

Real estate indicators in Hong Kong SAR

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Abstract

This paper provides an overview of available real estate indicators in Hong Kong SAR that may be used for monitoring the vulnerabilities of the banking sector and the economy to fluctuations in property prices. These include mainly two types of statistics: property prices and banks' exposure to property-related lending. The paper also reviews the nexus between property prices, the macroeconomy and the banking sector in Hong Kong SAR, drawing on studies carried out at the research department of the Hong Kong Monetary Authority in recent years.

This paper was prepared for the BIS/IMF Conference on Real Estate Indicators and Financial Stability, 27-28 October 2003. The views expressed are solely the authors' and not necessarily those of the HKMA.

I. Introduction

International experience suggests that movements in real estate prices have important implications for macroeconomic and financial stability. In Hong Kong SAR,² the relationship between the property market and the wider economy is of particular significance for a number of reasons. First, the property market plays an important role in the Hong Kong economy. Housing is the most important form of savings for many households. In the banking sector, about half of domestic credit currently comprises mortgage loans for the purchase of private residential properties and loans for building and construction and property development. Changes in property prices and rents influence consumer price inflation, and affect Hong Kong's competitiveness as a service-based economy. Land sales and stamp duties on property transactions have also been a significant source of government revenue.

Secondly, property prices tend to be more volatile in Hong Kong than elsewhere, with a number of large swings in the past two decades. In particular, prices of various types of premises have dropped by around 60% since the collapse of the bubble triggered by the Asian financial crisis. This has resulted in significantly negative wealth and balance-sheet effects on private consumption and investment. Weak domestic demand explains why overall economic growth has been sluggish despite the strong performance of exports of goods and service in recent years. The falls in property prices have also contributed to consumer price deflation via a direct channel through declines in rentals and an indirect channel through weak demand.

Thirdly, under the Currency Board arrangements, interest rates in Hong Kong are largely determined by those in the United States and the risk premium that is required by investors for holding Hong Kong dollar (HKD) assets. Thus, monetary policy cannot be used to guard against movements in asset prices and, more generally, for macroeconomic stabilisation purposes. Regulatory policies are therefore of particular importance in maintaining financial stability. Indeed, while the difficult macroeconomic environment, including the collapse of property prices, has affected banks' profitability, the banking sector remains generally healthy. As is explained below, prudential measures by the regulatory authorities and risk controls by banks have helped limit the exposure of the banking sector to the property market, and hence its vulnerability to fluctuations in property prices.

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² Henceforth, referred to as Hong Kong.

This paper provides an overview of the various real estate indicators in Hong Kong that may be used in monitoring the vulnerabilities of the macroeconomy and in particular the banking sector to property price changes. Section II discusses two main types of real estate indicators: property prices and measures of the exposure of banks to the property sector. Section III reviews the nexus between property prices, the macroeconomy and the banking sector in Hong Kong, drawing mainly on analyses conducted by the Research Department of the HKMA in recent years. These studies help shed light on the usefulness of the various indicators for monitoring the impact of property price changes. The final section offers some concluding remarks.

II. Real estate indicators

Statistics about property prices and banks' exposures to property lending are useful indicators for monitoring the health of the banking sector. The *Encouraged Set of Financial Soundness Indicators* proposed by the IMF includes real estate prices, and the ratios of residential real estate loans and commercial real estate loans to total loans (IMF, 2003). These indicators can serve as early warning signals of emerging asset quality problems, as the impact of property price shocks generally occurs with a lag and the size of the impact depends on banks' exposure to the real estate market. This section reviews the available indicators in Hong Kong.

a. Property price indicators

Property market statistics in Hong Kong are mainly compiled by the Rating and Valuation Department (R&VD). The R&VD publishes a comprehensive set of price, rental, and transaction statistics for various types of private residential and non-residential premises in its *Property Market Statistics* on a monthly basis. There are two main types of price statistics: average prices and price indices. The compilation methods of these two types of statistics and their respective merits as an aggregate indicator of property price movements are discussed below.

Average prices

Average prices for various types of private properties (for residential, retail, office and factory uses) are expressed in terms of price per square metre of floor area. They are computed based on the actual transaction prices reviewed by the R&VD for stamp duty purposes. Transactions that involve a mix of property types and properties that have not yet been assessed for rateable values are excluded from the calculation. Residential properties sold subject to existing tenancies³, primary sales of residential properties,⁴ residential properties sold under government-subsidised schemes,⁵ and transactions involving government-owned quarters are also excluded.

Average prices are the most straightforward and simplest indicators of the central tendency of property prices of the entire population. However, this method suffers from sampling problems in that the sample of properties differs over time. In particular, average prices in a given month depend in part on the special characteristics, such as quality and location, of the premises sold during the period, which may not be representative of the overall stock. Therefore, changes in average prices between two periods may be due to change in these characteristics and may not represent the price change in the underlying population.

³ This refers to a transaction that involves a transfer of ownership of the property together with an existing rental contract of the property at the same time from the seller to the buyer. As such, the transaction price may be affected by the terms of the rental contract and may differ from that of other normal transactions.

⁴ Real estate developers usually provide a variety of payment terms for buyers to choose. The selling prices of these primary transactions may be affected by the differences in payment terms.

⁵ Include Private Sector Participation, Home Ownership, Buy or Rent Option, Mortgage Subsidy, Sandwich Class Housing, Urban Improvement, Flat-for-Sale and the Tenants Purchase Schemes.

Price indices

The price indices are designed to measure changes in prices with quality kept constant. They are derived based on the same set of transaction data for computing the average prices, but using a more sophisticated statistical procedure. The compilation of the indices involves the following steps. First, component indices for different classes of residential properties or different grades of non-residential estates are derived.⁶ The indices measure price changes by reference to the factor of sales price divided by the rateable value of a subject property rather than by reference to price per square metre as in the calculation of average prices. The rateable value of a property is an annual rental value assessed by the R&VD as the basis for charging rates.⁷ In assessing the rateable value of a property, reference is made to open market rents for similar properties in the locality, with adjustments to reflect differences in size, location, facilities, standards of finish, and management. Therefore, by utilising the rateable values in compiling the price indices, allowance is made not only for floor area but also other qualitative differences between properties. A technical note on how the rateable value can be used to adjust the transaction prices for quality differences is provided in the Appendix.

Secondly, a composite index (I) for a certain type of premises such as residential properties is calculated as a weighted average of the component indices, so that:

$$I = \sum I_i w_i$$

where I_i and W_i are the component index and weight for property class or grade i respectively. The weights for residential premises are based on the proportions of the numbers of transactions of the components in the current and previous 11 months, while those for non-residential premises are based on the proportions of the total floor area of the components in respect of the current and previous 11 months.⁸ The use of 12-month rolling transaction data for determining the weights helps smooth out the volatility due to short-term fluctuations.

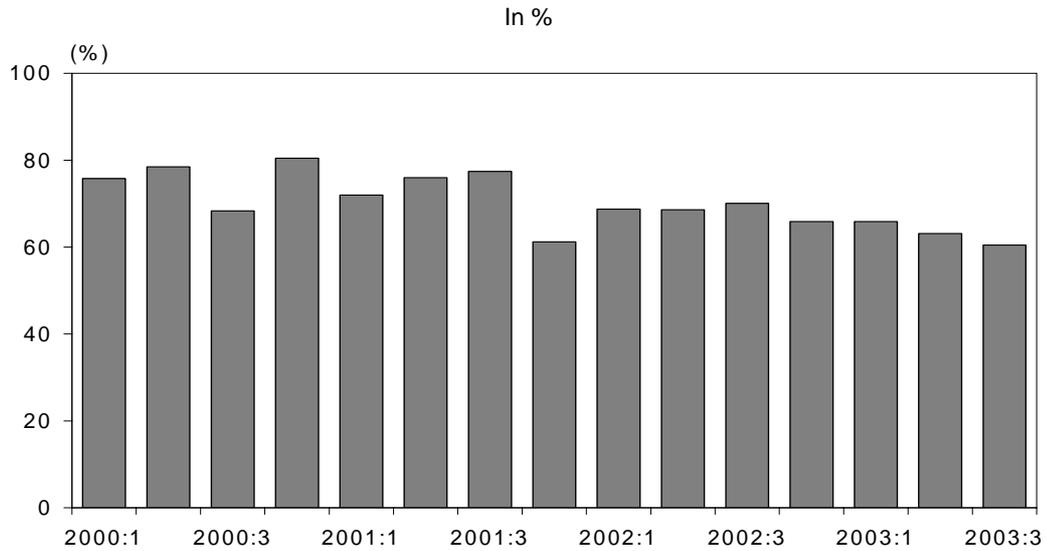
It should be noted that like average price statistics, the residential price indices do not include transactions of primary sales. However, transaction prices in the secondary market should be able to reflect the market trend owing to a relatively high liquidity in this segment. In recent years, the secondary market accounted for about two-thirds of the total transactions of residential premises (Chart 1). Nevertheless, the indices may be affected by outliers when the number of transactions in a particular class/grade of properties is small. In particular, the number of transactions of a certain grade of non-residential properties for a certain period may not be sufficient to represent the market prices in the whole grade. Finally, to what extent the price indices represent the underlying trends of the entire population depends importantly on whether the rateable values are able to capture all quality differences between properties.

⁶ Private residential properties are classified into classes A to E, with saleable area of less than 40 m², 40-69.9 m², 70-99.9 m², 100-159.9 m², and 160 m² or above, respectively. Private office premises are divided into grades A to C, with grade A offices having the best quality in terms of, for example, finishes, layout flexibility, size of floor plates, management services, and parking facilities.

⁷ Rates are one of indirect taxes levied on properties, which are charged at a percentage of the rateable value. The rateable values are reviewed annually so as to reflect up-to-date information.

⁸ In calculating the weights, numbers of transactions are used for residential properties rather than the total floor area as for non-residential properties. This is because the variety, in terms of floor area, of residential properties is relatively small compared with that of the non-residential properties.

Chart 1
Share of secondary market transactions in total transactions of residential properties



Source: R&VD.

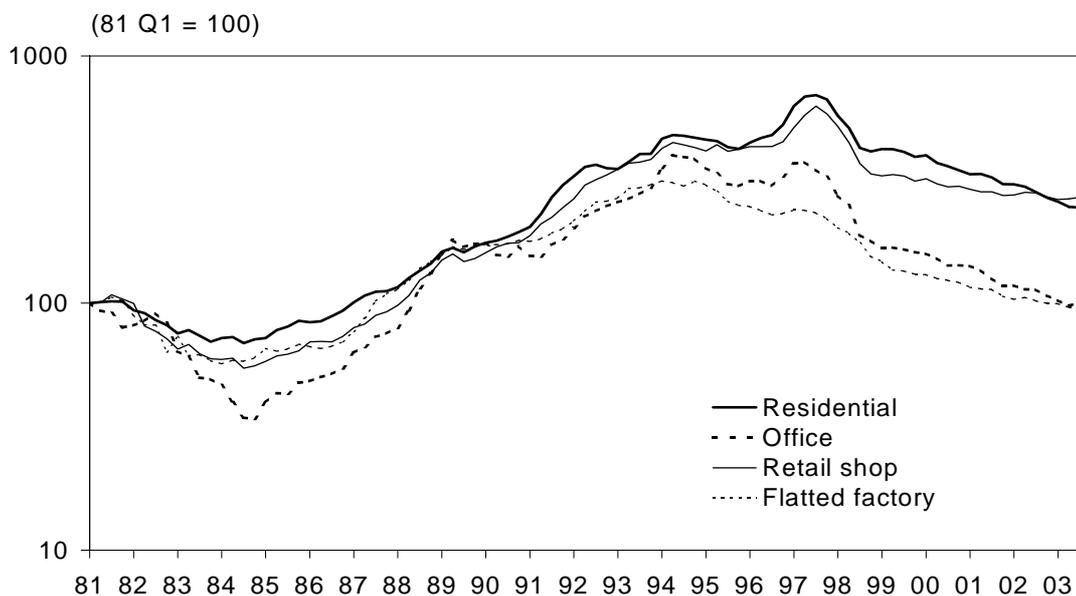
Recent developments in property prices

Chart 2 plots the price indicators discussed above over the past two decades. Panel A compares the levels of the price indices for various types of private properties including residential, office, retail shops and flatted factories. Panel B depicts the growth rates of these indices. Panel C compares the residential property price index with some average price indicators. A number of observations are worth noting.

Chart 2
Developments in property prices

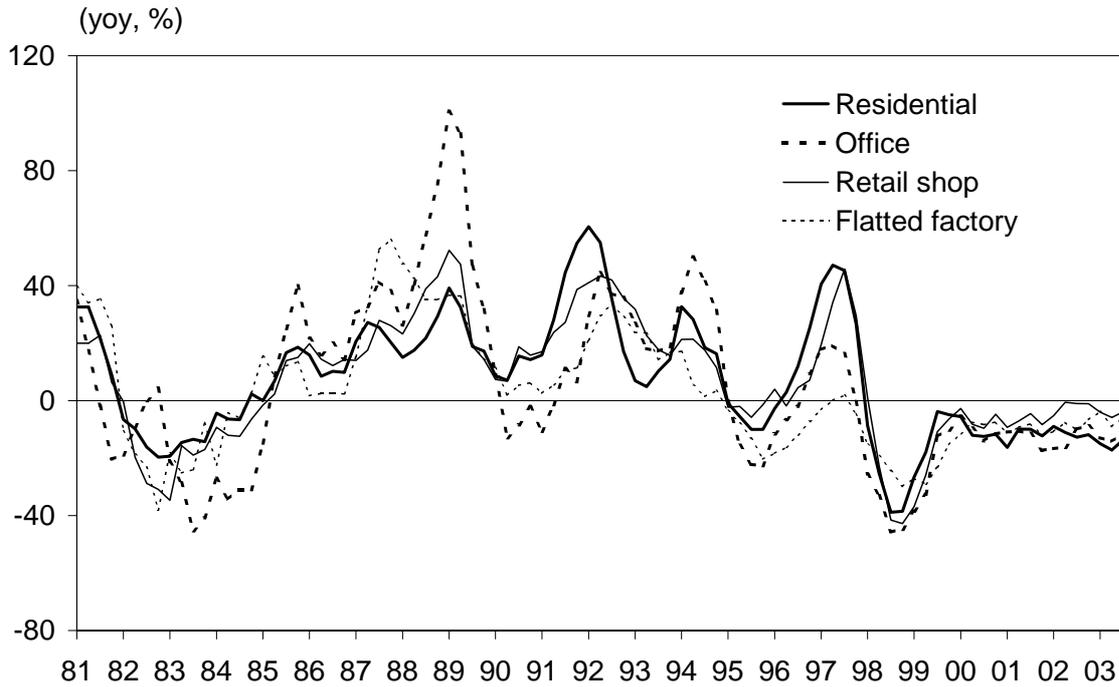
A. Property price indices

1981 Q1 = 100 (semi-logarithmic scale)



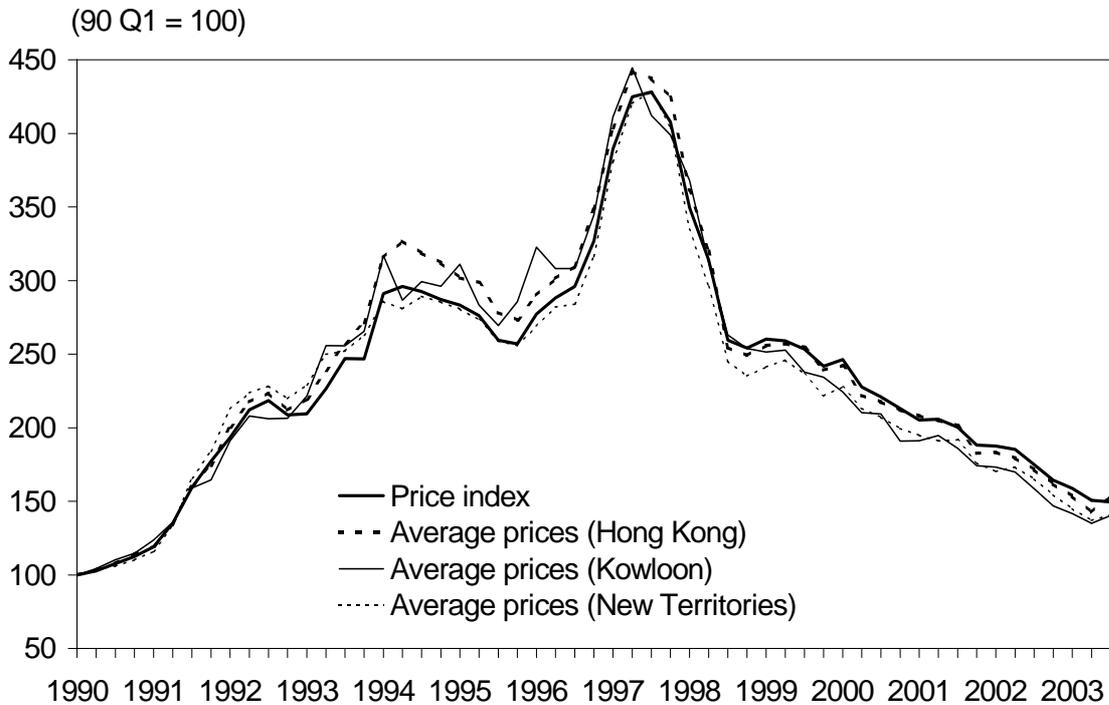
B. Growth in property price indices

Annual percentage changes



C. Price index and average prices for class B residential property

1990 Q1 = 100



Source: R&VD.

First, the price indices for all types of private (residential and non-residential) premises have declined sharply in recent years. The price indices for residential, retail and office properties were generally rising from the mid-1980s up to the onset of the Asian financial crisis in 1997, with a notable correction in 1994-95.⁹ Since the burst of the bubble in 1997, prices of retail shops, residential and office properties have dropped by more than 55%, 60% and 70% respectively.

Secondly, the price index for flatted factories reached a peak much earlier than the other price indices and started to fall from the early 1990s.¹⁰ This reflected a decline in demand for factories due to the relocation of Hong Kong's manufacturing sector to the Mainland of China.

Thirdly, because the levels of these indices are dominated by pronounced trend-wise increases, they obscure several episodes of sharp price fluctuations, as indicated by the growth rates of the indices. In particular, the residential price index has undergone recurrent fluctuations, reaching peaks of four-quarter growth rates of 25%-60% in 1991-92, 1994, and 1997 and troughs with declines of 10% in 1995, 39% in 1998, and 17% in 2003.

Finally, indicators of average prices have had broadly the same trends as the price indices. During Q1/1990-Q3/2003 the price index for the class B residential properties recorded an average year-on-year growth rate of 6%, compared with annual increases of 5%-6% in average prices for the same class in the three broad districts.

The large swings in property prices raise questions as to what drives property prices, and whether speculative activities lead to bubbles. There are indicators supporting the argument that a property bubble developed and burst in the 1990s.¹¹ One is the Affordability Index of Home Purchasers, which is compiled by the R&VD on a quarterly basis. The index measures the effect of changing prices, mortgage rates and household incomes on the ability of purchasers to afford a mortgage. It is derived by dividing a typical monthly mortgage repayment by the median household income.¹² A rise in the index represents deterioration in affordability. Having increased significantly during the boom period, the index declined sharply in the past five years (Chart 3). It has dropped by more than 70% since the second quarter of 1997, as the declines in property prices and mortgage rates outweighed the fall in median household income. The ratio of property prices to GDP shows a similar pattern, but with a smaller decline, as it does not reflect the effect of lower mortgage rates.

Another indicator is the so-called buy-rental gap, which compares the cost of purchasing and maintaining a flat to the cost of renting it. A simple measure of this is compiled by the Research Department of the HKMA, as the difference between an estimated effective funding cost and rental yield.¹³ The buy-rental gap widened considerably in the 1990s, reaching a peak in early 1998, reflecting mainly the rise in prices which drove down rental yields (Chart 4). Thus, it was increasingly more expensive to buy than to rent a property. The widening and persistence of the positive gap was probably supported by expectations of future capital gains. The gap fell in recent years due to the decline in interest rates as well as the increase in rental yield. The latter was owing to a sharper drop in prices than in rentals. The gap has declined to negative territory since the second quarter of 2001

⁹ The declines between mid-1994 and late 1995 were mainly due to the implementation of a package of anti-speculative measures by the government as well as increases in interest rates.

¹⁰ Flatted factories refer to premises designed for general manufacturing processes and normally intended for sale or letting by the developers. They exclude factory premises that are primarily purpose-built for specialised manufacturing processes and usually for occupation by a single operator.

¹¹ It is difficult to estimate the fair values of property prices. Peng (2002) presents two different empirical models of property prices that combine fundamental variables with the concept of speculative bubbles. Both approaches indicate a significant bubble component in property prices in the earlier part of the 1990s.

¹² The mortgage repayment is estimated assuming a 20-year mortgage on 70% of the purchase price for a 50m² flat. The purchase price is estimated by applying the average price for a class B residential unit. The median household income is deseasonalised.

¹³ Specifically, the buy-rental gap is calculated as:

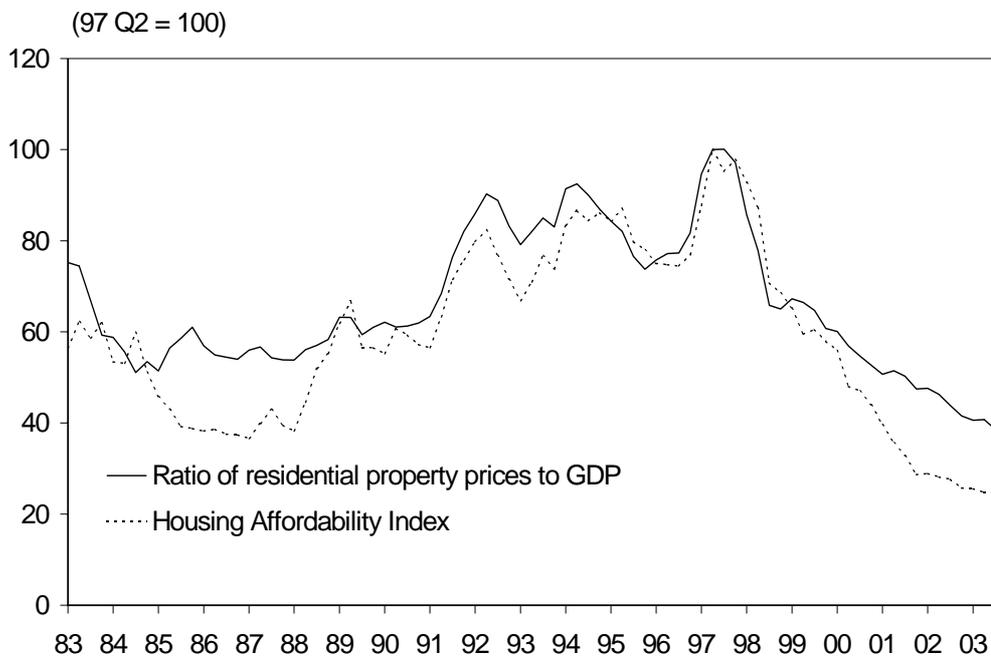
$$[((1 - \text{downpayment ratio}) \times \text{mortgage rate}) + (\text{downpayment ratio} \times \text{1-month time deposit rate})] - \text{rental yield}.$$

The terms in the square bracket represent the effective funding rate. To derive the latter, the downpayment ratio is taken as 30%, and the mortgage rate is a weighted average for new loans approved. The 1-month time deposit rate is used to represent opportunity cost of foregone interest earnings on downpayments. Rental yield refers to the average of yields on residential premises in classes A and B.

and stayed around -3.5% in recent quarters. The widened negative gap suggests incentives for households to purchase rather than rent flats, subject to expectations of future capital gains/losses.

Chart 3
Housing affordability

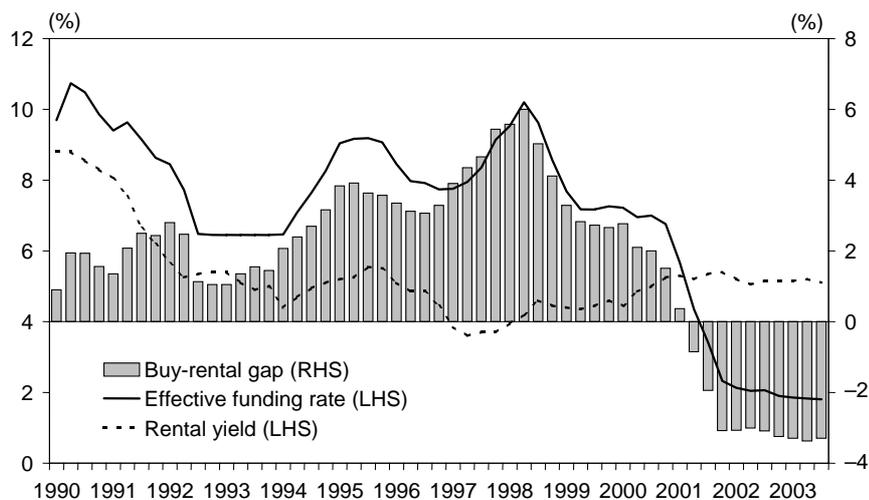
1997 Q2 = 100



Sources: R&VD; HKMA Research Department staff estimates.

Chart 4
Buy-rental gap

In per cent



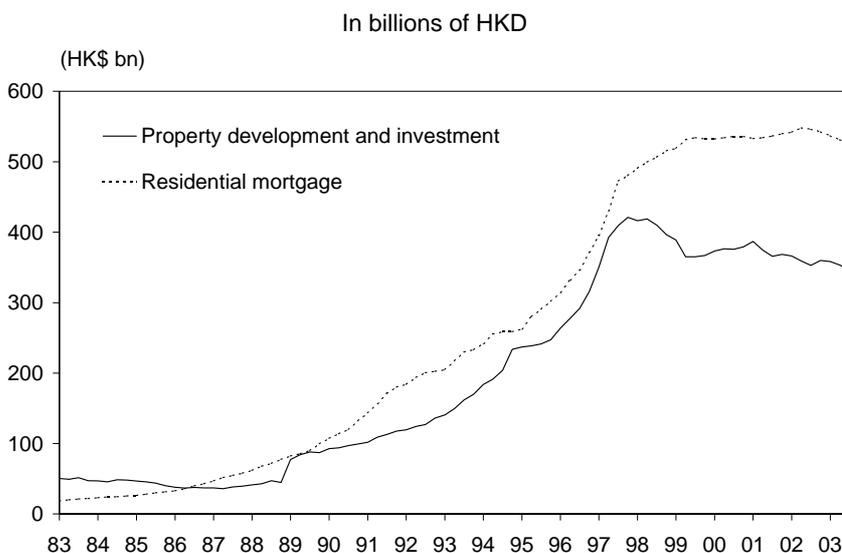
Source: HKMA Research Department staff estimates.

b. Indicators of property lending exposure

In Hong Kong, the banking sector's exposure to the property market is mainly related to residential mortgage lending and loans for construction, property development and investment. The HKMA collects statistical information about these loans through a regular statutory return. The statistics are published on a quarterly basis by the HKMA in its statistical bulletin.

Property-related loans have increased significantly over the past two decades. Both residential mortgage loans and loans for property development and investment grew rapidly between 1990 and 1997, by an average annual rate of 227%.¹⁴ Subsequently, residential mortgage loans increased at a much slower rate in 1998-2002, while loans for property development and investment dropped considerably (Chart 5).

Chart 5
Outstanding amount of property lending



Source: HKMA.

The share of property-related lending - including both residential mortgage loans and loans for property development and investment - in total loans for use in Hong Kong also increased over the past two decades from around 30% in the mid-1980s to over 50% in 2003 (Chart 6).¹⁵ The rise in recent years was mainly attributable to an increase in the share of residential mortgage lending by banks, while the share of loans for property development and investment was generally stable. It should be noted that the actual exposure is likely to be higher than is suggested by these statistics, which do not include other consumer and corporate loans extended against property collateral. Data on the latter are not available, but anecdotal evidence indicates that they are significant.

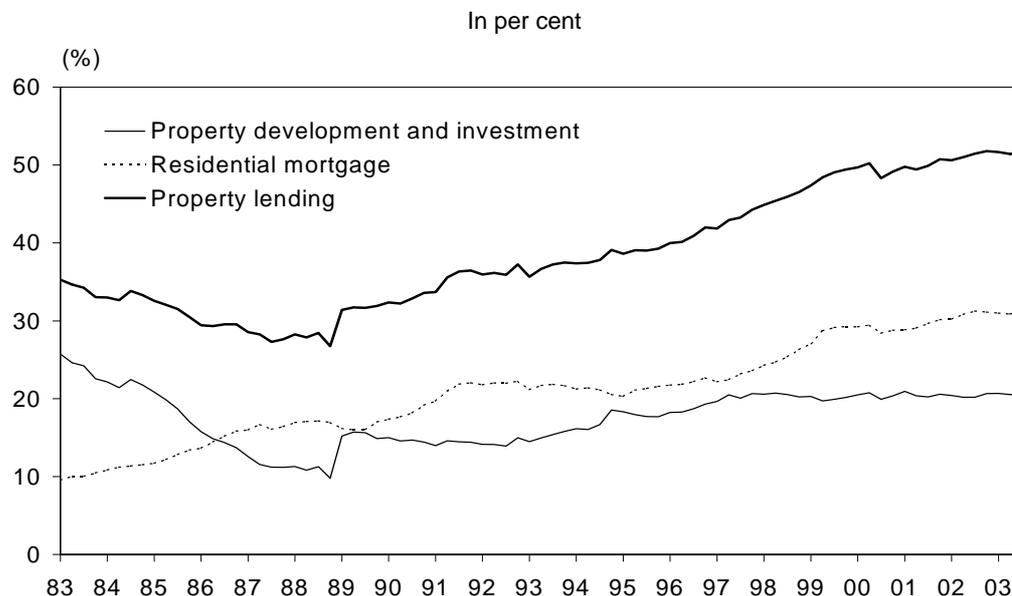
In order to contain the risks associated with excessive concentration or expansion of bank lending to the property market, a number of prudential measures have been adopted by the HKMA and the banking industry over the years. These include a guideline issued by the HKMA in 1994 to banks to maintain their ratio of property lending to loans for use in Hong Kong at about the industry average of 40%. The guideline was well observed in the aggregate during the boom period. It was withdrawn in 1998, as the property market was no longer overheated and banks were much more restrained in their

¹⁴ A reclassification of loans was implemented in 1989, which explained the sharp rise in loans for property development and investment in that year. Specifically, from 1989 loans are classified according to the usage rather than the main business of the borrower as in the past.

¹⁵ Loans for use in Hong Kong are those for financing economic activity in Hong Kong, but do not include those for financing import and export trades.

property lending. The increase in the ratio in recent years mainly reflected a contraction in lending to other sectors as a result of the economic slowdown.

Chart 6
Share of property lending in total loans for use in Hong Kong



Source: HKMA.

In view of the increasing importance of residential mortgage lending in banks' loan portfolios, the HKMA also started to conduct a monthly survey on residential mortgage loans from December 1992. This is in addition to the collection of data on outstanding amounts of residential mortgage loans through the statutory return on a quarterly basis. Following rounds of enhancement, the monthly survey now collects key indicators on banks' mortgage business including value and number of new loans approved during the month, amount of outstanding loans, asset quality of mortgage loans, and interest rate spread against the best lending rate of new loans. These more frequent and more detailed statistics are useful for monitoring and assessing banks' exposure to property market developments.

Reflecting the sharp decline in property prices in recent years, there has been an increase in the phenomenon of negative equity.¹⁶ The HKMA has conducted a survey to obtain information on banks' residential mortgage loans in negative equity since the third quarter of 2001. The information collected includes the number of mortgage loans in negative equity, their total outstanding value, the loan-to-value ratio breakdown, and the breakdown of interest rate spread against the best lending rate. The number of residential mortgage loans in negative equity rose substantially to over 20% of the total mortgage borrowers by the end of the second quarter of 2003, with the loan-to-value ratio averaging 127% (Chart 7). At the end of the next quarter, aggregate outstanding loans amounted to HK\$ 155 billion or 29% of total residential mortgage loans. The unsecured portion of these loans was estimated at about HK\$ 33 billion or around 6% of the total.¹⁷ Nevertheless, the three-month delinquency ratio of mortgage loans in negative equity declined to 2.2%, from 2.9% in the third quarter of 2002.

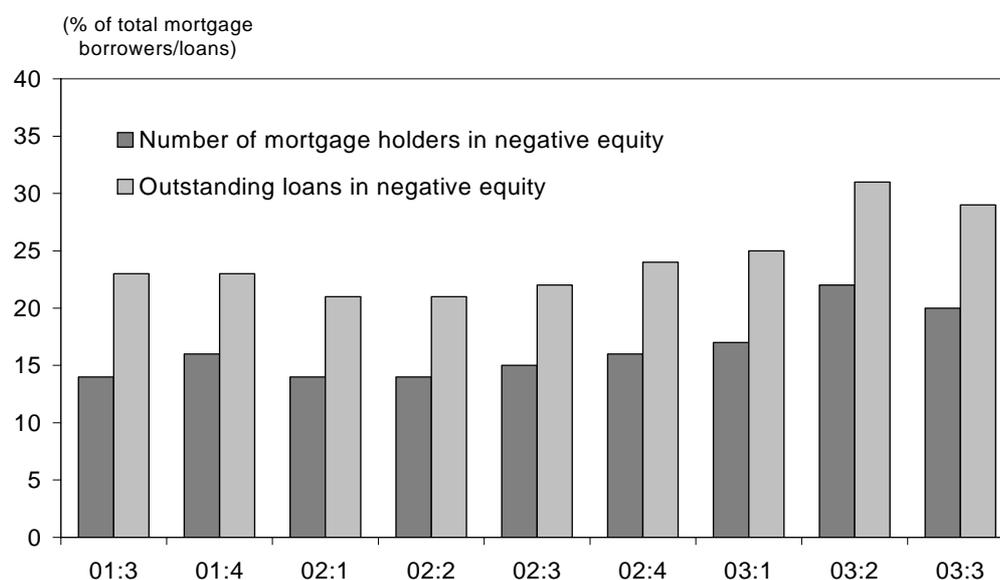
¹⁶ A loan is regarded as in negative equity if its outstanding loan amount exceeds the market value of the mortgaged property.

¹⁷ These figures relate only to the residential mortgage loans provided by authorised institutions on the basis of first mortgages, which do not reflect the situation of mortgage loans associated with government-funded co-financing schemes and private sector co-financing schemes.

Chart 7

Residential mortgage loans in negative equity

As a percentage of total mortgage borrowers/loans



Source: HKMA.

III. Property, the macroeconomy and banking performance

Fluctuations in property prices may affect the banking sector via its direct exposure to the property market and indirect effects due to the associated changes in overall economic conditions. The sharp declines in property prices in the past five years have contributed importantly to the weak economy and persistent deflation. Banks' profits have declined significantly from the pre-1997 levels, reflecting in part an increased provision for loan losses. Nevertheless, the banking sector as a whole remains healthy, with a relatively high capital ratio which averaged 15.6% at end-September 2003. This section provides a brief summary of the effects of property price declines on the economy and particularly the banking sector, based on a number of studies by HKMA Research Department staff in the past few years.

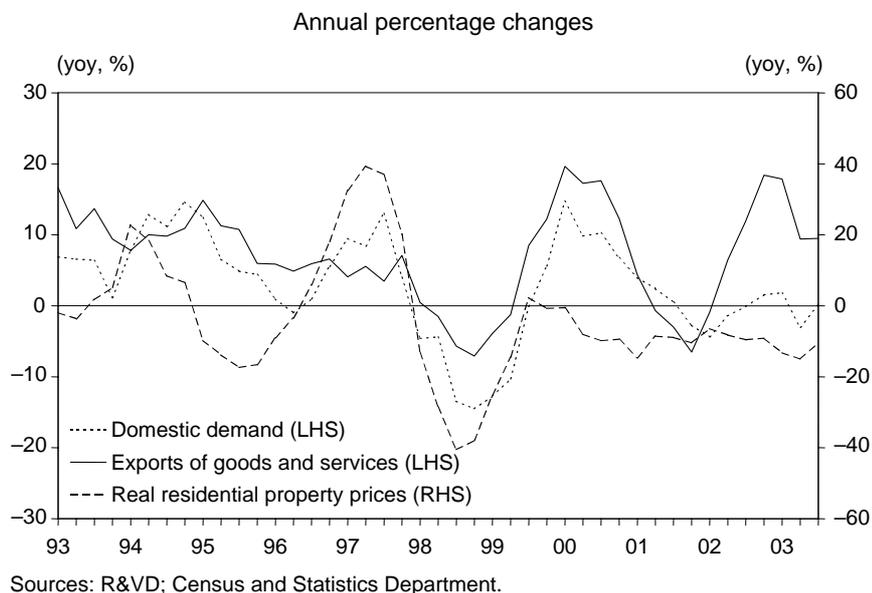
a. Property prices and the macroeconomy

The economy is affected by fluctuations in property prices through a variety of channels. Changes in property prices can influence private consumption and investment through wealth and balance-sheet effects. The phenomenon of negative equity may have reinforced the wealth or balance-sheet effects on consumption, as households with negative equity are more likely to have responded to price declines by increasing savings to strengthen their balance sheets. Property price fluctuations also affect consumer price inflation via a direct channel through declines in rentals and an indirect channel through weak aggregate demand.

Peng et al (2001) review the various linkages between the property market and the macroeconomy in Hong Kong. In particular, the study uses a multi-equation structural model to assess the impact of property price declines on economic growth. The results suggest that declines in property prices have reduced growth by affecting private investment and, to a lesser extent, consumption spending. This has been an important reason for the weakness in domestic demand notwithstanding strong increases in the exports of goods and services in recent years (Chart 8). However, any estimate of the effects should be interpreted with caution for a number of reasons. First, there are interactions between the property sector and the rest of the economy. In particular, while weak property prices may depress growth, weakening in economic activity reduces the demand for property and therefore prices.

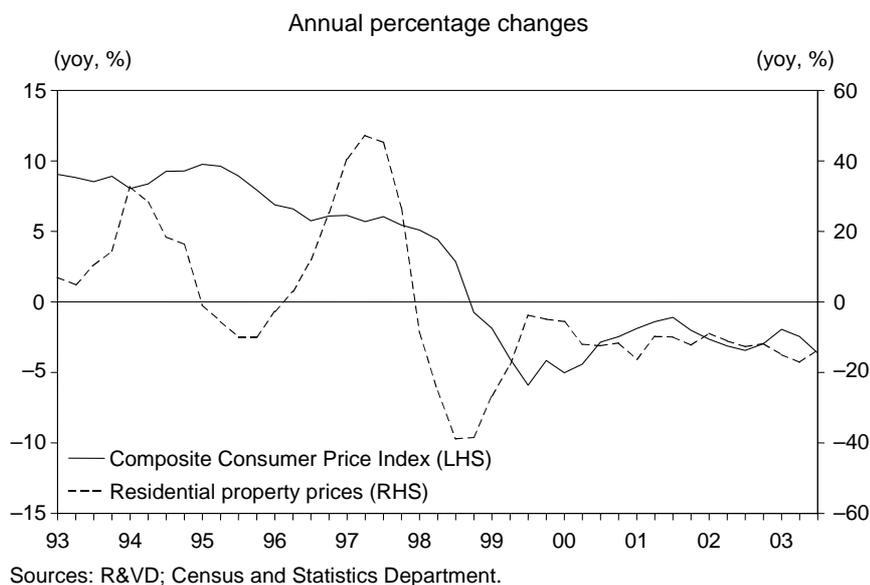
Secondly, property prices and other parts of the domestic economy are subject to common shocks such as changes in external demand, a factor particularly important for Hong Kong.

Chart 8
Property prices and the macroeconomy



On an accounting basis, declines in property rentals have contributed about half of the total decline in the consumer price index (CPI) since 1998. Considering the interaction between the property market and the rest of the economy, the exact size of the contribution may be above or below this number. However, it is fair to say that property price falls have played an important role in consumer price deflation in Hong Kong (Chart 9). Ha et al (2002) estimate a model of inflation for Hong Kong, and find that domestic prices are influenced by property prices, reflecting the lagged effect of rentals which are stickier due to lease contracts, as well as weak aggregate demand.

Chart 9
Property prices and consumer prices



b. Property prices and bank lending

The widespread practice of using property as collateral for consumer and business loans in Hong Kong points to the importance of balance-sheet and credit effects. There can be significant feedback and magnification effects through the function of the financial intermediaries. In boom periods with rising asset prices, as the net worth of households and corporations increases, so do banks' balance sheet positions and lending capacity, which may foster a credit boom and which reinforces the rise in asset prices and magnifies the effects on private spending. Conversely, under generalised asset price deflation, the negative effects on households' and banks' balance sheets can become self-reinforcing, creating a credit crunch and worsening the contractionary effects triggered by the original drop in asset prices.

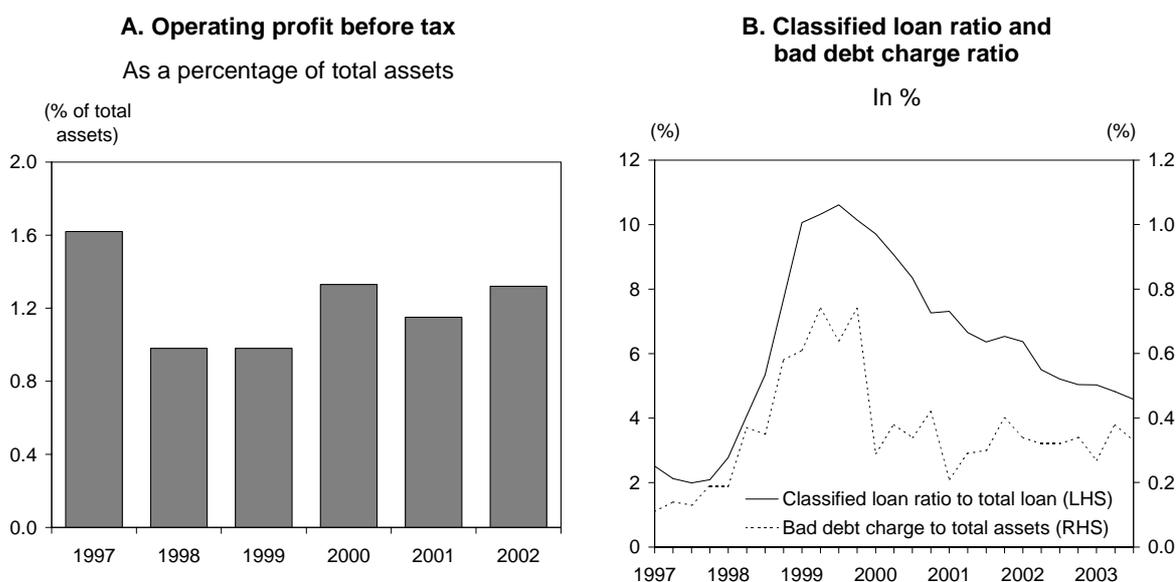
Gerlach and Peng (2002) study the nexus between output, property price and bank lending in Hong Kong. They find that bank lending appears to be mainly demand-driven and that the direction of influence goes from property price to bank credit. This implies that financial intermediaries did not play an "accelerator" role in the run-up of the property prices during the boom periods. Part of the reason would be related to the prudential regulation and risk control by banks in granting loans, which limited the responses of credit to property price changes. In particular, the study finds that the maximum loan-to-value ratio of 70%, which was adopted by the banking industry voluntarily in 1991 and later incorporated in the HKMA's guidelines on property lending, helped limit credit expansion in the bubble period.

c. Property prices and bank profitability

Banks' balance sheets and profitability have been affected by the downturn in the economy and the property market. Retail banks in Hong Kong experienced a considerable decline in profitability following the Asian financial crisis (Chart 10A). Profitability recovered somewhat in 2000-02, but remained below its pre-crisis level. The decline in profitability was associated with a deterioration in asset quality. Specifically, the ratio of classified loans to total loans of retail banks rose substantially from around 2% in 1997 to over 10% in 1999 before falling gradually to 4.5% at the end of September 2003 (Chart 10B).

Chart 10

Retail banks' profitability and asset quality

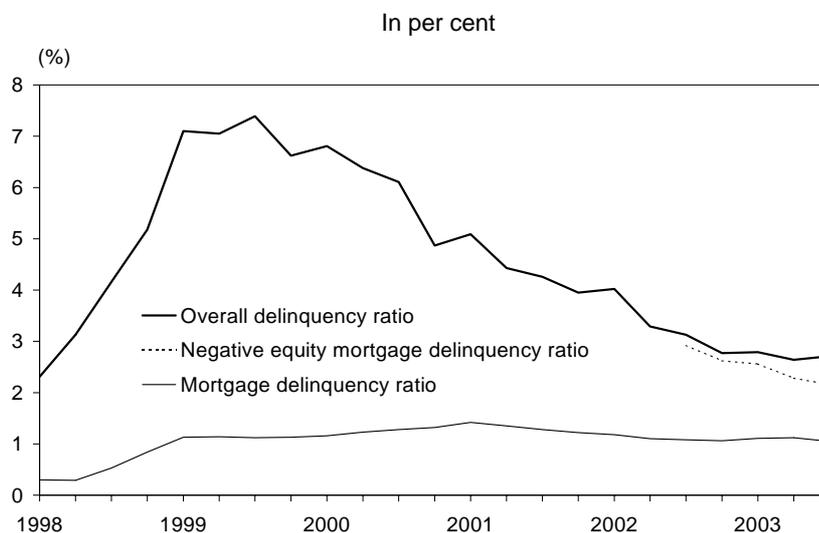


Source: HKMA.

The mortgage delinquency ratio (defined as mortgage loans overdue for more than three months relative to total mortgage loans) rose substantially from 0.3% in mid-1998 to over 1.4% in 2001 before falling gradually to below 1% in November 2003 (Chart 11). On the other hand, the ratio of rescheduled loans has been rising since the data for September 2001 were first released by the

HKMA. The continued rise in the rescheduled loan ratio suggests that banks were accommodative in restructuring mortgage loans for borrowers in financial difficulty, thereby taking the pressure off mortgage delinquencies. While the mortgage delinquency ratio has increased substantially in recent years, it remained low compared with the overall ratio of loans overdue for more than three months.

Chart 11
Delinquency ratios



Source: HKMA.

There have been a number of studies on the determinants of bank profitability in Hong Kong, using both aggregate and bank-level data. Shu (2002) finds that declines in residential property prices, reduced economic growth, and persistent consumer price deflation have had significant impacts on banks' asset quality. A study by Jiang et al (2003) suggests that the deterioration in banking institutions' profitability in recent years was mainly attributable to the adverse macroeconomic environment in Hong Kong, particularly the persistent deflation in general prices, which was in part due to declines in property prices as discussed above. Gerlach et al (2003), using confidential supervisory bank-level data, find that banking performance is affected by macroeconomic developments with the net interest margin of smaller banks being more exposed to changes in economic conditions. The collapse of the property "bubble" has also put banks under distress due to the generally large exposure to property-related lending. However, and perhaps surprisingly, the asset quality of property-related loans is found to be *less* sensitive to changes in economic conditions including property prices than that of other types of bank lending. This is in line with the stylised fact that mortgage lending is less risky than most other bank loans.

IV. Conclusions

This paper provides an overview of the real estate indicators that may be useful for monitoring the vulnerability of the banking sector in Hong Kong to fluctuations in property prices. Two types of indicators are reviewed: property prices and statistics of banks' exposure to property-related lending. These statistics are published on a regular basis by the R&VD and the HKMA respectively. In view of the increasing importance of residential mortgage lending in banks' loan portfolios, the HKMA has conducted a monthly survey on residential mortgage loans to obtain higher frequency and more detailed information, which is now also published.

The sharp declines in property prices have had a significant impact on the economy and the banking sector. Banks' asset quality and profitability fell considerably in the wake of the Asian financial crisis. These indicators have rebounded in more recent years, but remained below their pre-crisis levels. Nevertheless, the banking sector as a whole has remained in a healthy position, as evidenced by the strong capital position and high asset quality and profitability relative to banks in other economies in the region.

Appendix: The use of rateable value for adjusting quality differences between properties

This appendix illustrates how rateable values can be utilised to adjust transaction prices for differences in quality characteristics between properties.

The rateable value is an estimate of the annual rental value of a property at a reference date, assuming that the property is then vacant and to let. It is the basis on which rates, one of Hong Kong's indirect taxes on properties, are charged. In assessing the rateable value, reference is made to other open market rents agreed at or around the date of assessment, for similar properties in the locality, with adjustments to reflect any differences in size, location, facilities, standards of finish and management. The rateable value is reviewed annually by R&VD so as to reflect more up-to-date rental values of the properties.

Consider that the sale price of a property is determined by the average market price and a number of quality factors such as size, location, age, management services and facilities, etc. Algebraically, the sale price (P) of a specific property can be expressed as:

$$P = \bar{P} + \bar{P}X_1 + \bar{P}X_2 + \bar{P}X_3 + \dots + \bar{P}X_k = \bar{P}(1 + X_1 + X_2 + X_3 + \dots + X_k) \quad (1)$$

where \bar{P} is the central tendency of the property prices in the entire population (it can be viewed as the market price of a "typical" property in the population). X_i ($i = 1, 2, 3, \dots, k$) are the quality factors, which measure the deviation of the sale price of the specific property from the market price of the "typical" property due to quality differences. For example, if, other things being equal, the size of the specific property is smaller than that of the "typical" property, then the value of the quality factor for size will be negative.

Assume that the assessment of rateable value of a property is based on the same set of quality factors as in the determination of sale price, and the influence of individual quality factors on sale price and rateable value are the same.¹⁸ Given these assumptions, the rateable value (R) of the specific property can be expressed as:

$$R = \bar{R}(1 + X_1 + X_2 + X_3 + \dots + X_k) \quad (2)$$

where \bar{R} is the central tendency of the rateable values in the entire population. Thus, the factor of sale price divided by rateable value is:

$$\frac{P}{R} = \frac{\bar{P}(1 + X_1 + X_2 + X_3 + \dots + X_k)}{\bar{R}(1 + X_1 + X_2 + X_3 + \dots + X_k)} = \frac{\bar{P}}{\bar{R}} \quad (3)$$

By keeping the rateable values (and hence \bar{R}) unchanged in consecutive periods, changes in the factor of P/R represent changes in \bar{P} , that is, the central tendency of the property prices in the entire market.

¹⁸ In reality, the degrees of influences on price and rent (rateable value) for some quality factors may not be the same. For example, the age of a property usually has a greater influence on price than rent in Hong Kong.

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