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UNIVERSITI TEKNOLOGI MARA

INSPIREd 2022
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IeGRESAFE 2022

E-PROCEEDING OF

1st INTERNATIONAL E-CONFERENCE ON GREEN & SAFE CITIES 2022

"Sustaining the **Resilient, Beautiful and Safe Cities** for a Better Quality of Life"

20 & 21 SEPTEMBER 2022

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" Sustaining the Resilient, Beautiful and Safe Cities for a Better Quality of Life "

ORGANISED BY

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ANALYSIS OF OFFICE RENT DETERMINANTS BASED ON SPEARMAN CORRELATION

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Abstract

This study presents the relation between office rent determinants and rental values in the Kuala Lumpur office market. The datasets comprise office rental transactions acquired from the Valuation and Services Department from year 2015 until 2021, prioritising Kuala Lumpur city centre were analysed. Based on the 538 rental transactions, inferential statistics were employed to analyse the relationship between the rent determinants grouped into 5 (five) categories, locational, physical, macroeconomics, lease details and certifications. By employing the Spearman Correlation analysis, this study identified the statistical relation of office rent determinants towards the rental values, through the consideration of the correlation coefficient value of 'Rs'. The results indicate that office rent determinants such as amenities and in-house services and green certificates positively react to the office rental values. Nonetheless, the analysis conducted demonstrates that from 17 included determinants, most of it appears to have a weak relation to rental values. This study will provide new insight for property investors by considering these determinants to base their investment decision-making.

Keywords: *Office Rent, Determinants, Spearman Correlation*

INTRODUCTION

Real estate has always attracted high demand in every country and city. It has become one of the essential industries for the economy that can push the stock exchange market up and down and even cause disruptive economic events (Jha et al., 2020). The real estate industry was generally separated into a few categories, such as residential, commercial, and industrial real estate, and the performance of each use varies from the performance of the others, sometimes even within the same use (Oyewole, 2013). Above all, in the commercial real estate industry, office markets are frequently associated with good investment prospects, becoming the primary focus for both domestic and foreign investors. Cova et al (2021), argued that investing in office buildings can be very profitable whilst drawing a lot of capital, but the returns are frequently very substantial. Today, any investors choosing to invest in office property will base their decision on the rental rate of an office building to secure guaranteed capital and cash flows. Their reliability on a few presumptions of office market dynamics has become a key value driver to accurately anticipate the future profitability of their income projections (Kołodziejczyk et al., 2021). Nevertheless, the office space markets are more

synchronised in terms of exposure to macro-effects and performance. The heterogeneity of this market makes them more complex to analyse. It can be really challenging to understand the market, for which the property's price might be determined on the market, but it may not always equate with the valuation of property in the market (Isaac & O'Leary, 2012). To help investors assess rental patterns for a certain time frame, identification of the factors affecting rental rates has become a necessity. Henceforth, rather than depending on unreliable property market data, this study primarily aims to explore the office rent determinants, influencing the rental rates in the Kuala Lumpur office market. To achieve this need, this paper revealed the determinants that influence office rent by studying the statistical relation between the determinants and office rent.

OFFICE INVESTMENT OPPORTUNITIES

Investing in commercial real estate can be profitable and serve as a hedge against stock market volatility. Investors can profit from property appreciation when they sell, but most of their returns come from tenant rents. There are two (2) types of a common methods to invest in the office building, direct investment, and indirect investment. Direct investments allow investors to become landlords by owning tangible property. People that have a substantial degree of information about the sector can hire firms that are best suited for the direct investing office building. It was considered a high-risk, high-reward investment. Because office investment involves a significant amount of capital, such an investor is likely to be a high-net-worth individual. The ideal property is in a market with low office supply and high demand, resulting in favourable rental rates. The value of the office purchase is also affected by the strength of the local economy. Indirect investment, on the other hand, allows investors to participate in the commercial market indirectly by owning market securities such as real estate investment trusts (REITs) or exchange-traded funds (ETFs) that invest in commercial property-related stocks, or by investing in companies that serve the commercial real estate market, such as banks and Realtors. According to Mona (2013), the most difficult part of office investment is measuring the income that could be gained from the property through the rental rates. Due to the heterogeneity of office buildings, it becomes difficult for investors to base their investment decision. By considering the determinants influencing office rent, it would help investors to secure their capital. This study assesses past literature to discover the rent determinants influencing office buildings.

Office Rent Determinants

Office rent determinants have been the subject of numerous studies during the past few years (Bera, 2019). A plethora of previous studies has revealed that practitioners often base their rents on demand and sensitivity analyses, whereas academics are more interested in the relative importance of these determinants and their impact on office rents in predicting market dynamics (Jun Hwa & Imm Ng, 2015). Determinants of office rent might be different from one study to another. However, this paper has classified the office rent determinants into four (4) major groups: physical, locational, lease details and macroeconomics. Consequently, previous studies indicate the necessity of considering these determinants of office rent. Therefore, a proper method should be used to study the relationship between these determinants and office rent. The following section reviews the office rent determinants under five (5) different attributes.

Locational

It is well-established for any real estate market, prices and rentals vary over locations (Bera, 2019). Location effects, which are distinctly perceived or observable characteristics of an area, also have an impact on property prices and rentals (Fuerst, 2007; Oven & Pekdemir,

2004; Öven & Pekdemir, 2006). It is due to the location is a fluid phenomenon driven by a range of characteristics that retail investors have recognised. (Čeh et al., 2012). Within the European office market, locational diversification is important in which it is likely to contribute to high environmental regulations, shifting tenant preferences (Kok & Jennen, 2012) and labor accessibility (Öven & Pekdemir, 2006), which are considered to have a major impact on the rental value of the office building.

Macroeconomics

Macroeconomics is a branch of economics that studies an economy's overall performance, structure, behaviour, and decision-making. It focuses on the overall performance of the economy. Macroeconomic determinants such as GDP, unemployment, income level, and stock market performance have all been considered macroeconomic determinants of demand-side factors affecting office rents (Leung, 2007). A contemporaneous office sector employment was determined as one of the critical factors in the variations of office rents (Ng & Higgins, 2015). It positively reacts to a rise in employment, especially when the vacancy rates when the vacancy rate is lower than the long-term average (Dirk & Maarten, 2009). Considering the macroeconomic variables, inflation was considered to have a relation to the performance of the commercial real estate market. Dynamically, rents have historically risen when inflation causes prices and wages to rise (Ahrens et al., 2019; Cheruiyot, 2015; Rosen, 1984). Since commercial real estate values are frequently based on net income, rents and expenses should increase or rise in lockstep with inflation. According to Giussani et al (1993), in European studies, rental values are determined based on the Gross Domestic Product (GDP). However, the consideration of GDP effect towards the Malaysia office rental market is yet to be embraced. A study on the macroeconomic determinants of office rent for major cities in Southeast Asian Cities (including Kuala Lumpur) by Wei (2003) articulates that GDP is not a strong driver. In comparison, the author claimed that in European studies, GDP contributes the most in determining office rent.

Physical

Bera (2019) argued that physical characteristics which affect office rent include quality, prestige, environmental aspects, and internal services. The building's physical structures relate to the age of the building where office rent declines with effective age (Jun Hwa & Imm Ng, 2015). According to Levkovich et al (2018), building age is expressed as the number of years since it was built so a more recent construction date has a positive impact on the rental rates. These phenomena influence the dynamics of property prices and, as a result, the returns on real estate investment. In terms of renting a property, building design may be regarded as one of the tenant preferences in selecting property, with the seriousness of how the office is constructed being the first thing that will attract potential tenants to purchase services. The developer's role was critical in offering rental offices for commercial activity, but the developers focused solely on the location element, ignoring tenant preferences (Nurzukhrufa et al., 2018). A good building design can be costly owing to the expensive materials required throughout the design process, but it may be considered an investment because it can increase the price and rental of a building. Nonetheless, the appearance and design may be disregarded to be included as rent determinants since only a few studies highlight on this factor (ibid, 2018). Bera (2019) mentioned that, with a physical characteristic to be included as determinants, it was wise to include the amenities and in-house services considering the internal services which define the quality of available amenities and the office space. The amenities' determinants may include landscaped gardens or courtyards, banks and retail services, health clubs or gyms, food outlets or restaurants (Ho et al., 2005). Previously, Fuerst (2007) suggest that office tenants

will pay a premium for convenient access to these amenities which is confirmed in the significance levels of this variable throughout the estimated period.

Lease Details

Leasing period and rental area size are the most often used as lease characteristics in identifying literature to study the office markets (Bera., 2019). A lease is an implied or written agreement that specifies the terms under which a lessor accepts to rent out a property to a lessee including the rentable area, tenancy duration and service charge (Cheah et al., 2015; Ke & White, 2009; Kok & Jennen, 2012). In property valuation, the rentable area and usable space must be determined when calculating office building rental rates to arrive at an exact rental rate. Van der Voordt (2004) observed on the proper utilisation of office space can greatly reduce cost thus affecting rent rates. Nurzukhrufa (2018) articulates that the leasing period or tenancy duration would affect the rental rates. Tenants with longer-term leases should be paid lower rents to minimise turnover costs which it is interrelated to the financial management that involves the commercial property and associated investors (Jun Hwa & Imm Ng, 2015). The length of the lease can be used as a criterion for determining rent. Figure 1 shows the conceptual framework of the office rent determinants based on previous literature.

Certifications

Current global concerns regarding environmental sustainability, and the concept of sustainable architecture, particularly the development of green buildings, appear to be exploding recently (Mohd Reza et al., 2011). According to Cheah & Siew (2015), office building certification is one of Malaysia's government policies as an indicator to determine the level of sustainability through Green Building Index (GBI) Certificates to support business operations. Besides green certification, another certification was awarded for an office building in Malaysia due to the technological advances applied to the building which is MSc status. Multimedia Super Corridor (MSC) Status is a designation provided by the Malaysian government through the Multimedia Development Corporation (MDeC) to enterprises that participate in and carry out ICT activities in the MSC. The conspicuous aspects of such buildings are that they are built or planned in accordance with severe specifications to assure world-class infrastructure and the deployment of cutting-edge technologies. The significance of certification as a determinant for office rent is yet to be discovered. However, Cheah (2015) comprehends the certifications determinants, and MSc status to significantly affect the office rental market in Kuala Lumpur.

Figure 1
*Conceptual Framework of Office Rent Determinants*
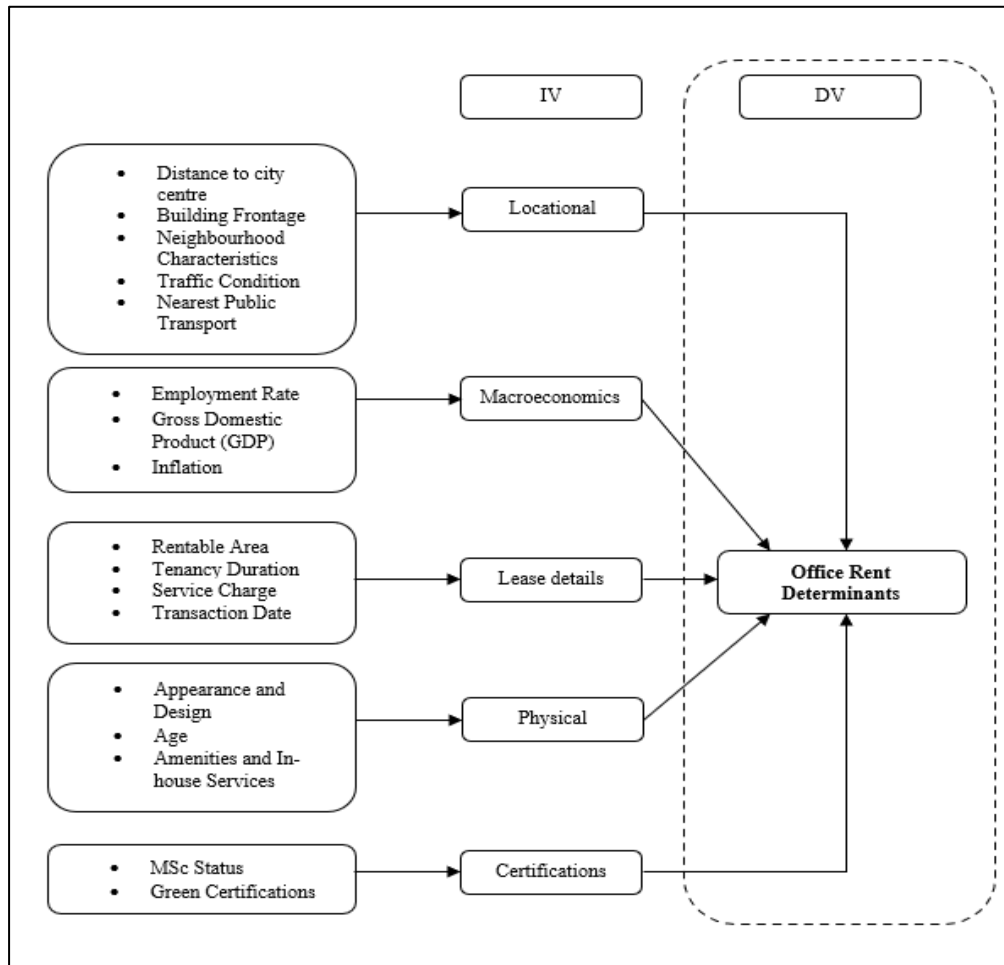
METHODS AND MATERIALS
Study area

The area for this study will be focused on the Kuala Lumpur city centre specifically. This area was chosen due to its status as one of the most developed regions as compared to the other states in Malaysia. Kuala Lumpur city centre is a huge area that covers several main streets and is known as Kuala Lumpur's business, shopping, and entertainment core. The physical manifestation of its physical function as a business and office location activity is seen in the emergence of the Golden Triangle area (the area bounded by Jalan Ampang, Jalan Sultan Ismail, and Jalan Bukit Bintang), which is surrounded by international hotels and office and commercial blocks (Adnan & Daud, 2010). The urban area is approximately 2,793.27 square kilometres in total, with the population expected to increase from the current estimate of seven million to ten million by the year 2020 (Yau et al., 2016). Figure 2 depicts the study area involved.
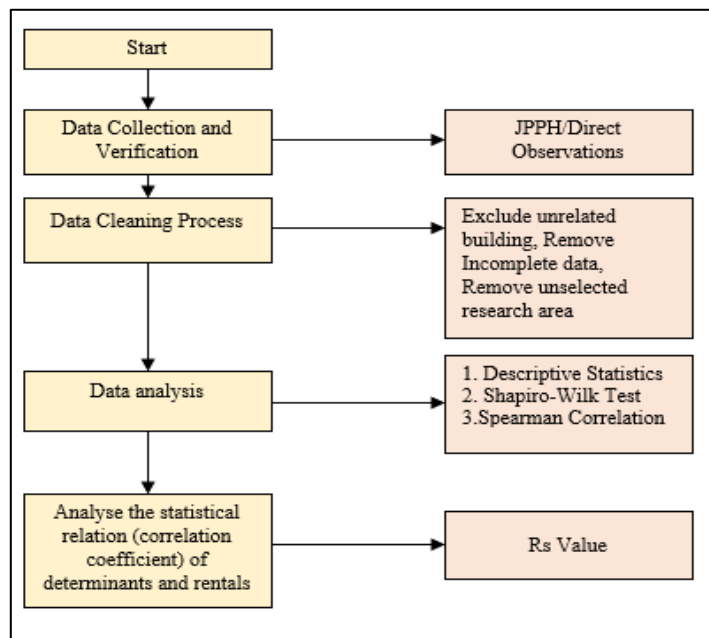
Figure 2
Study area
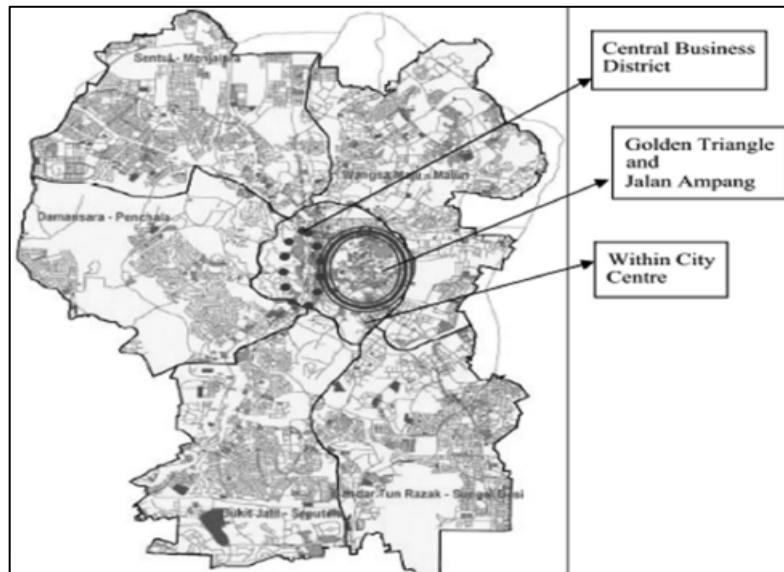
Methodology

In achieving the objective of the study, this study performs three (3) stages of methods analysis namely the inferential statistical analysis, test of normality and Spearman correlation analysis. The stages involved for the analysis is explained as provided in Figure 3.

Figure 3
Summary of methodology

Inferential Statistical analysis

This study was based on quantitative analysis. It was conducted through the observation checklist and by analysing the secondary data sources from government agencies which is Valuation and Property Services Department (JPPH) and Department of Statistics Malaysia (DoSM). Based on the JPPH data, 722 office building transactions from (2015-2021) covering

Kuala Lumpur city centre area were cleaned and analyse. Table 1 shows the data collection and cleaning process of the datasets.

Table 1
Data Collection and Cleaning

Data	Number of Record left
Available Office Rent Transactions	722
Excluding unrelated building	10
Remove Incomplete data	171
Unselected Research Area	3
Available data	538

The cleaning process remove some outliers data with only 538 considered as acceptable. The data then were interpreted in inferential statistics as shown in Table 2.

Table 2
Summary of Descriptive Statistics of Rental *Transactions*

Measures	Values
Mean	83.800
Standard Deviation	121.6254
Skewness	4.424
Minimum	20.0
Maximum	959.5

Normality test

Normality tests are used in statistics to examine if a data set is well-modelled by a normal distribution and to compute the likelihood that a random variable underlying the data set is normally distributed. According to Mishra & Pandey (2019), normality tests can be performed using the Shapiro-Wilk test if the sample size is (n<50) but can also handle sample sizes as large as (n=2000). For this reason, this study performs the Shapiro-Wilk test as a numerical means in assessing data normality. The original equation of Shapiro-Wilk test statistics was computed as followed:

$$w = \frac{\left(\Sigma_i^n = 1^{a_i x}(\text{i})\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Where y_i = the ith order statistics,
ȳ = the sample mean

Multiple methods can be done in assessing the Shapiro-Wilk normality test such as observing the Sig.value, data distribution through skewness and kurtosis, or graphical quantile-quantile (Q-Q) plot. A normal Q-Q plot is one that can be created by charting quantiles from one distribution versus quantiles from another (Rani Das, 2016). When the quantiles of two distributions coincide, the depicted dots align with the line y = x. If the curve size increases from left to right, it suggests that the data distribution is skewed to the right, and if the curve size decreases from left to right, it indicates that the distribution is skewed to the left. Figure 4 depicts the Q-Q plot for the rentals addressed as the dependent variable in this study.
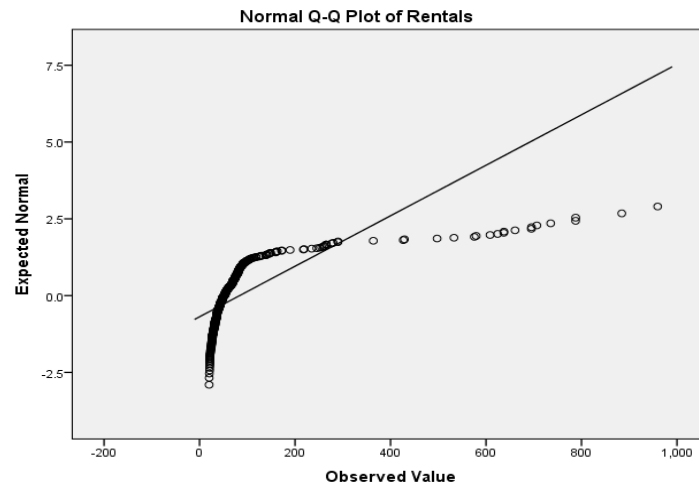
Figure 4
Q-Q plot of rentals

Figure 4 explains on the non-normality of the datasets used in this study. The interpretation was made based on the data points that were stray away from the line in an obvious linear fashion that indicates the non-normality of data. The significance of the normality test in this study was to determine what types of correlation analysis that need to be performed in the next stage. To be emphasis, the disruption of the data normality is not the primary objective in this, but only serves as a standard procedure before performing the correlation task. Henceforth, this test will be important to examine the various aspects of the distribution output and the nature of the underlying relationship between the variables (Gerald, 2018).

Correlation analysis

Correlation in general serves as a gauge for the degree of relationship between different variables (Schober & Schwarte, 2018). In analysing the correlation, Spearman Rank Correlation Coefficient were broadly used in analysing the relationship between variables through the correlation value and the significance of the included variables. It literally depends on the types and nature of the data itself. One of the relevant studies concluded that Spearman's are more reliable and powerful when handling a non-normal data distribution compared to (Bishara & Hittner, 2012). As shown in figure 3, the office rent transactions depict a non-normal distribution that strengthen the fact that this study should performed the Spearman Correlation.

The researcher viewed (Mundry & Fischer, 1998) where the non-parametric test such as Spearman are better performed with small datasets. Small data is primarily sampled (for example, census or statistical data), whereas big data is automatically obtained from a huge population of users or crowds using, for example, crawling techniques or application programming interfaces supplied by social media providers (Jiang, 2015). The fact that the datasets utilised in this study are regarded as small with just 538 office rental transactions gathered from Valuation and Property Services Department is another justification for using the Spearman Correlation.

Spearman's Rank Correlation Coefficient in general is usually abbreviated as ρ (rho) or "rs." because ordinal data can also be listed, and the use of this technique is not limited to continuous variables. Indeed, it is analogous too as Spearman's Rank Correlation Coefficient ranges from -1 to +1. and it can be interpreted as describing anything between no relation (ρ =

0) and perfect monotonic relations (ρ = -1 or +1) (Schober & Schwarte, 2018). Akoglu (2018) interpret the spearman's correlation based on the strength level as shown in table 3.

Table 3
Interpretation of Spearman's Correlation Coefficient

Correlation Coefficient		Strength Level
+1	-1	Perfect
(0.6 to 0.9)	(-0.6 to -0.9)	Strong
0.5	0.5	Moderate
(0.4 to 0.1)	(-0.4 to -0.1)	Weak
0	0	No Correlation

The Spearman correlation analysis can be used to analyse the significance of the rent determinants; however, this study will only present the statistical correlation between the determinants and office rent. The analysis was performed using the Statistical Package for the Social Sciences (SPSS) as tool for this study. The equation below shows the computing for Spearman correlation without any statistical significance test.

$$Rs = 1 - \frac{6\Sigma\, d_{1^1}^2}{n(n^2 - 1)}$$

R_s = Spearman's Correlation Coefficient
d_i = difference between two ranks of each observation
n = number of observations

RESULTS AND DISCUSSION
Results
The statistical relation was interpreted based on the correlation results from the Spearman correlation analysis. The 'Rs' value indicated the statistical relation between each determinant mentioned in methodology. Table 4 shows the correlation between the office rental in Kuala Lumpur city centre area and the locational determinants.

Table 4
Statistical relation of locational determinants and rentals

Locational determinants	Rs Value
Distance to city centre	-0.052
Building Frontage	0.072
Neighbourhood Characteristics	0.023
Traffic Condition	-0.009
Nearest Public Transport	0.103

Under the locational factors, building frontage shows a weak positive linear correlation towards office rentals (R_s = 0.072). Conversely, other factors show a negative linear relation between office rental and the locational factors. The researcher however tends to highlight that the negative relation does not signifies the factors cannot contribute to the office rent determination. As shown in Table 4, distance to city centre (R_s = (-0.052) and traffic condition (R_s = -0.009) shown a negative linear relationship towards office rentals. Table 5 shows the correlation between the office rental and the macroeconomic factors.

Table 5
Statistical relation of macroeconomics determinants and rentals

Macroeconomics determinants	Rs Value
Inflation	0.026
Gross Domestic Product (GDP)	0.046
Office Employment	0.08

It was depicted that whenever there is an increase in the employment rate, office rent goes up, it can be seen from the weak positive linear relationship ($R_s = 0.08$) between the employment rate and office rentals from the R_s value acquired. The result generated also shows that Gross Domestic Product (GDP) ($R_s = 0.08$) and inflation rate ($R_s = 0.026$) tend to react toward office rentals but with a weak correlation. Table 6 indicates the statistical relation of physical determinants and office rent.

Table 6
Statistical relation of physical determinants and rentals

Physical determinants	Rs Value
Building Appearance and Design	0.569
Amenities and in-house services	0.732
Building Age	-0.043

Amenities and in-house services show a strong positive linear relation with ($R_s = 0.732$). The building appearance and designs also shows a moderate linear relation towards office rentals with ($R_s = 0.569$). It indicates the results of a negative correlation by building age towards the office rent ($R_s = -0.043$).

Table 7
Statistical relation of lease details determinants and rentals

Lease details determinants	Rs Value
Transaction date	-0.067
Rentable area	0.557
Tenancy duration	0.212
Service charge	0.067

Most of the factors categorised under this category have a positive linear relation to office rentals. It includes service charge ($R_s = 0.067$), tenancy duration ($R_s = 0.212$), rentable area ($R_s = 0.257$), and rented floor level ($R_s = 0.119$). Transaction date ($R_s = -0.067$) somehow shows a negative linear relation towards office rentals.

Table 8
Statistical relation of certifications determinants and rentals

Certification determinants	Rs Value
Green Certificate	0.512
MSc status	0.254

The green certification acquire a moderate linear correlation value with office rent ($R_s = 0.512$). It was stated in many previous research that the green certification gives a higher

valuation for building associated with this feature. The adaptation of green techologies can be proved, since it shows a good correlation values as depicted.

Discussion and Analysis

The results of Spearman correlation analysis demonstrated that most of the determinants have an unexpected value. The overall locational determinants show a weak correlation value towards office rent. As depicted, the nearest public transport determinants have a weak positive linear relationship towards office rental and does not signify that the availability of the public transport near the office building would likely contribute to a higher rental price. As mentioned by Kopczewska & Lewandowska (2018), property rental located near to public transport access have higher rates, considering the short walking distance to the public transport location and ease of accessibility but the analysis somehow predicted a low correlation value for this variable might possible due to data scoring. While the public transport determinants show a weak correlation value, the building frontage also demonstrates the same results. This theory was supported by previous research associating with the relation between the building accessibility and rental rates particularly on commercial types of property including office building (Hui et al., 2015). Subsequently, the findings from Spearman Correlation results does not shows a strong correlation between the building frontage and rentals. Conversely, other determinants show a negative linear relation between office rental and the locational factors. The negative weak relations between the traffic condition indicates that building allocation associated with a lower rates of traffic condition have a higher rental, it was signified through the negative R_s value generated by the determinants. Same concept to the distance to city centre factors that shows a negative linear relation towards office rentals. The shorter the distance of the building to city centre, the higher the rentals. The fact that minus allocation of office building to the city centre increase rental rates particularly on office building can be proved as stated by Kopczewska & Lewandowska (2018), as people prefer shorter duration to reach their office with less time consuming. This theory however does not significant due to low correlation values acquired.

As mentioned by (Brounen & Jennen, 2009; Harrami & Paulsson, 2017), office rents react to positive changes in office employment. The theoretical assumptions made by the previous researcher can be considered valid since there is a positive relation between rentals and office employment. Besides, the result generated also shows that Gross Domestic Product (GDP) (R_s = 0.08) and inflation rate (R_s = 0.026) tend to react toward office rentals but with a weak correlation as depicted. As mentioned by (Udoekanem et al., 2014). This evidence provided is enough to support that GDP and inflation tend to have a relation toward office rental rate but not much.

The overall correlation results from physical factors show a strong positive relation towards office rental. As demonstrated in the results, amenities and in-house services acquired the highest correlation results. This determinant has a good relation towards rental values might be due to services that were provided by the building to the tenants. For instance, the availability of banks, retail services, health clubs and food outlets contribute to the higher rental rates for a specific building. As stated by Bera (2019), services provided by an elite office building contribute to higher rental rates where the occupants are usually willing to pay higher rents. On the other hand, the building appearance and design acquired a moderate correlation value which can be considered acceptable compared to the overall results. It was due to the unique architectural design provided by a building that increases some value in the rental. As stated by Wan Rodi (2019) a good building design can be costly owing to the expensive materials required throughout the design process.

Lastly, the certification determinants shows an interesting result since the green certification achieved a moderate correlation with rent rates. This signifies that in many previous research that the green certification gives a higher valuation for building associated with this feature. The adaptation of green techologies can be proved, since it shows a good correlation values as depicted.

CONCLUSION

To understand office rental market, it is required to investigate the impact of numerous aspects such as location, transportation, social services facilities, density requirements, and urban and architectural design quality on office rent. This study has presented the relationship between office building determinants and rentals. Based on Spearman correlation analysis, this study managed to identify the degree of correlation between the determinants included. Using the fundamentals approach in correlation analysis, the amenities and in-house services shows a strong relation to office rent. Overall, other determinants that were included in this study shows a weak relation with office rent. Despite that, a more in-depth analysis should be done in near future to identify other determinants influencing office rent. To the best of researcher's knowledge, other determinants can be include in terms of real estate financing areas involving governmental policies, insurance company and the roles of financial institutions.

As addressed in this study earlier, the heterogeneity of the office building makes it really difficult to analyse. It would be extremely tough since property prices and rentals are influenced by a variety of factors. Henceforth, the resulted findings from this study will be benifical to all real estate market participants including valuers and investors in particular to analyse the volatility of office rent. The implication that will be derived according to these findings are important for investors decision making. For instance, by considering the availability of excellent amenities and in-house services in an office building would be a worth investment.

Nonetheless, the determinants presented here were only limited on finding the statistical relation between the office determinants and rentals but not on the significance. Despite that, the results from this study can be used as a preliminary or extensive study in the future. By conducting a more in-depth analysis or implementing other methods such as prediction or forecasting office rental based on the rent determinants.

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