

THE DETERMINANTS OF MACROECONOMIC FACTORS ON THE RETURN OF REAL ESTATE INVESTMENT TRUSTS IN MALAYSIA

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ABSTRACT

The purpose of this study is to examine the macroeconomic determinants on real estate investment trusts (REITs) return volatility in Malaysia. The sample period of this study is eight years from 2010 Q1 to 2017 Q4. In this study, the REIT return volatility and its macroeconomic determinants are examined. This study employed Autoregressive Conditional Heteroscedasticity (ARCH) and Generalised Autoregressive Conditional Heteroscedasticity (GARCH) models to assess the volatility for REIT returns. Furthermore, the analysis also aims to evaluate the significance of macroeconomic determinants on REIT return volatility in Malaysia. The findings revealed several macroeconomic factors such as Base Lending Rate (BLR), money supply, industrial production, Gross Domestic Product (GDP) and Consumer Price Index (CPI) were the major factors in determining the return of REITs in Malaysia. This study has an implication for investors and fund managers when they have to consider REIT return volatility in investment decision-strategic decision making. This research will also provide more information on the REIT investment risk levels as the property portfolio market has become more complex and requires more transparency in terms of information.

Keywords: *Determinants, macroeconomics, factors, return, REITs, Malaysia*

1. INTRODUCTION

REITs are investment vehicles in many financial markets, especially in Europe and Asia, although they have more than half a century of history in the United States (Stevenson 2013). It is worth noting that it is necessary to understand that mature and developed markets, such as Japan and the UK, launched their REITs only after the turn of the millennium in 2000 and 2007 respectively. Malaysia real estate investment trusts (M-REITs) are the unitised portfolio of property assets, listed on the Bursa Malaysia Stock Exchange which allows investors to purchase diversified and professionally managed real estate portfolios.

The development of M-REITs began in 2006. The market for REITs has shown substantial growth rates in the last decade in Malaysia. The total market capitalisation of the M-REIT market has grown significantly from just RM1.8 billion at the end of 2005 to a considerable RM46 billion in December 2017. Nevertheless, the two major financial crises in 1997 and 2008 have made investors take more precautionary measures in terms of financial market conditions. Consequently, the information from the market has become vital. Hence, investors began to study, analyse, understand and manage the risk of their portfolio investments. They were concerned of the risk and return by investment analysis. The market efficiency has evolved due to the complexity of several external factors, especially macroeconomic factors.

There is very limited literature available on the macroeconomic determinant of REIT returns over the past decades in Malaysia. Abdullah and Zahari (2011); Lee and Ting (2009); Ting (2002); and Ting and Tan (2008) focused on the Malaysian real estate market, focusing only on the performance of REITs. These researchers conducted extensive research on the performance of real estate portfolios in China and Hong Kong to reflect the performance of Malaysia and other Asian countries to show the performance of each country. Therefore, it is important to make Malaysia a major case study so that local property stakeholders can better understand the macroeconomic determinants of the real estate industry, especially REITs. Hence, the form of market efficiency in Malaysia can only be determined when a reliable test and study is undertaken. Researchers have also been making efforts to find the answer to the question: what should be the most significant macroeconomic determinants that affect the return of REIT stocks?

Since real estate is an integral part of the economy, its revenue is closely related to the macroeconomic and business environment (Liu & Mei, 1992). For instance, Chan et al. (1990); Gyourko and Keim (1992); and Peterson and Hsieh (1997) all concluded that the risk premiums of equity REITs correlate to that of common stock returns. In addition, some studies such as Ling and Naranjo (1997) and Mei and Hu (2000) considered the economic factors of income and the time-varying aspect of risk premium. There is no doubt that research in this area has greatly improved investor understanding of the macroeconomic impact of real estate investment performance.

Research on econometric analysis preferences such as ARCH, GARCH, and EGARCH still lacks research, especially for the study of M-REIT's return volatility. Although Liow (2012) used the EGARCH model, the analysis focused only on the common changes and correlations of the Asian securitised real estate market and the stock market. Liow (2012) used only Malaysia as a comparative case study. Moreover, only Liow used GARCH as a technique in his analysis. Therefore, it is believed that this study will be the first to use a variety of econometric techniques to evaluate the volatility of REIT returns. Pham (2012) studied the returns of the Asian REIT market and the dynamics of volatility spillovers. However, the focus of these studies is based on the general Asian perspective.

The significant of REIT return volatility has been studied by several researchers. The study of the relationship between the REITs and volatilities of macroeconomic factors in developing markets (Bulgaria and South Africa) and a 'benchmark' developed market were investigated by Kola and Kodongo (2017). They found that macroeconomic risk cannot explain excess returns on REITs. However, they documented a positive correlation between REIT fund returns and the real economy in the United States. Loo et al. (2015) undertook research on the integration between Asian REIT markets and macroeconomic variables and found that some emerging REIT markets have already shown a higher degree of integration with macroeconomic variables. This means that the emerging REIT market is more sensitive to changes in the macroeconomic environment than the developed REIT market.

In summary, a study of the determinants of macroeconomic factors to M-REITs is important but also inevitable, due to the challenges in the financial markets. Investors need to be informed and local markets are pressured to be more transparent. Previous studies in other countries have shown that macroeconomic factors are very important and are capable of influencing the return of REIT portfolio markets. The findings of this study provide more understanding and valuable information about REITs, thus helping investors to redefine their investment strategies and make sound decision in every investment. Besides that, this study can assist investors in analysing REITs compared with other investment tools.

2. REAL ESTATE INVESTMENT TRUSTS IN MALAYSIA

REITs provide investment opportunities and channels for individual and institutional investors, and also allow small investors to enter the real estate market with a small amount of funds. According to Boon and Phuah (2005), a REIT is one type of collective investment that is involved in real estate and real estate related assets. Examples for real estate sectors include office properties, industrial facilities such as warehouses and distribution centres, retail properties, lodging facilities such as hotels, residential properties such as apartment buildings, student housing, manufactured homes and single-family homes, timberland properties, healthcare-related properties, storage facilities, industrial infrastructure properties and other sectors. While there are variances in terms of ownership, dividend distribution, borrowing limits and other requirements for REITs in every country (Phuah, 2005).

Malaysia is the first Asian country to develop the REIT market. It was previously called Public Trusts Funds (PTFs) in 1986. Malaysia uses Australia's Listed Property Companies (LPTs) model to establish a regulatory framework, although the structure has several different aspects. This is mainly because of restrictions on the "birth of earth" rule that favours foreign investment in Malaysia. The first regulatory framework was approved by Bank Negara Malaysia (Central Bank of Malaysia). Its regulatory principles include the Company Act 1965 and the Securities Act 1983 (Rozali & Hamzah, 2006). Later, when the Securities Commission (SC) was established, it became a regulatory agency. The specific guiding principles for PTF were introduced by the SC in 1991 and later revised in 1995 and 2002. The published performances of REITs were very limited in the Malaysia context. Newell et al. (2002) found that although Malaysia was the first Asian country to develop REITs, based on risk-adjusted performance analysis, they noted that M-REITs performed poorly. Factors that constrained the development of LPTs in Malaysia (Shun 2003; Ting, 1999) were:

- i. Lack of demand and poor perception for the product amongst investors;
- ii. Properties available for acquisition provided a low yield and Malaysia had too few institutional investors;

- iii. Strong performance by competing investment options; and
- iv. Local investment psyche favoured speculative investment.

In 2010, Malaysia revised its guidelines again to provide a regulatory framework that would protect the interest of investors and facilitate the development of the REIT industry. The revised regulation would push future investing in REITs in Malaysia towards a global investment and attempt to attract more REITs to be list in Bursa Malaysia in the future.

As of 31 December 2017, there were 18 M-REITs with a total market capitalisation of RM46 billion listed on the Malaysian Stock Exchange (see Table 1). This made Malaysia the fourth-largest REIT market in Asia. However, compared with Japan, Singapore and Hong Kong, Malaysia's REIT industry is still relatively small. Four of the largest M-REITs are: KLCC REIT (RM11.48 billion), Pavilion REIT (RM5.74 billion), IGB REIT (RM5.62 billion) and Sunway REIT (RM4.88 billion), were among the top 50 REITs in Asia in terms of market value.

Table 1: Profile of Malaysian Real Estate Investment Trusts (M-REITs)

Company	Listed Date	Property Sector	Market (Million)	Cap	USD
KLCC REITs	May 2013	Retail	3,899.5		
Pavilion REIT	December 2012	Retail	1,626		
IGB REIT	September 2012	Retail	1,581		
Sunway REIT	July 2010	Diversified	13,111		
Capitalmall Malaysia TRT	July2010	Retail	777		
Axis REIT	August 2005	Office	462		
YTL Hospitality	December 2005	Retail	503		
Quill Capital TRT	January 2007	Office	334		
Al Aqar Healthcare REIT	August 2006	Speciality	260		
UOA REIT	December 2005	Office	171		
Hektar REIT	December 2006	Retail	150		
As Salam REIT	September 2015	Diversified	145		
Amanahraya REIT	February 2007	Diversified	130		
KIP REIT	January 2017	Retail	109		

3. MACROECONOMIC DETERMINANTS ON REITS

The study on macroeconomic determinants on REITs has been carried out by several researchers. According to the study of He and Ng (1994), they found that when examining the relationship between market fundamentals, economic power, and the stock market, several measures of macro risk are very important. In Loo et al.'s (2015) study, the emerging REIT market showed a higher degree of integration with macroeconomic variables over the long term. This means that the emerging REIT market is more sensitive to changes in the macroeconomic environment.

REIT returns have been empirically investigated in various markets with macroeconomic determinants such as industrial production growth, output growth, inflation, interest rates and term structure being

found to be important sources of systematic risk that directly affect real estate returns, particularly equity REITs (Chan et al., 1990; McCue & Kling, 1994). For example, a recent Bloomberg report suggests that a recovering economy and low-interest rates since the end of the recession have contributed to increasing yields of REITs in the US; consequently, higher interest rates can make REIT dividend yields less attractive in comparison to other securities such as bonds.

In a study of the US REIT market, it was pointed out that previously used macroeconomic variables were interest rates (Allen et al., 2000; Chen & Tzang, 1988; McCue & Kling, 1994), inflation (Chan et al. 1990; Chatrath & Liang, 1998; Chen & Tzang, 1988; Ewing & Payne, 2005; Glascock et al., 2002; Jirasakuldech & Emekter 2012; Liu et al. 2012; McCue & Kling 1994; Park et al. 1990; Simpson et al., 2007; Yobaccio et al., 1995; Yunus, 2012), industrial production (McCue & Kling, 1994), GDP (Chang et al., 2011; Ewing & Payne, 2005; Li & Lei, 2011; Yunus, 2012), and money supply (Anderson et al., 2012; Bredin et al., 2007, 2011; Chang et al., 2011; Ewing & Payne, 2005; Jirasakuldech & Emekter, 2012; Yunus, 2012).

In contrast, studies of the real estate market use macroeconomic variables that include interest rates (Liow & Yang, 2005; Stevenson et al., 2007), inflation (Lee et al., 2011; Liow & Yang, 2005; Yunus, 2012), industrial production (Lee et al., 2011), GDP (Liow & Yang, 2005; Yunus, 2012) and money supply (Lee et al., 2011; Liow & Yang, 2005; Xu & Yang, 2011; Yunus, 2012). In their study, Lee et al. (2011) found no evidence of the impact of money supply and industrial production on Malaysian and Taiwanese real estate stocks. However, Yunus (2012) found that Japanese real estate stocks were evidenced by long-term and short-term impacts of GDP, inflation, money supply, and long-term government bonds. Liow and Yang (2005) found that long-term perspectives were combined with factors such as GDP, inflation, short-term interest rates, long-term interest rates, and money supply in Japan, Hong Kong, Singapore, and Malaysian real estate stock markets.

A study by Yunus (2012) found that long-term relationships and short-term relationships between the US, Canada, Japan, Australia, Germany, France, Italy, the Netherlands, Switzerland and the UK with real estate stocks, inflation, and currencies were examined through macroeconomic factors such as GDP. With supply and long-term government bonds, the study found that each real estate market was co-integrated with macroeconomic variables, and these markets were also affected by the overall economy in the short term. Liow and Yang (2005) also proved the impact of the real estate stock markets in Japan, Hong Kong, Singapore and Malaysia on GDP, inflation, short-term interest rates, long-term interest rates and money supply. Chen and Tzang (1988) found similar results, in which real estate stocks met macroeconomic fundamentals. Overall, most studies showed significant relationship between REIT returns and macroeconomic determinants of interest rates, inflation rates, gross domestic product, money supply, industrial production and currency exchange rates.

Interest rates are one of the key determinants of market returns in the literature. Most studies have shown that there is a negative correlation between interest rates and stock prices, consistent with financial theory. Abdullah and Hayworth (1993) found that the return of the S&P 500 index is more closely related to the long-term interest rate than the short-term interest rate. Bulmash and Trivoli (1991) also observed similar negative correlations between long-term treasury bond rates and US stock prices, as well as the findings of Maysami and Koh (2000) in Singapore. Mukherjee and Naka (1995) found a mixed relationship between Tokyo stock market returns and interest rates. They found that there was a normal negative correlation between long-term government bond interest rates and market returns, but there was a controversial positive relationship between short-term interest rates and earnings.

In most studies, inflation, whether expected or unexpected, was negatively correlated with market returns. Bodie (1976); Chen et al. (1986); Fama and Schwert, (1977); Geske and Roll, (1983); Jaffe and Mandelker (1976); and Marshall (1992) demonstrated evidence of a negative correlation between US inflation and stock market returns. Hamao's (1988) study of the Japanese stock market is consistent with the US evidence. Bulmash and Trivoli (1991) pointed out that CPI is falsely related to stock prices. Mukherjee and Naka (1995) used Johansen's (1991) co-integration analysis to find that the Tokyo Stock Exchange (TSE) index movement was negatively correlated with changes in inflation in Japan.

Maysami and Koh (2000) showed an increase in evidence of negative co-integration between inflation and Singapore stock market returns. However, Abdullah and Hayworth (1993) found that the S&P 500 stock price index return was positively correlated with inflation. Nasseh and Strauss (2000) also pointed out that there were positive co-integration relationships between inflation and stock prices in six European countries: France, Italy, the Netherlands, Switzerland, the United Kingdom, and Germany. Ibrahim and Aziz (2003) and Ibrahim (2003) also found similar results in the Malaysian stock market. The Kuala Lumpur Composite Index (KLCI) was considered to be positively correlated with the Malaysian consumer price index. Bulmash and Trivoli (1991) showed that CPI is falsely related to stock prices.

Money supply is one of the factors that other macroeconomic variables are likely to explain stock market returns. The money supply was found to be positively correlated with the US stock price (Homa & Jaffee 1971; Palmer 1970; Rudolph 1972). The literature found evidence of positive co-integration between the supply of money and changes in stock prices. Habidullah (1998) also recorded strong positive correlations and the existence of long-term co-integration between the money supply (defined as M1 or M2) and the stock prices of the Malaysian stock market. Bulmash and Trivoli (1991) recorded a positive co-integration relationship between the changes in US stock prices and money supply.

Thornton's study (1998) pointed out that there is a significant positive correlation between the actual stock price in Germany and the long-term demand defined as the actual monetary balance of M1. Maysami and Koh (2000) also found positive but negligible co-integration between Singapore stock prices and money supply. Ibrahim (2003) found that Malaysian stock prices were positively correlated with money supply M1. However, Kwon and Shin (1999) found contrasting results, indicating that the stock price of the Korean stock market was negatively correlated with the money supply. Ibrahim and Aziz (2003) also recorded a negative co-integration between the Malaysian stock exchange price and the local money supply if it was defined as M2. Regarding causality, Hashemzadeh and Taylor (1998) pointed out that money supply and stock prices were two-way causality.

GDP is one of the most popular indicators used by researchers to represent economic conditions. It has the strongest influence on the development of the real estate industry. For example, many companies are undergoing restructuring and consolidation as the economy declines. In the study of Maysami and Koh (2000), the relationship between stock prices and real GDP showed a positive relationship. According to studies by Fama (1986), Ibrahim and Aziz (2003), and Mukherjee and Naka (1995), real GDP growth will affect stock prices by affecting corporate profits. This is because when the real GDP increases, the company's expected future cash flow will increase, and the stock price will increase.

There have been several studies conducted to investigate the impact of currency volatility on the share market. The results were generated differently from several studies in different countries.

Home country currency appreciation leads to an increase in home country share returns (Aggarwal, 1981; Muzindutsi, 2013). Qian (2011) provided a similar result but in a different direction. The study found that appreciated home country currency will cause an increase in the present value of expected future cash flows on foreign shares in foreign currencies. In contrast, Soenen and Hennigar (1988) reported that there has been a strong negative relationship between US dollar value and US stock indexes. These findings are supported by Moghadam and Moghadam (2016) who found negative relationships between exchange rates and stock prices as the change in 1 of exchange rate will bring a negative impact for stock prices in the size of -0.18 in Tehran.

Nath and Samanta (2003) provide a different point of view as the exchange rate and stock price are not interrelated in India. Research by Rahman and Uddin (2009) also supports Bangladesh, India, and Pakistan where there is no fixed relationship between the exchange rate and the stock market, there is no co-integration relationship, and there is no causal relationship. Market participants cannot use one part of market information to predict another market. Inci and Lee's (2014) results were in contrast with Nath and Samanta (2003) and Rahman and Uddin (2009); where the research found exchange rates and stock returns were significantly linked and their relationship even became stronger during recent years.

4. METHODOLOGY

In this study, the quarterly total return price changes for the 17 listed REITs in Bursa Malaysia from January 2010 to December 2017 will be assessed. There are a total 18 REITs listed in Bursa Malaysia as at 31 December 2017. To determine the applicability of REITs in this study, the REITs to be selected in this study must be listed in Bursa Malaysia after January 2015 until December 2017. Only quarterly price changes of the 17 listed REITs are collected for the study. The quarterly total return index of the listed REITs is collected from Thomson Reuters DataStream from the period of January 2010 to December 2017, which is the total study period of eight years.

The macroeconomic determinants for REITs which are identified from the literature review are Base Lending Rate (BLR), inflation rate, industrial production, GDP, money supply and currency exchange rates. This data will be obtained from the Datastream service by Thomson Reuters. All variables will be computed into natural logarithms except BLR, CPI, industrial production and currency exchange rate. The "LOG" function is used to convert the RM millions in industrial production, GDP and money supply into smaller values. The natural logarithm of a number is its logarithm to the base of the mathematical constant, which can be convenient in calculating and getting the result. The application of this transformation makes the data more consistent with the statistical inference of the study, and also improves the interpretability and appearance of the graph.

Data analysis is a crucial step in any research. Fundamentally, data analysis is the systematic process that adopts statistical testing and standardised procedures to interpret and evaluate the data. The main purpose of data analysis is to achieve research goals and support research conclusions. Therefore, the results of data analysis must accurately reflect the objectives of the study. A variety of quantitative methods are involved in the data analysis of the study. The data analysis used for statistical software is EViews.

Market Capitalisation Weighted Index is a stock market index with individual components weighted according to their market capitalisation. The capitalised weighted index is calculated by adding the total market capitalisation of all components and dividing by the arbitrary value determined when the

index appears. Market Capitalisation Weighted Index aims to measure the performance of financial markets. A study on REITs in the investment market by Osmadi (2010) had developed the M-REIT index by applying the market capitalisation weighted scheme. The REIT index will be developed from January 2010 until December 2017. All the total return indices are constructed every quarter and the market capitalisation weighted scheme is applied to construct the REIT index. The market value-weighted index is used to compute a new index for every group of data series. The formula below is used in the computing process:

$$\left\{ \left(\frac{\sum MV_n R_n}{\sum MV_n} \right) 1 \times \text{base value}_{t-1} \right.$$

Where:

$\sum$ = sum product

MV_n = Market value for n number of asset

R_n = Return index for n number of asset

Unit root test is used as a method in the study to test the stationarity of a series before using it in a regression. If the series mean and auto co-variances do not depend on time it can be considered as stationary, conversely it is said to be non-stationary (Quantitative Micro Software 2010). The unit root test accounts for stationarity of series tested, therefore in this study the Augmented Dickey-Fuller test (ADF) was applied (Dickey & Fuller, 1979).

Engle's ARCH test is a Lagrangian multiplier test that assesses the significance of the ARCH effect (Engle, 1982). The ARCH effect or volatility clustering is a condition where the variance changes over time, with low volatility and high volatility. The volatility clustering shows the temporal correlation and the change over time in REIT returns.

Volatility clustering or ARCH effects usually exist in the asset market (Lin & Fuerst, 2013). Therefore, in order to test the REIT fund's earnings volatility, the existence of volatility clustering or ARCH effects must first be tested. The LM test proposed by Engle (1982) is computed as follow:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \varepsilon_t \quad (1)$$

$$\varepsilon_t^2 = \varphi_0 + \varphi_1 \varepsilon_t^2 + \dots + \varphi_p \varepsilon_{t-p}^2 \quad (2)$$

R^2 represent REITs return (difference of the natural logarithms of the REITs index) and T is the sample size. The null hypothesis of LM test is that $H_0: \varphi_0 = 0$ and $\varphi_2 = 0$ and $\varphi_3 = 0 \dots$ and $\varphi_p = 0$. If $T R^2$ exceeds the critical value of X^2 , the null hypothesis of no ARCH effects is rejected. The series is considered to exhibit volatility clustering or ARCH effect, the period of high volatility will be followed by high volatility or vice versa.

ARCH is an econometric term used for observed time series. It has been widely used in financial time series analysis and can capture clusters and predict volatility. Engle (1982) developed the ARCH model to estimate the variance of British inflation. A regression model was introduced to simulate time-dependent variance. The ARCH model allows the conditional variance of the time series to change as a function of past squared error over time by applying an autoregressive structure on the conditional variance.

The ARCH model is calculated by using the following formula:

$$y_t = x_t \beta + \sigma_t^2 + \varepsilon_t \quad (3)$$

Where: σ_t^2 = one-period ahead forecast variance based on past information x = predetermined variables t = error

In this research, identifying the variance equations as well as estimation techniques and samples uses EViews software. The final analysis of the volatility joint movement must be done through systematic methods, such as analysing the volatility of M-REITs. The multivariate GARCH model helps capture the important relationship between macroeconomic determinants in Malaysia and REITs. The multivariate approach eliminates the two-step process, thereby avoiding the problems associated with estimating regression factors (Kourmous & Booth, 1995).

The GARCH model is estimated by computing the conditional log-likelihood function:

$$\sigma_t^2 = \alpha + \alpha_1 \epsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (4)$$

Where:

t = number of observations

σ_t = time varying conditional variance-covariance matrix

5. DISCUSSION AND FINDINGS

The correlation analysis is aimed to assess the relationship of macroeconomic factors within REIT investments in Malaysia. Table 2 shows the inter-correlation matrices between macroeconomic determinants and REIT returns in Malaysia from January 2010 to December 2017. There are six macroeconomic determinants in total, which are: base lending rate (BLR), money supply (MSUPPLY), industrial production (INDPRODUCT), exchange rate in Ringgit Malaysia per United States dollar (RM/USD), consumer price index (CPI) and gross domestic product (GDP).

Based on the result, the correlation value of all the variables is positive and high in value. The range of correlation between macroeconomic determinants and REITs is between $r = 0.5879$ to $r = 0.9727$. The highest correlation value is $r = 0.9727$ which is contributed by MSUPPLY, followed by INDPRODUCT with $r = 0.9617$, CPI with $r = 0.9615$, GDP with $r = 0.9594$, RM/USD with $r = 0.843$, while the lowest correlation value is $r = 0.5879$ which is contributed by BLR.

Overall, all macroeconomic factors show a high correlation to each other which indicates the strong relationship among macroeconomic factors. Thereafter the past eight years have seen each of the macroeconomic determinants highly relate to each other and could have high spill-over. The result is similar to Chatrath and Liang (1998) and Kola and Kodongo (2017) whereas the macroeconomic determinants are positively correlated to REIT returns. However, the result was in contrast with Abdullah and Hayworth (1993) and Soenen and Hennigar (1988) who found that interest rates and exchange rates have a negative relationship with REIT returns.

Table 2: Correlation Coefficient of Macroeconomic Determinants for REITs in Malaysia: January 2010 – December 2017

	REITs	BLR	MSUPPLY	INDPRODUCT	RM/USD	CPI	GDP
REITs							
BLR	0.59						
MSUPPLY	0.97	0.66					
INDPRODUCT	0.96	0.59	0.98				
RM/USD	0.84	0.35	0.86	0.87			
CPI	0.96	0.63	0.99	0.98	0.86		
GDP	0.96	0.67	0.97	0.99	0.82	0.99	

The ARCH model ADF unit root test is used to examine whether the variables are stationary or not. In general, there are three necessary conditions in applying unit root test, intercept, trend intercept and none. As the P-value is greater than 0.10 ($P > 0.10$), the data series are not stationary or has unit root. This unit root test involves REITs, BLR, MSUPPLY, INDPRODUCT, RM/USD, GDP and CPI. The lag length is two maximum lags in the selection of Schwarz Info Criterion.

Table 3 shows the ADF unit root test results. The table shows that all variables are not stationary in the level stage except BLR has stationary in intercept condition and GDP has stationary in trend and intercept condition. However, after the first differencing on each variable, all the data is showing stationary at a 1% level of significant. This means that all the variables are stationary of order 1, which is $I(1)$. From the table below, it shows all the data successfully achieved stationary after the first difference. Table 3 tabulates the t-statistics for all data series.

Table 3: Unit Root Test Analysis

Variable	ADF		
	None	Intercept	Trend and Intercept
T-Statistic Level			
REITs	2.2693	-0.0793	-3.4463
BLR	1.3984	-6.8566	-5.5830
MSUPPLY	5.6918	-0.5587	-4.1636
INDPRODUCT	4.2409	1.0013	-5.3986
RM/USD	0.7358	-0.4827	-2.4689
GDP	4.2869	-0.0817	-9.7953
CPI	5.7312	0.5256	-2.6056
T-Statistic 1 st Level difference			
REITs	-4.8022	-5.7092	-5.5947
BLR	-6.0835	-5.9832	-6.0509
MSUPPLY	-1.3547	-6.0113	-5.8795
INDPRODUCT	-8.2323	-7.6553	-9.1548
RM/USD	-5.3369	-5.3984	-5.3798

GDP	-5.4343	-30.0183	-29.2573
CPI	-3.1994	-6.1039	-6.0863
unit root test at 1% level			
unit root test at 5% level			
unit root test at 10% level			

ARCH LM test by Engle (1982) was undertaken to investigate the existence of volatility clustering in the macroeconomic determinants on REIT returns prior to employing an ARCH model. In order to employ the ARCH model, there are two conditions that need to be fulfilled, being volatility clustering and an ARCH effect. The results of LM tests for macroeconomic determinants on REIT returns are shown in Table 4.

Figure 1 shows the residual graph of ARCH LM test for volatility clustering of REIT returns which is the dependent variable while the macroeconomic determinants such as BLR, MSUPPLY, INDPRODUCT, RM/USD, GDP and CPI are independent variables. The findings depict that there is high volatility on REIT returns starting from Q1 year 2012 to Q1 year 2014 then continues with low and consistent volatility on REIT returns to the end of Q4 year 2017 for a prolonged period. The high volatility in the year of 2012 to 2014 is due to the peak in oil price crisis which caused uncertainty in Malaysia's economy. This means that there is volatility clustering in this model and fulfilled the first condition of the ARCH model.

Table 4 shows that all of the macroeconomic determinants have positive LM values at 1% of significance. This means that all of the macroeconomic determinants are significant and have an ARCH effect in the LM test. It had met the second condition of the ARCH model. Overall, all the macroeconomic determinants have clustering volatility and an ARCH effect. It has all the permission and validity to run the ARCH model. The results are consistent with the findings by Liow et al. (2011) which found the presence of ARCH effects in almost all real securities indexes.

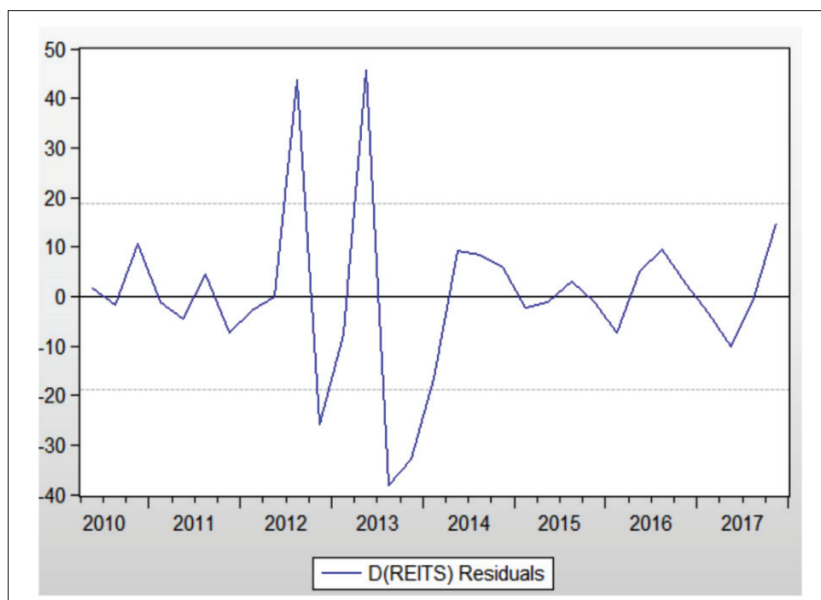


Figure 1: Residual graph of ARCH LM test for volatility clustering

Table 4: ARCH LM Tests for Volatility Clustering

Macroeconomic Determinants	LM (P-Value)
	REIT Return
BLR	215.6746 (0.0004)
MSUPPLY	954.4911 (0.0000)
INDPRODUCT	8.300025 (0.0000)
RM/USD	159.5192 (0.0000)
CPI	1747.099 (0.0000)
GDP	14.92676 (0.0000)
unit root test at 1% level	
unit root test at 5% level	
unit root test at 10% level	

Understanding the volatility of the real estate market is particularly important, especially REITs, to assess investment and leverage, because volatility and investment risk are synonymous. Volatility is synonymous with risk and will provide a general overview of the country's economic activities. If the REIT market in Malaysia shows high volatility, investor participation may decrease. This may have an adverse effect on Malaysia's investment. Therefore, to investigate the volatility changes during the period from January 2010 to December 2017, the ARCH model will be used to develop the modeling of volatility changes. Once the REIT regression sequence is determined to have a volatility clustering and ARCH effect, the ARCH model is conducted along with macroeconomic determinants to test the volatility of the series. From the results of the ARCH LM test, all macroeconomic determinants are estimated in the ARCH and GARCH models. The results are shown in Tables 5 and 6.

In analysing the results, the significance of the variables (P-value) was determined from the Z score. The Z score is a measure of standard deviation. In the end, a two-tailed P-value ($|Z| > 1$) was adopted in this study. The null hypothesis is the volatility of dependent variables (REIT returns) is affected by independent variables (macroeconomic determinants). The findings from the analysis showed that MSUPPLY has the most macroeconomic significant determinants at the 1% level of significance to the REIT volatility. Moreover, GDP and CPI are at the 5% level of significance to the REIT volatility. In addition, REIT volatility is affected by the changes of BLR at the 10% level of significance. Therefore, from the ARCH analysis perspective, the macroeconomic determinants of REIT return volatility are MSUPPLY, GDP, CPI and BLR. Table 5 tabulates the findings from the ARCH model for all macroeconomic determinants.

The volatility analysis further continues to use the GARCH technique to test the significance of macroeconomic determinants on the volatility of M-REITs. Table 6 shows the results of the GARCH model for REIT return volatility. The results suggest the conditional mean coefficients for all macroeconomic determinants were significant over this period with P-value equal to 0, with the exception of RM/USD. Based on the minimum AIC/SIC values and maximum log-likelihood values, it can be concluded that the GARCH model best captures volatility dynamics of the macroeconomic determinants on REIT return volatility. In addition, the coefficients in the ARCH model are negative. The results of the study indicate that GARCH is the better model than ARCH over the period. GARCH succeeded in simulating the volatility during the period for BLR, MSUPPLY, INDPRODUCT, GDP and CPI with statistically significant coefficients. The results correspond with the findings by Liow (2008) which found some volatility persistence in Asian property securitised markets. The strong presence

of the GARCH effect has also been found in the analysis of Asian REITs by Pham (2012) which reflects the whole property market.

Table 5: ARCH Model Results

Macroeconomic Determinants	ARCH
	REITs
Mean equation	
Equation	-11061/34 (-3.9444)
BLR	-63.8627 (-1.9119)
MSUPPLY	1309.873 (3.7189)
INDPRODUCT	-1.0348 (-0.3740)
RM/USD	-2.9572 (-0.1364)
GDP	1297.627 (2.2665)
CPI	-12.6358 (-2.0444)
Variance equation	
Constant	406/5287 (2.5673)
ARCH	-0.1059 (-0.2136)
AIC/SIC	9.28/9.70
Log Likelihood	-139.6155
unit root test at 1% level	
unit root test at 5% level	
unit root test at 10% level	
P-value = 0.00	

Table 6: GARCH (1,1) Model Results

Macroeconomic Determinants	ARCH
	REITs
Mean equation	
Constant	-11822.67 (-6740.770)
BLR	-65.95120 (-4.6732)
MSUPPLY	1198.891 (521.9759)
INDPRODUCT	-5.6579 (9.1080)
RM/USD	4.9075 (0.3055)
GDP	1508.865 (990.4822)
CPI	-6.4326 (-6.2382)
Variance equation	
Constant	0.3677 (0.1347)
GARCH (1)	0.0455 (0.4605)
AIC/SIC	8.98/9.44
Log Likelihood	-133.7384
unit root test at 1% level	
unit root test at 5% level	
unit root test at 10% level	
P-value = 0.00	

Based on the findings, the difference between the significant determinants to REIT returns from correlation analysis and its volatility from ARCH and GARCH models were identified. The findings indicate that all of the macroeconomic determinants are significant to REIT returns while there are five for REIT return volatility. The significant determinants for REIT returns are: BLR, MSUPPLY, INDPRODUCT, RM/USD, GDP and CPI, while in the case of REIT return volatility, RM/USD is not included as the determinant. This explains that shocks in BLR, MSUPPLY, INDPRODUCT, GDP and CPI will produce dynamic responses in the M-REIT market. Table 7 summarises the macroeconomic factors that are significant to the REIT returns and volatilities.

The results of ARCH and GARCH test examined that there is significance of macroeconomic determinants on REIT return volatility in Malaysia. The findings from the analysis showed that MSUPPLY has the most macroeconomic significant determinants at the 1% level of significance

to the REIT volatility. The results of the study indicate that GARCH is a better model than ARCH over the period. GARCH succeeded in simulating the volatility during the period for BLR, MSUPPLY, INDPRODUCT, GDP and CPI with statistically significant coefficients.

Table 7: Macroeconomic determinants for REIT returns and volatility

REIT Returns	REIT Volatility
Base lending rate	Base lending rate
Money supply	Money supply
Industrial production	Industrial production
Exchange rate	GDP
GDP	CPI
CPI	

6. PROPERTY IMPLICATIONS

This study aims to examine the macroeconomic determinants on REIT returns from January 2010 to December 2017. From the output, it is observed that content analysis shows there are six common macroeconomic determinants on REIT returns which are: Interest Rate, MSUPPLY, INDPRODUCT, RM/USD, GDP and CPI. These macroeconomic determinants were then analysed together with the quarterly REIT returns to find the most significant macroeconomic determinants on REIT returns in Malaysia. From the output, it is observed that all the macroeconomic determinants are exposed to the same correlation status. All of the macroeconomic determinants show a positive linear relationship to the REIT returns. The range of correlation between macroeconomic determinants and REITs are between $r = 0.5879$ to $r = 0.9727$. It indicates a strong relationship between macroeconomic determinants and REIT returns in Malaysia, as the increase of macroeconomic determinants represents the increase of REIT returns. In order to conclude the findings in general terms, the increase of macroeconomic determinants will lead to a rise on REIT returns.

Based on the results, all of the macroeconomic determinants have volatility clustering and the ARCH effect by using the ARCH LM test. From the result of the ARCH analysis, it can be noted that only MSUPPLY, GDP, CPI and BLR are significant and volatile. The analysis on volatility further continues by using the GARCH technique to examine the significance of macroeconomic determinants on REIT returns of volatility in Malaysia. The findings suggest that GARCH is performing better than the ARCH model over the period. All of the macroeconomic determinants are significant to the REIT return volatility, with the exception of RM/USD.

7. CONCLUSIONS

This paper provides insight to the REIT return volatility in Malaysia based on the macroeconomic determinants such as BLR, MSUPPLY, GDP, CPI, INDPRODUCT and RM/USD which has a significant growth in the M-REIT market. The result of the content analysis from a previous study found that the inflation rate is the most used determinant on REITs followed by interest rates, MSUPPLY, currency exchange rate, GDP, INDPRODUCT, population and lastly employment rate. Policymakers can identify macroeconomic determinants that are significant to REIT returns and make decisions on the rate, such as interest rates and inflation rates, which will determine the REIT return volatility. Speculation and herd behaviour in the REIT return volatility will be decreased as this study is directly analysed with macroeconomic risk in Malaysia.

This study does provide some implications, especially to the investors and fund managers. Fundamentally, this study managed to provide information about the issue of relationships and the significance of the macroeconomic determinants and REITs by using correlation analysis, ARCH and GARCH models. The findings can reflect the REIT return movement in response to macroeconomic determinant trends. Through the correlation analysis, it provides information to investors to enable a better understanding of the current REIT market related to macroeconomic determinants. Therefore, in an uncertain economic situation, investors can better distribute wealth through the proposed REITs and diversify their portfolios.

The findings of this study show that there are volatility clustering in all of the determinants on REIT returns in Malaysia. This indicates that the REIT market is exposed to unsystematic risk and uncertainty especially during Q1 year 2012 to Q1 year 2014 when Malaysia experienced the peak of the oil price crisis. The identification of volatility clustering in the macroeconomic determinants in Malaysia will increase the awareness of investors and policymakers toward the importance of REIT return volatility. Furthermore, the results from the GARCH model show that five determinants have an impact on to REIT return volatility in Malaysia. This study provides information of the level of significance of determinants to the REIT return volatility. This will contribute to decision-making for portfolio investment and diversification. Fund managers can take into consideration the specific determinants which will impact REIT returns before making investment decisions to minimise the risk. Policymakers can also consider these determinants in making their REIT's policy.

In summary, the results of this study have increased investor awareness of investment allocation strategies related to the macroeconomic movement. Therefore, they can redefine their investment strategy and make wise decisions based on the information provided in this study. In addition, this study may be beneficial to academicians or researchers, especially REITs applied in the macroeconomy.

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