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**An analysis of the relationship between rental growth
and capital values of office spaces**

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Keywords - office capital growth, inflation rate, rental growth

Abstract

Purpose – The objective of this research is to model capital value growth in the office market by taking into consideration inflation.

Design/methodology/approach – A regression model is employed to model office capital value growth in Kuala Lumpur for the 1990 to 2008 period. Independent variables used in the model are rental growth and annual inflation rate.

Findings – Real office rentals growth are found to be significant factors affecting office capital value growth rate in Kuala Lumpur.

Practical implications – The regression model provides a better understanding of the factors affecting office capital growth and provides a simple forecasting tool.

Originality/value – A model of office capital growth is determined which could be used for the prediction of future growth in office capital value.

Keywords - office capital growth, inflation rate, rental growth

Introduction

Institutional investors consider modelling and forecasting real estate prices as an important part of an investment strategy as the risk associated in property investment portfolio is the main concern for many investors. The relationship between inflation and capital growth is a constant source of research within the property industry. This research investigates the relationship between these variables in order to come to a conclusion on how inflation proofed is office property; focusing on the Malaysian office market, using the data from 1989 to 2008. The result helped to illustrate whether theoretical assumptions of how inflation proofed is property and interdependency of certain variables over a period of time can be described by way of a mathematical model. Being equipped with such knowledge is hugely beneficial when investing in property since the modelling and forecasting of property cycles help identify future investment risks and aid investor's timing strategies.

Brief history of the Malaysia Property Market: 1989-2008.

The Asian financial crisis severely affected the Malaysian Property Market after 1997; property transaction fell up to 32.3% over two years. The trend for the transaction of property did not follow the changes in inflation rate as can be seen in Figure 1 below.

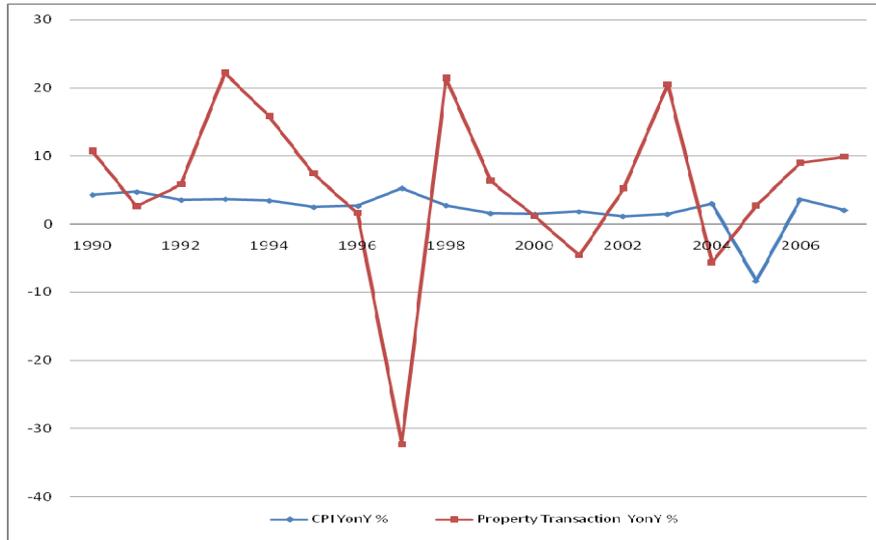


Figure 1: Inflation rate (CPI) and property transactions.

However, Figure 1 does not reflect what happens in the commercial property sector as the property transaction above covers all property sectors i.e. residential, commercial, retail and industrial in Malaysia. Hence, a further investigation needs to be conducted to investigate the relationship of variables of commercial property in Kuala Lumpur.

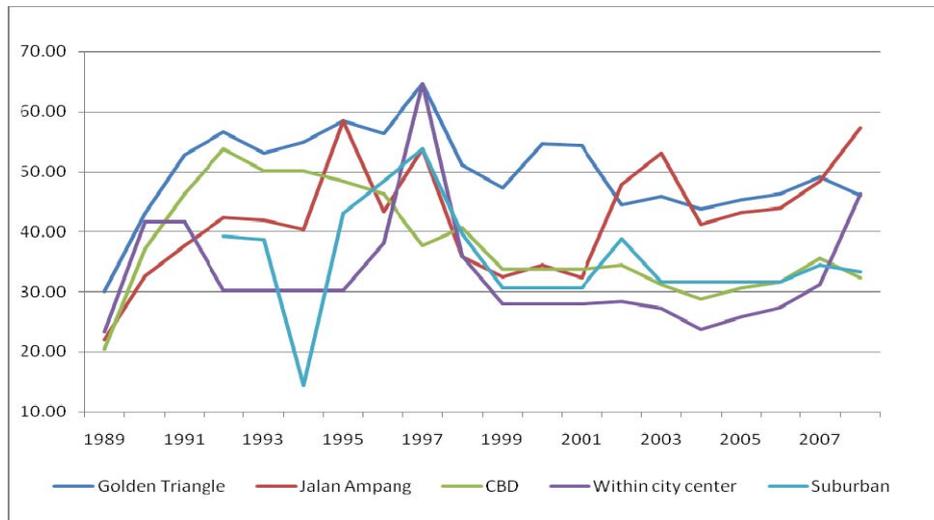


Figure 2: The rental of office market in Kuala Lumpur (1989-2008)

As depicted from Figure 2 above, the rental of office market in Kuala Lumpur continues to see growth despite heightened economic and political uncertainties.

Literature Review

Previous researchers such as Hoesli *et. al.* (2000) considered the short term inflation hedging characteristics of UK real estate and concluded that the data showed no statistical relationship between inflation and property performance.

As mentioned by Tarbert (1996), most studies on the inflation hedging attributes of commercial property have followed the methodology of Fama and Schwert. The form of regression typically used to determine if an asset is a hedge against inflation is:

$$R_{it} = a_{it} + b_{it} + e_{it},$$

where

R_{it} = nominal return on the i th asset during time period t

a_{it} = a constant

i_t = inflation rate during period t

e_{it} = a random disturbance.

If the asset is a complete hedge against inflation then the coefficient on inflation would not be significantly different from one. This would be classified as a full Fisher relationship. A coefficient on inflation of between zero and one would indicate a partial hedge, or a partial Fisher. A coefficient which is not significantly different from zero would be indicative of no relationship. A coefficient which is negative would indicate that the asset had a negative relationship with inflation (Tarbert, 1996).

Apart from that, checking for delays or the time lag in the changes of rental growth will also be done in the research as the rent review system may mean that there is a delay before the change in rents respond to the change in other variables; capital growth. This tends to create a lagging effect. However, it is interesting to note that, based on the research conducted by Carderia (2007) in UK, 53% of the respondent did not consider the lagging effect as a problem that could affect the development of the product whilst 25% were unsure that indices actually lag the market at all.

The basic premise for the subsequent data modelling is that rental changes in the office market are triggered by excess demand and excess supply.

Methodology

Conceptual Framework

With the above information in mind, the conceptual framework for the research can be illustrated in Figure 3 below:

1. To examine the extent to which inflation affects the property performance. In order to achieve this objective, empirical analysis was performed against the hypotheses below:

Hypothesis H=1: There is a significant association between real rental growth and real capital growth.

Hypothesis H=0: There is no significant association between real rental growth and real capital growth.

2. Modelling the capital growth as a function of rental growth.



Figure 3: Conceptual framework

Data

Specifically, the sample of this study was obtained by means of cluster sampling. The sample was taken from the Property Market Report whereby the data had been clustered into geographical areas. The data from the Kuala Lumpur city area was selected as the sample for prime office market. Secondary data was obtained from a several sources. These include published reports from various organisations such as Property Market Report by NAPIC, statistical statement by Bank Negara, newspapers, journals, books, academic surveys, e-resources, government websites and publications from related government agencies. Property Market Report issued by NAPIC is deemed to be a dependable, reliable and valid source of information as they are the most reputable property information center in Malaysia.

There are two main measures of inflation used by Bank Negara Malaysia are the Consumer Price Index (CPI) and the Producer Price Index (PPI). For the purpose of this research, the CPI measure of inflation has been chosen to examine the relationship between inflation and capital growth of the Malaysian Property Market.

Findings

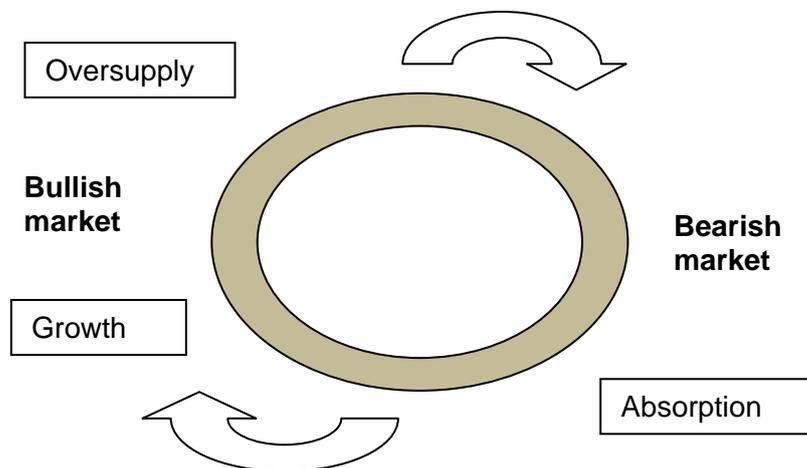


Figure 4: Property cycles

The property market is inherently cyclical and this arises from the cyclical nature of tenant demand and development activity due to differential measurement in property values and development cost, property's short run supply inelasticity, and time lags involved in property development.

Kuala Lumpur Office Market 1996 - 1999 (recession stage)

In the early 1996, the rents rate is positive growing but slowing and it start to fall and becoming negative growth due to the Asian Financial crisis. During this stage, the supply is limited and demand and occupancy rate starts to decline giving the impact on the capital values. Hence, there will be limited interested investor during this stage as the values are declining.

Kuala Lumpur Office Market 1999 -2000 (recovery stage)

During the recovery stage there is minor supply in the market and demand and occupancy rate begin to increase to balance rate. There will be no growth in rent but the capital values are increasing. Interested investors at this stage are the bottom fishers.

Kuala Lumpur Office Market 2000 - 2003 (expansion stage)

The demand is becoming greater than the supply as the supply beginning to increase. During this stage, there will be a very high number of interested investor with a high number of transactions as the occupancy rate and the capital value start to increase.

Kuala Lumpur Office Market 2003 - 2008 (contraction stage)

In this stage, the supply in the development pipeline is greater than demand. The demand is positive but slowing as the occupancy rate decrease to balance rate. As a result, the rental growth is positive but slowing. During this stage, the number of interested investors decline with limited number of transactions as the capital value declines.

Correlation analysis

In assessing the strength of the relationship between all variables, a correlation analysis was performed. This correlation test will determine the data set with the strongest relationship. These descriptive statistics enabled the report to evaluate the findings of each variable and compare them accordingly. Table 1 depicts the correlation and coefficient of determination analysis data.

Table 1: Correlation and coefficient of determination Analysis Data

Correlation	Rental	Capital	CPI	Real Rental	Real Capital
Rental	NA				
Capital	0.6157	NA			
CPI	0.0346	0.0406	NA		
Real Rental	0.9749	0.6299	-0.1152	NA	
Real Capital	0.5776	0.8739	-0.0896	0.5850	NA

R ²	Rental	Capital	CPI	Real Rental	Real Capital
Rental	NA				
Capital	0.3791	NA			
CPI	0.0012	0.0016	NA		
Real Rental	0.9504	0.3968	0.0133	NA	
Real Capital	0.3336	0.7638	0.0080	0.3422	NA

Assessing the relationship between CPI and Nominal Rental Growth

Using the CPI as the independent variable and the rental change as the dependant variable, an analysis using varying time lag between these two variables has been carried out. By using the coefficient of determination, the time lag that results in the strongest relationship between the two variables can be determined. From this analysis, the percentage of accuracy could be determined by the changes in rental values following inflation changes by two years as in Table 2.

Table 2: Correlation and coefficient determination of CPI and Nominal rental growth

Lagging effect	Data set	Correlation	R ²
lag t-3	16	0.1147	0.0132
lag t-2	17	-0.0364	0.0674
lag t-1	18	-0.0917	0.0084
coincident	19	0.0346	0.0012
Lead t+1	18	0.0909	0.0083
Lead t+2	17	0.2496	0.0623
Lead t+3	16	0.2380	0.0566

To further illustrate the improved relationship, a scatter graph as in Figure 5 has been constructed for the 2 year time lag as well as the 0 time lag, so that a comparison could be made.

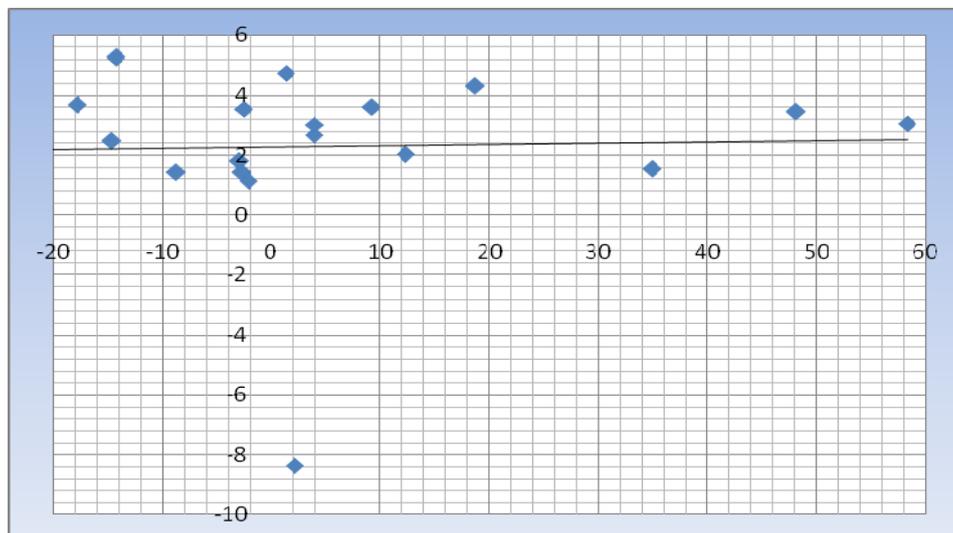


Figure 5: No lag annual CPI and annual rental change

The strength in the relationship between the two variables is determined by the proximity of the points to the trendline in Figure 5. As illustrated in Figure 5 above, there does not appear to be any positive relationship. The R square of the CPI and the nominal rental growth is 0.0012 which reflects a weak relationship between the two variables.

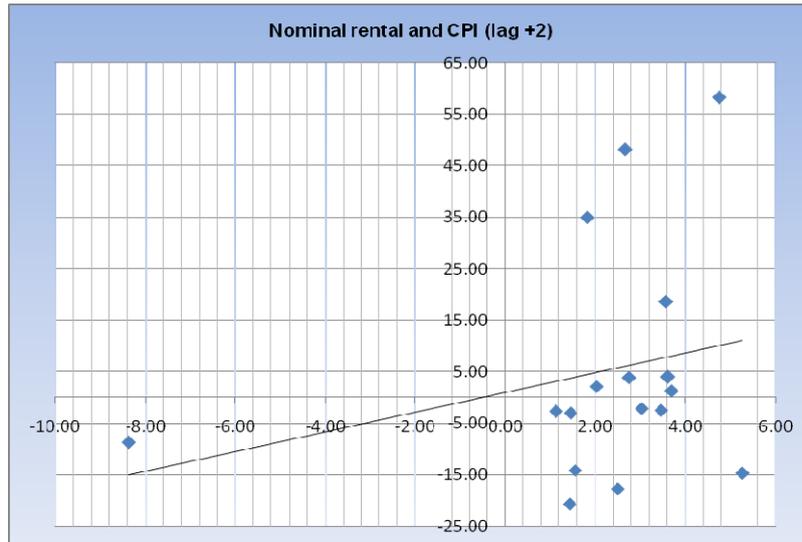


Figure 6: +2 lag annual CPI and annual rental change 1989 – 2008

As depicted in figure 6 above, the relationship appears stronger, albeit only slightly. The points are closer to the trendline and the numbers of stray points are reduced. This graphical representation assists us in proving that the t-2 lag has been found to be the best relationship between CPI and Nominal Rental Change as compared to the others. Furthermore, the coefficient of determination 0.0674 is the highest.

The actual increase in correlation between the 0 and t-2 time lag could be due to a number of factors. The most significant would be due to rent reviews occurring on a three to five yearly frequency. As a result, it would take time for the nominal rents to catch up with rising inflation rates.

Assessing the relationship between real rental and real capital growth

In examining the relationship between real rental growth and real capital growth, an index was drawn up, illustrating similar movements, yet at differing degrees as in Figure 7. Firstly, the decline in the early 1990s appears united, albeit at different percentage changes. However, the growth in capital rents seemed to rise before rents in 2001. Also, throughout the time period in question, the two variables did not appear to maintain equal levels of growth or declines.

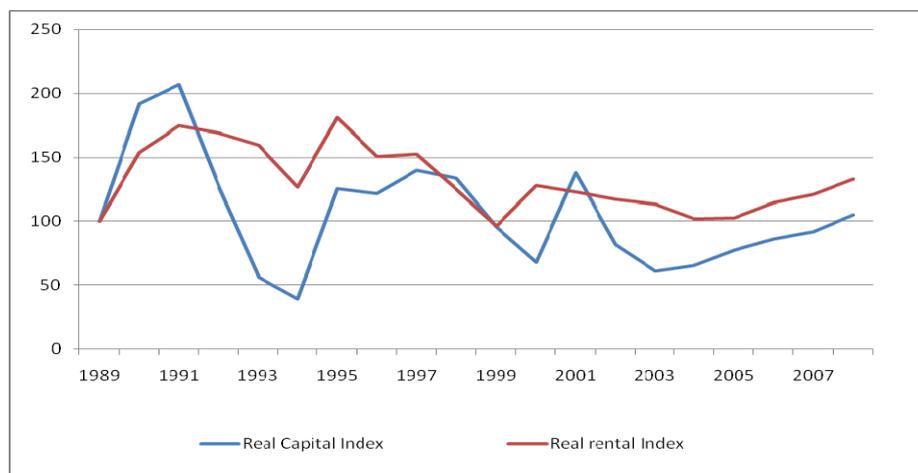


Figure 7: Real rental and real capital growth (index 1989 = 100)

In Figure 8, there appears to be a link between capital and rental growth during major changes, such as the rise in 1991 and the significant fall in 1994. Furthermore, there appears to be similar behaviour from 2002 to 2007. However, the rest of the graph demonstrates that there is no general pattern of similar movements. For instance, changes in capital values were positive in 1999, whereas changes in rents were negative. However, we have already determined that they were not negatively related, due to the similar positive movements in 2002 and 2007, yet again illustrating the lack of relationship.

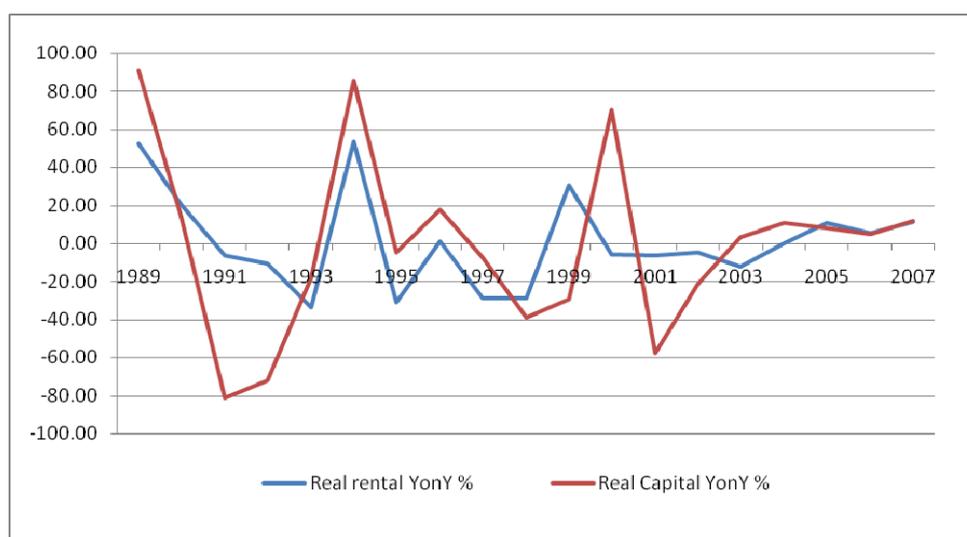


Figure 8: Year on year real capital and real rental change

If the same test be applied to the relationship between real rental and real capital growth with the real rental growth as independent variables in this case, the following results were found as in Table 3:

Table 3: Correlation and coefficient of determination of real rental and real capital

Lagging effect	Data set	Correlation	R ²
lag t-3	16	-0.3443	0.1185
lag t-2	17	-0.4366	0.1906
lag t-1	18	0.0378	0.0014
no lag	19	0.5850	0.3422
lag t+1	18	0.0179	0.0003
lag t+2	17	-0.0524	0.0027
lag t+3	16	-0.3376	0.1140

The results from table 3 demonstrated that with no time lag, the relationship is stronger with 34% (R sq. value). The following graph illustrates the scatter graph with no lag with the strongest relationship.

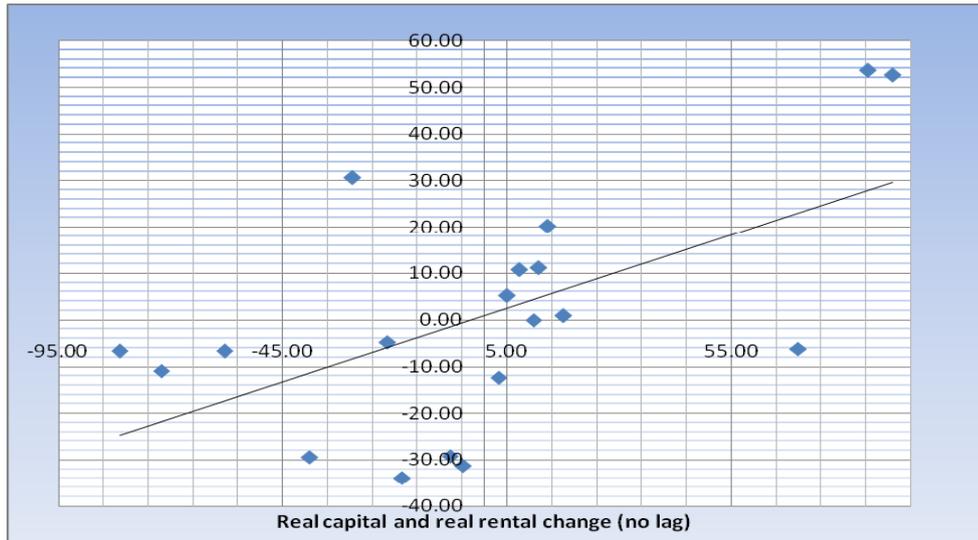


Figure 9: scatter diagram of annual real rental and annual real capital change

The two variables as depicted from the graphs in Figure 9 are very similar to the trendline, which was expected due to the coefficient of determination of 0.3422 or being 34% in common. Furthermore, it is important to note that the coefficient determination is only 0.3422, which does not illustrate a significant strong relationship. In fact these two variables are more related than the relationship between rent and CPI.

Linear regression analysis

Capital growth as a function of rental growth

The real capital growth as a potential function of real rental growth can be determined by using the linear regression as depicted in Table 4 below.

From the regression output in Table 4, the real rental growth independent variable is statistically significant as its t statistic is 2.9741. Thus, based on the result above, the hypotheses is failed to be rejected; there is a significant relationship between real rental growth and real capital growth. The regression model is as follows:

$$\text{Real Capital Growth} = 1.086435 \text{ Real Rental Growth} - 1.52902$$

Table 4: Analysis of Variance summary of Real Capital Growth as a function of Real Rental Growth

<i>Regression Statistics</i>	
Multiple R	0.585019
R Square	0.342247
Adjusted R Square	0.303555
Standard Error	39.17798
Observations	19

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	13577.17	13577.17	8.845558236	0.008510762
Residual	17	26093.54	1534.914		
Total	18	39670.71			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	-1.52902	8.991938	-0.17004	0.866983235	-20.5003492
Real rental growth	1.086435	0.365293	2.974148	0.008510762	0.315734539

If the predicted capital value and the real capital value is plotted on a graph, the graphical relationship can be seen in Figure 10 below.

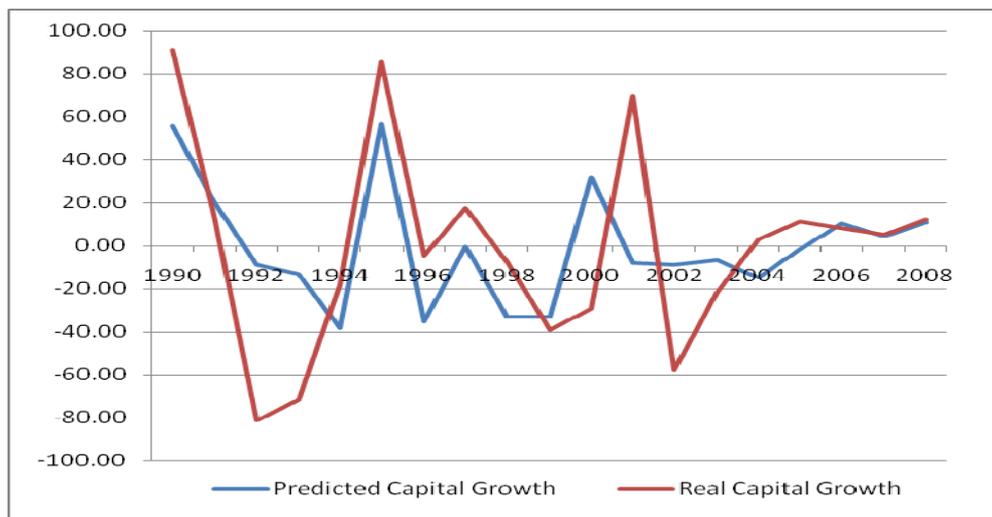


Figure 10: Linear model of predicted and real capital change 1990 – 2008

As depicted in Figure 10 above, it can be seen that there are variances between the predicted and actual values. This partly explain the correlation coefficient of real capital growth and rental of 34.25% (with no time lag).

Capital growth as a function of inflation rate

In order to investigate the possibility of a linear relationship between capital growth and CPI, a correlation analysis is performed. The results are shown in Table 5.

Table 5: Correlation analysis (r) and coefficient of determination (R^2) of capital growth and CPI

Lagging effect	Data set	r	R^2
lag t-3	16	0.4200	0.1764
lag t-2	17	-0.1421	0.0202
lag t-1	18	-0.1913	0.0366
no lag	19	0.0406	0.0016
lag t+1	18	0.0253	0.0006
lag t+2	17	0.0198	0.0004
lag t+3	16	0.1913	0.0366

Now that the strongest related time lag has been found at t-3 years with a R square of 17.64%, a linear regression model was formulated using the related data. A t-test was used again, with the regression output presented in Table 6 below which is not significant reflecting the lack of relationship of inflation rate with the office capital growth.

Table 6: Analysis of Variance summary of Real Capital Growth as a function of CPI with t-3 time lag.

<i>Regression Statistics</i>	
Multiple R	0.420029
R Square	0.176425
Adjusted R Square	0.117598
Standard Error	37.98775
Observations	16

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	4327.84	4327.84	2.999053266	0.105278004
Residual	14	20202.96	1443.069		
Total	15	24530.8			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	-41.9027	24.71995	-1.6951	0.112173309	94.92175864
CPI t-3	13.6349	7.873353	1.731777	0.105278004	-3.25176719

Conclusion

In answering the question posed in the problem statement, the results from the model testing, statistical and graphical analysis had demonstrated the lack of relationship between inflation and rental and capital changes. This does not mean that there is no relationship between them, just the findings did not strongly point to one. It could be tentatively said that a slight relationship between rental movement and inflation was found graphically, however this was not backed up by the correlation analysis.

The findings in the report illustrate that it is extremely difficult to forecast future movements in the capital and rental values from inflation, most importantly, the results pointed to the capital values being unaffected by inflation, even though as an investment, over time capital values have decreased in value in real terms. Rental values have proven to withstand inflationary pressure, seen by the tentative relationship and the possible effect of index-linked rent reviews. To further understand these potential relationships other models could be used to examine the data, including Chi Square tests, multiple box plots, Pearson's correlation and covariance.

There are limitations in this research, among which are the small number of data points and annual inflation values. In particular, monthly figures for inflation, capital and rental movement could potentially illustrate stronger results. Furthermore, it is important to know that the data from Bank Negara and NAPIC do not represent all transactions and is only a strong representation of them. For instance the rental data collated is the average of the rental value of the five prime locations in Kuala Lumpur which include the Golden Triangle, Jalan Ampang, within the city center, central business district (CBD) and the suburban area. A further investigation could be made focusing on the office market of the abovementioned locations.

As to conclude, it can be said that capital values are not affected directly by inflation, while rents do tend to follow it. Also, as in the medium to long term capital values do tend to follow rents; so all three variables are potentially linked. From the findings in the report, the capital values are inflation proofed, yet rental values appear not to be so protected in the Malaysian property market. The hypothesis has been proved that there is a significant relationship of real rental and real capital growth.

APPENDIX

Descriptive Statistics

Year	CPI Y on Y %	Rental Y on Y %	Capital Y on Y %	Transaction Y on Y %
1986	0.74			
1987	0.32			
1988	2.53			
1989	2.81			
1990	3.07	58.36	97.84	
1991	4.33	18.69	12.58	10.7
1992	4.76	1.34	-35.79	2.6
1993	3.56	-2.48	-54.25	5.8
1994	3.69	-17.73	-28.25	22.2
1995	3.45	48.15	233.80	15.8
1996	2.49	-14.65	-0.55	7.4
1997	2.66	3.93	18.36	1.6
1998	5.27	-14.17	0.28	-32.3
1999	2.74	-20.67	-26.44	21.4
2000	1.55	35.01	-28.59	6.3
2001	1.42	-2.69	108.43	1.1
2002	1.81	-2.96	-40.09	-4.6
2003	1.12	-2.11	-24.46	5.2
2004	1.44	-8.73	8.43	20.5
2005	3.02	4.00	22.05	-5.7
2006	-8.36	2.15	2.25	2.7
2007	3.61	9.21	10.91	9
2008	2.03	12.29	16.57	9.9
Mean	2.1765	5.6287	15.4253	5.5333
Standard Error	0.5458	4.9057	15.4527	2.9333
Median	2.6600	1.3430	2.2461	6.0500
Std Deviation	2.6177	21.3834	67.3567	12.4451
Sample Variance	6.8526	457.2502	4536.9209	154.8800
Kurtosis	12.4687	1.2285	5.6569	4.3516
Skewness	-3.0848	1.2643	2.1981	-1.4927
Range	13.6300	79.0244	288.0429	54.5000
Minimum	-8.3600	-20.6654	-54.2473	-32.3000
Maximum	5.2700	58.3590	233.7956	22.2000
Sum	50.0600	106.9455	293.0811	99.6000
Confidence Level (95.0%)	1.1320	10.3065	32.4649	6.1888

Table 1: Descriptive Statistics for CPI, Rental Growth, Capital Growth and Property transaction change from 1986 to 2008.

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