Excess returns in the Hong Kong commercial property market

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by

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Abstract

This paper examines the existence of excess returns in the commercial property market of Hong Kong using time series data for both valuations and transactions prices. The proposition is that if the valuation series is accurately processing transactions prices then excess returns, if they exist, should be detected in both series.

Our findings confirm that excess returns can be detected in both valuation and transaction based series. The excess returns are not, however, persistent although there appears to be greater opportunities for earning excess returns in the office sector.

Keywords: Excess returns, market efficiency, filter rules, Kalman filter

Introduction

Hong Kong is a densely populated city with more than 6 million people living in a total area of 1,092 square kilometres. More than 67% of the total area are woodland and scrubland. The developed land only comprises less than 16% of the total area (see Appendix 1). Due to the limited supply of land, the real estate sector plays an important role in Hong Kong's economy. This can best be illustrated by some statistics (averages for the period 1983-92) taken from Walker et al (1995):

- More than 45% of the listed companies are either real estate developers/investors or are heavily involved in real estate development/investment.

- The real estate sector, and the construction industry contributes to more than 20% of GDP (The construction industry contributes approximately 7% to GDP)

- More than (35%) of total loan and advances in the banking sectors are used for real estate development, investment or home purchase.

- More than one third of total government income is related to real estate. This includes income from land sales, premium charged for change of land use, property tax and rates, stamp duties for property transactions, profit tax from developers and property investment by the government.

- More than one third of total government expenditure is real estate related, a majority of which is expenditure on provision and maintenance of government subsidised housing.

The majority of personal wealth in Hong Kong is in three major forms; real estate, shares of listed companies and money. Of these, real estate is the most significant. The total value of all real estate in Hong Kong exceeds the total value of all shares and money. The market value of the total stock of real estate, as at the end of 1995, is estimated to be over US$500 billion which is more than double the size of the stock market during the same period (Stock Exchange of Hong Kong limited, 1996).

Despite the relative size of the real estate sector, there are few formal studies which examine its informational efficiency. Although high returns have been earned in Hong Kong real estate but there is no guarantee that they can be regarded as excess returns, in an economic sense. In this context an excess return means a return which is higher than expected given the risk class of the asset. This paper considers the informational efficiency of the Hong Kong commercial property market by examining both valuation and transactions based data. If each of these capture the same information set then evidence of excess returns should be reflected in both series. There should, therefore, be some similarity between an analysis of excess returns using both transactions prices and valuation data.

The paper is organised as follows. Section 1 briefly describes the background and relevant previous research. Section 2 discusses the data and methodology used in the analysis. Section 3 presents the results and Section 4 offers some concluding comments.

1: Background and previous research

Over the last ten years the study of market efficiency has produced more research papers than any other area of financial economics. This is understandable as tests of market efficiency are concerned with how well information is impounded into market prices. If inefficiencies can be identified in any market then it presents opportunities for earning excess returns.

Studies of real estate efficiency have also grown substantially over the past 10 years. A comprehensive review can be found in Gatzlaff and Tirtiroglu (1995). Allied to this strand of research is the area of valuation smoothing. Any views concerning market efficiency are dependent on the time series characteristics of the data used. Tests of market efficiency in the real estate sector should, for example, be carried out using transactions prices. In the absence of such data most studies have used valuations. This, however, introduces additional difficulties caused by a combination of temporal aggregation and valuation smoothing. Attempts to desmooth property valuation series have assumed that the profile of the underlying, true market returns, are random. If, however, this structure is imposed on the transformed series it will be evident is no longer possible to undertake a valid test for market efficiency. In order to examine the effect of market efficiency in terms of both valuations and prices it is, therefore, necessary to use a transformation process which does not make strong assumptions concerning the stochastic properties of the underlying implied transactions prices. This is the approach adopted in this paper.

We have chosen to briefly review a few of the studies in the area of market efficiency and valuation smoothing that we believe to be relevant to this research.

Tests of Real Estate Market Efficiency

One of the major difficulties in testing for weak form efficiency in the real estate market is the availability of reliable time series data. Due to the heterogeneous nature of real estate and thinly traded markets, transaction based price indexes are usually not readily available.

Those studies that have been carried out have generally inferred transactions prices indirectly from limited market data.

Some of the major problems of undertaking weak form efficiency test in the real estate markets are:

(1) Availability of reliable data series for constructing the return series over a reasonably long time interval.

(2) Methods of assessing after tax and transaction costs excess return, especially when the market is not active and therefore investors cannot buy and sell at the prices indicated by the price indices.

(3) Data and method for estimating transaction costs including search costs and costs for information collection and processing

Not all of these problems are fully addressed in previous studies. For example, one of the earliest studies on weak form efficiency undertaken by Gau (1984) was based on return series construct from a limited number of heterogeneous transactions (one transaction per month). The reliability of his results is therefore limited by the small sample size. Another similar study was undertaken by Brown (1985) using 136 monthly commercial property valuations over a short time interval (four years). Although both studies suggest that there was little serial correlation in periodic returns at both the individual property and portfolio levels, the reliability of the data series is questionable.

As a result of appraisal smoothing, return series constructed from valuation based indexes tend to overstate serial correlation and are not suitable for weak form efficiency test. Transaction based indices are commonly used instead. Two major types of transaction based time series are commonly used, namely the average selling price index and repeat-sales index. The average selling price index is based on the average transaction price per accommodation unit. This type of index has been used by Rayburn at. el. (1987) and Green at. el. (1988) to test the market efficiency of the residential market in the U.S. Both studies report results which cannot reject the hypothesis of weak form efficiency.

The average price indexes are based on the transaction prices of heterogeneous products and are not adjusted for price influencing attributes of the transacted properties. The reliability of the index may therefore be affected by the changing quality of the transacted properties. To overcome this difficulty, Case and Shiller (1989) constructed repeat-sale indexes[1] using actual home transaction data in Atlanta, Chicago, Dallas and San Francisco. Their analyses are consistent with earlier studies using average transaction prices when implicit rent is not taken into account. However, Case and Shiller find that the after tax real total return series exhibits significant first order serial correlation. They were also able to construct trading rules that yielded consistent excess returns.

The repeat-sale index approach has also been adopted by Hosios and Pesando (1991) to test the market efficiency of the Toronto single-family housing market. They find that quarterly lagged annual changes in real housing prices are significantly correlated but no trading rules tests have been applied. The repeat sales index seems to be a better alternative, however, a large number of transactions are required for the construction of these type of indices.

Valuation smoothing

Tests of market efficiency based on valuations may be biased due to the fact that valuers estimate current valuations by combining information about known comparable transactions

1 An alternative method for adjusting differences in quality is the hedonic pricing index.

prices with the most recent valuation. If we assume that an individual property has a current transaction price, P_t this can be represented as a combination of its true market value $\hat{P}_t$ plus a random error term, e_t thus:

$$P_t = \hat{P}_t + e_t \qquad (1)$$

Quan & Quigley (1989) demonstrate that if transaction prices follow a random walk the optimal current estimate of value can be estimated from:

$$V_t = kP_t + (1-k)V_{t-1} \qquad (2)$$

where V_t = Valuation at time t and

$$k = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}, \quad 0 \le k \le 1$$

σ^2_u = exogenous and specific variability of the property's implied return

σ^2_v = transactions noise

All information concerning the property is summarised in the variance, σ^2_u resulting from random market wide movements and the variance of property specific factors, together with the transactions noise σ^2_v which will be determined by factors such as buyer and seller valuations and their relative bargaining strength.

The factor *k* in this expression is a function of the relative size of transactions noise and signal variance of market-wide/idiosyncratic factors. This simple exponential smoothing approach to updating valuations has been demonstrated to be optimal, under certain conditions (Giaccotto and Clapp (1992)). Changes in value derived from this model can be shown to exhibit serial correlation due to the smoothing of valuations. Thus tests of market efficiency based on smoothed returns cannot reject the hypothesis that the market is efficient.

A number of models have been proposed for removing the serial correlation which exists in an index of capital values. Blundell and Ward (1987), for example, used a first order autoregressive process to estimate unobserved market values on the assumption that the underlying returns generation process followed a random walk. Similar procedures have also been followed by Ross & Zisler (1991), Geltner (1989, 1991, 1993) and Fisher, Geltner & Webb (1994). Geltner (1993) and Barkham and Geltner (1994) have also examined the problem of smoothing without making the assumption that the underlying market is efficient. A common feature of these models is that the smoothing parameter is assumed to be constant.

Although the model implicitly assumes that the value of k is constant over time, so that valuers use the same updating rule *under all market environments*, Quan and Quigley (1989) suggest that the optimal updating rule can be made more realistic by employing a Kalman algorithm and recognising that the value of k will change in response to different market conditions. It can be shown, however, that as long as the smoothing parameter is not less than 0.5 that the estimation of implied prices is little affected by using time varying parameters (Brown & Matysiak 1996).

Given that current valuations are a function of market prices and assuming that it is possible to extract market prices from the valuation data then this presents two propositions.

1 That excess returns observed using prices should be similar to those extracted from valuations

2 That valuations are correctly processing information concerning transactions prices

2 Data and methodology

The Hong Kong commercial property market is unique in having both valuation and transaction based indexes.

The valuation indexes used in this study are based on data collected by Jones Lang Wootton (JLW). The indexes are available since the fourth quarter of 1983 and are based on the valuation of a portfolio at the end of each quarter. Both price and rental indices are available for the four major sub-markets, namely residential, offices, retail and industrial. Each valuation included in the index is an estimate of the market view concerning transactions prices. They can, therefore, be considered to be a weighted average of an unknown transactions price together with information concerning the most recent valuation.

By contrast the Rating and Valuation Department (RVD) of the Hong Kong Government publish capital and rental price indexes for different sub-sectors of the property market based on transactions. The RVD price indexes are based on average transaction prices per square meter of gross floor area adjusted for differences in price influencing attributes of the property such as quality, age, location etc. by the Rating and Valuation Department's rateable value. The rateable value is the RVD's assessment of the annual rental income of the property. The RVD rental index is based on the average rent per floor area of the registered leases. There are one price index and one rental index for each of the four sub-markets, namely offices, retail, industrial and residential[2]. The indexes are available on a quarterly basis since the fourth quarter of 1979.

The reliability of a transaction based index depends on the trading volume and the method of controlling for different price influencing attributes of the transacted properties which are heterogeneous. The volume of real estate transactions in relation to size of the total stock of real estate is relatively high in Hong Kong compared with most other cities. Since the early 80's, the value of real estate transaction is, on average, more than 10% of the total value of stock of the private real estate assets. (Chau and Ma, 1996)

The high trading volume is attributable to the dynamic nature of Hong Kong's economy and simple taxation system. There is also no capital gains tax and rental income tax is only 15% for individual and 16.5% for corporations. The (tangible) transaction costs are also relatively low. Real estate agents are free to charge any market rates and normally will not exceed 1% of the transaction prices from both the buyer and seller.

The small size of Hong Kong and the relatively short economic life of buildings structures imply that the transacted real estate within a sub-sector is less heterogeneous. This helps to reduce the error in the construction of the price index arising from possible bias in adjusting the average transaction prices for differences in the price influencing attributes of the transacted property.

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2 The residential market is further divided into five sub-markets according to the size of the residential unit.

The mortgage policy adopted by most banks in Hong Kong is to discriminate older buildings (Chau and Ma, 1996). More favourable terms will normally be given to buildings not more than 10 years old. The result of this policy is that most properties transacted in the market are less than 10 years old. This also helps to keep the transactions less 'heterogeneous' and reduces the bias that may result from the 'attribute adjustment' process.

Despite the favourable situations in Hong Kong that allows the RVD to construct transaction based indexes, these indexes are not without problems. First, the indexes are based on average prices of transactions within a quarter. The intra-quarter averaging effect tends to smooth the index, which will lead to an over-estimation of the serial correlations. Second, the registered transaction prices may not represent the true market prices. Rent concessions are common during the down turns of the property cycle. In some cases, facilities such as furniture and fixture, machinery, equipment etc. are provided by the landlord and thus the property can be rented out at a higher price. The price indexes also suffer from similar problem. New and uncompleted units are most problematic since major developers in Hong Kong often provide very favourable financing packages to buyers in order to keep the transaction price at a higher level on paper so as to boost confidence. The decline in property prices during the property slump is therefore not fully reflected in the RVD indexes. Third, the rateable values used by the RVD for the 'attribute adjustment' process may themselves be biased. However, the nature of the resulting bias is difficult to assess.

Alternative methods are used to test for excess returns using transactions and valuation data. These are discussed below.

*Transactions series (RVD)*The approach adopted in this study is similar to those adopted by Guntermann and Smith (1987), Krashinsky and Milne (1987), Rayburn et. al (1987), and Case and Shiller (1989). Two tests of real estate market efficiency are performed using a real total return series. The real total return series include both real capital gains and after tax net rental income and takes into account of depreciation of the building structure. The RVD capital price indices, rental income indices and inflation indices are used to construct the real total return series. In addition, assumptions depicted in Exhibit 1 are also required for the construction of the total real return series.

For the calculation of the return series, a straight line depreciation method is adopted. The after tax net rental income are assumed to be reinvested in the same real estate sub-markets or able to earn the same real return. Since the major components of the real return is the real capital appreciation, the results of is not sensitive to these assumptions.

Exhibit 1: assumptions used for estimating real total returns

Marginal Tax rate	16.5% of net rental income
Average duration of leases	2 Years
Average maintenance costs, rates etc.	20% of rental income
Economic life of the building structure	
Offices	25 Years
Residential	30 Years
Shops	20 Years
Industrial	20 Years
Average building construction costs as % of property value	
Offices	30%
Residential	35%
Shops	40%
Industrials	50%

The serial correlations in the returns are examined to see if future returns can be predicted from past returns. Significant serial correlation indicates the possibility of predicting future returns and implies market inefficiency. Since the presence of significant serial correlation may not necessarily be inconsistent with the fair game model, mechanical trading strategies are developed to see if consistent excess returns can be exploited.

The trading strategies examined are simple filter rules using different filter size. The filter rule gives a buying signal when the price has increased from a previous low by x%, where x is the size of the sell filter. Similarly, a sell decision is triggered when the price has decreased from the previous peak by x %. These are shown in Figure 1. Since it takes time for price information to be released and for properties to be traded there will always be a time lag between the realisation of the buy/sell signals and actual transactions (see Exhibit 2).

Excess returns are calculated as the real total return that can be achieved by adopting the filter rule, taking account of transaction costs and the real return that could be achieved by adopting a buy and hold strategy. Since short selling in real estate is not possible, the money received after a sell decision is assumed to be invested in an interest bearing bank account. The interest is assumed to be the 3-month fixed deposit rate offered by the Hong Kong Bank.

In this part of the study buying and selling signals are derived from the changes in the real total values series derived from the real return series (i.e. inclusive of after tax rental income and net of inflation) and not from the real capital price series. Only tangible transaction costs such as agent's fee, stamp duty and legal charges are taken into consideration in the calculations. These are relatively straightforward since there is no capital gains tax in Hong Kong.

If excess returns can be earned consistently using the filter rules, this signals rejection of the efficient market hypothesis at the weak form level.

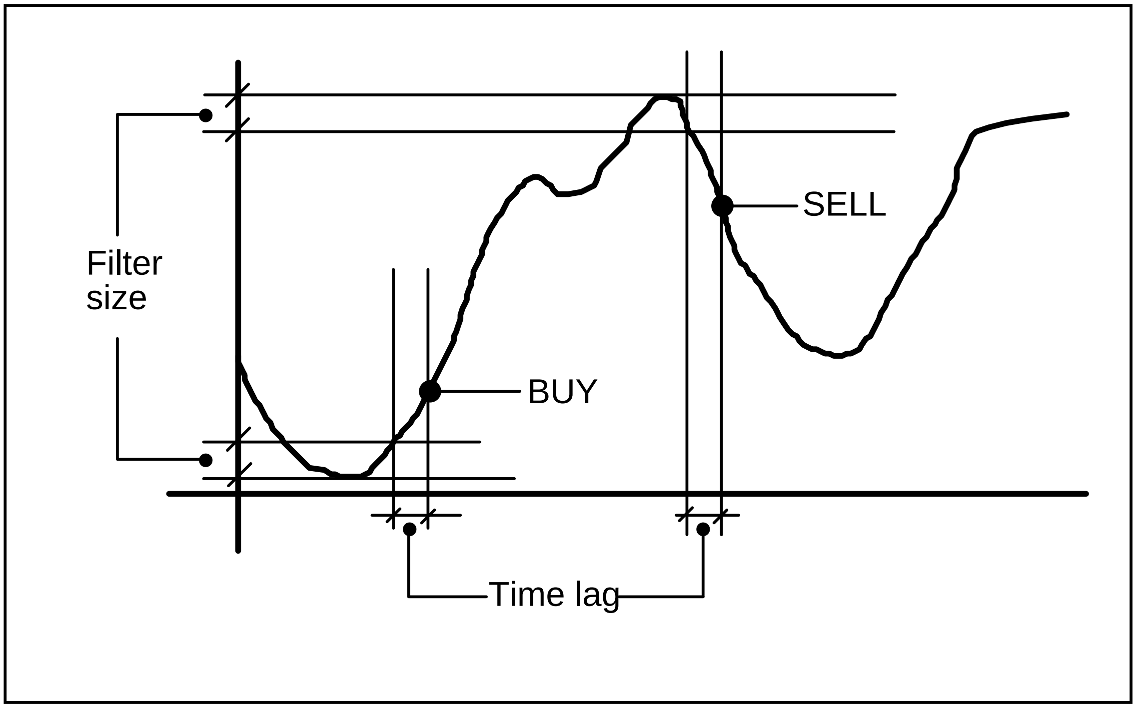

Exhibit 2: Illustration of the filter trading rules.

Valuation series (JLW)

An alternative way of looking at excess returns is to consider them within the framework of trying to achieve positive net present values (NPVs). For a property to generate a positive NPV it must be bought when it is underpriced and/or sold when it is overpriced. This results in a strategy for buying or selling which is similar to the filter rule identified above. Briefly this can be considered as follows.

If a property can be sold at a figure in excess of its current equilibrium market value, after having made allowance for transactions costs, the market can be regarded as being ‘overpriced’. This will result in a sell recommendation and generate a positive NPV. Similarly, if a property can be bought at a figure below its current equilibrium market value, because the market is ‘underpriced’, then this will result in a buy recommendation and again generate a positive NPV

At the individual property level ‘prices’ may be ‘sticky’. However, professional valuations will also be ‘sticky’ if they use ‘sticky’ prices as comparable evidence. Nevertheless there will still be an equilibrium value for each property which will respond to the random arrival of information on a continuous basis. This principle can also be extended to the index level and suggests a two stage process of decomposing a valuation index into equilibrium market values and underlying implied transactions prices. As both these elements are unobservable the solution is non trivial and raises a number of complex issues.

One approach to the estimation of implied transactions prices is to derive a series of equilibrium market values from the valuation series, using an unobserved components model, and to use this information as the basis for estimating the smoothing parameter identified in equation (2). Once this value is known it can then be used to estimate the implied transactions prices. The difference between the transactions prices and equilibrium market values will indicate when the market is under and over priced.

Assume that a valuation smoothed series (X_t) can be expressed in two alternative forms[3]:

$$X_t = kP_t + (1-k)X_{t-1} \quad \text{where } 0<k<1 \tag{3}$$

$$X_t = MV_t + e_t \tag{4}$$

P_t represents the prices implied in the valuation smoothed series. MV_t represents the equilibrium, or liquid market values. The term e_t is a random error which picks up the effects of non trading.

In order to solve equation (4) it is necessary to specify a transition equation which determines the evolution of the underlying, unobservable, equilibrium market values. This can be expressed as follows:

$$\begin{aligned} MV_t &= MV_{t-1} + \gamma_{t-1} + \varepsilon_t \\ \gamma_t &= \gamma_{t-1} + \eta_t \end{aligned} \tag{5}$$

3 It is assumed that at the index level the effects of temporal aggregation are small so that the series only reflects valuation smoothing. In situations where this is an issue the effects of temporal aggregation may first need to be removed.

The equilibrium market values MV_t are assumed to evolve as a random walk with the trend in MV_t also evolving stochastically through the behaviour of γ_t. If information arrives randomly this assumption is not unreasonable. The solution to this set of equations is given in Harvey (1993)

The equilibrium market values extracted above can also be used to establish the smoothing parameter *k* in equation (3), if it is assumed that the equilibrium market values (MV_t) and market prices (P_t) both have the same variance. If this assumption is valid then it is possible to derive *k* by taking the variance of equation (2) and rearranging as follows:

$$\frac{\sigma_{P_t}}{\sigma_{X_t}} = \frac{\sigma_{MV_t}}{\sigma_{X_t}} = \frac{1}{k}\sqrt{\left[1+(1-k)\left\{(1-k)-2\rho_{X_t X_{t-1}}\right\}\right]} \qquad (6)$$

The only unknown in this equation is *k* as all other variables can be established from the valuation series and the equilibrium market values as described above.

Once a value for *k* has been established it can be substituted back into equation (3) to solve for P_t as follows:

$$P_t = \frac{X_t - (1-k)X_{t-1}}{k} \qquad (7)$$

Given that MV_t is assumed to represent equilibrium market values, a comparison of P_t with MV_t will indicate when the market is under and overpriced. Thus if
$(P_t - MV_t) > 0$ then the market is overpriced. Similarly if $(P_t - MV_t) < 0$ then the market is underpriced.

The unobserved components model represents current valuations as the sum of an unobserved equilibrium market value together with a random non-trading adjustment. This is less restrictive than equation (2) but does make the assumption that equilibrium market values evolve in a random fashion. If the information influencing market values cannot be predicted then it must be regarded as a random event. Changes in price must also be random (see Ross

1989). The evolution of equilibrium market values can be assumed to respond in a similar fashion.

The estimation process proceeds by using a Kalman filter to derive the unobserved equilibrium market values from the published valuation series.

3: Results

Transactions data

Exhibit 3 shows that all sectors exhibit significant serial correlation up to a lag of four quarters. With the exception of the retail sector the first order serial correlation figure is in line with upper limit suggested by Working (1960) for data which is averaged if the underlying series follows a random walk. The higher order coefficients remain high and do not die away for several lags. The returns have, however, been adjusted for the effects of inflation. Part of the serial correlation might, therefore, have been introduced by the Consumer Price Index. Another possible source of the high serial correlation is the intra-period averaging effect of the RVD indices as the indices are based on the average transaction prices within a quarter.

Nevertheless, there is some evidence to suggest that, in real terms, there is some relationship between current and past prices which may be capable of being exploited.

Exhibit 3: Serial correlation of real total return series: 1980-1994

Lag (quarters)	Office	Retail	Industrial
1	0.236	0.369*	0.207
2	0.306*	0.254*	0.454*
3	0.262*	0.220	0.399*
4	0.163	0.358*	0.197
5	0.266*	0.148	0.066
6	0.005	0.133	0.132
7	0.181	0.162	-0.096
8	-0.170	0.022	-0.010

* significant at the 5% level

The possibility of earning excess returns is examined by using the filter rule. Exhibit 4 to 6 show the results of the filter tests, net of transactions costs of 2%(1% agent's fee and 1% legal and related charges) on sales and 6% (1% agents' fee, 2.75% stamp duties 2.25% legal charges) on purchases. The higher transaction costs for buying is due to the higher legal charges and the need to pay stamp duties.

Exhibit 4: Excess returns - Retail sub-sector

	Time lag in quarters			
Filters	**1**	**2**	**3**	**4**
15%	-0.23%	-1.29%	-1.92%	-2.57%
10%	+1.35%	+0.71%	-0.70%	-0.97%
5%	+1.22%	+0.12%	+0.07%	-1.73%

Exhibit 5: Excess returns - Industrial sub-sector

	Time lag in quarters			
Filters	**1**	**2**	**3**	**4**
15%	+1.17%	+0.60%	-0.83%	-0.69%
10%	+1.35%	+1.03%	-0.12%	-0.88%
5%	-0.03%	-0.44%	-1.23%	-3.74%

Exhibit 6: Excess returns - Office sub-sector

	Time lag in quarters			
Filters	**1**	**2**	**3**	**4**
15%	+2.49%	+0.33%	-3.38%	-3.70%
10%	+4.19%	+3.22%	+1.51%	-0.61%
5%	+2.12%	+2.12%	-1.62%	-0.49%

The 10% filter yields the highest excess returns for all sectors for almost all time-lags. Other filters around 10% yields similar results. The 10 % filter is optimal or close to optimal since a larger filter (15%) missed some profitable trading opportunities and a smaller filter (5%) generates too many transactions which dissipates a large proportion of the trading profits as transaction costs.

In all cases, the shorter the time-lag, the higher the excess returns. That is, timely response to new information is important in terms of investment performance. Responding to short term signals is, however, difficult to achieve in practice since it takes the Rating and Valuation Department two quarters to release their index. Thus, a three quarter lag is not an unreasonable assumption if investors rely on official statistics. Therefore the chance of exploiting excess returns from the serially correlated real return series is slim for most sub-sectors.

The excess returns for the retail and industrial sub-sectors are positive only when the time-lag is shorter than or equal to two quarters. Excess returns for the office sub-sector are, however, larger and remain positive up to a lag of 3 quarters using a 10% filter. The significant positive excess returns for the office sub-sector indicate that this sector may be inefficient. If the investor can commit resources to analysing changes in price level, based on transaction records instead of relying on the official release of price indices, and thus shorten the time lag to two quarters, a significant return of more than 3% can be earned. The success of this strategy will, however, depend on the ability to minimise search costs.

Exhibit 7 to 9 shows the excess returns when the nominal instead of real return series are used. They are in general, a lot smaller than those of the real return series. The results suggest that the real estate markets are efficient with respect to historical real estate price and rental information (efficient of the weak form in the normal sense). When the set of historical price data also includes general inflation (i.e. when the real return series is used), the markets seems to be less efficient. In particular, the results suggest that the office sub-sector is not efficient with respect to the set of historical information which includes real estate prices, rental and inflation. The result is not surprising as when the reference set of information is larger, more effort is needed to analysis extra historical information (general inflation). Part of the observed excess return could be accounted for reward to the effort of analysing the additional information.

Exhibit 7: Excess returns from nominal return series - Retail sub-sector

	Time lag in quarters			
Filters	**1**	**2**	**3**	**4**
15%	+1.17%	+0.60%	-0.83%	-0.69%
10%	+1.35%	+1.03%	-0.12%	-0.88%
5%	-0.03%	-0.44%	-1.23%	-3.74%

Exhibit 8: Excess returns from nominal return series- Industrial sub-sector

	Time lag in quarters			
Filters	**1**	**2**	**3**	**4**
15%	-0.17%	-0.72%	-2.10%	-2.02%
10%	-0.17%	-0.71%	-2.08%	-2.00%
5%	0.35%	0.49%	-0.86%	-0.99%

Exhibit 9: Excess returns from nominal return series - Office sub-sector

	Time lag in quarters			
Filters	**1**	**2**	**3**	**4**
15%	0.53%	-1.38%	-1.29%	-2.46%
10%	-2.81%	-3.00%	-5.73%	-6.63%
5%	-5.54%	-6.18%	-11.94%	-11.55%

Valuation data

The serial correlation structure of the changes in capital growth for the JLW valuation series is summarised in Exhibit 10. It will be seen that there is some evidence of serial dependency but this dies away after the first lag.

Exhibit 10: Serial correlation of JLW capital growth series: 1984-1994

Lag (quarters)	Office	Retail	Industrial
1	0.368	0.489	0.202
2	0.085	-0.053	-0.099
3	-0.009	-0.172	0.185
4	-0.118	-0.237	0.007
5	-0.171	-0.263	-0.221
6	-0.128	-0.117	0.016
7	0.060	-0.014	0.168
8	-0.139	-0.056	-0.202

The higher order serial correlations are smaller compare with the RVD real total returns series (Exhibit 3). However, the correlation structures are not directly comparable as the latter is over a longer time horizon and also adjusted for inflation. Exhibit 11 shows the serial correlations for the RVD nominal capital return series over the same time horizon as the JLW series. The first order serial correlations for the RVD are insignificant. They are also smaller than those of the JLW series. This is not unexpected as the RVD index is transaction based and the JLW index is valuation based.

Exhibit 11: Serial correlation of RVD capital growth series: 1984-1994

Lag (quarters)	Office	Retail	Industrial
1	0.176	0.213	0.138
2	0.174	-0.092	0.276*
3	0.187	-0.004	0.338*
4	-0.079	0.112	0.024
5	-0.048	-0.040	-0.015
6	-0.072	-0.027	-0.116
7	0.040	0.041	-0.090
8	-0.282*	-0.013	-0.354*

Significant at the 5% level.

The serial correlations in Exhibit 11 are also a lot smaller than those of the RVD real total return serial (Exhibit 3). It would be interesting to know whether the difference is due to inflation or difference in time horizon (the rental income return a very insignificant component of the total return and therefore will not be a major cause of the difference in the serial correlations).

Exhibit 12 shows the serial correlations for the capital growth series over the period 1980-94. The results are similar to those of the RVD real total return series (Exhibit 3) but are in general larger than those RVD capital growth series over the period 1984-94. The results indicate that difference in time horizon is the major reason for the observed difference in the serial correlations (between Exhibit 3 and 6). This also implies that the serial dependency before 1984 is higher than those after 1984. The implication could be that the Hong Kong real estate markets are more efficient after 1984. This is could be the case if the market is becoming more mature as it develops over time. However, further analysis is beyond the scope of this study.

Exhibit 12: Serial correlation of RVD capital growth series: 1980-1994

Lag (quarters)	Office	Retail	Industrial
1	0.242	0.373*	0.281*
2	0.297*	0.273*	0.427*
3	0.232	0.327*	0.427*
4	0.166	0.284*	0.122
5	0.221	0.168	0.115
6	-0.028	0.186	0.102
7	0.158	0.138	-0.129
8	-0.157	0.041	-0.067

Significant at the 5% level.

Using the methodology discussed in Section 3 it is possible to decompose the JLW capital value index into an equilibrium market value index and an implied transactions price index. As discussed, the difference between these two indexes should identify when the market is both under and overpriced. Our a priori belief is that over long periods the difference valuations and prices should be zero. However, this does not preclude the possibility that excess returns may be achieved for short periods. Exhibit 13 summarises the excess returns for each sector over the period from 1984 to 1995.

Exhibit 13: Excess returns based on JLW capital value index 1984-95

	Office	Retail	Industrial
Mean	1.733	0.985	0.668
Standard Deviation	15.088	9.947	7.968
Maximum	34.700	28.310	14.830
Minimum	-44.520	-21.680	-27.560

For each sector the mean excess return is statistically indistinguishable from zero. The office sector has a mean excess return which exceeds both the retail and industrial sectors. This implies that there was greater opportunity for earning excess returns in the office sector.

There is considerable volatility in the profile with the office sector tending to dominate in most periods. The opportunities for earning excess returns are in most cases relatively short. This would imply that it is probably difficult to achieve returns in excess of the market average without acquiring specific knowledge concerning the potential performance of individual properties.

The correlation between sectors is summarised in Exhibit 14. If there is some persistence in mis-pricing a strong positive correlation between the excess returns in each sector would justify the creation of a portfolio of properties.

Exhibit 14: Cross correlation of excess returns 1984-95

	Office	Retail	Industrial
Office	1.000		
Retail	0.437	1.000	
Industrial	0.546	0.506	1.000

4: Conclusions

The analysis of both transactions data and valuation data confirm the same general result. The office sector offers the greatest opportunity for earning excess returns, although the periods when this occurs may be short lived. In addition valuation and transactions data appear to respond to the same information set.

The opportunity to exploit any mis-pricing is however based on the assumption that buying and selling activities will not affect market prices and that the indexes are representative of the investor's portfolio. This implies that excess returns can only be exploited if the investor can construct a portfolio that replicates the returns implied by the respective indices. The construction of such a portfolio, if it were possible, would require considerable resources. Another issue is that the size of the portfolio is likely to be extremely large. This raises two implications. First, there may be barriers to entry for some investors since the amount of investment is large. One way of overcoming this is to securitize the portfolio but this implies additional costs. Second, the size of the portfolio may be large in relation to the total transactions volume. This is especially true in less active markets such as the office sector. Buying and selling these properties could affect market prices and as a result investors may not be able to buy or sell according to the trading rules at the levels indicated by the price index. Taking these issues into consideration the higher excess return in the office sector may not, therefore, be inconsistent with the efficient markets hypothesis.

Nevertheless the office sector does appear to offer the greatest potential for earning excess returns. This also implies that real estate practitioners may be able to make use of local information in innovative ways which would enable them to capitalise on any potential mispricing.

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Appendix 1: Land usage in Hong Kong as at 31 March 1995

Class	Approximate area (km^2)	percentage of total	Remarks
A. Developed Lands			
i. Commercial	2	0.2	
ii. Residential	42	3.8	Include all residential areas except public rental housing estates, HOS/ PSPS and temporary housing areas
iii. Public Rental Housing	12	1.1	Include HOS/PSPS
iv. Industrial	11	1	Include warehouse and storage
v. Open Space	16	1.5	
vi. Government, Institution and Community Facilities	18	1.6	
vii. Vacant Development Land	41	3.8	Include land with construction in progress
viii Roads/Railways	27	2.5	Include flyovers and railway lands
ix Temporary Housing Areas	1	0.1	
Sub-total for developed land	**170**	**15.6**	
B. Non-built-up Lands*			
I. Woodlands	220	20.1	Natural and established woodlands
ii. Grass and scrub	519	47.5	Natural grass and scrubland
iii. Badlands, swamp and mangrove	44	4.0	Land stripped of cover, or denuded granite country including coastal brackish swamp and mangrove
iv Arable	63	5.8	Cultivable lands, including orchards and market gardens, under cultivation and fallow
v. Fish ponds	16	1.5	Fresh and brackish water fish farming excluding coastal marine fish farms
vi. Temporary structures / livestock farms	12	1.1	
vii Reservoir	26	2.4	
viii Other uses	22	2.0	Include cemetery, crematorium, mine and quarry etc.
Total	**1 092**	**100.0**	

Note:
* Within these are 413 km^2 of country parks and special areas designated under the Country Parks Ordinance for protection of vegetation and wild life and for recreation.

Sources: Hong Kong 1996 Annual Report., Information Services Department, Hong Kong Government Printer (Howlett, 1996)