PACIFIC RIM PROPERTY RESEARCH JOURNAL, 2016
VOL. 22, NO. 3, 245–265
http://dx.doi.org/10.1080/14445921.2016.1235758

Routledge
Taylor & Francis Group

The dynamic of linkages of Islamic REITs in mixed-asset portfolios in Malaysia

Ahmad Tajjudin Rozman, Muhammad Najib Razali, Nurul Afiqah Azmi and Hishamuddin Mohd. Ali

Faculty of Geoinformation and Real Estate, Universiti Teknologi Malaysia, Johor Bahru, Malaysia

ABSTRACT

Islamic REIT (I-REITs) were introduced to the Malaysian stock market approximately ten years ago. This paper assesses dynamic linkages by using the Granger causality test of I-REITs. The study period is from 2008 to 2014. The study concentrates on comparisons between I-REITs and conventional REITs (C-REITs) and provides a better overview of comparisons and linkages of both asset classes. A Cointegration Test determined that a mixed-asset portfolio is cointegrated and shows less diversification benefits between the mixed-asset portfolios. The Granger causality test results has identified that industry portfolio can cause Granger I-REITs' returns to change. This further confirms that I-REITs have good potential to diversify within any asset classes, including shares and bonds.

ARTICLE HISTORY
Received 20 March 2016
Accepted 9 September 2016

KEYWORDS
Islamic REITs; Malaysia; linkages; REITs

Introduction

In order to fulfil the demands from the Muslim community, the Islamic Banking Act, 1983, in Malaysia was endorsed to support the establishment of Islamic financial institutions. The Act's endorsement is the stepping stone for any financial institution or corporate company to be involved in Islamic finance and services (MIFC, 2014). I-REITs are part of the Malaysian REITs where the investment scheme combines the purchasing of real estate products through the stock market using Shariah principles.

Malaysia established I-REIT guidelines in November 2005 in order to expand Malaysia's REIT market. The establishment of the I-REIT guidelines makes Malaysia the first country to start the business of I-REITs. The principles of Shariah are adopted in the I-REITs and are the same as the Islamic finance institutions. It is forbidden to approach any business or financial activities that relate to *riba or* interest rate, alcohol, pornography, gambling, conventional insurance, pork or *non*-halal food, and excessive entertainment.

In Malaysia, Islamic real estate stocks known as I-REITs were introduced in 2006. The I-REITs could enhance the development of the REIT market in Malaysia and attract Muslim investors to participate in the real estate stock market. In recent years, researchers have shown some interest in the development of Malaysian REITs (M-REITs) market as well

CONTACT Muhammad Najib Razali muhammad.najibr@gmail.com
© 2016 Pacific Rim Real Estate Society

the Asian REIT market. This study contributes to expand the existing literature of I-REITs and M-REITs generally.

The property finance literature offers extensive research on linkages that exist among world portfolio markets. The research on dynamic linkages and causality has been done by several researchers. The aim to assess the linkages within mixed-asset portfolio markets is to explain the movement of a specific market to other markets and vice versa. Furthermore, the study also identifies diversification benefits in portfolio markets. As a new vehicle of investment that was establised almost 10 years ago, it is sigificant to study dynamic linkages of I-REITs within mixed-asset portfolios. The study identified how far the integration of I-REITs was within local mixed-assset portfolios. Consequently, it can inform investors of the potential for investment in I-REITs by observing the returns and interactions within the market.

Literature review

M-REITs are becoming an important emerging REIT market for Asian markets. M-REITs are among the earliest REIT established in Asia. Development of REITs in Malaysia was the foundation of the beginning of I-REITs in the world. Development of REITs in Malaysia was the result of the establishment of Property Trust Funds (PTF). However, the low performance of PTF forced REITs to take over the system with the establishment of REIT guidelines in January 2005. M-REITs must follow certain requirements and regulations to develop a REIT. A particular company must be registered as the trust. The trustees must be approved by the Securities Comission. REITs must have a management company to manage the REITs. The real estate held by the trust must be managed by a qualified property manager.

Real Estate Investment Trusts have their own regulations that are related to Malaysian law. Specific tax provisions were introduced by appropriate measures for the REITs. REIT regulations were enacted in 2005, 2006, 2007 and 2008 (EPRA, 2009). Malaysia has introduced a new initiative in the form of an Islamic Capital Market – viable, sustainable and feasible to the needs of Muslims. However non-Muslims are also allowed to invest in I-REITs. The initiatives ensure that any form of products and services attract investors and issuers, regardless of race or religion. One investment opportunity that was introduced in the Islamic Capital Market is the Islamic Real Estate Investment Trusts or I-REITs (Dusuki, 2008).

I-REIT is a type of ethical investment. It is different from the conventional REIT (C-REIT) framework because the I-REIT is closely related to the principles of Islam. This principle is also known as the principle of Islamic Sharia by investors. Principles of Islamic law prohibits any form of business, activity, trade, service or exchange with unlawful activities (religiously non-permissible). However, Islamic law calls for any such activities to be carried out by the halal principles (religiously permissible) to receive blessings and the pleasure of God the Almighty. Illegal activities are prohibited by Islamic law due to the disadvantages inherent in these activities and could damage society, institutions or culture (Osmadi, 2006).

Despite the study on dynamic linkages among Asian REITs being covered; studies on dynamic linkages of Malaysia REITs is limited, in particular I-REITs. Among others, Nawawi, Husin, Hadi, and Yahya (2010) attempted to investigate the relationship between M-REITs and Asian REITs. Lean and Smyth (2012) also studied the integration of M-REITs on interest rates and stock prices. The study revealed REITs were highly integrated with both macroeconomic variables. However, due to the short period of time, the findings were less

conclusive. More importantly, the study did not focus on I-REITs which were considered relatively new during the time. However, I-REITs in Malaysia has caught attention of several researchers to investigate empirically with various points of view. For instance, Newell and Osmadi (2009) studied the performance of I-REITs in Malaysia over the period 2006–2008. Their findings revealed that I-REITs had remarkable robustness during the Global Financial Crisis (GFC) period, and displayed better diversification benefits. However, the performance analysis indicated that C-REITs performed better than I-REITs over the period 2006–2008. However, it should be noted that their study did not include a causality test due to I-REITs' data limitation. The study was further extended by Rozman, Azmi, Mohd Ali, and Mohamed Razali (2015) using an extended time period from 2008 to 2014, which found that I-REITs outperformed both the shares market and bonds market. This indicates that I-REITs was able to achieve a good performance with a longer time horizon. However, the findings contrast with the study done by Morad and Masih (2015) which revealed the returns for I-REITs was lower than C-REITs. However, their study included structural breaks analyses with macroeconomic factors to be shown as variables in assessing the performance. Another study of M-REITs has been done by Ting and Noor (2007), which examined the portfolio characteristics of REITs' performance. The characteristics were based on standard deviation, beta and Sharpe ratio.

Furthermore, Razali and Sing (2015) examined the systematic risk of I-REITs vs. C-REITs in Malaysia. The study found that new I-REITs' entry created significant risk reduction effects for the C-REITs' market. In other words investment in I-REITs in Malaysia was able to offer low risk as well as protecting C-REIT investors against stock market volatilities. However, the linkages among the I-REITs and other asset classes in Malaysia was not provided in any literature review. This study will explore the dynamic linkages of I-REITs in Malaysian mixed-asset portfolios to add more information for the development of I-REITs using the Johansen cointegration test and Granger causality test.

Studies of dynamic linkages have only been done on the Asian REIT level. There were a number of studies done on the market integration in Asian REIT markets. For instance, Li and Yung (2007) studied the transmissions of property returns from the Atlantic REIT markets of the US and UK to the Asia Pacific REIT markets of Australia, Hong Kong, Japan and Singapore. Pham (2011), in his study, found that Asian REIT market linkages showed that Asian REIT returns tended to transmit from the developed markets to the emerging markets in Asia. He suggested that investors could take advantage of available information from the more dominant markets to predict movement of REIT returns in the smaller markets. Tsai and Lee (2012), Tsai (2013) examined the convergent behaviour of Asian REITs including Malaysia during the GFC and post-GFC period. Coëna and Lecomteb (2014) studied the linkages of Asian REITs during the post-GFC period. Whilst Liow and Ye (2014) expanded their study to assess the linkages of Asian REITs with other Pacific countries.

Several studies also have been done in other non-Asian countries. Another study that explored the linkages of REIT markets was done by Pavlov and Wachter (2011). Their study examined between REIT returns and returns of direct real estate portfolios based on geographical locations in the US. Their findings revealed investment in REITs was able to achieve real estate exposure, unlike direct investment in real estate property. Other studies also focused on the US REIT markets, such as: Allen, Madura, and Springer (2000), Basse, Friedrich, and Bea (2009), Downs, Fung, Patterson, and Yau (2003), Glascock, Lu, and So (2000), Lee (1998), Subrahmanyam (2007), Zhou (2012). Studies have also been done to

assess the linkages between US REITs and Asia Pacific REITs such as Liow (2014) and Liu, Loudon, and Milunovich (2011). Dynamic linkages of REIT markets has also been examined in Australia (Lee & Ting, 2009; Newell, Wen Peng, & Yam, 2011; Siew, 2015; Yong, 2010; Yong, 2013; Yong & Singh, 2013; Zarebski, 2014), Singapore (Koh, Lee, Phoon, & Seah, 2014; Lean & Smyth, 2012; Liow, 2001), India (Vishwakarma & French, 2010) and China (Yu & 俞思渊, 2007).

Previous research has shown the significance in assessing the linkages of a portfolio investment to investigate the interdependency of the portfolio. Nevertheless, given the importance of studying the linkages among all asset classes, relatively very little work has been done in this area. Most of the work has only focused on securitised real estate markets. As I-REITs in Malaysia is relatively new, the limitation of the study is understandable. However, given the awareness and importance of Islamic finance in recent years, it is important to assess the dynamics of the investment by looking at it from different angles of analyses.

Islamic REITs and conventional REITs in Malaysia

Development of REITs in Malaysia is the foundation of the beginning of Islamic REITs (I-REITs) in the world. Development of REITs resulted from the establishment of PTF. However, the low performance of PTF made REITs take over the system by the establishment of REIT guidelines in January 2005. The Malaysian REITs must follow certain requirements and regulations to develop a REIT. A particular company must be registered as the trust. The trustees must be approved by the Securities Comission. REITs must have a management company to manage the REITs. The real estate held by the trust must be managed by a qualified property manager. A Shariah committee must be appointed for the I-REITs. Conventional REITs were established well before the establishment of I-REITs. Table 1 shows there are 14 Conventional REITs listed on the main board of Bursa Malaysi and 3 I-REITs. On 31 December 2013, the Total Asset Value of Malaysian REITs including I-REITs were RM41,049.38 million while the Net Asset Value was RM28,559.23 million. The Market Capitalisation including the stapled group was RM33,132.75 million.

Methodology

For the purpose of this research, weekly total returns were assessed over the period 2008–2014. The sample period was chosen prior to the availability of the I-REITs' data and the longest time period for the I-REITs. The data consisted of various asset classes for mixed-asset portfolios in Malaysia, for example: I-REITs, C-REITs, shares, bonds, property, industrial, finance and plantation. All of the data were accessed from Datastream. Due to unavailability of an index series in Datastream as well as short time series for I-REIT, the I-REIT and C-REIT indexes were constructed using the market cap total return series. All of the data were considered in local currencies to avoid fluctuation of exchange rate risk. Total observations counted in the analysis were 316 observations. All of the data were converted into a natural logarithm before conducting the analysis to assist in achieving the best fit model. In addition, I-REITs' and C-REITs' indices were created by using the market cap-weighted total return series formula. In order to create these indices, total return series

Table 1. Profile of Malaysia REITs.

No.	Real Estate Investment Trust (REITs)	Listed on Bursa Malaysia	Market capitalization as at 2014	Property sectors in portfolio
1	Axis REIT*	29 July 2005	RM 1982 Million	Office, Industrial
2	Al-Aqar KPJ REIT*	10 August 2006	RM 960 Million	Healthcare
3	AmFirst REIT	21 December 2006	RM 641 Million	Office
4	Atrium REIT	02 April 2007	RM144 Million	Industrial
5	Amanahraya REIT	26 February 2007	RM475 Million	Office, Retail, Industrial, Hotel
6	Capitamalls REIT	16 July 2010	RM 2500 Million	Retail
7	KLCC REIT*	9 May 2013	RM 12100 Million	Office, Retail, Hotel
8	IGB REIT	21 September 2012	RM4515 Million	Retail
9	Pavilion REIT	7 December 2011	RM 4400 Million	Retail, Office
10	Sunway REIT	8 July 2010	RM 4220 Million	Retail, Hotel, Office
11	Hektar REIT	4 December 2006	RM 604 Million	Retail
12	Quill Capital REIT	8 January 2007	RM 475 Million	Office
13	Tower REIT	12 April 2006	RM 359 Million	Office
14	UOA REIT	30 December 2005	RM 672 Million	Office, Retail
15	YTL Hospitality REIT	16 December 2005	RM 1350 Million	Hotel, Retail, Apartment
16	Amanah Harta Tanah REIT	28 December 1990	RM 116 Million	Office

*Islamic REITs; Source: Authors' Compilation and Bursa Malaysia, 2015.

and market capitalisation series for all REIT companies in Malaysia were obtained. Market Cap-weighted Total Return Series.

I-REITs' and C-REITs' total return indices are not available in Datastream or any other database. Thus, I-REITs' and C-REITs' market cap-weighted total return series were constructed to fulfil the main objective of the study. Data of weekly total return index and market capitalisation for each REIT companies are vital to create the index. The calculation to create the index is based on the formula given:

$$\text{Market cap} - \text{weighted total return series}_{t} = \left(\left(\frac{\sum M_n R_n}{\sum M_n}\right) + 1\right) \times \text{base value}_{t-1}$$

where: $\sum$ = sumproduct, M_n = Market Value for n number of assets, R_n = Total Return for n number of assets, Base value = 100 (for the first data).

Unit root analysis

The Augmented-Dickey Fuller (ADF) test was performed before implementing the Johansen Cointegration Test. A unit root test was employed to make the data stationary because most of the time series data is not stationary over the time. It can be applied in different tests to conduct a unit root test, such as an ADF test, to make the data stationary. It is important to make our data stationary; if the data is not stationary, it often gives misleading parameters when estimating the relationship between the variables by applying the least squares regression (Kilian & Diebold, 1999). In executing the test, it is necessary to decide on the AR order and the shift date (Assaf, 2016). As the break is already known, the analysis will start by choosing reasonably large AR as well as choosing a shift dummy. To test the structural break, this research uses adjusted version on iterated cummulative sum of squares (ICSS) which was proposed by Inclan and Tiao (1994). The ICSS test has been widely in order to determine the structural breaks during volatility period. This test requires to remove a number of observations from the beginning as the GFC occurred early of the time series

data. Given the clear evidence of the structural break cause by GFC, the equation need to be re-estimated for samples January 2008–December 2009.

The hypothesis can be written as shown below:

If = 0, then the null hypothesis is accepted, thus it indicates the series is non-stationary time series. Otherwise, if < 0, the null hypothesis is rejected and the series is stationary.

There are three necessary conditions in applying the unit root test: intercept, trend intercept and none. It is not necessary to convert the data series into log form, however, it is recomended to do so to avoid any inconsistency in testing the unit root. In this study, all the data series have been converted to the log form before the unit root test to ease the testing process. All the data series are not stationary at the level stage because the p-value is greater than .05. This means that all the data have unit root at the level stage.

Johansen cointegration test

The test of cointegration is employed to determine if all the variables are cointegrated with each other in the long run. Cointegrated variables indicate that the variables are tied together and are either weak or strong. Cointegrated variables are the opposite to the nature of diversification where the order of the portfolio needs to reduce the risk, the diversification is not needed to be cointegrated. The test uses 15 lag intervals and considers the equivalence with the value of weekly data. The lag intervals have been decided by Schwarzh Info Criterion and are based on the maximum lag length in the unit root test. The cointegration test must be done only at a certain level. Either original return or log return can be used to estimate the cointegration. The cointegration test used in this study is the Johansen cointegration test as most studies prefer this test, rather than the Engle-Granger cointegration test.

Granger causality test

VAR Granger causality is the fusion of the VAR model developed by Sims (1980) and Granger causality test by Granger (1988). The VAR model uses unrestricted reduced-form equations, including a uniform set of lagged dependent variables as regressors. The VAR model assumes that the economic or finance indices were changing in spite of correlating with each other.

The VAR model can also estimate and capture the current situation based on the sample period of study. It can read as many as possible shock occurances in the selected time period of study. It is significant to investigate the return movement based on the combination of asset classes in the portfolio. Accordingly, it will produce some information on the influence of I-REIT returns to another market and vice versa. The formula of VAR is derived as follows:

where:

$$X_t = c + \sum_{i=1}^{p} \varphi_i X_{t-i} + \varepsilon_t$$

where: $\varphi_1, \ldots, \varphi_p$ = parameters of the model, c = constants, ε_t = error.

Granger causality test is based on the concept of prediction where some lag value from the past return of asset y could predict the return movement of asset x and so forth. Granger (1988) proposed that co-integration is very important for long-term relationships between

asset classes and has stated that it must be at least one direction of causal relationship in the co-integrated time series indices. Eviews software will be utilised to investigate the relationship between I-REITs and other asset classes in mixed-asset portfolios. The formula of Granger causality in the biviariate form are:

$$Y_t = \propto_0 + \propto_1 y_{t-1} + \ldots \propto_1 y_{t-1} + \beta_1 x_{t-1} + \ldots \beta_1 x_{t-1} + \varepsilon_t$$

$$X_t = \propto_0 + \propto_1 x_{t-1} + \ldots \propto_1 x_{t-1} + \beta_1 y_{t-1} + \ldots \beta_1 y_{t-1} + \mu_t$$

F-statistic reported the Wald statistic for joint hypothesis of the group of pairs of (x, y) series in the group as:

$$\beta_1 = \beta_2 = \ldots \beta_1 = 0$$

The combination of VAR model and Granger causality test is evidence of powerful techniques to investigate the causal relationship between the asset classes, especially property-type assets (Razali, 2015). Therefore, the VAR Granger causality test is significant to investigate the causal relationship of I-REITs in mixed-asset portfolios in the period December 2008–December 2014.

This study covers time series analyses over the period 2008–2015 when GFC occured. As such test for structural breaks is also conducted. As mentioned by Zivot and Andrews (2012), this test benefits from the fact where potential breaks occur when they are neither specified nor determined. The importance of highlighting where a structural break may occur in the data is to identify the impact of GFC which will be examined, that of linear Granger causality testing. If no consideration is made for structural breaks, the results from the Granger causality test will be spurious. Furthermore, GFC can be predicted to decrease the return and increase the risk, particularly in relation to shorter lags of time series.

Descriptive analysis

Table 2 depicts the summary for the descriptive statistics for eight asset classes. The risk for the asset classes was provided by standard deviation. Over the period of the study, I-REITs had the highest average weekly return of .5%, while bonds had the lowest average weekly return of .049%. The average weekly risk (refer to average weekly standard deviation), I-REITs had the lowest risk level of .52%, while industrial had the highest level of risk (2.5%). Descriptive analysis has shown that I-REIT returns and risk level outperformed all the asset classes in a mixed-asset portfolio over the period 2008–2014.

Table 3 shows the risk-adjusted performance of I-REITs between December 2008 and December 2014. According to the results, I-REITs were higher compared to other investment classes (27.08%) with the corresponding risk of 14.15%. The results have indicated that the I-REIT portfolio market had a remarkable performance, compared to other mixed-asset portfolios over the period December 2008–December 2014. In terms of Sharpe ratio analyses, I-REITs also showed remarkable performance over the period 2008–2014. This is followed by shares, C-REITs and bonds. This indicates that since the establishment of I-REITs in Malaysia, these companies are able to show good performance in terms of Sharpe ratio performance, compared to C-REITs, as well as other asset classes. The results echoed with the recent analysis by Osmadi and Razali (2015), which revealed that I-REITs have been shown to perform well in comparison to C-REITs. Akinsomi, Ong, Ibrahim, and Newell

Table 2. Descriptive analysis.

	Shares	Bonds	I-Shares	I-REITs	C-REITs	Property	Industrial	Finance	Plantation
Annualised mean	17.18%	2.55%	17.67%	29.56%	11.28%	21.66%	11.29%	18.12%	17.41%
Annualised SD	10.33%	3.71%	10.80%	13.98%	10.80%	17.93%	11.64%	13.57%	15.40%
Skewness	−.031024	1.71995	−.173603	−.0996	−3.869186	.252781	.160222	.140367	.488302
Kurtosis	4.080965	18.22459	4.49864	5.060746	33.31587	6.700826	4.636437	6.238982	5.253309
Jarque-Bera	15.38691	3197.527	31.05996	56.25839	12848.51	183.1161	36.49551	138.7288	79.1589

Table 3. I-REITs vs. C-REITs risk-adjusted performance analysis: 2008–2014.

	I-REITs	C-REITs	Shares	Bonds
Average annual return	27.08%	10.34%	16.88%	2.91%
Annual risk	14.15%	10.80%	10.33%	3.85%
Risk-return ratio	.52	1.04	.61	1.32
Sharpe ratio	1.88	.92	1.59	.64
Rank	#1	#3	#2	#4

(2014) also concluded in their findings of idiosyncratic risk of I-REITs that I-REITs were able to earn high returns. Nevertheless, the results contrast with an earlier study by Newell and Osmadi (2009), which placed I-REITs amongst the lowest performers in mixed-asset portfolios. The differences in the findings by these researchers indicates that I-REITs' performance in recent years has shown a remarkable performance compared to its earlier years. According to Osmadi and Razali (2015), this shows a high quality of the management strength in I-REITs, especially during the GFC.

Results and discussion

Efficient frontier

Markowitz (1952) built a concept called the efficient frontier which contains a combination of assets, i.e. portfolios that offer a high level of expected return at certain risk levels or lower risk at certain expected returns. The portfolio that lies at the tip of the efficient frontier is sub-optimal because the risk involved is too high with the level of expected return. The portfolio that lies below the efficient frontier is also sub-optimal because the expected return provided is not sufficient with a low level of risk. The efficient frontier graph is curved rather than linear. The key point here is the diversification benefits where an optimal set of portfolios always have a high degree of diversification than the sub-optimal portfolio.

In this analysis, I-REITs' and C-REITs' asset classes will be included with a typical mixed-asset portfolio, i.e. shares and bonds. This analysis is to determine which asset class provides a greater expected return and lower risk level. Figure 1 presents the efficient frontier analysis of I-REITs versus C-REITs. The combination of asset classes of I-REITs-shares-bonds lay over the combinations asset classes of C-REITs-shares-bonds. At the beginning of both graphs, the combinations of I-REITs-shares-bonds starts with lower expected returns than C-REITs-shares-bonds. The graph continues to move towards north-west and resulted at the tip of I-REITs-shares-bonds, where the graph shows a higher expected return than C-REITs-shares-bonds. The combination of I-REITs-shares-bonds portfolio succeeds to improve the portfolio returns of the mixed-asset portfolio. This shows I-REITs play a more significant role than C-REITs when combined with a mixed-asset portfolio.

Portfolio optimisation

Portfolio optimisation is one of the concepts from the MPT and was developed by Markowitz (1952). The function of portfolio optimisation is to select the proportions of combination assets to allocate in the portfolio. The theory applies variance to measure the risk of the combinations of assets. The benefits of diversification offered by a portfolio are determined

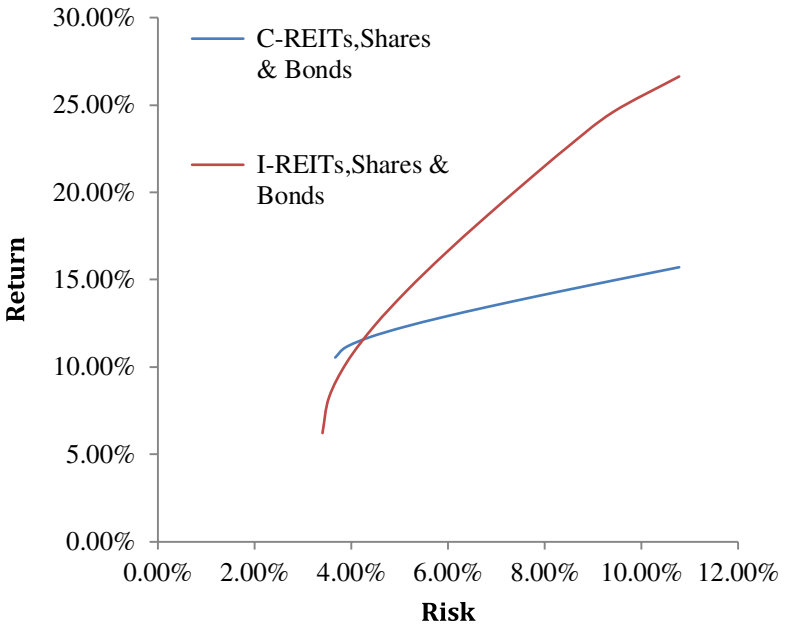

Figure 1. Efficient frontier analysis for I-REITs and C-REITs.

based on annual return. Diversification is the key to keep the value of the portfolio while minimising the risk by allocating investments in various asset classes.

This analysis will consider the minimum risk level and highest expected return in a portfolio. This analysis will be carried out by using the Excel Solver program. In this analysis, the empirical results are divided into two parts. First, the analysis starts with the combination of asset classes of I-REITs, shares and bonds. Second, the analysis examines the combination of asset classes of C-REITs, shares and bonds.

Table 4 tabulates the optimal portfolio matrix of I-REITs and other asset classes. A set of I-REITs optimal portfolio matrix is constructed with finding the lowest risk level in the portfolio. The procedure then continues with finding the highest attainable return of the portfolio. This portfolio is considered as having a small range of risk from 3.40 to 10.78%. The highest return attainable is 26.63% with the equivalent of the highest risk of 10.78% consisting of 100% of I-REITs. The proportion of I-REITs begins with 14% at the lowest risk level and 100% at the highest risk level.

This means I-REITs play an important role in a portfolio across the risk spectrum and is the most investable asset class, rather than shares and bonds. However, it is also observed that bonds play a role at the beginning of risk level until the medium–high level. Bonds play a role significantly at the lower risk level because of their investment characteristics that provide lower risk and lower return. Shares only play a role at the medium and high levels of risk.

The function of the gradient (Sharpe ratio) in this analysis is to determine the best proportion to allocate the investment. The highest gradient indicates the best portion to be invested in the portfolio. This analysis shows the highest gradient was 2.79 with a portion of I-REITs (41%), shares (15%) and bonds (44%). At the best optimum level, it is suggested to diversify the investment of bonds at 44%, I-REITs (41%) and shares (15%). These show

Table 4. I-REIT optimal allocation matrix: December 2008–December 2014.

Risk (%)	Return (%)	Gradient	I-REITs (%)	Shares (%)	Bonds (%)
3.40	6.21	1.82	14	3	83
3.54	8.25	2.33	21	6	73
3.91	10.29	2.63	27	9	64
4.47	12.34	2.76	34	12	54
5.15	14.38	2.79	41	15	44
5.91	16.42	2.78	48	18	34
6.73	18.46	2.74	55	21	25
7.58	20.50	2.71	62	23	15
8.46	22.55	2.67	69	26	5
9.41	24.59	2.61	81	19	0
10.78	26.63	2.47	100	0	0

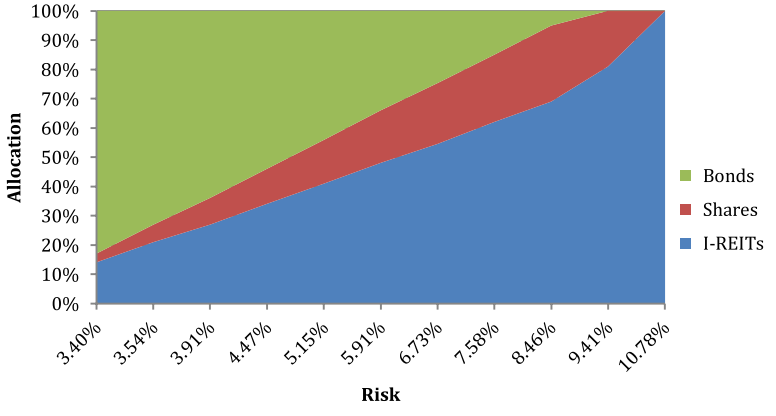

Figure 2. Asset allocation diagram of I-REITs.

that bonds offer better diversification benefits than I-REITs. The average asset allocation of I-REITs across the risk spectrum was 50.18%.

Figure 2 illustrates the asset allocation diagram for I-REITs, shares and bonds. Over this period, bonds and I-REITs clearly dominate the diagram of asset allocations. The proportion of bonds decreased as the risk level increased. This shows that bonds is a low-risk investment options. Bonds show dominance on the lower end of risk, while I-REITs show dominance at the high-end of the diagram.

Table 5 demonstrates the optimal asset allocation of C-REITs and other asset classes. The combination of C-REITs, shares and bonds produces a low spread of risk from 3.64 to 10.78%. The highest return gains from this portfolio were 15.73% with the corresponding risk of 10.78%. The empirical result indicates the proportion of C-REITs in the portfolio diverges from the lowest 8% to the highest 100%. Domination of the portfolio is controlled by C-REIT and bonds.

However, shares play a less significant role in the portfolio. Bonds plays its role at the lower risk level, while C-REITs dominate at the high-end risk level. The gradient of this portfolio is high at the lower risk level and decreasing at the lower risk level. The optimum gradient for this portfolio was 2.87. However, the proportion of optimum allocation for this portfolio only allocates C-REITs (12%) with a small percentage number compared to bonds (87%). The average asset allocation for C-REITs comprises 51.6%.

Table 5. C-REIT optimal allocation matrix: December 2008–December 2014.

Risk (%)	Return (%)	Gradient	C-REITs (%)	Shares (%)	Bonds (%)
3.64	9.98	2.74	8	5	86
3.68	10.56	2.87	12	1	87
3.89	11.14	2.86	21	0	79
4.39	11.72	2.67	31	0	69
5.09	12.30	2.42	41	0	59
5.92	12.88	2.18	51	0	49
6.83	13.46	1.97	61	0	39
7.80	14.04	1.80	71	0	29
8.80	14.62	1.66	81	0	19
9.83	15.20	1.55	91	0	9
10.78	15.73	1.46	100	0	0

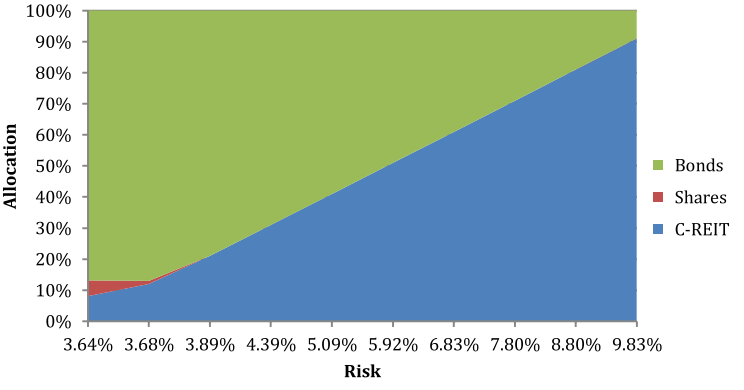

Figure 3. Asset allocation diagram of C-REITs.

Figure 3 exhibits the asset allocation diagram for C-REITs and other asset classes. The diagram is clearly dominated by bonds and C-REITs. Across the risk spectrum, bonds decreased its domination at a higher level of risk. C-REITs show large domination at the higher risk level. The analysis suggests that bonds have a significant role in this portfolio and set aside the C-REIT role.

Table 6 exhibits the comparison between the performance of I-REITs and C-REITs. In summary, the risk-adjusted performance analysis shows that I-REITs outperform C-REITs in terms of returns and higher Sharpe ratio. Both I-REITs and C-REITs have higher risk levels than the shares market. The contrary results were evident by Newell and Osmadi (2009) who exhibited that C-REITs have a better performance than I-REITs. However, their study was conducted over a short time period. The empirical evidence shows that I-REITs outperform shares in terms of Sharpe ratio. From this analysis, both REITs indicate a lower correlation to shares and bonds, but I-REITs have better diversification potential than C-REITs.

From the empirical result of the efficient frontier analysis, I-REITs show a better role in the portfolio compared to C-REITs. The inclusion of I-REITs in the portfolio has provided better returns than C-REITs with the same risk level. The optimisation portfolio also shows I-REITs (44%) provide a larger proportion than C-REITs (12%) at the optimum level. Investors should focus their investment allocation on I-REITs because at the optimum level,

Table 6. Comparison of I-REITs and C-REITs.

	I-REITs	C-REITs
Outperforms shares market return	Yes	No
Lower risk than shares market	No	No
Better sharpe ratio than shares	Yes	No
Low correlation with shares market	.18	.30
Average correlation to all assets classes	.11	.21
Asset allocation at optimum level	41%	12%

Table 7. Correlation analysis.

	I-REITs	C-REITs	Shares	I-Shares	Bonds	Property	Industrial	Financial	Plantation
I-REITs	1								
C-REITs	.28	1							
Shares	.18	.30	1						
I-Shares	.20	.30	.94	1					
Bonds	−.12	.05	.14	.13	1				
Property	.24	.27	.72	.78	.07	1			
Industrial	.16	.24	.79	.82	.16	.55	1		
Financial	.15	.28	.87	.75	.16	.67	.59	1	
Plantation	.11	.21	.71	.74	.09	.47	.66	.48	1

they could provide better returns (14.38%) compared to C-REITs with 10.56% returns at minimal risk.

Potential of diversification

Table 7 indicates the correlation analysis of I-REITs in a mixed-asset portfolio over the period 2008–2014, to get a picture of diversification benefits that I-REITs might offer to other asset classes within mixed-asset portfolios. The results indicate that I-REITs possess low correlation (below $r = .50$) and C-REITs also show low correlation with all asset classes and provide great diversification benefits to all asset classes. This implies that I-REITs could provide diversification to all assets within a mixed-asset portfolio. However, property stocks had a higher correlation with shares ($r = .72$), which indicates that there is limited diversification shown by property stocks with shares market. These results suggest that I-REITs potentially provide portfolio enhancement over the period of study in a mixed-asset portfolio. Previous findings from research done by Newell and Osmadi (2009) have shown strong and improving diversification of I-REITs, especially during the GFC. Findings from Rozman et al. (2015) also indicate similar results. The results in different time horizons have shown I-REITs still offer high potential of diversification to investors.

One-year rolling correlation

One-year rolling correlation analysis is used to assess the changing diversification benefits of I-REITs with other asset classes. The analysis was investigated over the period December 2008–December 2014 and consisted of nine asset classes, namely I-REITs, C-REITs, shares, bonds, I-shares, property, industrial, financial and plantation. Figure 4 shows that I-REITs showed an average, low correlation with all asset classes and were mostly below $r = .50$ over

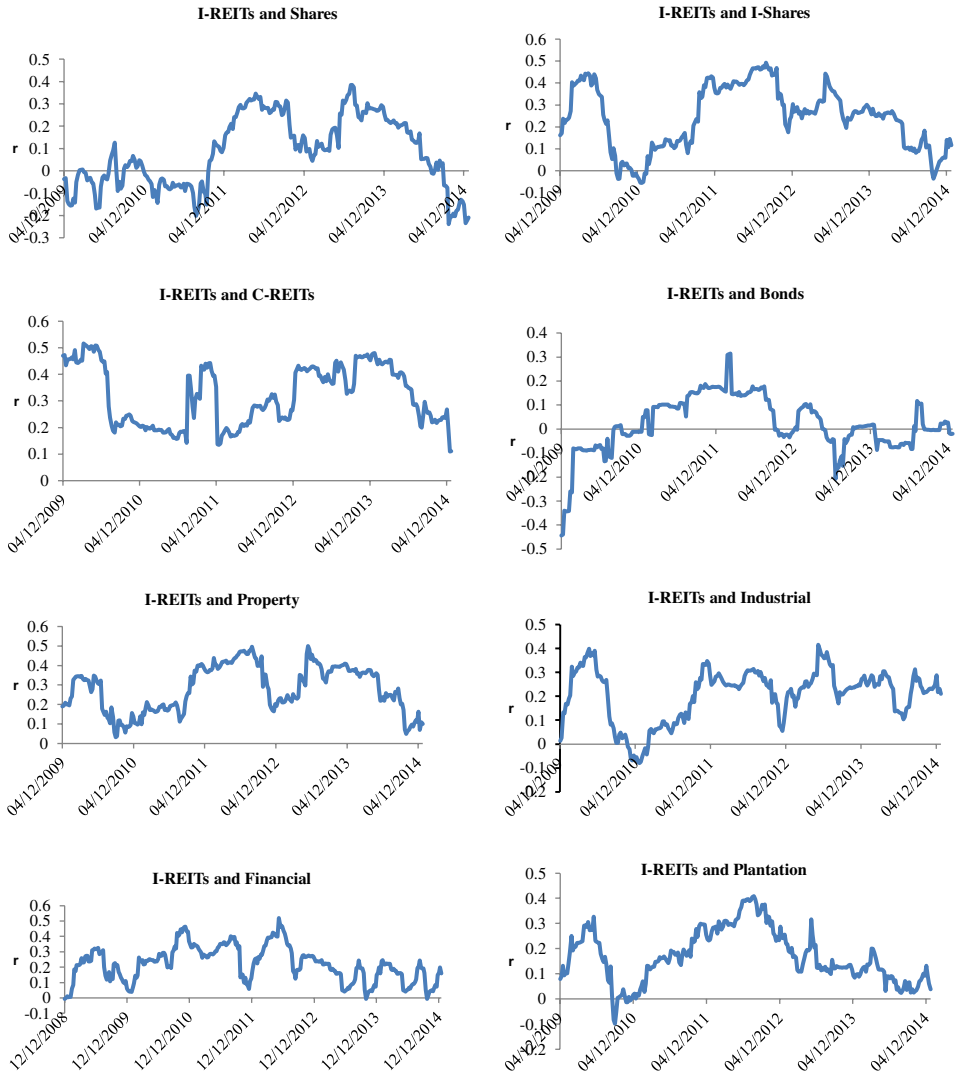

Figure 4. One-year correlation analysis: December 2008–December 2014.

the period of the study. This clearly shows that I-REITs has high diversification benefits over time when included in a mixed-asset portfolio.

The average of one-year rolling correlation for I-REITs with all asset classes is low and ranges from $r = .02$ (bonds) and $r = .32$ (C-REITs). Bonds investors have great advantages in investing in I-REITs as the diversification benefit's level is always below $r = .30$. Bonds investors could gain risk reduction and return enhancement by investing in an I-REITs portfolio, as the returns of I-REITs and bonds are not associated with each other. Overall, although the portfolio diversification benefits range in the low level ($r = .50$), the graph shows that the portfolio diversification benefits are unstable. The weakest diversification benefits occurred between I-REITs with finance and C-REITs with $r = .52$ in May 2012 and March 2010.

Table 8. Unit root test.

	Level	First difference
LIR	.066	.000
LCR	.1865	.000
LSH	.0116	.000
LISH	.028	.000
LBON	.9399	.000
LPRO	.1137	.000
LFIN	.0034	.000
LIND	.0040	.000
LAGR	.0009	.000

Table 9. Analysis on t-Stat for time series.

	ADF			PP		
Variables	None	Intercept	Trend and intercept	None	Intercept	Trend and intercept
T-Statistic's log level						
I-REITs	2.708	−.671	−2.849	2.531	−.686	−3.194
C-REITs	1.716	−1.761	−2.447	1.653	−1.761	−2.569
Shares	2.723	−2.168	−2.429	2.833	−2.318	−2.340
Bonds	1.623	−.450	−2.955	2.509	−.028	−2.587
I-Shares	2.672	−1.849	−2.817	2.691	−1.902	−2.926
Property	1.254	−1.526	−2.763	1.433	−1.566	−2.495
Industrial	1.477	−3.075	−3.132	1.561	−3.237	−3.062
Finance	1.805	−2.761	−1.538	1.812	−2.851	−1.462
Agriculture	1.359	−2.886	−2.640	1.364	−2.942	−2.640
T-Statistic's log first difference						
I-REITs	−16.071	−16.496	−16.470	−16.071	−16.468	−16.441
C-REITs	−17.120	−17.310	−17.324	−17.145	−17.317	−17.328
Shares	−17.005	−17.544	−17.660	−17.014	−17.564	−17.739
Bonds	−17.859	−17.988	−17.972	−18.408	−19.514	−19.722
I-Shares	−16.429	−16.896	−16.949	−16.435	−16.875	−16.944
Property	−14.860	−15.009	−15.016	−14.823	−14.916	−14.918
Industrial	−17.116	−17.270	−17.394	−17.104	−17.289	−17.478
Finance	−16.907	−17.198	−17.462	−16.907	−17.186	−17.478
Agriculture	−17.849	−18.022	−18.193	−17.857	−18.021	−18.205

Unit root test

In order to determine the order of integration and guarantee that the total return series is in a stationary state, the ADF test was performed. The ADF procedure identified that all total return series were not stationary in all level. The results of the unit root tests are depicted in Table 8. The ADF test suggests that all total series become stationary when at first difference. This further explains that the Johansen cointegration test can be performed when the total return series were only stationary at first difference. Furthermore, the test also checked on the stationarity properties of each return series to ensure that the use of Granger causality technique is appropriate.

There are three necessary conditions in applying the unit root test: intercept, trend intercept and none. It is not necessary to convert the data series into a log form, however, it is recomended to do so to avoid any inconsistencies in testing the unit root. In this study, all the data series has been converted to the log form for the unit root test to ease the testing process. All the data series is not stationary at the level stage because the p-value is greater than .05. This means that all the data has unit root at the level stage.

Table 10. Short memory againts structural breaks.

Asset classes	Break dates June 2008, December 2008, January 2009, December 2009						
Estimating the relevance of short memory againts structural breaks							
LIR	.551	.620	.555	.618	2.765	−1.387	.320
LCR	.382	.378	.587	2.217	4.987	−.872	.312
LSH	.439	.587	.786	8.487	9.439	.987	.198
LISH	1.210	.878	.879	8.467	10.987	−1.43	.134
LBON	.589	.497	.839	.401	3.137	−1.281	.287
LPRO	.487	.587	.501	.627	2.871	−1.256	.267
LFIN	.278	.276	.478	2.013	4.824	−.743	.278
LIND	.378	.472	.521	2.187	4.783	−.767	.278
LAGR	.378	.489	.872	8.318	8.178	.856	.120

Table 11. Johansen cointegration test.

Hypothesised No. of CE	Trace	.05 Critical values	Prob.
$r = 0$	195.2347	197.3709	.0635
$r \leq 1$	136.3712	159.5297	.4416
$r \leq 2$	98.28817	125.6154	.6551
$r \leq 3$	69.3633	95.75366	.7434
$r \leq 4$	48.36873	69.81889	.7068
$r \leq 5$	31.58575	47.85613	.6349
$r \leq 6$	15.9511	29.79707	.7157
$r \leq 7$	7.032128	15.49471	.5739
$r \leq 8$	1.765136	3.841466	.1840

Note: Trace test indicates no cointegration at the .05 level.

Table 9 tabulates the *t*-stat for the data series, becoming negative at all conditions. This indicates the data series achieves stationarity after the first difference. Then, identification of series in the three conditions needs to be investigated. The majority of the data is suitable in the none condition, rather than constant and constant and trend. Only finance has shown significant $p < .05$ where it includes trend in the variables. Overall, all the data series has been in a stationary condition.

Table 10 presents the analysis on short memory against structural breaks. The ICSS which identified volatility breaks for time series analysis revealed that there is evidence of at least one common structural break in squared returns with unconditional variances. The results also signify only one break in the squared returns for all asset classes including I-REITs. This suggests Malaysian local portfolios was not immune from global event such as GFC. The presence of structural breaks in the squared returns of mixed-asset portfolios suggests that the evidence of short memory might be spurious. In order to test short memory against structural breaks, sample period was divided into 4 sub-samples based on GFC event. The results suggested that the use of sub-sample, that the null hypothesis of the constantancy of estimated values is rejected across the time series for volatility measures. However, the squared returns for I-REITs, conventional REITs, and bonds do now show evidence of spurious short memory in Bursa Malaysia mixed-asset portfolios returns volatility measures.

Johansen cointegration test

The results from the unit root test further determine that all the total return series can be included in the cointegration test. The cointegration test follows the procedure from

Table 12. Granger causality.

Asset	I-REITs	C-REITs	Shares	Bonds	I-Shares	Property	Industrial	Finance	Plantation	All
I-REITs		.3467	.4235	.3228	.1618	.2841	.4011	.3922	.7588	.5742
C-REITs	.499		.5545	.3291	.2474	.7800	.9210	.9565	.6701	.0993
Shares	.9567	.4163		.5846	.0805*	.1428	.1090	.2399	.0139***	.0557*
Bonds	.7488	.3283	.2014		.3477	.3056	.0731*	.0172***	.2716	.2668
I-Shares	.9402	.1687	.1215	.5318		.3687	.5828	.4115	.2224	.0878*
Property	.4701	.4624	.3288	.0832*	.8642		.9966	.4804	.6745	.1163
Industrial	.0327**	.1298	.0602*	.3737	.0272**	.0320**		.0495**	.7026	.2664
Finance	.9442	.6659	.0211**	.5769	.0330**	.0823*	.0332**		.0058***	.0930*
Plantation	.5092	.0976*	.2626	.3699	.5366	.5031	.6109	.3511		.1099

Note: Each entry denotes the *p*-value of the market on the left affect the top.
***Significant at 1% level; **Significant at 5% level; *Significant at 10% level.

Johansen (1988) and Johansen and Juselius (1994). VECM model was used to identify the best model to test the Johansen cointegration test. The optimum lag length was 1 with corellogram of the residual above .05. Table 11 displays the results of the Johansen cointegration test. The findings found that trace statistic indicates that there is no cointegration of variables in the equation. This means the variables have great diversification potential with I-REITs.

Granger causality test

Granger causality tests were conducted to test the short-run linkages of I-REITs in a mixed-asset portfolio. It is understood that the Granger causality test is based on a prediction where *Y* Granger cause *X*, then *Y* should contain information on *X* over the information that lies within *X* itself. Thus, this indicates that when *Y* Granger cause *X*, then *Y* could predict the return of *X*. The Granger causality test for this study used the VECM model. Table 12 depicts the causality relationship among the asset classes in Malaysia's investment market. The evidence of the causality test has revealed that all mixed-asset classes are interlinked and influenced by each other. The results from the VAR Granger causality test can further analyse the dynamic linkages of the mixed-asset classes' performance. The impulse response functions provide information to analyse the dynamic behaviour of a variable due to a random shock in other variables. The impulse response traces the effect of current and future values of the endogenous variables.

Granger causality test results indicate that the I-REITs market was only affected by the industrial sector, while C-REITs was affected by plantation with 10% significant level. There is no sign of a bidirectional effect from I-REITs and C-REITs, as that asset class seems not to have much influence in the Granger causality test. The most influenced market in the mixed-asset portfolio is finance as it can influence shares, I-shares, property, industrial and plantation. Finance also shows a bi-directional relationship with industrial. This means the finance sector is essential to other markets in Malaysia. However, Granger causality test indicates that in overall terms, shares and I-shares market could influence all the asset classes in a mixed-asset portfolio. This is because shares and I-shares markets play a very important role in the growth of the capital market in Malaysia. There is no evidence of causality testing in previous research on I-REITs to other mixed-asset portfolios, due to a short history of data. Nevertheless, the results signify the potential growth of M-REITs as mentioned by Newell and Osmadi (2009) and Trust (2008). I-REITs as part of M-REITs was

also positively affected by the aggressive measurement taken by the Malaysian Government to strengthen the local portfolio markets including I-REITs.

Conclusion

This study analyses the dynamic linkages of I-REITs in a mixed-asset portfolio over the period 2008–2014 using weekly total return. The I-REIT market was introduced in Malaysia in 2006 to attract Muslim investors, particularly to invest in Islamic capital markets. It also offered an alternative to all investors beside conventional systems, which has shown some volatility based on previous studies. As I-REITs can be considered as a new type of investment, there is very limited study ventured into empirical study on I-REITs, especially within local mixed-asset portfolios.

The results show that I-REITs provide diversification benefits for all assets in the mixed-asset class. The Johansen cointegration test was used to examine the long-term relationships of I-REITs in mixed-asset portfolios. The analysis revealed that by using the Trace test, there was no cointegration found in the mixed-asset portfolio. The non-cointegrated variables in the long run further explain that I-REITs possess great diversification in a mixed-asset portfolio. The diversification benefits are important to reduce risk and enhance returns when I-REITs was included in a mixed-asset portfolio. In the short-term, I-REITs were only affected by the industrial asset class. This explains that other markets cannot determine the return, growth and development of I-REITs. I-REITs also do not influence any market in a mixed-asset portfolio, due to the market being very small compared to the other mature markets. Overall, I-REITs provide good diversification benefits and could add value to a mixed-asset portfolio. The investment players, either individuals or institutional, should consider I-REITs in their mixed-asset portfolios. Policy-makers, such as the Securities Commission, should actively review the advantages that I-REITs could potentially unleash. It is also suggested that policy-makers make I-REITs an attractive investment alternative in the property investment market.

The Granger causality test is aimed to assess the linkages of I-REITs within mixed-asset portfolios in Malaysia. The impulse response functions provide information to analyse the dynamic linkages of a variable due to the random effect in other variables. Furthermore, investor will understand interrelationships among mixed-asset portfolios in Malaysia, especially for I-REITs, which is still a relatively new investment vehicle. This test allows for how much of the I-REITs' returns can be explained by its past values and whether adding lagged values of selected returns can improve the explanations. The results show that I-REITs are only affected by only one mixed-asset portfolios. This suggests that investors can take advantage of available information from the more dominant portfolios to predict movements of I-REIT returns into other portfolio markets. As such, the results unveil more fundamental relationships among mixed-asset classes in Malaysia and more essential issues. In particular for I-REITs over the past six years, there was less causality evidence of I-REITs to other mixed-asset portfolios. The period of study has seen the GFC as well as the Eurozone debt crisis, with a considerable affect on Malaysia's portfolio market performance.

This study extends the knowledge of I-REITs and explores the relationship within Malaysian mixed-asset portfolios including C-REITs. The findings explored the linkages of I-REITs with other asset classes, specifically C-REITs. It also has shown that although there is a sceptical perception of Islamic or Shariah concepts in REITs, nevertheless I-REITs

were able to show a remarkable performance by the major indicator in property investment performance. Moreover, from the causality test, it is shown that I-REITs connected with other mixed-asset portfolios in a unidirectional way. It is shown that I-REITs has an important influence on Malaysian asset classes. According to Tsai and Lee (2012), portfolio managers constantly review their diversification models and strategies in respect to the constituent markets because of possible changes in market interdependence triggered by a major crisis. Therefore, a major practical implication of this study is that investors in real estate securities should take into account information on diversification as well as linkages of I-REITs within mixed-asset portfolios. Furthermore, Islamic concept in REITs is also able to show incomparable performances with other C-REITs as well as asset classes. Such knowledge will enable fund managers to make better choices in terms of investments in Malaysian portfolio markets.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCiD

Ahmad Tajjudin Rozman http://orcid.org/0000-0002-2897-8209
Muhammad Najib Razali http://orcid.org/0000-0001-7926-1892
Nurul Afiqah Azmi http://orcid.org/0000-0001-8318-9619

References

Akinsomi, O., Ong, S. E., Ibrahim, M. F., & Newell, G. (2014). The idiosyncratic risks of a Shariah compliant REIT investor. *Journal of Property Research, 31*, 211–243.
Allen, M. T., Madura, J., & Springer, T. M. (2000). REIT characteristics and the sensitivity of REIT returns. *The Journal of Real Estate Finance and Economics, 21*, 141–152.
Assaf, A. (2016). MENA stock market volatility persistence: Evidence before and after the financial crisis of 2008. *Research in International Business and Finance, 36*, 222–240.
Basse, T., Friedrich, M., & Bea, E. V. (2009). REITs and the financial crisis: Empirical evidence from the US. *International Journal of Business and Management, 4*, 3–10.
Coëna, A., & Lecomteb, P. (2014). Another look at Asian REITs performance after the global financial crisis. *Handbook of Asian Finance: REITs, Trading, and Fund Performance, 2*, 69–94.
Downs, D. H., Fung, H. G., Patterson, G. A., & Yau, J. (2003). The linkage of REIT income- and price-returns with fundamental economic variables. *The Journal of Alternative Investments, 6*, 39–50.
Dusuki, A. W. (2008). Understanding the objectives of Islamic banking: A survey of stakeholders' perspectives. *International Journal of Islamic and Middle Eastern Finance and Management, 1*, 132–148.
EPRA. (2009). *Monthly statistical bulletin*. Brussels: European Public Real Estate Association.
Glascock, J. L., Lu, C., & So, R. W. (2000). Further evidence on the integration of REIT, bond, and stock returns. *The Journal of Real Estate Finance and Economics, 20*, 177–194.
Granger, C. W. (1988). Some recent development in a concept of causality. *Journal of Econometrics, 39*, 199–211.
Inclan, C., & Tiao, G. C. (1994). Use of cumulative sums of squares for retrospective detection of changes of variance. *Journal of the American Statistical Association, 89*, 913–923.
Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics & Control, 12*, 231–254.

Johansen, S., & Juselius, K. (1994). Identification of the long-run and the short-run structure an application to the ISLM model. *Journal of Econometrics, 63*, 7–36.
Kilian, L., & Diebold, F. X. (1999). *Unit root tests are useful for selecting forecasting models*. Cambridge: National Bureau of Economic Research.
Koh, C. C. F., Lee, D. K. C., Phoon, K. F., & Seah, E. S. (2014). Market structure and growth potential of Singapore REITs. *Handbook of Asian Finance: REITs, Trading, and Fund Performance, 2*, 53–67.
Li, D. D., & Yung, K. (2007). REIT returns: Between the Pacific and the Atlantic. *Review of Accounting and Finance, 6*, 353–369.
Lean, H. H., & Smyth, R. (2012). REITs, interest rates and stock prices in Malaysia. *International Journal of Business and Society, 13*, 1–11.
Lee, S. L. (1998). *The case for property in the long-run: A cointegration test* (Working paper 06/98). Reading: Department of Land Management.
Lee, C.L., & Ting, K.H. (2009). The role of Malaysian securitised real estate in a mixed-asset portfolio. *Journal of Financial Management of Property and Construction, 14*, 208–230. doi:10.1108/13664380911000440
Liow, K. H. (2001). The abnormal return performance of Singapore property companies. *Pacific Rim Property Research Journal, 7*, 104–112.
Liow, K. H. (2014). The dynamics of return co-movements and volatility spillover effects in Greater China public property markets and international linkages. *Journal of Property Investment and Finance, 32*, 610–641.
Liow, K. H., & Ye, Q. (2014). Switching volatility and cross-market linkages in public property markets. *Journal of Property Research, 31*, 287–314.
Liu, J., Loudon, G., & Milunovich, G. (2011). Linkages between the US and Asia-Pacific REITs: The role of economic and financial factors. *Available at SSRN 1895847*.
Markowitz, H. (1952). Portfolio selection. *The journal of finance, 7*, 77–91.
MIFC. (2014). Islamic real estate and investment trusts (Islamic REITs) a promising asset class for wealth management. Retrieved from http://www.mifc.com/?ch=28&pg=72&ac=60&bb=uploadpdf
Morad, S. N., & Masih, M. (2015). *Islamic REIT response to macroeconomic factors: A Markov regime switching auto regressive approach* (No. 65237). Munich: University Library of Munich.
Nawawi, A. H., Husin, A., Hadi, A. R. A., & Yahya, M. H. (2010). Relationship and lead-lag effect between Asian Real Estate Investment Trusts (REITs) performance and Malaysian REIT market: Cointegration modelling. *Science and Social Research*, 522-527.
Newell, G., & Osmadi, A. (2009). The development and preliminary performance analysis of Islamic REITs in Malaysia. *Journal of Property Research, 26*, 329–347. doi:10.1080/09599916.2009.485417
Newell, G., Wen Peng, H., & Yam, S. (2011). Assessing the linkages between corporate social responsibility and A-Reit performance. *Pacific Rim Property Research Journal, 17*, 370–387.
Osmadi, A. (2006). A guide to Islamic finance and Islamic REITs. *Australian Property Journal, 39*, 212–218.
Osmadi, A., & Razali, M. N. (2015), Assessing the financial and management strength of Islamic Real Estate Investment Trusts (I-REITs) during the Global Financial Crisis (GFC) *PERINTIS eJournal*, 4, 48-69.
Pavlov, A. D. & Wachter, S. M. (2011). REITs and Underlying Real Estate Markets: Is There a Link? *U of Penn, Inst for Law & Econ Research Paper,* 11–20.
Pham, A. K. (2011). The significance and performance of South Korean REITs in a mixed-asset portfolio. *Journal of Real Estate Literature, 19*, 373–390.
Razali, M. N. (2015). *The significance and performance of Malaysian listed property companies in Pan-Asian property portfolios* (Doctoral dissertation). Sydney: University of Western Sydney.
Razali, M. N., & Sing, T. F. (2015). Systematic risk of Islamic REITs and conventional REITs in Malaysia. *Journal of Real Estate Portfolio Management, 21*, 77–92.
Rozman, A. T., Azmi, N. A., Mohd Ali, H., & Mohamed Razali, N. M. (2015). The performance and significance of Islamic REITs in a mixed asset portfolios. *Jurnal Teknologi, 77*, 1–9.
Sims, C. A. (1980). Macroeconomics and reality, *Econometrica: Journal of the Econometric Society*, *70*, 1–48.

Siew, R. Y. J. (2015). Predicting the behaviour of Australian ESG REITs using Markov chain analysis. *Journal of Financial Management of Property and Construction, 20*, 252–267.
Subrahmanyam, A. (2007). Liquidity, return and order-flow linkages between REITs and the stock market. *Real Estate Economics, 35*, 383–408.
Ting, K. H., & Noor, A. R. M. (2007, July). Islamic REITs: A Syariah-compliant investment option. Paper presented at the Asian Real Estate Society Annual Conference, Macau, China.
Trust. (2008). *Asia-Pacific REIT survey*. Singapore: Trust.
Tsai, I. C. (2013). Volatility clustering, leverage, size, or contagion effects: The fluctuations of Asian real estate investment trust returns. *Journal of Asian Economics, 27*, 18–32.
Tsai, I. C., & Lee, C. F. (2012). The convergent behavior in REIT markets. *Journal of Property Investment & Finance, 30*, 42–57.
Vishwakarma, V. K., & French, J. J. (2010). Dynamic linkages among macroeconomic factors and returns on the Indian real estate sector. *International research journal of finance and economics, 43*, 151–166.
Yu, S., & 俞思渊. (2007). Real estate investment trusts (REITs) in China: With Hong Kong REITs as an approach (unpublished Doctoral Thesis). Hong Kong University, Hong Kong.
Yong, J. L. (2013). *Economic linkages between Australian REITs and the commerical real estate market.* Retrieved from http://ro.ecu.edu.au/theses/577
Yong, J. L., & Singh, A. (2013). Interest rate sensitivities of externally and internally managed Australian REITs. In *MODSIM2013, 20th International Congress on Modelling and Simulation* (pp. 1319–1325). Canberra: The Modelling and Simulation Society of Australia and New Zealand.
Yong, J. L. P. (2010, November). *Integration of Stapled A-REIT, Stock and Bond Returns*. Paper presented at 23rd Australasian Finance and Banking Conference, Sydney.
Zarebski, P. D. (2014). *Agency issues surrounding A-REITS and the global financial crisis* (No. Doctor of Philosophy). Melbourne: Deakin University.
Zhou, J. (2012). Multiscale analysis of international linkages of REIT returns and volatilities. *The Journal of Real Estate Finance and Economics, 45*, 1062–1087.
Zivot, E., & Andrews, D. W. (2012). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business & Economic Statistics,10*, 25–44.