completion of Private Residential Units (RHS)
- Change in Stock of Private Residential Units (RHS)

85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01
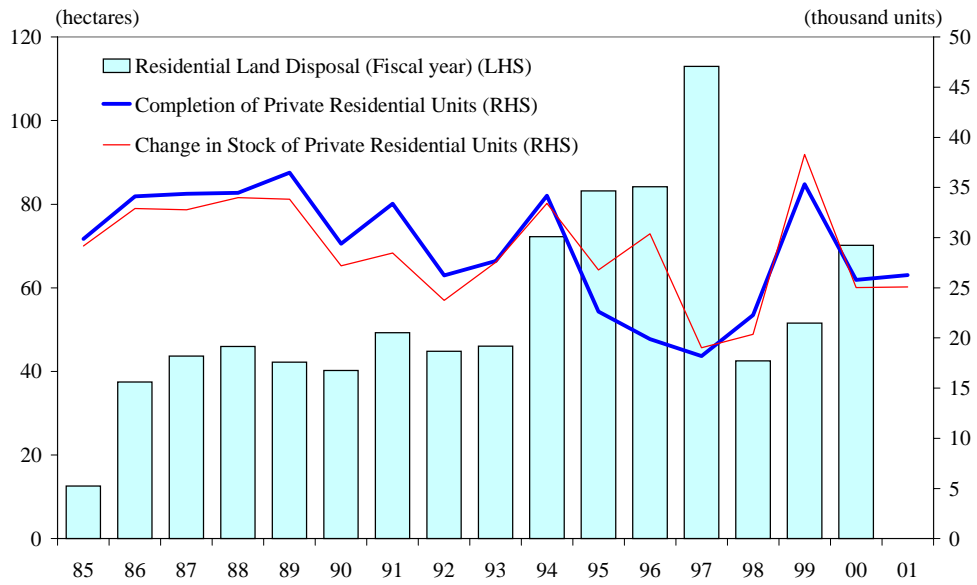
Chart 6. Public Housing Stock

(thousand)

- Stock of Public Rental Housing
- Stock of Subsidized Sale Flats
- Total Stock of Public Housing

76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01
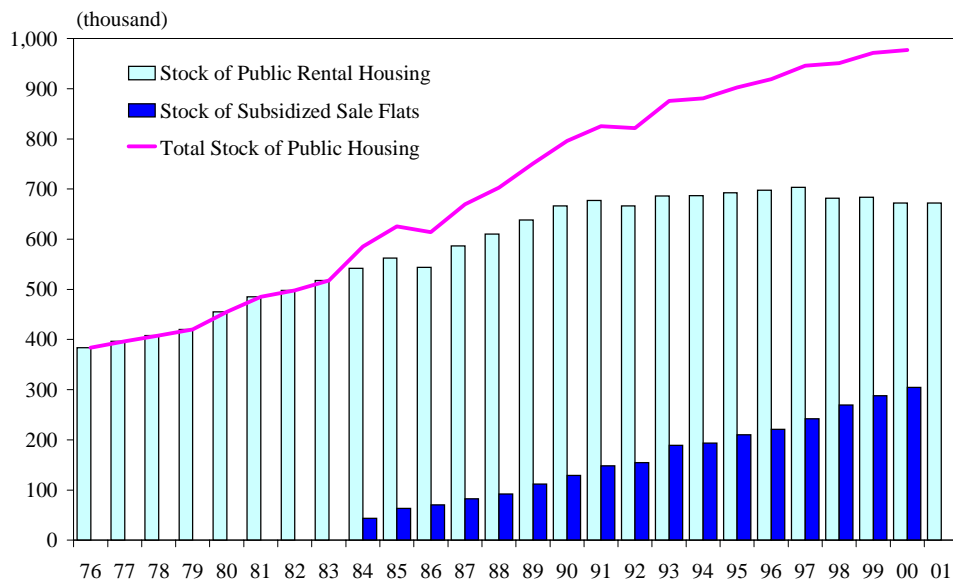
Chart 7. Ratio of Property Price to GDP (Nominal)

(ratio)

0.0007

0.0006

0.0005

0.0004

0.0003

0.0002

80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02
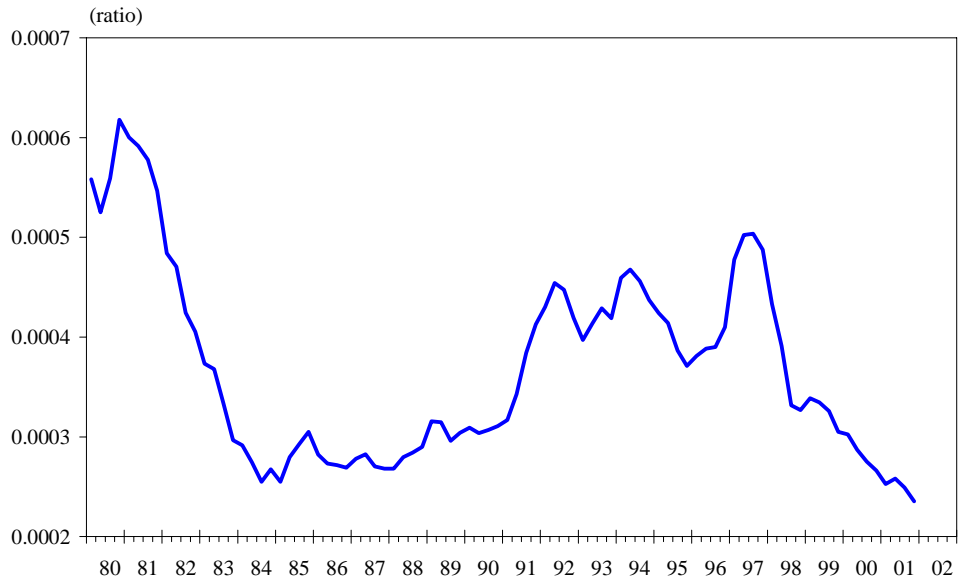
Chart 8. Number of Conformer Transactions

(units) (%)

2,000 — 12

1,800 — 10

1,600 — ☐ Number of Confirmor Registrations (RHS)

1,400 — — % of Total Secondary Registrations (LHS)

1,200 — 8

1,000 — 6

800 —

600 — 4

400 —

200 — 2

0 — 0

1996 1997 1998 1999
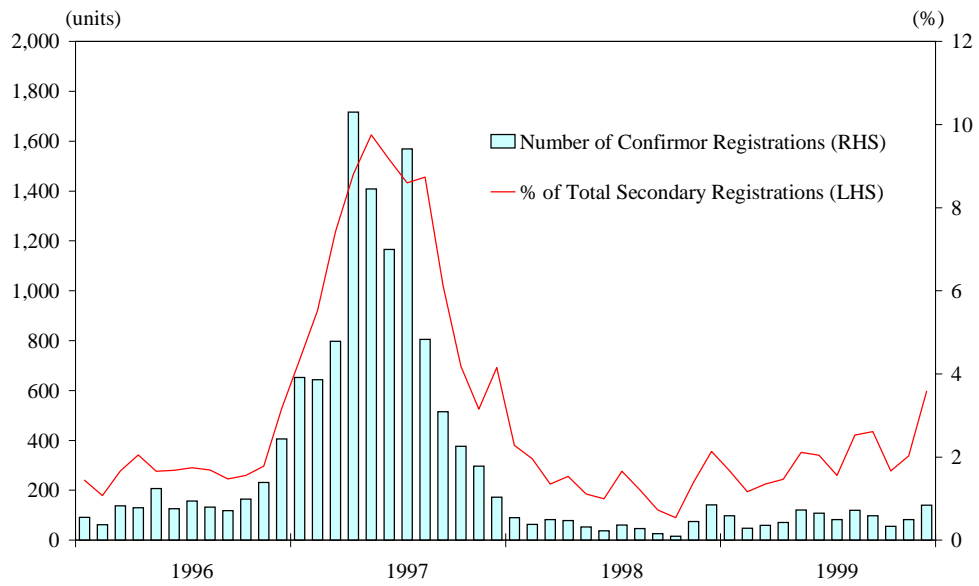
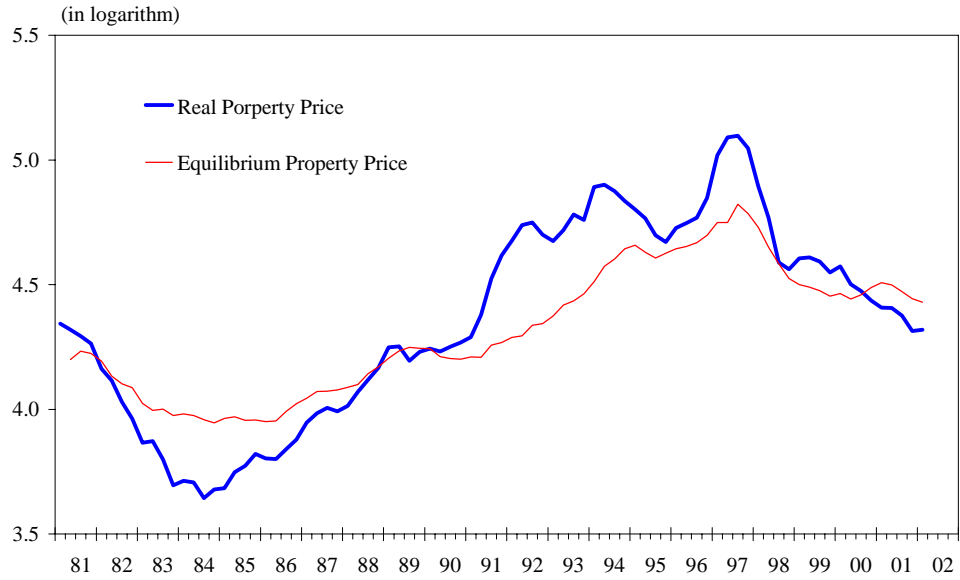# Chart 9. A "Speculative Bubbles" Model of
Hong Kong Property Prices

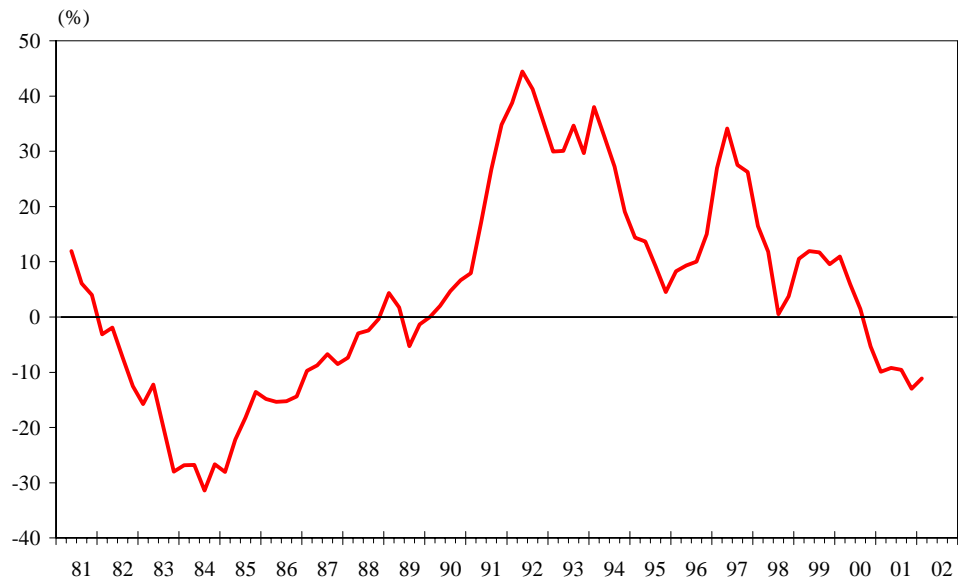## A. Fitted Values
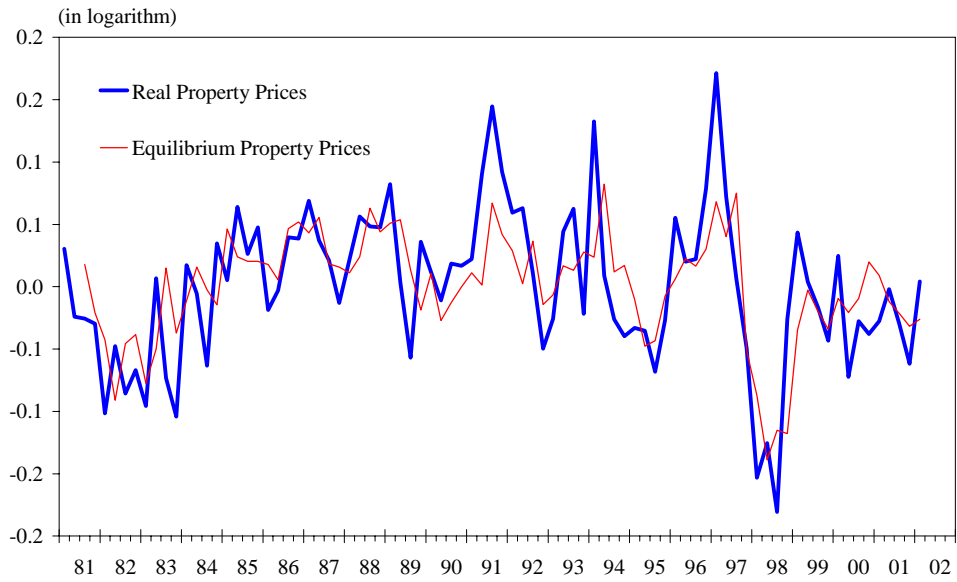
B. Residuals
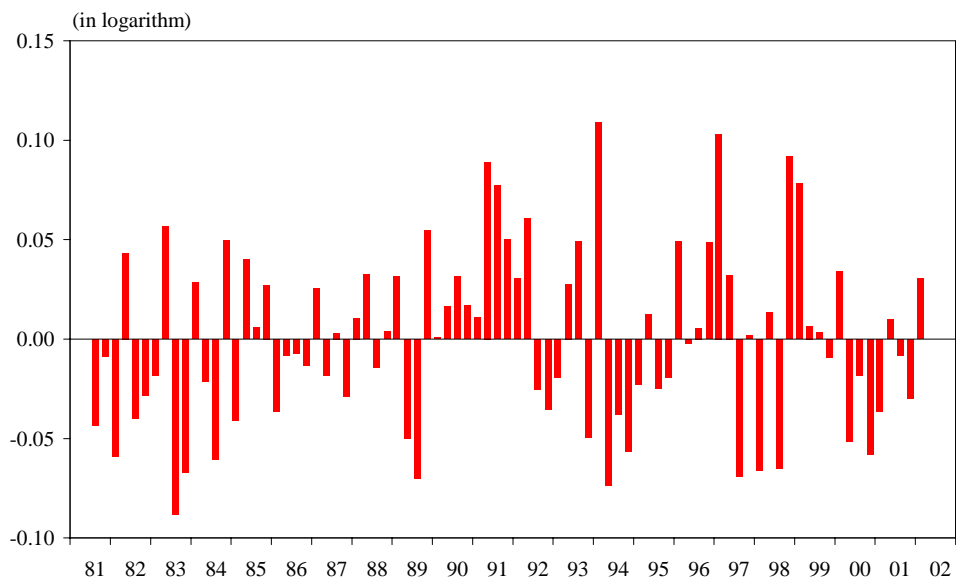
Chart 10. Estimated Fundamental Value and Property Price Disequilibrium

A. Estimated Fundamental Value

(in logarithm)

B. Property Price Disequilibrium

(%)

Annex — Chart 1.
Recursive Estimates of Equation (4) Coefficients