**Pacific Rim Real Estate Society (PRRES)
Conference 2000**

Sydney, 23 - 27 January 2000

THE IMPACT OF DEPRECIATION- A HEDONIC ANALYSIS OF OFFICES IN THE CITY OF KUALA LUMPUR

Aminah Md Yusof, PhD
Construction Technology and Management Centre
Faculty of Civil Engineering
University Technology of Malaysia
Locked Bag 791, 81310 Johor Bahru,
Johor, Malaysia

Phone: 0060 07-557 6160 Ext:3011, Facsimile: 0060 07-556 6157,
E-mail:aminah@fka.utm.my or drmie@hotmail.com

Keywords: Depreciation, systematic and specific sources, City of Kuala Lumpur's offices, and hedonic price technique.

Abstract

This paper examines the impact of depreciation on offices in the city of Kuala Lumpur. It begins with a brief review of sources of depreciation and the Kuala Lumpur's office market in 1996 and 1998. The study aims to analyse a variation in office rental in order to explain the impact of depreciation for two periods, 1996 and 1998. It is hope that the 1998 analysis will provide some indications on the effect of market-wide factors, which have not been addressed in 1996 study. The 1996 study on depreciation was undertaken by the same author, who analysed the impact of depreciation on forty-nine offices in the city of Kuala Lumpur. The study revealed that building obsolescence largely attributed to the impact of depreciation, which are property-specific factors. The finding, nonetheless, was based on the analysis of the strong market in 1996. The strong demand to occupy modern (termed as intelligent building) was significant, which was indicated by high occupancy rate especially for these offices. The pattern, however, may change since 1997's ASEAN economic turmoil, as slow economic activities may have significant impact on demand for offices. This paper extends the previous research by considering 1998 office market. The main analytical tool in this study is Multiple Regression Analysis and its extension of Hedonic Price Technique. Some related statistical tools such as Principal Component Analysis is presented. The relative importance of each factor included will be calculated in Hedonic Price Technique. The findings of both periods will be compared to examine the role of market-wide factors in property depreciation as well as to test the validity of property specific factors as dominant cause of office depreciation in the city of Kuala Lumpur.

THE IMPACT OF DEPRECIATION- A HEDONIC ANALYSIS OF THE CITY OF KUALA LUMPUR OFFICES

1. Introduction

Investment in direct property is normally associated with special characteristics, such as the ability to achieve long-term capital and income growth as well as hedge against inflation. However, property investment is also associated with a high level of risk as, when demand and supply forces change, properties decline in their relative, if not in their real value. Morrel (1992), Brown (1991), Salway (1986) and Baum (1989) suggest that property investment risk arise largely from factors specific to the property itself. Baum (1989), for examples, also identifies depreciation as a significant source of risk in property investment.

However, there has been less effort to analyse depreciation on property explicitly. This is explained by two reasons. Firstly, there has been less concern on the extent of its impact, as in high inflation and high growth times; the negative impact of asset value depreciation is largely hidden by high nominal growth rates. Secondly, as all assets depreciate, property depreciation is regarded as a normal phenomenon and, there is less interest to look at the issue in detail and it is assumed that property depreciates in a similar pattern as other assets. The main issues related to depreciation which have been constantly raised in many property investment studies are, firstly, how explicit the problem of depreciation has been dealt with and, secondly whether the correct approach has been adopted to determine the rate of depreciation in current practice. Depreciation is a decline or loss in relative values of a property compared to an equivalent new property. The impact of depreciation on property investment can be seen in declining total return as rent, yield and capital are affected.

The rate of depreciation in valuation process needed in (i) the estimation of future growth or decline in rental cash flows, (ii) the estimation of the exit yield at the end of the holding period, and (iii) the estimation of future refurbishment expenditure. There is a major concern that unreliable estimates of depreciation may lead to property market mispricing. The issues have been addressed in some works with varying levels of success.

Various attempts to explicitly analyse the impact of depreciation have been undertaken. In most studies, depreciation is explained by ‘age’ (for example Salway, 1986 and Barras and

Clark, 1996). Whilst others, such as Baum (1989) and Khalid (1992) consider multiple building obsolescence factors to explain the impact of depreciation using statistical model. Although the attempt to explicitly analysed depreciation has been undertaken by Md Yusof (1999), the study is subject to the same limitation as the impact of depreciation is explained cross-sectionally using property-specific factors. There are fewer attempts to examine the effect of other factors, for instance to analyse whether the economic downturn would trigger the level of depreciation, especially in office investment sector. The level of economics activity determines the demand for properties; for example, during the low economic growth period demand for offices may be low. In many property studies, the impact of national and local economy may be considered though it may not as heavily emphasised as property-specific factors.

This paper aims to analyse depreciation explicitly. It identifies various sources of property investment depreciation. The analysis of the city of Kuala Lumpur office market is aimed to explain the scale of office depreciation. The 1996 and 1998 were compared to provide some indications of factors that contribute to depreciation.

2.0 Literature review

Depreciation is a decline or loss in relative value of a property in comparison with the equivalent prime modern or new property, which achieve best rental in the similar sub-market (Md Yusof, 1999). It is widely accepted that many factors influence or determine the value of property investment. The review of literature from accounting and economics indicates that causes of depreciation are typically divided into two groups. The first group suggests depreciation arises through ageing process whilst the second group identifies multiple causes of depreciation and focuses more on commercial properties (see Baum, 1989).

Two broad sources of depreciation are physical deterioration and obsolescence (Wofford, 1983, Baxter, 1971, Salway, and 1986). Physical deterioration refers to normal wear and tear of a building through use and the passage of time. The rate at which physical deterioration progressed is a function of the design and the quality of construction, including the nature of the materials and the level of maintenance carried out (Dubben and Sayce, 1991). Physical deterioration can cause a decline in the utility of a building and subsequently the rent, yield and market value.

Obsolescence is normally treated as differently from physical deterioration, as it involves a more complex process. Obsolescence is defined as "a decline in the usefulness or utility" (Salway, 1986 and Baum, 1989). Obsolescence can result in a decline in usefulness (consequently loss in value) which is not directly related to physical deterioration. Baxter (1971) argues that obsolescence can be a matter of unfavourable comparison with rival assets. A property, for example, may be 'structurally and physically' good but other properties may be better still in terms of performing its function in conjunction with the tenant's need, so it suffers in comparison from obsolescence. It falls in comparative status, which may be due to factors such as better technology or design of a new property.

In some studies, such as Salway (1986) and Baum (1989), various categories of obsolescence, such as functional, aesthetic, economic etc have been introduced. Md Yusof (1999), however, classifies obsolescence into site and building as a property consists of site and building.

Building obsolescence can be regarded as the degree of mismatch between a building and its use (Golton, 1989). As new ones replace standards of performance, obsolescence takes place. Whenever any building loses its appeal, it is no longer acceptable by the standards in which it was put there for during its prime time. Building obsolescence may arise due to three aspects: building design, building systems and buildings services. As the society's characteristic way of carrying out social and economic activities changes, the desirability of various properties to tenants also changed. The need to occupy high quality space and achieve a more efficient and more desirable image in carrying on business leads to an increase in demand for properties with modern and high-tech specifications.

Site obsolescence is a decline in usefulness of a site. In order to consider causes of site obsolescence, it is important to analyse the mechanism upon which site values are derived. The value of a site is a function of a complex series of factors. Generally, land or site value, is affected by the demand for and the supply of it. These are based on the demographic structure and the patterns of land use in a particular area. Md Yusof (1999) suggests that factors, which may cause a particular site or location to obsolete, include deterioration in accessibility, factors specific to site (such as size), environmental and other market-wide factors such as the level of economic activities in the area.

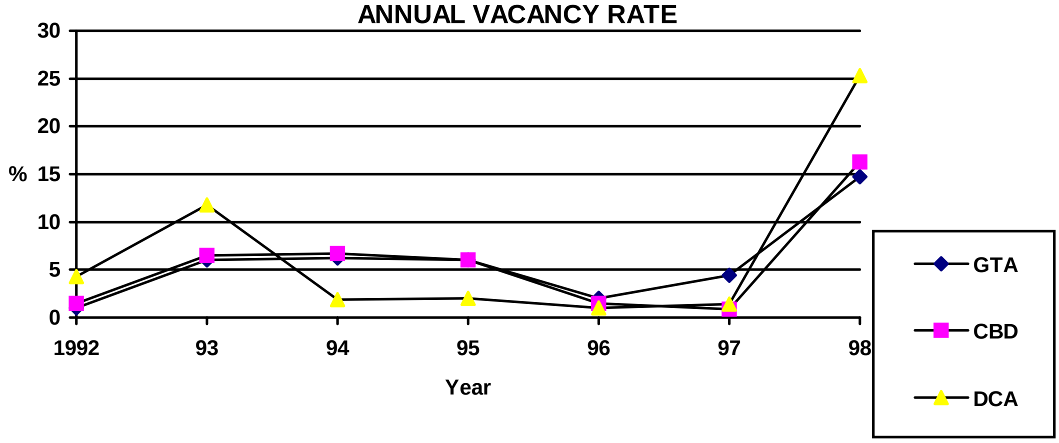
Most studies, for example Md Yusof (1999) concentrate on property-specific factors. The study indicates that the impact of depreciation is explained by factors specific to property: physical deterioration, building obsolescence and site obsolescence. Van Manen (1983), however, points out that property investment is not a separate commodity. It is affected directly and indirectly by changes in price of other commodities hence related to the state of national economy. The role of market-wide factors has been underestimated in all depreciation studies especially when the data was analysed cross-sectionally. The factors are particularly concern with the national economy which in turn influence the level of business activities hence determines the demand for property. Consequently, this can be regarded as another depreciation factor. Whilst property characteristics can be specific dimension, market wide-factors can be treated as systematic aspect of depreciation.

3.0 The City of Kuala Lumpur office market.

Offices in the city of Kuala Lumpur are classified into three areas, Golden Triangle Area (GTA), Central Business District (CBD) and Decentralised Area (DCA). The GTA is bounded by Jalan Sultan Ismail, Jalan Raja Chulan and Jalan Ampang (please refer Exhibit 1.0). This is an area where prime offices, shopping complexes, financial institutions and major international banks are located. GTA is the best location of the office developments in the city but high demand to locate in the area can have negative impact on the development. Firstly, the high-density land in GTA allows intensive development and can be important traffic generators, especially during peak hours. Secondly, the escalation of land's price in the city centre due to high demand for development. Both factors have pushed new developments to CBD and DCA. Central Business District includes Jalan Raja Laut and surrounding district as in Exhibit 1.0. The area is recognised as the main financial centre in Kuala Lumpur. Current patterns of development indicate that the CBD has been an area of concentration for new large mixed-developments as the area has been supported by its locational advantage of being the city's public transport focal point. DCA is located along Jalan Bangsar, Jalan Ipoh and Jalan Pudu. Presently new developments tend to move towards the city fringe as a solution to congestion in the city centre.

The office markets in 1996 and 1998 represent two contrasting scenarios. In 1996, the strong market was mainly contributed by the nation's prosperous economic growth. Malaysia has experienced stable economic growth since the early 1990s until 1996 at more than 8%. Nonetheless, the 1997's ASEAN financial crisis has affected the ASEAN region badly. The crisis has dragged Malaysian economy to grow at very low level: below zero. The effect of slow pace of economic activities on demand for offices began to take place in early 1998 and slumped further throughout that year.

FIGURE 1.0 THE CITY OF KUALA LUMPUR OFFICES-ANNUAL VACANCY RATE



In 1996, the property market in the City of Kuala Lumpur sustained its strength despite the general expectation that the supply would exceed the demand (PMR 1995). The number of office complexes completed in 1996 was two hundred and forty-four, made-up a total of 38,809,359 square feet of office space during this period. The massive expansion of the office sector is linked to the economics situation. Most building especially new offices in 1996 enjoyed favourable rental and higher occupancy. During the period, all offices had an average vacancy rate of less than 5% (refer Figure 1.0). This meant that high occupancy rates were not only enjoyed by prime offices (in term of location and specification) but for offices in the CBD and DCA. The probable reason outlined was the shortage of quality space in all areas (PMR 1996).

The well-absorbed supply of office space in 1996 caused the rental rates for office in the city remained relatively stable compared to the year before. In 1996, the city of Kuala Lumpur office rental ranged from (Ringgit Malaysia) RM2.50 per square foot to RM5.80 per square foot. A large variation in average rent between the offices was significant. Higher rents are normally enjoyed by spaces in prime area (GTA) or intelligent offices regardless its location.

As opposed to the above scenario, the 1998 office market took a downturn with a sharp easing of both occupancy and rental rates. The occupancy rates rise to as high as 16%, the highest recorded since 1990's (please refer Figure 1.0). The highest office vacancy was recorded in the DCA. The main reason for the overall drop in occupancy was the poor absorption of new office supply. In 1998, there was an addition of 7,825,742 square feet to the existing stock. The vacancy rate is further escalated by tenant's relocation either to their own building or cheaper alternative within or outside the city centre. As a result of over supply and low demand, both the existing and asking rental rates saw significant reduction. Buildings in the city centre have an occupancy rates lower than 80% and had higher reductions of 20% to 30% in rental (PMR, 1998)

While some prime offices maintain high rent, the rates were generally pegged at RM3.80 per square foot per month. The existence of attractive packages such as rent free periods of one to three months, carpeting and agent's fees, were actually reducing the effective rentals to RM3.00 -RM3.50 per square foot (PMR, 1998).

4.0 Methodology and Data

In this study, forty-nine offices in Kuala Lumpur's traditional commercial areas (GTA, CBD and DCA) were chosen. Twenty-four, thirteen and twelve properties were located in the GTA, CBD and DCA respectively. There was no intention to include only prime office or prime location. The survey was focused only on "purpose-built offices" of more than 8 storeys to comply with the definition outlined by the City Hall of Kuala Lumpur. Other criteria taken into consideration were age (buildings of less than twenty-five years, which is common in the city) and tenanted offices. Detail discussion on the preparation and survey is illustrated in Md Yusof (1999). To explain rental depreciation for 1996 and 1998, the information collected are:

a) Property-specific characteristics

A survey on offices was undertaken to obtain comprehensive details of property characteristics. A standard questionnaire was prepared. The selection of property characteristics or attributes is guided by the analysis of sources of depreciation. Variables selected are linked to physical deterioration, building obsolescence and site obsolescence. Although a total of fifty-one variables were collected, only thirty -one variables were found to be significantly associated with rental depreciation. These variables have been used for further analysis.

An examination of correlation matrices showed that strong associations (multicollinearity) exist between independent variables. Principal Component Analysis is performed on thirty-one variables, aimed to summarise and reduce the number of independent variables. The use of a large number of independent variables can create a number of problems such as multicolinearity. Principal Component Analysis, moreover, eliminates mulicollinearity; problem, which can be easily, observed when variables are linked to each other. The problem of multicolinearity may cause difficulty in determining causal variables in the regression equation, as the independent variables are closely associated among themselves. A full discussion on PCA used can be found in Md Yusof (1999) and in Exhibit 2.0. A summary of the PCAs is shown in the same exhibit.

b) Performance indicator

The impact of depreciation has also been observed on rental. For this reason, rental for forty-nine selected offices for both period 1996 and 1998 were collected. In this study, rental for 1996 was the actual rental paid which is measured as an annual rental per square foot. However, for 1998, due to some problems, the rental for every offices was derived from Property Market Report 1998 which is asking rent thus may not be actual rent paid.

The highest rentals achieved for both time markets are selected as a benchmark. Difference between prime rental for 1996 and 1998 are used as dependent variables. In 1996 the prime rent was RM5.80 and in 1998 was RM6.50. The rate of depreciation is arrived as follows:

$$\text{Rental Depreciation}(\%) = \frac{[\text{Prime Rent} - \text{Office Rent}]}{[\text{Prime Rent}]} \times 100$$

<u>Hedonic Price Technique</u>

In this study, a hedonic model solves the main problem in analysing property values and depreciation. Valuation of a particular set of property attributes is not done in terms of each individual attribute but is represented in a single measure of office value, rental. Therefore, to indicate the price variation in the individual attributes from one office to another, the price measure must be aggregated. Hedonic theory in this study enables an estimation of the implicit price of each characteristics by relating depreciation of an office building to its individual factors. Depreciation arises from three major causes and can be shown as:

Dep = f (Physical deterioration, Building obsolescence and Site obsolescence)

The selected independent factors are regressed against rental depreciation and the hedonic price of each factor is calculated to determine the importance of each in explaining depreciation for offices in the city of Kuala Lumpur. The models of the analysis are:

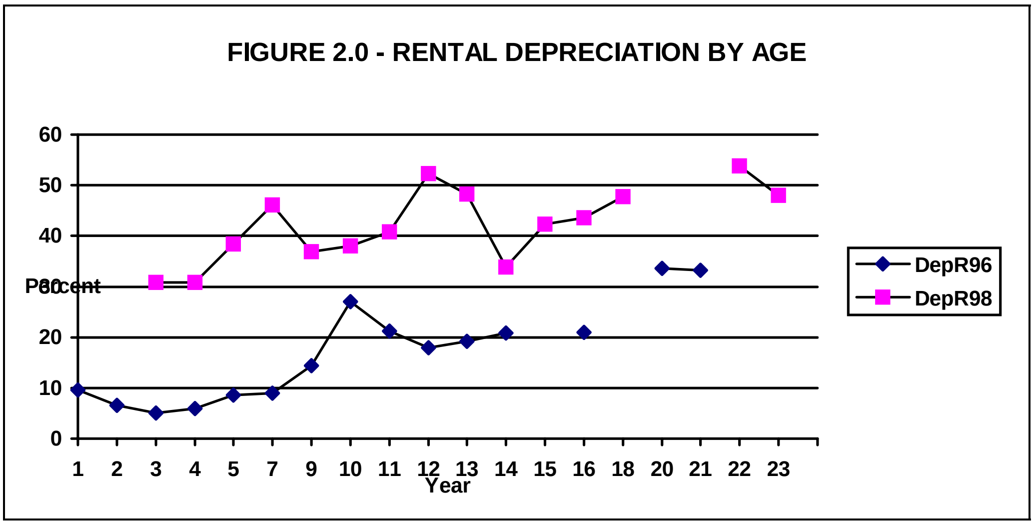
$$DepR_{96} = bo + Fac_1x_{1t} + Fac_2x_{2t} + Fac_3x_{3t}.......+Fac_nx_{nt} + eit.$$
$$DepR_{98} = bo + Fac_1x_{1t} + Fac_2x_{2t} + Fac_3x_{3t}.......+Fac_nx_{nt} + eit.$$

5.0 Empirical Results and Discussion

The main findings of the analysis are as follow:

First, based on age, it was shown that the rate of depreciation for 1 and 2 years old offices is higher than for 3 and 4 years old buildings (9.6% and 6.6% compared to 5.1% and 6% respectively. Please refer Figure 2.0). As shown in Exhibit 4.0, the rate of depreciation ranged from 0% to 33.6% in 1996. The average rental depreciation for that year was 15.91%. For the first nine years of life, the level of depreciation is less than average rental depreciation of all offices in dataset. Depreciation is moderated after year 11 and picked up again toward year 21.

The general picture of 1996 indicated that the level of depreciation was considerably low with an exception of 10 years old. High level of depreciation was due to a ‘vintage effect’. The offices were built mainly to responds high demand created by the economic boom in the late 1970s. Some offices were built with lower specifications and have limited capacity to be upgraded. As a result, the buildings suffer high level of depreciation.



Meanwhile the rate of depreciation for 1998, ranged from 0% to 56.92% with an average of 38%. The relationship between rental depreciation and age for both periods is visualised in Figure 2.0. In 1998, the rate of depreciation for offices (five years and over) is higher than average rate of depreciation (38%). The escalating rate of depreciation is obvious. The rate of depreciation in 1998, peaked at year five before dipped between year seven to eleven and peak again at age 12. This is associated with the high level of depreciation of 10 years offices in 1996 where the offices suffered high level of depreciation due to lower specifications. The offices were built in mid 1980s and inherit traditional specifications hence less favoured compared to intelligent offices in 1996 and 1998.

The overall finding is that the rate of depreciation accelerates further during the recession. As some offices maintain their prime share in letting market, some experience deteriorating state. When the prime rent is sustained, whilst the overall level of rental declined, the impact of depreciation is significant as shown in 1998. From the above figure, it is obvious that most offices in the dataset depreciate at the rate of 50% per year after 1996. The pattern of rental depreciation in 1998 is likely to replicate 1996's. Systematic dimension of depreciation affects all properties and it was shown that during recession the level of depreciation escalate faster than ever. Nonetheless, the unsmooth pattern of relationship in the figure indicates that the pace of depreciation cannot be linked directly to 'age' of offices only. This is true when there is less evidence to show that depreciation increases as property ages, especially at the early and middle stages of the building's life. Hence the analysis of specific factors was undertaken.

Second, the building components are dominant influences on the rate of depreciation. It was shown that in 1996, regardless of the location, modern offices achieved higher rentals than other offices. It is shown that for both periods, most variables included in the models are building obsolescence and physical deterioration related. The building quality has been main preference for both periods, indicated by the high proportion of variance explained (R^2) that is 32.2% and 20% for 1996 and 1998 respectively. The rate was decrease as another variable has been included in 1998's model. Two models for both periods are developed as follows:

$$DepR_{96} = 15.61 - 5.202(BldgQty) - 3.438(SizeEfficient) - 1.557\,(DesLay) - 3.143\,(Location) - 1.947(Compl) - 1.587(Facil\,) - 1.515(Parking)$$

$$DepR_{98} = 40.244 - 5.46(BldgQty) - 4.12(SizeEfficient) - 3.32\,(DesLay) -.3.12\,(Serv) - 1.64(Appear) - 3.06(Prox\,) - 3.33(Facil) - 2.78(Access)$$

Based on the hedonic regression result, the 1996 depreciation model explains 73.8% of variation in rental depreciation using seven variables/factors. The factors are 'SizeEff','DesLay', 'BldgQty', 'Facil' and Park' which can be categorised under physical deterioration and building obsolescence. The inclusion of 'Locat' and 'Compl' can be used to show the relative impact of site obsolescence. The 1998's model consists of eight variables, 'BldgQty', 'SizeEff', 'DesLay', 'Serv', 'Facil', 'Appear', 'Prox' and 'Acces'. As above, 'BldgQty', SizeEff', 'DesLay', 'Serv', 'Facil' and 'Appear' are related to physical deterioration and building obsolescence. Similarly, 'Prox' and 'Access' are related to site obsolescence.

Based on the above information collected the analysis revealed that building-related variables explain a large variation of depreciation. This indicates that the variables significantly determine the level of rental and consequently rental depreciation (Please refer Exhibit 3.0). Generally, the models suggest that offices, which were built with better and modern specifications, suffer less depreciation than offices without them. Better location, although could minimise the level of depreciation, it was not as significant as building-characteristics. There was tendency of modern offices to cancel the impact of secondary location, where some modern offices in the DCA and CBD were able to achieve high rent hence low depreciation.

However, a combination of both site and building offers strong resistant from depreciation. For offices in the GTA there was scope for cancelling the impact of physical deterioration and building obsolescence by site advantage. The average rental depreciation for older offices in the GTA is lower compared to the same offices in the CBD and DCA.

6.0 Summary and Conclusion

The above analysis shows that depreciation may arise from factors, which are specific and systematic to the property. Systematic dimension of depreciation in this study is shown in the comparison between 1996 and 1998 office market. In 1998, the city of Kuala Lumpur suffered high level of depreciation as shown by an increment of 100% from 1996. This has been explained by the low demand created by slow economy activities during recession. This is worsened further by the completion of a large amount of high-quality office spaces. When all offices are affected by slow demand, some offices depreciate faster than others do. The phenomenon is explained by specific dimension of depreciation. Variation in offices' characteristics, denoted by site obsolescence, building obsolescence and physical deterioration explained the scale of depreciation in the city of Kuala Lumpur. Among these three, physical deterioration and obsolescence were found to be major sources of depreciation in the City of Kuala Lumpur.

It can be concluded that whilst economy may affect the whole market (hence all offices suffer high level of depreciation) the analysis of depreciation is best initiated with factors specific to the property itself. The analysis will provide more appropriate indication of property investment depreciation hence will minimise the risk of mispricing which is due to this factor.

REFERENCES AND BIBLIOGRAPHY

Barras. R and Clark.P (1996), 'Obsolescence and performance in the Central London Office Market', *Journal of Property Valuation and Investment*, Vol. 14 No 4, 1996 (63- 78).

Baum. A.E (1991), *Property Investment Depreciation and Obsolescence*, Routledge, London.

Baum, A.E (1989), *An Analysis of Property Investment Depreciation and Obsolescence*, Unpublished PhD thesis, University of Reading.

Baxter .W.T (1971), *Depreciation*, Sweet and Maxwell, London.

Brown, G.R (1991), *Property Investment and Capital Markets*, E & FN Spon, London.

City Hall of Kuala Lumpur (19__) '*A Guideline for classification of office Buildings in Kuala Lumpur'*, Master Plan Unit, Planning and building Control Department.

Domain Properties (1997), *1996 Property Market - Office sector*, Unpublished Report, Malaysia.

Domain Properties (1996), *1995 Property Market - Office sector*, Unpublished Report, Malaysia.

Dubben.N and Sayce.S (1991), *Property Portfolio Management - An Introduction*, Routledge, London.

Dunse.N and Jones. C., (1998), 'A Hedonic Price Model of Office Rents', *Journal of Property Valuation and Investment*, Vol. 16, No 3, 1998 p.297 - 312.

Golton, B.L (1989), 'Perspective of building obsolescence' in *Land and Property Development- New Directions*, Ed Richard Grover, E & F.N Spon: 269 -280.

Huat L.C and Khalid. Abdul (1997) 'Malaysian -1997 Property Market Report', Colliers Jordan Lee and Jaafar. *Real Estate Review*, Vol. 25/1997.

Khalid , A.G (1992) *Hedonic Estimation of the Financial Impact of Obsolescence on Commercial Offices Buildings*, Unpublished PhD Thesis, University of Reading.

Md Yusof, A (1999), *Modelling the Impact of Depreciation- A Hedonic Analysis of Offices in the City of Kuala Lumpur*, Unpublished PhD thesis, University of Aberdeen.

Morrel, G. (1995), "Property indices: a coming of age?", *Journal of Property Valuation and Investment*, Vol. 13 No.3, pp. 8 -21.

Myers R.H (1990) 2nd Ed *Classical and Modern Regression with Applications*, Duxbury Press.

Salway.F.W (1986) *Depreciation of Commercial Property*, CALUS Research Report 1986

Valuation and Property Service Department, Ministry of Finance (1992), '*Why Rent in Kuala Lumpur'*, Research Report.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1997) *Property Market Report 1996*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1996) *Property Market Report 1995*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1995) *Property Market Report 1994*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1994) *Property Market Report 1993*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1993) *Property Market Report 1992*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1992) *Property Market Report 1991*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1991) *Property Market Report 1990*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1990) *Property Market Report 1989*, National Printing Department, Malaysia.

Valuation and Property Service Department, Ministry of Finance, Malaysia (1989) *Property Market Report 1988*, National Printing Department, Malaysia.

Valuation and Property Services Department, Ministry of Finance, Malaysia (1997) *Malaysian Home Price Index- A Technical Summary*, National Printing Department.

Van Manen.F.J (1983), ‘Economic Recession creates Economic obsolescence’, *Real Estate Appraiser and Analyst*, Spring, 1983.

Woofford, L.E (1983), *Real Estate* (revised edition) New York, John Willey.

EXHIBIT 1.0

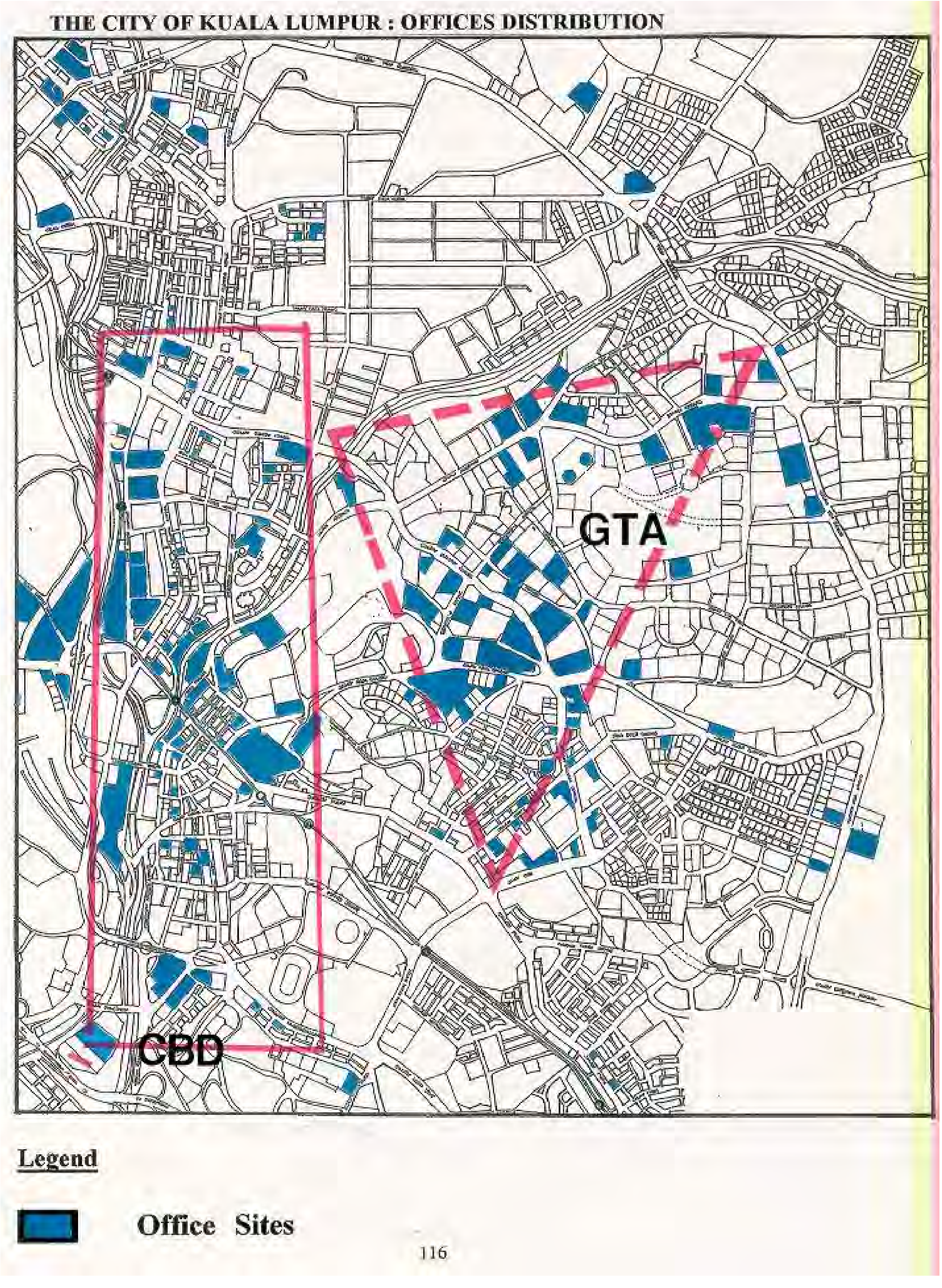

THE CITY OF KUALA LUMPUR : OFFICES DISTRIBUTION
GTA
CBD
Legend
Office Sites
116

EXHIBIT 2.0 PRINCIPAL COMPONENT ANALYSIS

Principal Component Analysis.

The objective is to derive underlying dimensions, which greatly simplifies the description and understanding of the complex phenomena such as depreciation. As mentioned earlier, the analysis is used for the following reasons:

1) To reduce the number of independent variables. If there is a large number of independent variable, they are unlikely to measure different constructs. Therefore, it makes sense to determine what the main constructs we are investigating.
2) To reduce or eliminate the potential of multicollinearity. Since the factors derived are orthogonal, multicollinearity, which causes unstable regression equation, is eliminated.
3) To increase n/k ratio ('n' is sample size and 'k' is number of predictors). If the independent variables are reduced to a smaller number, the ratio increases dramatically hence the higher the ratio, the better the equation.

The basic assumption of the analysis is that the underlying dimensions, or components, can be used to explain the complex phenomena. Therefore the goal of the analysis is to identify the non-directly observable factors or components based on a se of observable variables. The model for the *i*th standardised variable is written as:

$$X_i = A_{i1}F_1 + A_{i2}F_2 + \ldots\ldots\ldots\ldots A_{ik}F_k + U_i.$$

Where the *F*'s are the common factors, the *U* is the unique factors, and the A_i's are the constant used to combine the k factors. The factors can be derived from observable variables and can be estimated as linear combinations of them. The general expression for the estimate of the jth factor Fj is;

$$F_j = \sum W_{ji}X_i = W_{j1}X_1 + W_{j2}X_2 + \ldots\ldots\ldots W_{jp}X_p$$

The Wi's are known as factor score coefficients, and *p* is the number of variables.

Two Principal Component were undertaken for 1996 and 1998 rental depreciation. The analyses proceed in four steps, (i) a preliminary tests for an appropriateness of the analysis, (ii) an extraction of factors, (iii) factors rotation and, (iv) the computation of factor's score.

i) Preliminary test

The tests used are the computation of correlation matrices and the Keser-Myer Olkin (KMO) test. The test measures sampling adequacy. As the objective of the analysis is to link variables together into factors, the variables must be strongly related to one another. The result shows that the correlation matrices between independent variables are 0.3 or greater in absolute value (the correlation matrices are not attached). These strong correlations indicate that many independent variables possess or share common factor hence PCA worth pursuing. KMO is an index for comparing the magnitudes of the observed correlation coefficient to the partial correlations. Small value of KMO indicates that PCA may not be a good idea. Myer (1990) suggests that if the value of KMO lower than 0.5, PCA should be abandoned. For both $DepR_{96}$ and $DepR_{98}$, the values of KMOs are exceeding 0.7, hence the analysis is continued to the second level.

(ii) Factor extraction

At this stage the component analysis will extract factors from selected independent variables. The number of factors to be retained for further stage of the analysis is depending on eigenvalue. (Eigenvalue is the sum of squares of each factor, which measure the variance of each). Nonetheless, the factors are not normally interpreted until they are rotated (for easier interpretation).

(iii) Factors rotation

Rotation transforms the initial matrix into one that is easier to interpret or to achieve a simple structure. Varimax rotation was used to enhance the interpretation of the factors. A summary of rotated factors for both $DepR_{96}$ and $DepR_{98}$ is shown in Tables A and B below.
Eight orthogonal factors derived in $DepR_{96}$ are:
1) The quality of the building (BldQty),
2) Size and Efficiency (SizeEff),
3) Design and Lay-out (DesLay),
4) Location (Locat),
5) Appearance (Appear),
6) Complementary (Compl),
7) Facilities (Facil),
8) Parking services (Park),

Eight orthogonal factors derived in $DepR_{98}$ are:
1) The quality of the building (BldgQty)
2) Size and Efficiency (SizeEff)
3) Design and Lay-out (DesLay)
4) Services (Serv)
5) Facilities (Facil)
6) Appearance (Appear)
7) Proximity (Prox)
8) Accessibility (Acces)

iv) Score computation

The final stage of PCA is the computation of factor's score. The score is used in the regression analysis.

TABLE A A SUMMARY OF ROTATED FACTORS - FACTOR MODEL $DepR_{96}$

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Bas	0.87834	0.23470						
Fire	0.86085	0.21599						
Ac_fl	0.85660				0.25406			
Cr_fin	0.81943	0.40123						
Ac_sys	0.79886	0.29250						
Lif_con	0.73974		0.22218	0.23623	0.26494			
Spautl	0.73763	0.21110	0.33009					
Security	0.69925	0.39126				0.21456		
Wait_car	0.68396	0.41094				0.24674		
Int_car	0.68042	0.41281						
Ce_high	0.67139	0.25368	0.36080					
Spd_car	0.65230	0.44478						
Age	-0.6457		-0.27078		-0.2391	-0.2127		-0.3619
Lob_fin	0.60613		0.46831			0.25281		-0.2791
Ty_con	0.58347		0.28886		0.54475			
Schrg	0.58072	0.32799		0.23272	0.23858		0.25063	
Comm	0.55425				0.49492	0.25684	-0.2200	
Ex_fin	0.54429		0.35433		0.48427			
Fl_fin	0.42897			0.40333		0.41760	0.21337	
Fl_area	0.27058	0.83739						
Nt_let	0.35436	0.81319						
Lif_car	0.31524	0.79005	0.22471		0.20333			
Bay	0.38264	0.78278						
Stry	0.32056	0.61937	0.21132					0.43052
Ld_area		0.60879			0.22462			-0.4137
Re_count	0.33624	0.55291					0.33891	
Lobby	0.34039		0.70515					
Bay_rate	0.28630	0.26606	0.57093	0.24299			0-0.2368	-0.3416
Gym			0.53352				0.50643	
Locat	-0.21084			0.85348				
Ty_bay	0.41789			0.72417				0.25862
Lascap	0.33170	0.32342		0.39946	0.36963	0.25269		
Dine					0.68054		0.45437	
Prox						0.82223		
Cm_ref		0.43957				0.65133		
Conf	0.21615						0.82699	
Plratio								0.80980

TABLE B A SUMMARY OF ROTATED FACTORS - FACTOR MODEL $DepR_{98}$

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Ac-Fl	0.76617			0.42122				
Ac_sys	0.70888	0.32053		0.21743		0.3333		
Age98	-.80582						-.40588	
Bas	0.76053	0.28595		0.38492				
Bay	0.28985	0.79119	0.25527					
Bay-rate		0.25060	0.66857					
Ce_high	0.56227	0.29952	0.36404	0.35076	0.20685		0.2110	
Cm_ref		0.41616		0.24036			0.59425	
Comm	0.49815				0.82741	0.64302		
Conf					0.20212			
Cr-Fib	0.69961	0.39774	0.26718	0.28179	0.63099			
Dine	0.22411					0.34899	0.28321	
Ex_fin	0.70050		0.21659	-.25501		0.21635		
Fire	0.80946	0.23832				0.26314		
Fl_are		0.88030		0.21945				
Fl_fin			0.25995	0.62014		0.23821		0.20121
Gym			0.38427		0.59235		0.38855	-.25819
Int_car	0.56091	0.39787	0.43699			0.28022		
Lascap		0.29302		0.31049	0.25499	0.53908	0.25457	
Lif_car	0.31668	0.81719						
Lif_con	0.53158		0.41231	0.44753				
Lob_fin	0.47078		0.70264					
Lobby	0.37660		0.57385		0.20755	-.21755	0.29080	
N_lett	0.31486	0.83092						0.20251
Prox				0.20380			0.58413	0.46606
Re_count	0.28098	0.50837			0.39469			
Schrg	0.39990	0.31001		0.32264	0.32606	0.37777		
Security	0.61240	0.43190	0.21032	0.34709				
Spautl	0.76438	0.25971	0.21714					
Spd_car	0.53366	0.41156	0.30858	0.23214		0.30542		0.23207
Stry	0.41264	0.67309						
Ty_bay	0.26414	0.20326		0.71049			0.20439	
Ty_con	0.77726	0.31524				0.25698		
Wait_car	0.48794	0.38501	0.34894	0.20654		0.44941		
Access		0.22323						0.84665

EXHIBIT 3.0 A SUMMARY STATISTIC FOR RENTAL DEPRECIATION

1996	Increase in R^2	Coefficient	1998	Increase in R^2	Coefficient
BldgQty	32.2%	-5.2	BldgQty	20%	-5.46
SzeEff	15.9%	-4.03	SizeEff	13.1%	-4.12
DesLay	3.18%	-1.6	DesLay	8.1%	-3.32
Locat	12.5%	-3.14	Serv	7.0%	-3.12
Appear			Facil	8.3%	-3.33
Compl	4.96%	-1.956	Appear	2.1%	-1.64
Facil	3.8%	-1.597	Prox	7.4%	-3.06
Park	3.0%	-1.52	Access	5.2%	-2.78

A SUMMARY OF MULTIPLE COMPONENT REGRESSION ANALYSIS

DEPENDENT VARIABLE : DepR96

Multiple R	0.85893
R Square	0.73776
Adjusted R sq.	0.69069
Standard Error	4.98157

Analysis of Variance

	DF	Sum of Squares	Mean Squares
Regression	7	2722.80374	388.97196
Residual	39	967.82435	24.81601

F = 15.67424 Signif *F* = .0000

Variable	B	SE B	Beta	T	Sig T
(Fac1-BldgQty)	-5.203	0.741	-.576	-7.016	.0000
(Fac2-FffSize)	-3.438	0.729	-.387	-4.718	.0000
(Fac3- DesLay)	-1.557	0.720	-.177	-2.164	.0366
(Fac4-Locat)	-3.143	0.727	-.355	-4.323	.0001
(Fac6- Compl)	-1.947	0.728	-.219	-2.674	.0109
(Fac7- Facil)	-1.587	0.733	-.178	-2.167	.0364
(Fac8- Parking)	-1.515	0.720	-.172	-2.104	.0419
Constant	15.614	0.728		21.452	.0000

DEPENDENT VARIABLE : DepR98

Multiple R	0.85190
R Square	0.72573
Adjusted R sq.	0.66947
Standard Error	6.61276

Analysis of Variance

	DF	Sum of Squares	Mean Squares
Regression	8	4512.65361	564.08170
Residual	39	1705.41379	43.72856

F = 12.89962 Signif *F* = .0000

Variable	B	SE B	Beta	T	Sig T
(Fac1-BldgQty)	-5.46	.967	-.474	-5.642	.0000
(Fac2-FffSize)	-4.12	.954	-.362	-4.317	.0001
(Fac3- DesLay)	-3.32	.958	-.291	-3.471	.0013
(Fac4-Serv)	-3.12	.967	-.271	-3.234	.0025
(Fac5- Facil)	-3.33	.956	-.291	-3.481	.0012
(Fac6- Apper)	-1.64	.958	-.143	-1.712	.0949
(Fac7- Prox)	-3.06	.955	-.268	-3.202	.0027
(Fac8-Acces)	-2.79	.961	-.242	-2.896	.0062
Constant	40.24	.955		42.121	.0000

EXHIBIT 4.0 A SUMMARY OF RENTAL DEPRECIATION ANALYSIS

Offices	Age 96	Ann Ren96	Dep96	Age98	AnnRen	DepR98
1	21.0	55.20	14.40	23.00	42.00	46.15
2	16.0	45.60	24.00	18.00	37.20	52.31
3	10.0	48.00	21.60	12.00	38.40	50.77
4	14.0	48.00	21.60	16.00	45.60	41.54
5	13.0	43.20	26.40	15.00	38.40	50.77
6	14.0	50.40	19.20	16.00	48.00	38.46
7	13.0	49.20	20.40	15.00	45.60	41.54
8	21.0	63.60	6.00	23.00	50.40	35.38
9	12.0	66.00	3.60	15.00	51.60	33.85
10	3.0	69.60	-	5.00	78.00	-
11	14.0	48.00	21.60	16.00	38.40	50.77
12	7.0	66.00	3.60	7.00	49.20	36.92
13	9.0	50.40	19.20	11.00	42.00	46.15
14	16.0	48.00	21.60	18.00	42.00	46.15
15	11.0	54.00	15.60	13.00	39.60	49.23
16	2.0	60.00	9.60	5.00	48.00	38.46
17	11.0	45.60	24.00	13.00	43.20	44.62
18	13.0	48.00	21.60	15.00	38.40	50.77
19	1.0	54.00	15.60	3.00	48.00	38.46
20	3.0	66.00	3.60	5.00	48.00	38.46
21	2.0	66.00	3.60	4.00	54.00	30.77
22	13.0	54.00	15.60	15.00	48.00	38.46
23	13.0	54.00	15.60	15.00	48.00	38.46
24	21.0	45.60	24.00	23.00	36.00	53.85
25	11.0	45.60	24.00	13.00	38.40	50.77
26	4.0	68.40	1.20	5.00	68.40	12.31
27	12.0	66.00	3.60	14.00	54.00	30.77
28	16.0	54.00	15.60	18.00	44.40	43.08
29	5.0	45.60	24.00	7.00	37.20	52.31
30	9.0	60.00	9.60	11.00	50.40	35.38
31	21.0	38.40	31.20	23.00	33.60	56.92
32	12.0	69.60	-	15.00	62.40	20.00
33	20.0	36.00	33.60	22.00	30.00	61.54
34	3.0	66.00	3.60	5.00	48.00	38.46
35	20.0	48.00	21.60	22.00	42.00	46.15
36	16.0	46.80	22.80	18.00	39.60	49.23
37	12.0	43.20	26.40	14.00	36.00	53.85
38	1.0	60.00	9.60	3.00	54.00	30.77
39	4.0	66.00	3.60	6.00	57.60	26.15
40	4.0	66.00	3.60	6.00	66.00	15.38
41	20.0	43.20	26.40	22.00	36.00	53.85
42	12.0	60.00	9.60	14.00	54.00	30.77
43	4.0	54.00	15.60	6.00	38.40	50.77
44	20.0	50.40	19.20	22.00	45.60	41.54
45	10.0	37.20	32.40	12.00	36.00	53.85
46	3.0	66.00	3.60	5.00	60.00	23.08
47	3.0	60.00	9.60	5.00	60.00	23.08
48	1.0	60.00	9.60	3.00	60.00	23.08
49	3.0	54.00	15.60	5.00	54.00	30.77