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Macro-economic Factors Affecting Office Rental Values in Southeast Asian Cities: The case of Singapore, Hong Kong, Taipei, Kuala Lumpur and Bangkok

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Abstract:

The purpose of this paper is to identify the macro-economic drivers of office rental values in South-east Asian cities over the period 1988 – 2001 by adopting the demand and supply framework. The paper tries to use the existing single-equation method to examine influences on office rents in five South-east Asian cities (Singapore, Hong Kong, Taipei, Kuala Lumpur and Bangkok). Real GDP, unemployment rate, floor space for office buildings, interest rate, lending rate, consumer index and service sector output will be included in examining the movements of office rental values. In spite of data limitations, this research demonstrates that in Singapore and Taipei office markets, rental values are mainly determined by changes in office floor space, while in Hong Kong and Kuala Lumpur office markets, lending rates have a greater effect on rental values. However, there are no significant factors in the Bangkok office market. The results also suggest that office markets in South-east Asia are highly linked with development markets, while demand-side variables do not have much impact on those markets.

This paper also reviews previous empirical studies and assesses future research directions for South-east Asian office markets.

Keywords: South-east Asia Office Rents, Single-Equation Model, Regression.

Introduction:

The World Bank noted that from the 1960s to 1990s, twenty-three economies of East Asia grew faster than all other regions of the world. Most of the growth could be attributed to eight economies: Japan, the “Four Tiger Economies” (Singapore, Hong Kong, Taiwan, and South Korea), as well as Indonesia, Thailand and Malaysia which were known as “Newly

Industrialising Economies" (NIEs). The latter started to achieve high economic growth in the early 1990s. Nevertheless, the former have experienced high economic growth since early 1980s. These economies all achieved high economic growth and attracted large amounts of foreign investment.

These countries have several common characteristics in their economic performance and follow similar growth patterns (Armitage 1996, Yong 2000, Asian Development Bank 2001):

- Rapid urbanisation in emerging economies
- Sustained economic growth
- Extreme population pressure
- Accelerating rate of change in social and economic structures
- Increasing share of international economic activity
- Growing affluence
- Large domestic markets
- Social and political tension
- Swift adoption of new technology and work practices
- High technology exports accounting for large portion of GDP growth
- Higher initial levels and growth rates of human capital
- High rates of productivity growth

The relative attractiveness of a large number of alternative South-east Asian cities (such as Hong Kong, Singapore, Taipei, Kuala Lumpur, and Bangkok) is likely to become a more frequent consideration in the corporate investment strategies of occupiers and investors. This research aims at establishing the relationship between macro economic activities and office market performance in South-east Asian cities. There is much interest in South-east cities from global multi-national property companies and property investors. However, there is a lack of relatively detailed South-east Asian property research and data. This paper provides an overview of the office market analysis in South-east Asian cities and methodological issues concerning the application of Ordinary Least Square (OLS) model of office rental levels within five major South-east Asian cities.

Previous studies have attempted to employ demand and supply variables to explain office rental movements. There are two difficulties in this type of study. Firstly, the demand and supply variables are proxy variables for the property markets, because there are no direct-measured variables within the property markets. Secondly, the availability and reliability of the data are in question (Gardiner et al. 1988, Giussani et al. 1992, Tsolocas et al. 1993, D'Arcy et al. 1997).

This paper follows the author's paper to the PRRES conference in Christchurch (Chin, 2002). It attempts to model office markets in South-east Asian cities. The paper gives a brief overview of office markets in South-east Asian cities, previous empirical studies and reports results of an empirical investigation of the relationship between office rents and fluctuations in economic activities.

Overview of Southeast Asian Office Markets:

Since the 1960s, economic growth in East Asian countries has been higher than in other regions of the world (World Bank, 2000). From 1985 to 1997, the best economic performance in global terms was in the Asia-Pacific region, with the property sector and stock market particularly strong during that period. As a consequence, foreign investment flowed into this area in search of huge profits. However, some countries in the region experienced similar problems, while the accompanying risks were high. Lending to property and over-supply proved to be key causal factors in the 1997 financial crisis throughout the region. (D'Arcy, 1998).

From the 1980s a property boom occurred in most of the Asia-Pacific property markets, which encouraged property companies to continue building. In time, an over-supply emerged in many cities across the region, which led ultimately to a bad debt problem in the property sector, mainly as a result of the shallow banking system. At one time, over 200 million square feet of space was under construction, with a large proportion in Kuala Lumpur, Bangkok and Jakarta, and at the same time there was an increasing vacancy rate (Knight Frank 1998). It is worth noting that rents were very high for certain classes of space, even by international standards. In the area as a whole, differences in the property process, political uncertainty, and the regulation of the financial markets were all important factors, and were significant in the performance of the property market (Chin, 1999).

Investment return in property markets experienced high growth in the 1990s, attracting much local and foreign capital. In some countries, an oversupply problem had emerged by 1996. However, little attention was paid to this, which contributed to regional financial turmoil in 1997.

During the financial crisis, property companies experienced severe difficulties in repaying their debts as demand for property in most sectors dropped dramatically, especially in Thailand. New developments had to be halted when rapidly falling currencies doubled or even tripled debt repayments, and prices and rental values falling by 30% to 40% made the difficulties even

worse. In Hong Kong and Malaysia, property market prices and stock markets dropped by a large amount, and lending rates increased in these countries, leading to further falls in property prices and values, while vacancy rates rose. Singapore and Taiwan with their strong currencies and large reserves were able to limit this financial damage in 1997 and 1998 (Chin,1999).

South-east Asia experienced a strong economic recovery in 1999, marked by strong growth and a robust performance after the dramatic slowdown of 1998. Consistently strong global demand and recovering domestic demand proved to be major factors stimulating economic activity across the region. Capital moved from old business sectors into the new economy sectors such as the Internet and telecommunications. The obvious evidence is in the stock market. Many of the South-east Asian stock markets were then dominated by the new economic sectors, and these became one of the major tenants for the office market, especially in Hong Kong, Singapore and Taipei. However, the service sector is still a major contributor to the growth of real GDP (Asian Development Bank 2001) especially in Hong Kong, Taiwan, Singapore, and Thailand. Table (1) shows the sectoral share of GDP in 1980, 1990 and 2000. This can provide an idea of changes in economic structure in those countries.

Table (1): Sectoral Share of GDP (percent)

Country	Agriculture			Industry			Service		
	1980	1990	2000	1980	1990	2000	1980	1990	2000
Singapore	1.3	0.4	0.1	38.1	34.4	34.3	60.6	65.3	65.6
Hong Kong	0.8	0.3	0.1	31.7	25.3	14.6	67.5	74.5	85.3
Taiwan	7.7	4.2	2.1	45.7	41.2	32.4	60.6	65.3	65.6
Malaysia	NA	15.2	8.6	NA	42.2	51.7	NA	42.6	39.7
Thailand	23.2	12.5	9.1	28.7	37.2	41.7	48.1	50.3	49.2

Source: Asian Development Bank (2001), Key Indicators of Developing Asian and Pacific Countries, page 50.

An analysis of the office rental movement in those five cities from 1988 to 2001 (those figures can be seen in the appendix), office rents achieved their peak in the first half of 1990s, owing to the economic expansion across the region. Foreign investment flowed into the region from the late 1980s, due to attractive rates of return and the low cost of borrowing. Office investment markets played an important role in the anticipated high rate of economic growth. Yet oversupply problems existed in many of the cities, such as Bangkok and Kuala Lumpur, from the mid-1990s. Owing to oversupply, developers were unable to pay off their debts. Then the property and stock markets crashed in 1997, and turmoil spread across the region. Office rental levels dropped in late 1997 and early 1998. However, prime office buildings were not severely affected.

There are some common factors existing in the five cities: the markets grew dramatically from the late 1980s till 1997; foreign investment accounted for a huge proportion of property

investment; and governments supported development schemes in order to attract more investment. However, political stability played an important role in the region, especially in the Hong Kong and Taipei markets. These markets depend significantly on their political relationship with China. Within all five cities, IT, as well as the finance and telecommunications sectors, are the most active players in the markets. These sectors clearly affect growth and any recovery in the region. In 2001, the global economic situation slowed down, especially in the USA and Japan. The USA is one of the major trading partners for the region. Therefore, the economic situation did not seem to be as positive as in the first half of 2001, especially after the September 11th attack. Taiwan and Singapore suffered the lowest GDP growth and the highest unemployment rates in a decade. Thailand, Malaysia and Hong Kong also showed signs of slowing economic growth in the second half of 2001. Singapore, Taipei and Hong Kong were in the market recession period; while, Bangkok and Kuala Lumpur were in the market recovery process, according to Cushman and Wakefield Research (2001).

Previous Empirical Office Markets Reviews:

Previous studies have attempted to explain or forecast office rental values by using econometric models. Existing quantitative research on office markets has produced a variety of econometric models, which have estimated rental movement in the different geographical areas. Most of the research has been done in the USA, while in Europe most of the research has been performed in the UK. There are no relevant published research papers for South-east Asian countries.

In previous research, there were two approaches to analysis of the markets: the multi-equation model (Kelly 1983, Rosen 1984, Hekman 1985, Shilling et al. 1987, Wheaton 1987, McClure 1991, Hendershott et al. 1997, Parker et al. 2001) and the single-equation model (Gardiner et al. 1988 1991, Giussani et al. 1993, Tsolocas et al. 1993, D'Arcy et al. 1994, D'Arcy et al. 1997, Keogh et al. 1997, D'Arcy et al. 1998) In the former, the dependent variable in one equation might appear as the independent variable in other equations. This approach is very popular in American literature. In the latter, there is a single dependent variable and all the explanatory variables are in one equation. This approach has been widely used in the British literature.

In multi-equation modelling studies, equations represent demand, supply and rents, linking with a number of endogenous and exogenous variables. The exogenous variables normally include employment measures, construction costs, interest rates and tax rates. The endogenous variables are development, rents, absorption, vacancy, floor space, vacancy rates. These

models are widely used by American researchers, and cover the development markets and some user markets.

For these American researchers a key point is the assumption of a natural vacancy rate. This assumption is similar to those of the natural rate of employment in labour market studies. The rationale for the existence of a natural vacancy rate is that property developers and property owners, aware of the binding nature and the length of office leases, "*withhold vacancy office space in inventory to capitalise on opportunities to supply at higher rental during periods of increased demand*" (Shilling et al. 1987 page 91). Deviations away from the natural vacancy rate have been used as a measure of the short-term demand and supply conditions in the office market and as a determinant of rents. If demand for space is high and the actual level of office vacancies is below the natural vacancy rate, upward pressure will be exerted on rents. However, if the number of vacancies is higher than the natural vacancy rate, rents will face downward pressure. Therefore, rents move more rapidly the further the actual vacancy rate moves away from the natural vacancy rate in either direction. Rosen (1984), Hekman (1985), Shilling et al. (1987), and Wheaton and Torto (1988) use this idea to research aspects of the office user market and development market. In the UK, Hendershott et al. (1997) use the same idea for examining London office markets.

Multi-equation modelling is more theorised than single-equation modelling. However, there are no consistent forms in this area. If certain functions of the markets are not described adequately by equations, the result can be spurious (D'Arcy et al. 1998, Wong 2002).

The existing literature using multi-equation modelling has certain characteristics (Kelly 1983, Rosen 1984, Hekman 1985, Shilling et al. 1987, Wheaton 1987, McClure 1991, Pallakowski et al. 1992, Hendershott et al. 1997, MacFarlane et al. 1999, Parker et al. 2001):

- These models usually comprise two to three equations which include demand, development and rental change. The equations consist of some endogenous variables, such as absorption, rent, completed development, vacancy rates, and floor space; and also a number of exogenous variables, such as the employment rate, interest rate, rate of finance, construction costs and inflation rate.
- Rental changes are always modelled by the vacancy rates with some various gaps, and the variable is always significant in the model.
- The development (supply side) model is mainly driven by the profitability formulation. Vacancy rate is always significant in the model.
- Some of the American studies (Kelly 1983, Wheaton et al. 1983) suggest that measures of economic activity are not all equally effective in explaining office rental values (Giussani et

al. 1993a), but disaggregated service sector employment variables appear to be more consistently significant.

In their results, the vacancy rate is always significant among those studies. However, the use of a natural vacancy rate is another issue to be confronted. Most of the existing literature uses average vacancy rate as the natural vacancy rate, which is doubtful in theory, because of the way of calculating the natural vacancy rate.

The single-equation method generally tries to catch the relationship between economic activity and office rental markets by using a demand and supply framework. The theory justifying this method is based on the interaction of demand and supply. Rental values in the short term are the result of disequilibrium situations in real property markets. In the majority of empirical work on rent determination, the model used takes the form of an equation where both demand and supply determinants are included (Giussani et al. 1993a, Giussani et al. 1993b, Gardiner et al. 1988, 1991; Tsolocas et al. 1993, D'Arcy et al. 1994, Newell et al, 1996, D'Arcy et al. 1997, Keogh et al. 1997, Tsolocas et al. 1998, D'Arcy 1998).

Previous empirical studies in this area have examined a wide selection of demand and supply proxy variables in an attempt to predict office market performance. Office rental values can be modelled by using the theoretical demand-supply framework, which has been successfully employed by using a wide range of variables to proxy demand and supply influences, even if the availability and reliability of the data can be questioned. Various studies exist for single countries, particularly for European cities or sectoral office market performance, generally focussing on a set of common variables to determinate rental values.

Since the mid-1980's, commercial property forecasting services have relied on this technique, given the historically stable relationship between real rent levels and demand-side and supply-side variables. Commercial property performance can be predicted by the movement of activity of the economic sectors. Previous research in Australia and in the UK has focussed on linking commercial property with a variety of underlying economic factors (Giussani et al. 1993a, Giussani et al. 1993b, Hedershott 1995, Higgins 1996, Higgins et al. 2000, RICS 1994, Keogh et al. 1995, McGough et al. 1995 1997, Tsolacos 1998, D'Arcy 1999). In searching through previous literature about South-east Asian cities, not a single relevant research paper was found; the key literature review will therefore focus on relevant European papers.

Gardiner and Henneberry (1988, 1991) attempt to research rent determination in the standard planning regions, and do so using spatially disaggregated annual data for the period 1977 to 1984. They find that regional GDP and the regional stock of floor space are the main factors

effecting office rents in expanding regions. However, previous rental levels and GDP influence current rental levels in declining regions.

Giussani, Hsia and Tsolocas (1993) are the first to attempt to examine rent determinants across European cities, and their work can be used as a framework to examine Southeast Asian cities. They examine the relationship between rental value and economic activity by using cross-section and time series analysis (OLS methods). Again, this research is based on a demand and supply framework. However, the study ignores the supply-side variable because data is not available across Europe. They assert that the demand-side variable can explain office rental markets across Europe very well. In spite of limited data, the results show that GDP and unemployment rates play an important part in determining office rents. However, if supply-side variables had been available and included, the model would have been more theoretically robust.

After the comparative research by Giussani et al. (1993), D'Arcy, McGough and Tsolocas (1994) examine the determinants of office rental values in twelve European cities over the period 1982-1993. Their result is consistent with the results obtained by Giussani et al. (1993). They conclude that GDP and unemployment rates are the most important common determinants of changes in rental value across those twelve cities. They also suggest that larger markets (in terms of total office stocks) are better modelled by the standard explanatory variables; this appears consistent with the American study (Pollakowski et al. 1992).

After finding that market size might affect determinants of office rental values, D'Arcy, McGough and Tsolocas (1997) examine the relationship between office rents, national economic conditions, market size and the measure of economic growth and changes in 22 European cities' economies over the period 1982 – 1994 using time series cross-section methodology. The result shows that local factors still seem less influential on European cities relative to national factors. They again miss out the supply-side data, because of the lack of availability and poor quality of such data.

Keogh, McGough and Tsolocas (1998) model the user, investment, and development elements of British office markets. This is the first research paper which examines three sub-markets: user, investment and development. They use econometric models to estimate rents in user markets, capital value for investment markets and new volume of new office space for development markets. Their research is the first empirical investigation of the demand and supply framework in all three sub markets. Their empirical result shows that the investment market model does not produce a satisfactory result. The user market has a better result which is the same as in the study of RICS (1994).

In other single-equation modelling studies, Dobson and Goddard (1992) provide an insight into the determination of office rents in certain regions across the UK. In their research, only demand-side variables have been used to test the determination of rental levels, which is weak in theory, and they do not make a clear relationship between owner-occupied and rental markets. McGough and Tsolocas (1994, 1995) use vector autoregressive (VAR) and ARIMA methods to predict short-term office rental value forecast in the UK. They demonstrate the importance of the service sector and employment in banking, insurance and finance in office rent modelling. Other research papers examine individual markets and offer additional insights into factors affecting office rental movements (McGough et al. 1998, D'Arcy et al 1998). Both papers find that GDP and employment rates are important factors. Also there are some lagged effects on office space affecting rental movements. (Keogh et al. 1994, McGough et al. 1998, D'Arcy et al 1998). There are also a few other studies employing single-equation modelling in Australia and USA, such as Brennan et al. (1984), Newell et al. (1996). They also use macro, financial and spatial variables to explain movements in the property markets.

From this review, it can be seen that there are no relevant empirical studies for South-east Asian cities or countries. The author seeks to determine the main macroeconomic factors influencing office rental values in five South-east Asian cities.

The use of either the multi-equation model (structure model) or the single-equation (reduced model) model has to face the problem of availability and reliability of data. The usage of the respective models has to be based on data availability and quality in order to provide the best result. In many markets, significant problems exist in relation to the availability of suitable indicators of supply, which results in there being only demand-side influences in those models. In general, regression models based on key macroeconomic variables have provided good results over limited periods of time, but have tended to break down over longer periods (Lee 1998).

There are some typical demand side variables for a model of office rent determination, which include GDP/unemployment rate/service sectors output/employment and interest rates as demand-side variables. However, floor space is usually used as a supply-side variable.

- Real GDP

The variables affecting the demand-side are most likely to be economics-based. These variables are normally approximated by real GDP and employment rates in the service sector (D'Arcy et al. 1998). GDP normally represents general economic conditions, as does the

unemployment rate. In single-equation research, the real GDP figure remains a consistently significant influence on office rental markets. Barras (1983) noted that real GDP is the most appropriate and widely used demand-side measurement at an aggregate level, which gives a broad indicator of office activity, including both for manufacturing and service sectors of the economy. This assumption gains a lot of support from empirical studies (Gardiner et al. 1988, Dobson et al. 1992, Giussani et al. 1993, RICS 1994, D'Arcy et al. 1994, McGough et al. 1995, Tsolocas et al. 1998, D'Arcy et al. 1998, McGough et al. 1998, Higgins et al. 2000, MacFarlane et al. 2000).

- Employment/unemployment rates in the service sector

Employment/unemployment rates normally proxy for economic conditions, and the service sector employment rate has close links with office rental values according to previous studies (Gardiner et al. 1988, Dobson et al. 1992, Giussani et al. 1993a, Giussani et al. 1993b, D'Arcy et al. 1994, McGough et al. 1994, Hendershott et al. 1996, Keogh et al. 1998, Tsolocas et al. 1998, D'Arcy et al. 1998). It is believed that the majority of service sector activity takes place in an office environment (Dobson et al. 1992, D'Arcy et al. 1994, 1997, Keogh et al. 1998). Demand for office space is associated with employment level changes. It is a derived demand, reflecting the demand for the services produced by office-based activities. Changes in the level of employment in the service sector are expected to reflect the trends in particular office-based industries which have generally been considered to be the most dynamic (Giussani et al. 1993a, Giussani et al. 1993b, McGough et al. 1998). When employment in the service sector rises, it increases demand for office space and pressure rises on the rental values.

- Service sector output

Service sector output is a similar measure to service sector employment or unemployment. It is used as an alternative measure of national activity and performance in service sector industries, as the main occupier of office buildings is the service sector (D'Arcy et al. 1995, Keogh et al. 1998).

- Interest rates:

Interest rates provide an indication of the availability and cost of capital, and also they are considered as predictors of economic conditions. (Chang et al. 1999). There are a few articles using interest rates as a variable to examine office rental movements. (Giussani et al. 1993, D'Arcy et al. 1994, Keogh et al. 1998). High interest rates will discourage development decisions, and then rental values will increase. However, none of these empirical studies shows that interest rates have a significant effect on rental value. Interest rates can also indicate directions of monetary policy and the dampening effect of high interest rates on economic activity and well established.

- Office floor space

In some studies, the supply-side variables are omitted, because of data non-availability. There are a number of supply-side variables in the existing literature used to investigate influence on office rents. They mainly focus on office floor space, and such issues as changes in total stock of office space (Gardiner et al. 1988); the volume of new office construction (Keogh et al. 1998, D’Arcy et al. 1998); the level of new orders for office spaces (Giussani and Tsolocas 1993a); the completion of office and retail space (Tsolocas et al. 1998); and changes in the volume of office building output (McGough et al. 1994). Although some of the measurements are not perfectly represented by supply-side variables, the use of a more appropriate variable is restricted by data non-availability. The empirical results demonstrate that office floor space does have some significant effects on office rental markets, but find it is less influential than demand side variables (Hekman 1985, Gardiner et al. 1988, RICS 1994, Keogh et al. 1998, D’Arcy et al. 1998).

More than 20 variables have been tested as explanatory variables in the existing literature over the past 20 years. Table 2 shows the variables matrix which has been used in existing literature. This variables matrix shows that the majority of the single-equation models attempt to use macro factors and spatial factors (as supply-side variables) to examine office rental movements. Multi-equation models are more likely to use spatial factors and financial factors to explain the office rental adjustment process.

Table 2: Variables Matrix

<i>Explanatory Variables</i>		<i>Multi-Equation/ Single Equation</i>	<i>Employment Rate or</i>		<i>Interest rates (long term or short term)</i>	<i>Inflation</i>	<i>Economic Uncertainty</i>	<i>Income</i>	<i>Population</i>
			<i>GDP</i>	<i>GNP</i>					
Authors	Year		MACRO FACTORS						
<i>Kelly</i>	1983	M			*				
<i>Rosen</i>	1984	M	*			*			
<i>Hekman</i>	1985	M	*		*				
<i>Shilling, Sirmans, Corgel</i>	1987	M			*				*
<i>Wheaton</i>	1987	M			*	*			
<i>Gardiner and Henneberry</i>	1988	S	*		*			*	
<i>Wheaton and Torto</i>	1988	M							
<i>McClure</i>	1991	M		*	*	*			
<i>Gardiner and Henneberry</i>	1991	S							
<i>Dobson and Goddard</i>	1992	S			*	*			
<i>Pollakowski, Wachter, Lynford</i>	1992	M			*				
<i>Giussani, Hsia, Tsolocas</i>	1993a	S	*		*	*		*	
<i>D'Arcy, McGough, Tsolocas</i>	1994	S	*	*	*	*			
<i>McGough and Tsolocas</i>	1994	S	*	*			*	*	
<i>McGough and Tsolocas</i>	1995	S							
<i>Hendershott, Lizieri, Matysiak</i>	1996	M	*	*	*				
<i>D'Arcy, McGough, Tsolocas</i>	1997	S	*			*			
<i>Wheaton, Torto, Evans</i>	1997	M			*	*			
<i>Keogh, McGough, Tsolocas</i>	1998	S	*		*	*			
<i>D'Arcy, McGough, Tsolocas</i>	1998	S	*		*				
<i>McGough, Olkkonen, Tsolocas</i>	1998	S	*		*				
<i>MacFarland and Moon</i>	2000	M			*				
<i>Parker, MacFarlane, Whitley</i>	2001	M	*		*		*		

Continue:

<i>Explanatory Variables</i>		<i>Office-floor Space (Total/New/Changes)</i>			<i>Vacancy</i>	<i>Absorption</i>	<i>Past Rental Value</i>	<i>House Index</i>	<i>Share Price</i>	<i>Bond and Tbill Yields</i>	<i>Construction Cost</i>	<i>Cost of Capital</i>	<i>Operating Expenses</i>	<i>Yield/Capital value</i>	<i>Tax</i>
		<i>SPATIAL FACTORS</i>													
<i>Authors</i>	<i>Year</i>	<i>SPATIAL FACTORS</i>			<i>FINANCIAL FACTORS</i>										
<i>Kelly</i>	1983	*	*	*											
<i>Rosen</i>	1984	*	*			*				*	*			*	
<i>Hekman</i>	1985		*			*				*	*				
<i>Shilling, Sirmans, Corgel</i>	1987		*			*						*			
<i>Wheaton</i>	1987	*			*	*				*	*				
<i>Gardiner and Henneberry</i>	1988	*				*									
<i>Wheaton and Torto</i>	1988		*			*									
<i>McClure</i>	1991	*	*			*									
<i>Gardiner and Henneberry</i>	1991					*									
<i>Dobson and Goddard</i>	1992						*								
<i>Pollakowski, Wachter, Lynford</i>	1992	*	*			*				*	*				
<i>Giussani, Hsia, Tsolocas</i>	1993a														
<i>D'Arcy, McGough, Tsolocas</i>	1994							*	*						
<i>McGough and Tsolocas</i>	1994	*						*	*						
<i>McGough and Tsolocas</i>	1995					*									
<i>Hendershott, Lizieri, Matysiak</i>	1996	*	*	*		*				*	*	*			
<i>D'Arcy, McGough, Tsolocas</i>	1997	*				*									
<i>Wheaton, Torto, Evans</i>	1997	*	*	*		*				*	*				
<i>Keogh, McGough, Tsolocas</i>	1998	*						*						*	
<i>D'Arcy, McGough, Tsolocas</i>	1998	*													
<i>McGough, Olkkonen, Tsolocas</i>	1998	*													
<i>MacFarland and Moon</i>	2000	*	*	*											
<i>Parker, MacFarlane, Whiley</i>	2001					*	*							*	

Methodology:

The theoretical part of this research is constructed by use of the demand and supply relationship. When property markets are in equilibrium, changes in demand will tend to generate new supply. Before new supply reaches the markets, the price will increase. However, when markets are in disequilibrium, demand and supply relationship will be unbalanced, which will potentially result in over supply or shortage of property in the market. This will cause fluctuations in the price (Fisher 1992, Giussani et al. 1993a, 1993b, Keogh 1994, Morrison 1994, Tsolocas et al. 1998, D'Arcy et al. 1998). Office rental values in the short term exhibit similar results when there is imbalance in the office market.

In this study, the single-equation model of office rent determination is adopted. Office rental value can be determined by the interaction of demand and supply factors which affect office rental markets. In this model, office rental values in each South-east Asian city are determined by demand side factors (Demand_i) and supply side factors (Supply_i) affecting its office market in period t. Thus

$$Rent_{it} = (Demand_{jt} \text{ Supply}_{it}) \quad (1)$$

Where $Rent_{it}$ is the net office rent in city i in period t and j is the number of demand side variables and I is the number of supply side variables

Assuming that the relationships between variables are linear, the rental level can be expressed in the following terms:

$$Rent_{it} = A + B * Demand_{jit} + C * Supply_{it} + e \quad (2)$$

where Demand_i represents demand-side variables;

Supply represents supply-side variables and e is an error term. Equation (1) and (2) provide the general model of the single-equation for South-east Asian cities empirical investigation. This model is similar to that constructed by Giussani et al 1993a, 1993b, D'Arcy et al. 1994, Morrison 1994, Keogh et al. 1998, D'Arcy et al. 1998

The models of office rents include both demand-side variables and supply-side variables. In the author's model, net office rents are used. Real GDP (GDP), the rate of unemployment (U), interests rates (IR), lending rates (LR), consumer index (CI) and service sector output (Ser) are the proxy variables of demand-side. Changes in floor space (FS) are the proxy variables of supply-side.

Substituting the above variables into equation (2), it emerges as

$$Rents_{it} = A + B * GDP_{it} + C * U_{it} + D * IR_{it} + E * LR_{it} + F * CI_{it} + G * Ser_{it} + H * FS_{it} + e \quad (3)$$

Where i represents different cities and t represents different periods.

There are two problems associated with this type of approach. Firstly, the time series data for South-east Asian cities are limited to 14 annual observations from 1988 to 2001. On such limited data, equation (3) will be the result of the lack of degree of a freedom. Therefore, results will be affected. Secondly, there are also likely to be close relationships between dependent and

independent variables in equation (3). This suggests that there might be a multicollinearity problem existing in equation (3) (Giussani et al. 1993a, 1993b D'Arcy et al. 1994, Morrison 1994). In order to resolve this problem, it is reasonable to estimate the effect of those dependant variables individually on real office rental value. The equation can be explained as

$$\mathbf{Rent}_{it} = \mathbf{A} + \mathbf{B} * \mathbf{Variables}_{jit} + \mathbf{e} \quad (4)$$

Equation (4) will allow us to determine the variables which explain South-east Asian cities; office rental movements. However, because of limitations in time-series data, those data are marked by a trend, the equation (4) result might cause a spurious correlation. In order to eliminate this effect, the first difference method will be applied to all variables. Therefore, the equation can be re-written as

$$\Delta_1 \mathbf{Rent}_{it} = \mathbf{A} + \Delta_1 \mathbf{Variables}_{jit} + \mathbf{e} \quad (5)$$

where Δ_1 is the first difference operator. After the variable that explains the largest variation in growth of real office rents has been identified, stepwise regression will be employed. Within the 95% confidence level, all of the variables will be put into the equation (6) in order to find the best fit for the office real rental value movement in each South-east Asian city.

$$\Delta_1 \mathbf{Rent}_{it} = \mathbf{A} + \Delta_1 \mathbf{Demand}_{jit} + \Delta_1 \mathbf{Supply}_{jit} + \mathbf{e} \quad (6)$$

Equations (4), (5) and (6) are the starting points for the empirical investigation.

Data:

The availability of consistent time-series data on office rental values across South-east Asian cities is limited; few series contain the necessary comprehensiveness and consistency across markets and insightful analysis of the trends. Equally lacking are technically sound comparative analyses. The data for office rental values of Singapore, Hong Kong, Kuala Lumpur and Bangkok are obtained from Jones Lang LaSalle (Singapore JLL) series for investment-grade office buildings in CBD areas, which is probably one of the very few consistent South-east Asian data sets. They provide annual office rental value for the cities from 1988 to 2001, with the exception of Taipei. The quarterly data are available only from 1995. Taipei office rental data are from CB Richard Ellis (Taipei office) for prime office rental in the CBD area. Those rental data refer to prime office rents of investment grade in the best locations. This type of office building may be less sensitive to the economic cycle. Other factors might be more important to

its rental value, such as quality and location (Giussani et al. 1992). The data for changes in office floor space area are also from Jones Lang LaSalle for the markets of Singapore, Hong Kong, Bangkok and Kuala Lumpur. Taipei office floor space data are from CB Richard Ellis (CBRE).

The data for consumer index data and real GDP for all of the countries are obtained by the local government statistics departments, and are offered by Grosvenor Property, London. Unemployment rates for five cities are obtained from Asian Development Bank Publications. Prime lending rates and discount rates are used as interest rates in those five cities, obtained from their central banks (Taiwan, Thailand, and Malaysia) and government departments of statistics (Hong Kong and Singapore). Real GDP contributed by the finance sector is used as the variable of service sector output, are obtained from Asian Development Bank Publications.

Empirical Results:

The starting point for this analysis is to estimate Equation (4). Using office rental value in City i regressed individually on 7 different variables (variable i), Table 3 exhibits the estimated coefficient and the R^2 statistic for each of 7 equations for each city in the analysis.

Table (3): OLS estimation of $Rent_{it} = A + B * Variables_{jit}$

City	F.S		GDP		Unemployment rates		Interest rates		Lending Rates		Consumer Index		Service output	
	B	R Square	B	R Square	B	R Square	B	R Square	B	R Square	B	R Square	B	R Square
Singapore														
Hong Kong													0.02059 (1.881)	0.243
Taipei	-0.005274 (1.938)	0.273			169.657 (3.532)	0.508							10.007788 (1.727)	0.272
Kuala Lumpur			0.008990 (2.421)	0.328	-93.839 (5.493)	0.715			70.841 (2.325)	0.311	775.544 (2.332)	0.312	0.03189 (3.114)	0.447
Bangkok							37.725 (2.907)	0.413					-0.02007 (2.012)	0.31

There are several interesting points in Table (3): Firstly, there are few significant coefficients estimates in Table (3) and there are no single significant variables in Singapore office equations.

Secondly, service sector output seems significant in 4 out of 5 cities, except Singapore. Looking at the significant variables, changes in floor space, which represents a supply-side variable, only appear to be significant in the Taipei office market.

Thirdly, looking at the coefficient of determination (R^2), a couple of the R^2 exceed 40%,

especially in the unemployment rates equation for Taipei and Kuala Lumpur, which are statistically satisfying results.

Fourthly, the similarity of the estimates for every city in unemployment rates and service sector output is worth noticing. The estimated values in unemployment rates range between -93.839 and 169.657; and -0.02007 to 0.03189 for service sector output.

Finally, there are at least two significant variables in Taipei, Kuala Lumpur and Bangkok office markets, especially in Kuala Lumpur markets.

A close examination of Table (3) reveals a number of other interesting results. Service sector output appears to be the most common and important variable. It can be used to explain the office rental value in Hong Kong, Taipei, Kuala Lumpur and Bangkok. In Taipei and Hong Kong, service sector output can explain office rental value for 27.2% and 24.3% respectively. In Kuala Lumpur and Bangkok, it can even explain 44.7% and 31% of office rents respectively. Floor space only appears significant in the Taipei office market with the correct sign. Unemployment rate shows a very strong explanatory power in Taipei and Kuala Lumpur markets, and their R^2 are 50% and 71.5% respectively. There are 5 significant variables in the Kuala Lumpur office market's equations. They are real GDP, unemployment rates, prime lending rates, consumer index and service sector output. Real GDP, prime lending rates and consumer index only appear to be significant in the Kuala Lumpur office market. This result suggests there are high demand-side drivers in the Kuala Lumpur office market. Interest rates and service sectors output have shown significant effects on office rents in Bangkok.

Largely, demand-side variables are significant in the case of 5 cities, according to Table (3), apart from floor space in Taipei. This result shows that those demand-side variables which influence South-east Asian cities rental markets differ from city to city, but service sector output seems to be commonly significant.

For Hong Kong, Taipei, Kuala Lumpur and Bangkok, service sector output is statistically important, although rents in Taipei and Kuala Lumpur can also be explained by unemployment rates. The latter seems to be more important than service sector output in Taipei and Kuala Lumpur office markets. While service sector output seems to predominate in the Hong Kong office market and interest rates are the main explanatory factor in the Bangkok office market, at R^2 41.3%.

All the significant coefficients for floor space, real GDP, interest rates, prime lending rates and consumer price index are correctly signed. Yet the unemployment rate in Taipei and the service

sector output in Bangkok show incorrect signs.

Time-series data are characteristics of trend. Table (3) might cause spurious correlation results between variables. Thus, the first difference operation will transfer those variables in order to eliminate the time series effect.

Previous analysis (Equation 4) has focused on establishing a pattern to the relationship between office rental value and fluctuations in economic activity across the 5 selected cities, without looking at the highly trended time-series data. To allow for spurious correlations, and to model dynamic behaviour of office rents, Equation (4) was estimated once again, but using first difference operation, which is in Equation (5). Again, this step can eliminate the effect of time-series.

Table (4): OLS estimation of $\Delta 1 \text{ Rent}_{it} = A + \Delta 1 \text{ Variables}_{jit}$

City	F.S		GDP		Unemployment rates		Interest rates		Lending Rates		Consumer Index		Service output	
	B	R Square	B	R Square	B	R Square	B	R Square	B	R Square	B	R Square	B	R Square
Singapore	-0.003471 (2.525)	0.367							60.3295 (2.43)	0.349				
Hong Kong	-0.01969 (2.54)	0.364												
Taipei									107.442 (2.459)	0.355				
Kuala Lumpur									43.456 (2.245)	0.314				
Bangkok	na													

Table (4) shows the result of equation (5). It demonstrates the dynamics of office rents and the dynamics of macroeconomic variables in those 5 cities. Obviously, the number of statistically significant variables in Table (4) is far less than in Table (3). Unlike in Table (3), Bangkok does not have any significant variables to explain the variations of office rental value in Table (4). Furthermore, changes in service sector output do not appear significant in any of those 5 cities. Changes in floor space and changes in prime lending rates seem to be the most important determinants of rent behaviour in 4 out of 5 cities.

The R^2 statistics are also smaller than the value in Table (3). This suggests that those variables, taken individually, account for between 31.4% and 36.7% of observed variation in changes of South-east Asian office rental values. In Table (4), prime lending rates seem to be the main variable in 3 out of 5 cities (Singapore, Taipei and Kuala Lumpur). In prime lending rates, all of the coefficients are correctly signed. The magnitude of the estimated coefficient of prime lending rates suggests that a 1% increase in prime lending rate over a year will increase rental value around S\$ 60 in Singapore, NT\$ 107 in Taipei and Ringgit 43.456 in Kuala Lumpur. Changes in floor space are significant in Singapore and Hong Kong office markets, which are

both correctly signed. This shows that when office floor space increases, then office rents fall, and vice versa.

In equation (6), a high degree of correlation between changes in real GDP, unemployment rates, interest rates and prime lending rates suggest that multicollinearity is the most likely outcome from their simultaneous inclusion. However, the relatively short span of time-series data available for this analysis made it necessary to include all those variables in the search specification.

Table (5): OLS estimation of $\Delta 1 \text{ Rent}_{it} = A + \Delta 1 \text{ Demand}_{jit} + \Delta 1 \text{ Supply}_{lit}$

	<i>F.S</i>	<i>GDP</i>	<i>Unemployment rates</i>	<i>Interest rates</i>	<i>Lending Rates</i>	<i>Consumer Index</i>	<i>Service output</i>	<i>R-Square</i>
<i>City</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>	
<i>Singapore</i>	-0.00347 (2.52)							0.367
<i>Hong Kong</i>					1086.806 (2.802)			0.44
<i>Taipei</i>	-0.00298 (5.74)		140.234 (3.106)					0.821
<i>Kuala Lumpur</i>					43.456 (2.245)			0.314
<i>Bangkok</i>	NA							

Table (5) exhibits annual changes in office rental values across South-east Asian cities. All variables are included in the equation. Stepwise regression analysis is employed to find the significant variables in each city. Table (5) shows that changes in floor space and prime lending rates are significant variables in those cities. Changes in unemployment rates are only significant in the Taipei office market. Yet again, there are no significant variables in the Bangkok office market.

In Singapore, changes in floor space are significant (at 36.7%) in explaining office rental values with the correct sign. In Hong Kong, prime lending rate is the only significant factor. When the prime lending rate increases 1% per year, office rental value will increase HK\$ 1086.8 per year. The value of R^2 in this equation is 44%. In Taipei, changes in floor space and unemployment rates are significant. It is the only city which has more than one explanatory variable. The value of adjusted R^2 is 84%. Again, unemployment rate is wrongly signed. This might be because the prime office market in Taipei is located in the prime CBD area, but unemployment rates are from across the nation. The rental value has been very stable in the past 10 years and unemployment rates are also very low in Taiwan. Taipei prime office markets might be less sensitive to this wide proxy variable or even show a positive correlation. In Kuala Lumpur, prime lending rate is the significant variable. An increase of 1% in the prime lending rate each year will

lead the office rental value upward for Ringgit 43.45. It can also explain 31% of the variation in rents.

In Table (5), changes in floor space and changes in prime lending rates are the two main factors explaining office rental markets in South-east Asian cities. These two variables are strongly linked with development markets. In the past decade, changes in floor space (supply-side data) have affected the regional office market (Chin 1999). Oversupply tends to be the common problem across the region, which causes fluctuation in the rental level. In the late 1980s, Singapore rental value fell sharply, because of oversupply. Table (5) results provide the evidence of this. Prime lending rate is the key factor in financing in development. It seems to be the main factor affecting the Hong Kong and Kuala Lumpur office markets. In the financial crisis of 1997 across the region, oversupply and easy funding are the two main reasons which caused the office markets to collapse. This can be seen from the empirical investigation in Table (5).

Conclusion:

This paper has attempted to model the relationship between macro economic activities and office rental movement in South-east Asian cities over the period 1988 to 2001. Office rental value has been tested against some indicators of economic activity which have been used in previous empirical studies. Because of significant data restrictions, the model tested the influence of six demand-side variables and one supply-side variable. Those variables are Real GDP, interest rates, prime lending rates, consumer price index, service service output, unemployment rates and changes in office floor space.

Despite the short time span covered by the data, and deficiencies in its quality, there are still some interesting findings. Changes in floor space and prime lending rates are key factors determining rental values within the selected cities (apart from Bangkok). These two significant factors are closely linked with development markets. This may partly be because of the shortage of supply of floor space in the early 1990s, which drove rental value growth. Moreover, easy availability of funding stimulates development schemes. As a consequence, rental value dropped in 1997, because of the over-supply problem in South-east Asian cities. Compared to European studies where real GDP, service sector output, and service sector unemployment rates are the main determinants explaining office rental movements, none of those variables show as significant in any of the five South-east Asian cities, apart from unemployment rates in the Taipei office market (however, it is with a wrong sign). This might be because of the stability of unemployment rates in the past 10 years in Taiwan, and the data used are at the national level. The Bangkok office market does not have any significant variables to explain rental value

movement. This can possibly be explained by poor quality data or an immature market or both. Bangkok and Kuala Lumpur are both regarded as emergent markets (Chin 2001). As a consequence, those markets cannot be fully modelled by quantitative methods.

This research was hampered by the lack of consistent and comparable information for a reasonable sample size, and short periods of time coverage. This was the case for both office markets and economic data in South-east Asia, especially for the quality of office market data. This problem can be solved by improving data quality in the future. As soon as there is a more consistent, comparable and longer period of data, more sophisticated analysis can be undertaken.

Office markets in South-east Asia have been opening up since the late 1980s, but this research is still a relevant exercise, as it attempts to set up a benchmark for modelling South-east Asian office markets. The analysis presented here clearly indicates a number of potential avenues for future research. Firstly, the use of regional demand and supply indicators might improve the robustness of the models. Secondly, the use of quarterly data could give for a better understanding of the relative speed of the impact of changes in the key influences on market dynamics. Thirdly, more sophisticated methods can be employed once the data quality and range has improved.

The empirical results show that the explanatory power of the model is not very high. This may partly be explained by the fact that some determinants of office rental values in these South-east Asian cities cannot be quantified, and so cannot be included in the model. Therefore, the next step will be to employ qualitative methods to examine the impact of institutional factors on rental values across these cities.

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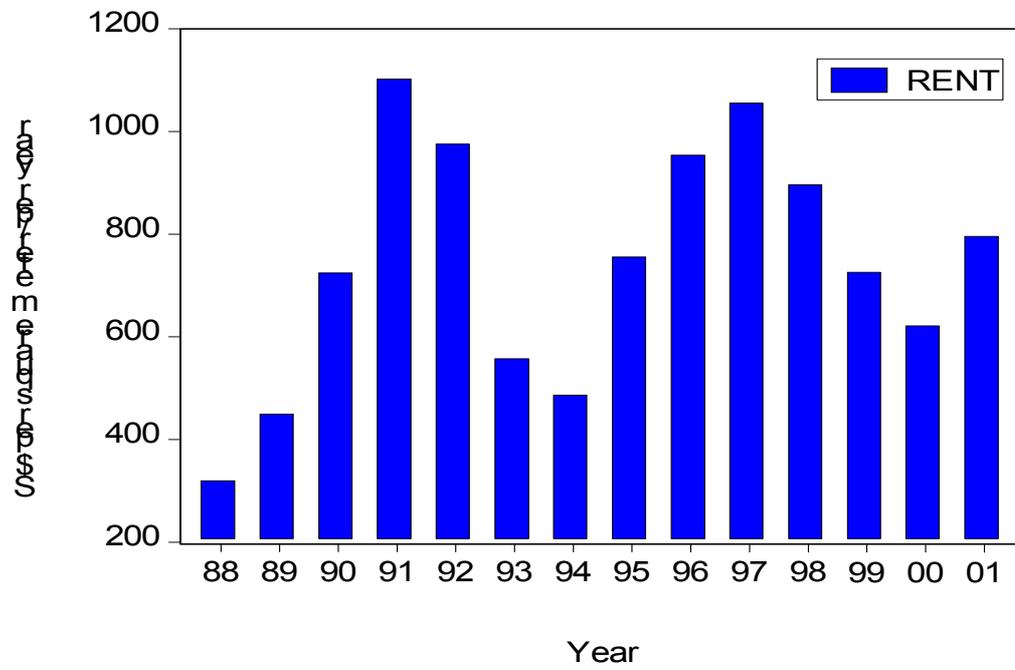
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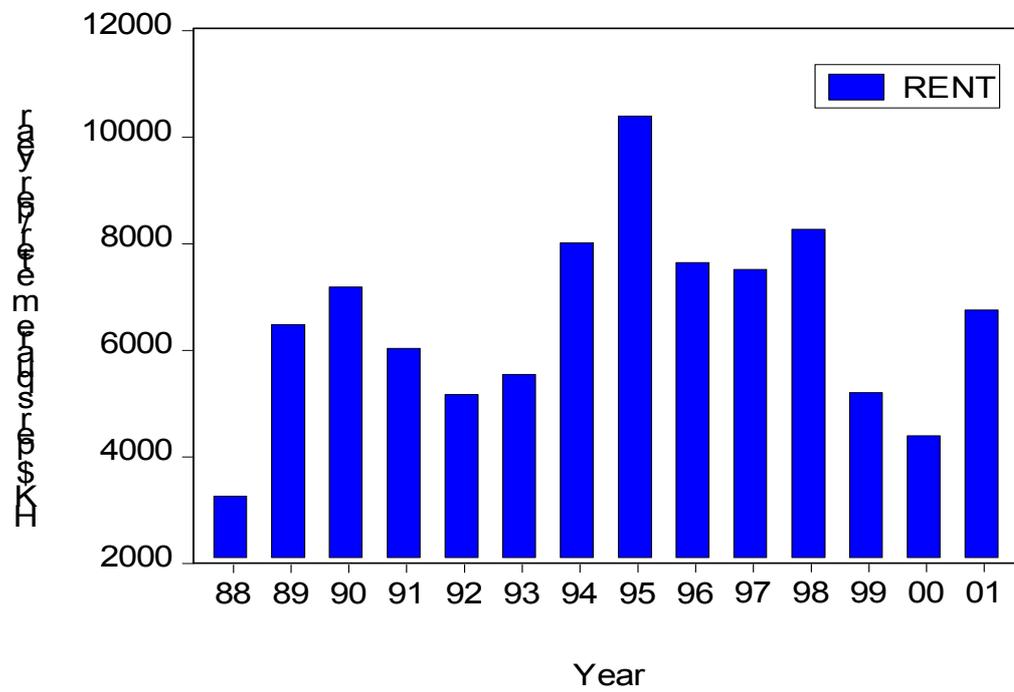
Appendices:

Appendix 1: Singapore Investment Grade Office Rental Market



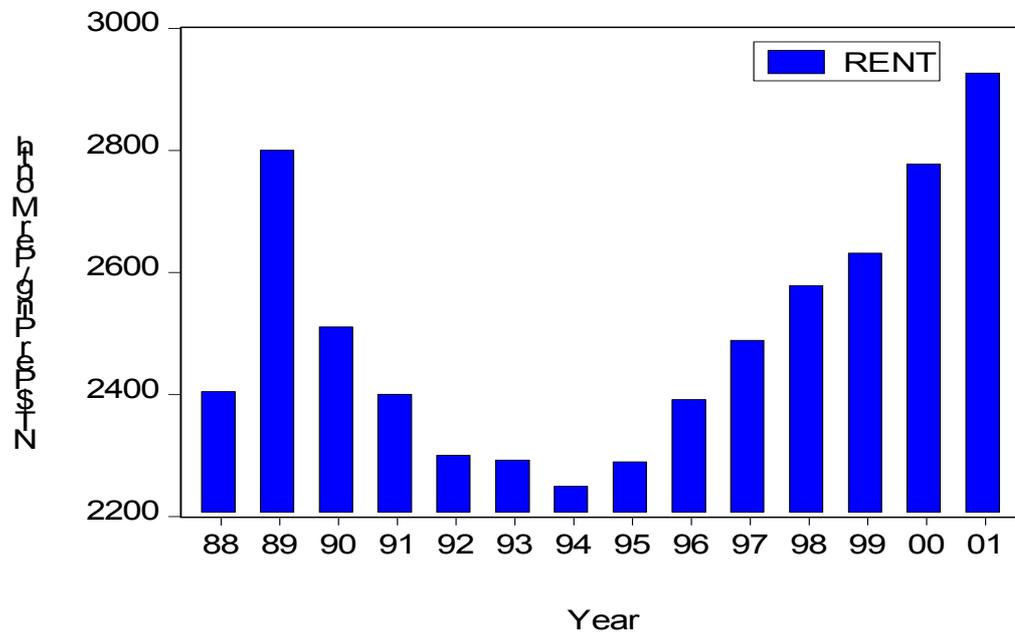
Source: Jones Lang LaSalle

Appendix 2: Hong Kong Investment Grade Office Rental Market



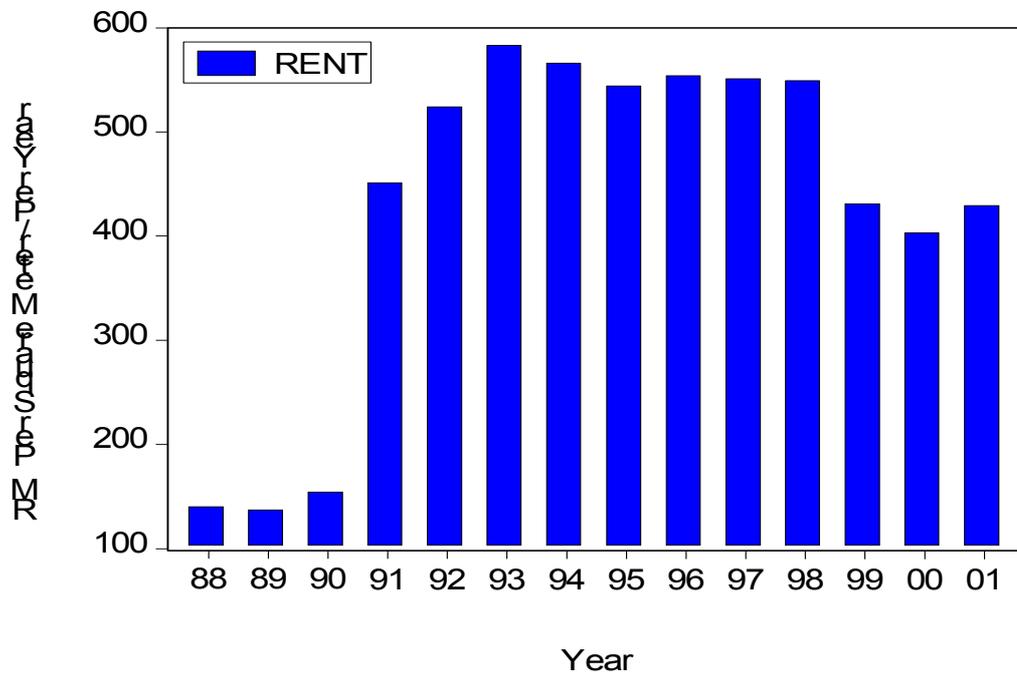
Source: Jones Lang LaSalle

Appendix 3: Taipei Prime Office Rental Market



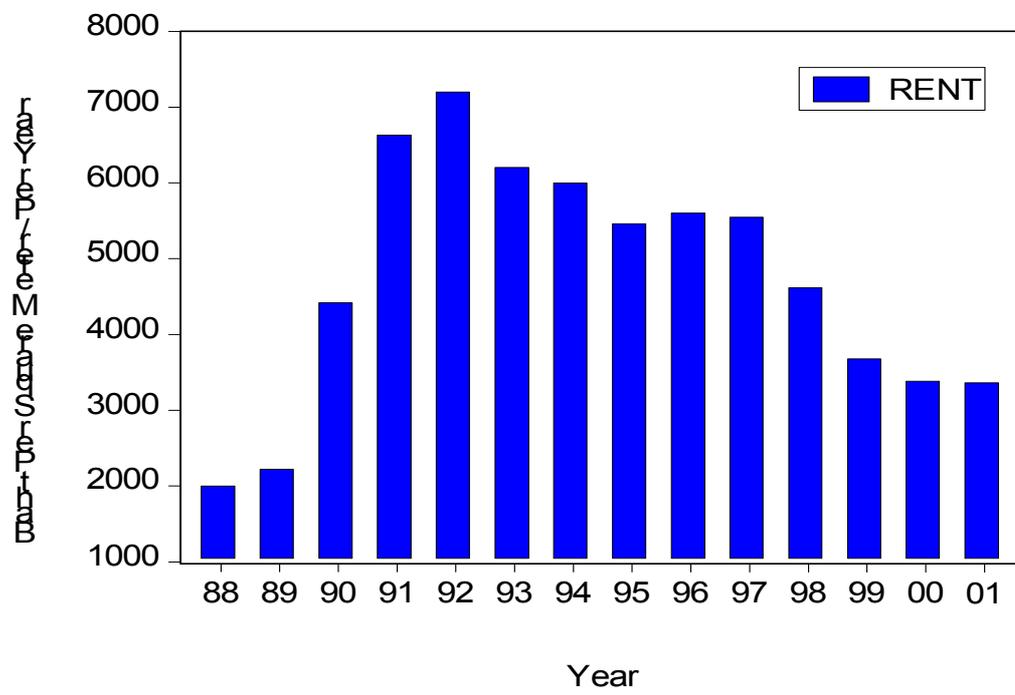
Source: CB Richard Ellis

Appendix 4: Kuala Lumpur Investment Grade Office Rental Market



Source: Jones Lang LaSalle

Appendix 5: Bangkok Investment Grade Office Rental Market



Source: Jones Lang LaSalle