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Return Spillover of Asian REITs

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This research examines the relationship and direction of return spillover of Asian REITs, between REITs and local stock markets, and its effect towards REIT returns. The samples are from Hong Kong, Japan, South Korea, Malaysia, Singapore, Thailand, and Taiwan. This research uses Diebold and Yilmaz's technique to measure the relationship and direction of return spillover between asset classes. The method also uses OLS regression to test the effects of return spillover on REIT returns. The results show that connectedness between Asian markets is low. Japan and Singapore are the strongest influencers. Low connectedness was also found between REITs and the local stock market. In general, net return spillover from Asian REIT markets significantly influence REITs' return. The results imply that the growth of REIT markets depends on the attractiveness of capital markets in a country. Regulators in developing countries need to improve the capital market environment to enable REIT markets to flourish.

Keywords: *Real estate investment trust (REIT); return spillover; stock market*

JEL Classification: C32, G15

Introduction

Real estate has been traditionally considered a fundamental asset class necessary to any diversified portfolio. The low to moderate correlation between real estate and other asset classes is the main advantage to provide diversification benefits to a portfolio. Real estate also has specific risk and return characteristics such that when it is included in a portfolio, then the portfolio's protection against inflation increases, especially over long-term investment horizons (Fabozzi & Markowitz, 2011). The most known real estate investment instruments are in the form of their physical assets. This way of investing is impractical because the asset is traded locally (country-specific) and illiquid, and usually its price (per parcel) is high.

Investing in real estate without having to trade physical assets is made feasible through the creation of real estate securities, in the form real estate shares or Real Estate Investment Trusts (REITs) (Bond, Dungey & Fry, 2006). REITs are securities consisting of share ownership of a real estate portfolio, including equity and mortgages. Originated in the US in 1960, REITs provide wide-ranging investors with an opportunity to own a share of income-producing assets or mortgages. REITs are an attractive and stable investment because its profits are not only obtained from buying and selling, but also through regularly paid dividends like fixed income securities (Tsai & Chiang, 2013).

Much research has been done to investigate

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whether REITs remain important to provide diversification benefits under the current global circumstance characterized by cross-border investments. Steinert and Crowe (2001) show that the inclusion of US REITs in a portfolio pushes the efficient frontier upward, thus increasing the portfolio return for a given level of risk. Furthermore, they claim that in global investment, the diversification advantages of cross-border real estate investment are substantially higher than for stocks or bonds. Most research on REITs are based in the US but they eventually spread to other countries following the development of REITs in other regions.

The number of REITs in Asia has proliferated over the last two decades. As of 2018, 215 REITs are active and listed in each country's stock exchange. From seven countries in Asia (Japan, Hong Kong, Malaysia, Singapore, South Korea, Thailand, and Taiwan), the REITs' market capitalization reached 228 billion USD in 2018. The development of REIT markets motivates much research about REITs. Despite the growing importance of Asian REITs as a part of the investment strategy of global portfolio investors, the amount of research on REIT markets in Asia is relatively low compared to the US and Australia.

As REIT markets mature, the markets become more integrated into other asset markets (Liu et al., 1990); thus, REIT investors are vulnerable to risks transformed from other asset markets. This leads to a different stream of research on REITs. While studying the direction of return spillovers between Asian REIT markets, Pham (2012) finds a clear indication for REIT returns to be transmitted from developed markets to emerging markets. Further, the research categorizes the markets into three clusters: the volatility emitters (Hong Kong, Singapore, and South Korea); the receiver (Japan and Taiwan); and the intermediary (Malaysia and Thailand). Lin (2013) examines volatility spillover of REITs in six Asian markets (Taiwan, Japan, Malaysia, Singapore, Hong Kong, and South Korea) using a generalized autoregressive conditional heteroscedasticity (GARCH) model. The research finds a negative spillover effect from stock to REIT markets and the opposite from bond to REITs. The negative spillover from the stock to the REITs was greatly enhanced during the 2007 financial crisis. This implies that a healthy stock market will reduce conditional uncertainty on REITs.

In a global market, Liow and Huang (2018)—using Diebold and Yilmaz's spillover index on the ten most advanced global REITs from 2004 to 2017—find a less similar process of integration in the global REIT markets. The local stock market is almost always a significant source of the volatility relation shocks from REITs. In addition, they indicate volatility-related effects of REITs are crisis-sensitive and decline faster than stocks during a crisis.

This research offers two distinct contributions to the literature on REITs in the Asian markets. First, this research enriches Liow and Huang's work (2018) that covers REITs only from the most-established REIT markets (ten countries) in the world. At the same time, this research includes both developed and developing markets in Asia (seven countries), expecting to elaborate behavior within and across the different markets. Second, to the best of our knowledge, this is the first research to adopt Diebold and Yilmaz's method (2009, 2012) in measuring the connectedness of REITs and other asset classes in Asia. Compared to other methods, such as dynamic conditional correlation (DCC) or GARCH models, the Diebold and Yilmaz's method provides a simple but reliable way of calculating spillover risks for a multi-asset network. The method also defines the path of risk spillovers based on a vector regressive (VAR) (Chiang, Sing & Tsai, 2017). Furthermore, this research uses nine years of data, which is longer than any earlier research on REITs in Asia.

The objective of this research is to examine four interrelated topics. The first is the level of connectedness in Asian REITs market, measured by return spillover factor. Second is the direction and intensity of return spillover transmission from advanced to emerging markets. The third is the level of connectedness between local stock and REITs market (two asset classes) in each country, measured by the return spillover factor. Lastly is the effect of return spillover factors between Asian REITs and be-

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Table 1. Asian REIT Market Capitalization (2018)

	REITs Market Capitalization	% on Stock Market Capitalization
Hong Kong	$ 35,422,313,139	1%
Japan	$ 107,088,150,610	2%
South Korea	$ 1,901,878,750	0,2%
Malaysia	$ 9,895,279,983	2%
Singapore	$ 60,467,298,269	10%
Thailand	$ 11,263,773,552	2%
Taiwan	$ 2,576,976,400	0,3%

Source: Processed from Data Stream (2019).

tween two assets (REITs and stocks) on returns from REITs in each country.

The results reveal interesting facts regarding the precondition to differentiate global portfolios considering the origins of their REITs. Firstly, the connectedness between the Asian REIT markets was low (14.08%). Advanced REIT markets have a much higher connectedness (18.6%) than developing markets (2.9%). Secondly, Japan and Singapore with the most advanced REIT markets have the most substantial influence in transmitting the spillover to other developing markets. The role of government is vital in enhancing the development of REITs in these countries. Thirdly, when investing in REITs, the stock market movements must always be monitored because they have a significant influence on the REIT markets. Finally, the return spillover factor of the Asian REIT markets has a stronger impact on REIT returns compared to the local market.

The remaining of this article is organized as follows. The next section provides a literature review and hypotheses. Subsequent sections describe the data and research methodology, followed by results and discussion. The final section concludes this article and provides the research implications.

Literature Review and Hypotheses

Real Estate Investment Trust (REIT)

A REIT is a company that owns –and typically operates –income-producing real estate or real estate-related assets such as office buildings, shopping malls, apartments, hotels, resorts, self-storage facilities, warehouses, and mortgages or loans (SEC, 2011). To be qualified as an REIT, a company must have a majority (about 75%) of its assets connected to real estate investments and distribute at least 90 percent of its taxable income to its shareholders annually in the form of dividends from such real estate sources or any source.

The Significance of REITs in Asia

The development of Asian REITs started when Japan issued REITs in 2001. REITs in Asia are usually managed by external parties assigned to manage the establishment, issuance, offer subscriptions, and operate REITs. In Asia, the average-rate compositions of income-producing real estate assets are between 70-80% and distribute at least 90 percent of its taxable income to shareholders.

Table 1 shows the market capitalization of seven Asian REIT markets in 2018 and the percentage of the REITs market on stock market capitalization. In 2018, the total of Asian REITs markets capitalization reached USD 228 billion with Japanese, Singapore and Hong Kong markets having the largest REIT market capitalization. Although the Japanese have the highest market capitalization in Asia, the Singapore REIT market has the most important role in their country's capital market due to their contribution to the local stock market.

The interdependence of REITs and other financial assets

The central issue of global portfolio formation is knowledge of interdependence across various asset classes and markets. Much research focuses on the co-movements between different financial markets and examines cross-

market correlations to evaluate the potential benefits of diversification (See Wilson & Zurbruegg (2003) for an examination of the correlation research). However, the use of correlation analysis is considered inadequate due to heteroscedasticity of financial data (Forbes & Rigobon, 2002). Thus, more recent work introduces the terms "contagion" and "spillover effect" to better understand the interdependence and suggest more sophisticated methods to measure interdependence.

Using an unconditional correlation coefficient to tackle the question of heteroscedasticity, Forbes and Rigobon (2002) clarify that the downturn in the Hong Kong stock market during the 1997 crisis had no contagious effects, despite the strong pre- and post-crisis correlations between stock markets. Case, Yang and Yildirim' study (2012) uses Engle's Dynamic Conditional Correlation Model & Generalized Autoregressive Conditional Heteroskedasticity (DCC-GARCH) to investigate the movement of return correlation between REITs and other stocks to tackle the heteroscedasticity problem as well. Their research shows three patterns of correlation between REITs and capital markets, which are distinct over time spans and regions.

Pham (2012) tests interdependencies with Exponential Generalized Autoregressive Conditional Heteroskedastic (EGARCH) and clarifies that the connection between REIT markets in Asia is evolving; it rises before the crisis and decreases after the crisis. Chiang et al. (2017) estimates, using the Diebold-Yilmaz index, the return spillovers of the four-asset scheme consisting of the equity REIT, the mortgage REIT, the stock, and the bond. They note that total return spillover risks lead to 30% of the overall return variance. Once commercial real estate is added into the scheme, the spillover risk is slightly decreased. Adding the expanded Fama-French five-factor CAPM to the model, they find that the net spillover risks have large and negative effects on EREIT and MREIT returns but had positive effects on bond returns. Liow and Huang (2018) use the Diebold-Yilmaz and TGARCH methods to examine the dynamics of volatility spillovers in global REITs. They find that the local capital market is the primary source of spillovers in volatility by REITs. On top of this, the volatility effects of the REITs are crisis-sensitive and fall faster than stocks.

Hypotheses

After the global financial crisis, regional integration in the stock market and the money market is found to be stronger in Asia (Sugimoto & Matsuki, 2018; Rughoo & You, 2016). Nevertheless, this might be not be applied to REIT markets that have not developed evenly in all markets in Asia. This notion is supported by Pham (2012, 2013) who found that the correlation in Asian REIT markets is relatively low and Liow and Huang (2018) proved that the connectedness in REITs market between 2004-2018 declined since the crisis. Therefore, we expected that level of connectedness on the REIT market to be low, measured by the total return spillover that is below 50%. Thus, we hypothesize that:

H1: There is low connectedness on the REIT markets in Asia.

The level of connectedness between local stock and REITs markets are expected to be low, measured by the total return spillover that is below 50%. This notion is supported by Chiang, Tsai and Sing (2013) who argue that in a stable market condition, incorporating REITs on stock portfolios will provide profits based on the value of the correlation coefficient which is two times smaller than during the crisis. Local stock return is expected to be the biggest contributor of return spillover to REITs' return in Asia, measured by net pairwise spillover from stock to REIT. Liow and Huang (2018) supported this idea by proving that the stock market is the primary source of volatility connectedness shocks from the REIT market in ten advanced countries, for 80% of the total period of research. Therefore, we hypothesize that:

H2: There is a low connectedness between local stock and REITs markets in Asia.

The spillover factors that are used are total return spillover and net return spillover both from Asia and local markets. This supposition

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is supported by Chiang et al. (2017) who found that return spillover factors significantly affect REITs' return of assets after controlling for unexpected inflation and interest rate. From a different angle, Hui and Wang (2018) also suggest that REITs' returns are affected by the spillover of idiosyncratic risk. Thus, this research hypothesizes:

H3: Return spillover significantly affects REITs' returns in Asia.

Data and Research Methodology

We use time-series data collected from DataStream, Thomson Reuters and Investing, ranging from January 2010 to December 2018. We use weekly data expressed in percentages. To avoid the problem arising from exchange rate fluctuation, all data are denominated in local currency (Loo, Anuar & Ramakrishnan, 2016). The countries that we use in our data sample are countries that have more than five issued REITs, namely, Hong Kong, Japan, South Korea, Singapore, Malaysia, Thailand, and Taiwan. Hong Kong, Japan, and Singapore classified as advanced REITs markets; whereas we classify South Korea, Malaysia, Thailand, and Taiwan as developing REITs markets. More details regarding the data used in the study are as follows:

1. Hong Kong, Japan, South Korea, Singapore, Malaysia, Thailand, and Taiwan REIT indices were compiled by the author using the market capitalization-weighted index method referred to BEI (2018).
2. Stock indices in Hong Kong (Hang Seng Composite Index), Japan (TOPIX), South Korea (KOSPI), Singapore (FTSE ST All-Share Index), Malaysia (FTSE Bursa Malaysia EMAS Index), Thailand (SET Index) and Taiwan (TAIEX).
3. Short-term (3-month) government bonds yield in Hong Kong, Japan, South Korea, Singapore, Malaysia, Thailand, and Taiwan.
4. Unexpected inflation Hong Kong, Japan, South Korea, Singapore, Malaysia, Thailand and Taiwan were calculated by looking for differences in actual inflation rates and one lag of the 3-month government bond rate [UXINFt = DCPIt - 3MBOND-1] referred to Fama and Schwert (1997).
5. Interest rate of Hong Kong (Discount Rate), Japan (Bank of Japan Main Policy Rate), South Korea (Bank of Korea Base Rate), Malaysia (Bank Negara Malaysia Overnight Policy), (Singapore Prime Lending Rate), Thailand (Bank of Thailand 1 Day Bilateral Repurchase Rate) and Taiwan (Discount Rate).

REIT and stock indices are converted into returns using a change in log price multiplied by 100. All data processing uses Microsoft Excel and EViews applications. For the spillover index, the "dyindex" Add-Ins feature on EViews is used. This add-in was published on April 25, 2018 by Davaajargal Luvsannyam.

Spillover Indices Diebold-Yilmaz

Diebold and Yilmaz (2009) proposed measurement of the spillover index based on the variance decomposition of the VAR framework. Based on the contribution of volatility previously described in variance decomposition, Diebold and Yilmaz (2009) developed a measurement of spillover, a total spillover that is defined as follows:

$$S^g(H) = \frac{\Sigma_{i,j=1,i\neq j}^{N} \theta_{ij}^{\sim g}(H)}{\Sigma_{i,j=1}^{N} \theta_{ij}^{\sim g}(H)} \times 100 = \frac{\Sigma_{i,j=1,i\neq j}^{N} \theta_{ij}^{\sim g}(H)}{N} \times 100 \quad (1)$$

Where $\theta_{ij}^{\sim g}(H)$ is the row sum of KPPS (generalized VAR framework of Koop, Pesaran, Potter and Shin) H-step-ahead forecast error variance decomposition. The total spillover index measures the contribution of spillovers of shocks across asset classes to the total forecast error variance.

Diebold and Yilmaz (2012) expanded the spillover measurements by adding three measures: directional spillover, net spillover, and net pairwise total. The directional spillover index specifies the spillover contribution between countries or asset classes. The directional spill-

over formula received by the market *i* from other markets *j* is as follows

$$S_{i.}^{g}(H)=\frac{\Sigma_{i,j=1,i\neq j}^{N}\theta_{ij}^{\sim g}(H)}{\Sigma_{i,j=1}^{N}\theta_{ij}^{\sim g}(H)}\times 100 = \frac{\Sigma_{i,j=1,i\neq j}^{N}\theta_{ij}^{\sim g}(H)}{N}\times 100 \quad (2)$$

Directional spillover that is transmitted by market *i* to another market *j* as:

$$S_{.i}^{g}(H)=\frac{\Sigma_{i,j=1,i\neq j}^{N}\theta_{ji}^{\sim g}(H)}{\Sigma_{i,j=1}^{N}\theta_{ji}^{\sim g}(H)}\times 100 = \frac{\Sigma_{i,j=1,i\neq j}^{N}\theta_{ji}^{\sim g}(H)}{N}\times 100 \quad (3)$$

The difference of this measurement with the directional spillover in the two equations above is the addition of net spillover, which is the difference in shocks transmitted and received by a market. If the value is positive, it is called a net transmitter, whereas if the value is negative it is called a net receiver.

$$S_{i}^{g}(H)=S_{.i}^{g}(H)-S_{i.}^{g}(H) \quad (4)$$

This net pairwise spillover measurement specifies the net spillover of net directional spillover equations where net pairwise spillover between market *i* and *j* is the difference from the shocks transmitted by market *i* to *j* and transmitted from *j* to *i*. The total value of net pairwise spillover is net spillover. The net pairwise spillover formula is as follows:

$$S_{ij}^{g}(H)=\left(\frac{\theta_{ji}^{\sim g}(H)}{\Sigma_{i,k=1}^{N}\theta_{ik}^{\sim g}(H)}-\frac{\theta_{ij}^{\sim g}(H)}{\Sigma_{j,k=1}^{N}\theta_{jk}^{\sim g}(H)}\right)\times 100 = \left(\frac{\theta_{ji}^{\sim g}(H)-\theta_{ij}^{\sim g}(H)}{N}\right)\times 100 \quad (5)$$

OLS Regression

The return spillover factors from the Diebold-Yilmaz (2012) method are used to test the effect of spillover factors on REIT returns in each country using OLS regression. The level of significance used in this OLS regression is 5%. The objective of OLS regression is not to find the best model in explaining REIT returns, but only to test how much influence spillover factors have on REITs returns in Asia. The OLS model for testing the return spillover factors between REIT markets in Asia and REITs return is:

$$REIT_{i,t}=\alpha_i+x_{i,t}+\delta_{11i}SPILL\_ASIA_{i,t}+\delta_{12i}SPILL\_ASIA_{i,t-1}+\varepsilon_t \quad (6)$$

The OLS model used to test the return spillover factors between local stocks and REITs toward REITs returns is:

$$REIT_{i,t}=\alpha_i+x_{i,t}+\delta_{21i}SPILL\_LOCAL_{i,t}+\delta_{22i}SPILL\_LOCAL_{i,t-1}+\varepsilon_t \quad (7)$$

Where $REIT_{i,t}$ is the return of REIT; $X_{i,t}$ are the control variables which are *unexpected inflation* and interest rate, SPILL_ASIA consists of total return spillover from Asian REITs markets (SPILL_ASIA) and net return spillover that is transmitted or received from each country ($NET\_country_i$). SPILL_LOCAL consists of total return spillover from local stock and REITs market in each country (SPILL_LOCAL) and net return spillover that is transmitted or received by REIT (NET_REIT).

Results and Discussion

Results

The REITs indices that were calculated, and their visual representation are shown in Figure 1. The number of REITs used in the Hong Kong REIT index is 12, Japan 66, South Korea 8, Malaysia 18, Singapore 40, Thailand 54, and Taiwan 7. Using a base value for the index equaling 100, Hong Kong and Japan REIT indices show the most rapid growth of 136% and 111%. South Korea's REIT Index grew 48%, Malaysia 63%, Singapore 41%, Thailand 61%, and Taiwan 35%. When the annual effective growth rate is included to the calculation, Hong Kong grows 33% per year, Japan 31% per year, South Korea 20% per year, Malaysia 24% per

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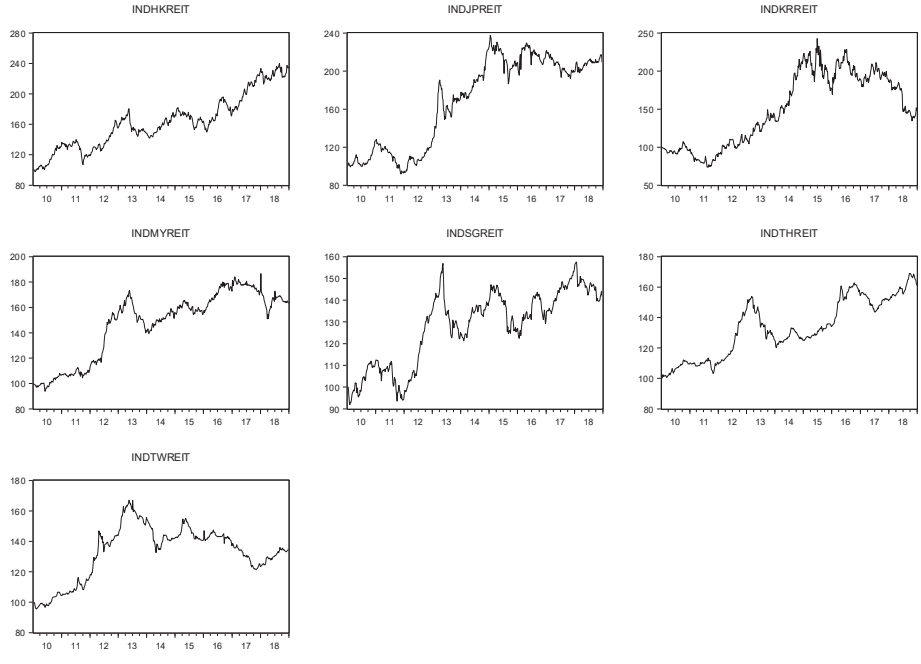
Figure 1. Asian REITs Indices



The indices, from the top-left corner, are consecutively: Hong Kong (INDHK REIT), Japan (INDJPREIT), Korea (INDKRREIT), Malaysia (INDMYREIT), Singapore (INDSGREIT), Thailand (INDTHREIT) and Taiwan (INDTWREIT).

Table 2. Total Return Spillover of Asian REITs

	From (*i*)							
To (*j*)	JPREIT	SGREIT	HKREIT	MYREIT	TWREIT	KRREIT	THREIT	Directional FROM others
Total Spillover								
JPREIT	98.7	0.1	0.1	0	0.1	0.7	0.3	1.3
SGREIT	15.1	83.7	0.5	0.1	0.1	0.6	0	16.3
HKREIT	8.8	30.6	60.2	0	0	0.2	0.1	39.8
MYREIT	2.5	9	0.1	87.3	0.5	0.6	0.1	12.7
TWREIT	2	4.7	2.3	0.8	90	0.1	0.1	10
KRREIT	2.1	2.8	0	0.4	0.8	93.9	0	6.1
THREIT	2.3	4.1	3.7	1.1	0.6	0.7	87.5	12.5
Directional TO others	32.7	51.2	6.7	2.5	2.1	2.9	0.5	**Total (98.6/700):**
Directional including own	131.4	135	67	89.8	92.1	96.7	88.1	**14.08%**

Source: Author's calculation (2019).

year, Singapore 19% per year, Thailand 23% per year, and Taiwan 17% per year.

All transformed indices (to series of return) are stationary at 5%, and the optimum lag for the VAR model of Asian REITs return is 1. Using Diebold-Yilmaz's Index, as shown in Table 2, it is found that three countries have the biggest influence on the forecast error variances between REIT markets: namely Japan, Singapore, and Hong Kong. However, the influence of shocks on assets themselves still has the greatest influence compared to other assets, shown by their own spillover, which has the most influence on the REITs returns of all markets. In general, REIT's total return spillover in Asia is 14.08%, means the connectedness in Asian REITs markets is relatively low. There has been an integration of the stock and bond markets in Asia after the global financial crisis, but there is no indication (Sugimoto & Matsuki, 2016; Rughoo & You, 2016). However, there is no indication of integration in REIT assets because of their "relatively young age", and it has not developed evenly in every market throughout Asia. This finding is consistent with the results from Liow and Huang (2018) that mentioned that the connectedness of the global REIT markets is currently lower than in the period of the global and European financial crisis.

Regarding the direction, the results are as

Table 3. Total Return Spillover of Stock and REITs in Malaysia

To (*j*)	MYSTOCK	From (*i*) MYREIT	Directional FROM others
MYSTOCK	100.00	0.00	0.00
MYREIT	15.00	85.00	15.00
Directional TO others	15.00	0.00	**Total Spillover (15/200):**
Directional including own	115.00	85.00	**7.5%**

Source: Author's calculation (2019).

Table 4. Total Return Spillover of Stock and REITs in Singapore

To (*j*)	SGSTOCK	From (*i*) SGREIT	Directional FROM others
SGSTOCK	98.80	1.20	1.20
SGREIT	55.20	44.80	55.20
Directional TO others	55.20	1.20	**Total Spillover (56.4/200):**
Directional including own	154.00	46.00	**28.2%**

Source: Author's calculation (2019).

Table 5. Total Return Spillover of Stock and REITs in Thailand

To (*j*)	THSTOCK	From (*i*) THREIT	Directional FROM others
THSTOCK	100.00	0.00	0.00
THREIT	26.30	73.70	26.30
Directional TO others	26.30	0.00	**Total Spillover (26.3/200):**
Directional including own	126.30	73.70	**13.2%**

Source: Author's calculation (2019).

Table 6. Total Return Spillover of Stock and REITs in Taiwan

To (*j*)	TWSTOCK	From (*i*) TWREIT	Directional FROM others
TWSTOCK	99.80	0.20	0.20
TWREIT	7.90	92.10	7.90
Directional TO others	7.90	0.20	**Total Spillover (8.1/200):**
Directional including own	107.70	92.30	**4.05%**

Source: Author's calculation (2019).

follows. From the seven REIT markets in Asia, HKREIT received the highest return spillover (39.8%), and JPREIT received the lowest return spillover (1.3%) from other markets. Meanwhile, SGREIT (51.2%) is the biggest transmitter of return spillover and THREIT is the smallest transmitter of return spillover to other markets. The markets which become the biggest net transmitter of the variance in returns to other markets are markets with the highest total REITs capitalization value, SGREIT (51.2−16.3 = + 34.9%) and JPREIT (32.7−1.3 = + 31.4%); and the markets that becomes the net receiver are HKREIT (6.7−39.8 = -33.1%), THREIT (0.5−12.5 = -12%), MYREIT (2.5−12.7 = - 10.2%), TWREIT (2.1−10 = -7.9%) and CRREIT (2,9−6,1 = -3,2%). These results are similar to the findings of Pham (2012), whot found the direction of return spillover tends to be transmitted from advanced REIT markets (Hong Kong, Japan and Singapore) to developing REIT markets (South Korea, Malaysia, Thailand and Taiwan).

Lag structure selection for the VAR equation of two classes of assets in Hong Kong, Japan and South Korea is zero. Therefore, we do not conduct the Diebold-Yilmaz's spillover index for those three countries. From the Malaysia, Singapore, Thailand and Taiwan market, the optimal lag structure is 1. There is a similarity between the remaining four markets (Table 3-6), and it is observed that there is a strong return spillover transmission from stock to REIT markets, where the Singapore market has the strongest spillover transmission from stock to REIT compared to other markets. The connectedness between the two classes is considered low, which is below 50%.

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Table 7. Stationary Variables of Spillover, Unexpected Inflation and Interest Rate in Hong Kong, Japan, and South Korea

	HK	JP	KR
Unexpected Inflation	HKUXINF	JPUXINF	ΔKRUIXINF
Interest Rate	ΔHKINTEREST	ΔJPINTEREST	ΔKRINTEREST
Total Spillover Asia	ΔSPILL_ASIA	ΔSPILL_ASIA	ΔSPILL_ASIA
Total Net Spillover Country i	ΔNET_HK	ΔNET_JP	ΔNET_KR

Source: Author's works (2019).

Table 8. Stationary Variables of Spillover, Unexpected Inflation and Interest Rate in Singapore, Thailand, and Taiwan

	MY	SG	TH	TW
Unexpected Inflation	MYUXINF	ΔSGUXINF	THUXINF	TWUXINF
Interest Rate	MYINTEREST	ΔSGINTEREST	ΔSGINTEREST	ΔTWINTEREST
Total Spillover Asia	ΔSPILL_ASIA	ΔSPILL_ASIA	ΔSPILL_ASIA	ΔSPILL_ASIA
Total Net Spillover Country i	ΔNET_MY	ΔNET_SG	ΔNET_TH	NET_TW
Total Spillover Local	ΔSPILL_LOKAL	ΔSPILL_LOKAL	ΔSPILL_LOKAL	ΔSPILL_LOKAL
Total Net Spillover REIT	ΔNET_REIT	ΔNET_REIT	ΔNET_REIT	ΔNET_REIT

Source: Author's works (2019).

Table 9. Regression Results of the Total Return Spillover Factor of the Asian REITs Markets

	HKREIT	JPREIT	KRREIT	MYREIT	SGREIT	THREIT	TWREIT
Variable	Coeff	Coeff	Coeff	Coeff	Coeff	Coeff	Coeff
Unexpected Inflation	0.05	-0.30	0.00	0.05	0.00	0.00	-0.09
Interest Rate	0.01	-0.02**	0.00	0.02	-0.69	0.00	0.03
Total Spillover Asia	-0.02	-0.05	0.07	0.09***	-0.02	-0.01	-0.01
Total Spillover Asia (-1)	0.03	-0.01	0.00	-0.05	0.02	0.03	0.00

Source: Author's works (2019).

Table 10. Regression Results of the Net Return Spillover Factor of the Asian REITs Markets

	HKREIT	JPREIT	KRREIT	MYREIT	SGREIT	THREIT	TWREIT
Variable	Coeff	Coeff	Coeff	Coeff	Coeff	Coeff	Coeff
Unexpected Inflation	0.05	-0.31	0.00	0.04	0.00	0.00	-0.07
Interest Rate	0.01	-0.02***	-0.01	0.15	-0.80	0.00	0.03
Net Spillover Country i	0.00	-0.02**	0.00	0.00	0.01	0.00**	0.05
Net Spillover Country i (-1)	-0.03**	-0.02**	0.00	0.00***	0.01	0.00	-0.08**

Source: Author's works (2019).

The rolling sample estimation for return spillover with a ten steps horizon and a 100-week window is done to see the fluctuations of the spillover value. Then this data is tested for its stationarity for the use of OLS regression. In addition, the authors also did the stationary testing on control variables, namely unexpected inflation (UXINF) and interest rate (INTEREST) at level. If the variable is proven to be nonstationary at the level, it will be transformed into the rate of change (Δ), expressed in percentages. Nonetheless, if the variable is proven to be nonstationary at the rate of change, it will be transformed into the difference (D). The variables that are proven to be stationary are shown in Tables 7 and 8.

The OLS regression results from the return spillover factor of the Asian REIT markets at REIT returns in each country are shown in Table 9-12, where ** shows a significant variable at 5% and *** significant at 1%. The result indicates that net return spillover in period t significantly affects REIT returns in Japan negatively and in Thailand positively. Net return spillover in lag 1 significantly affects REIT returns negatively in Hong Kong, Japan, and Taiwan but positively affects REIT returns in Malaysia. Total return spillover only significantly affects REIT returns in Malaysia.

Of the four countries tested by the local stock market and REITs spillover returns, the total return spillover factor in the period t positively affected Malaysia and was negative in Taiwan. The net return spillover factor in period t also

Figure 2. Net Pairwise Return Spillover of Asian REITs

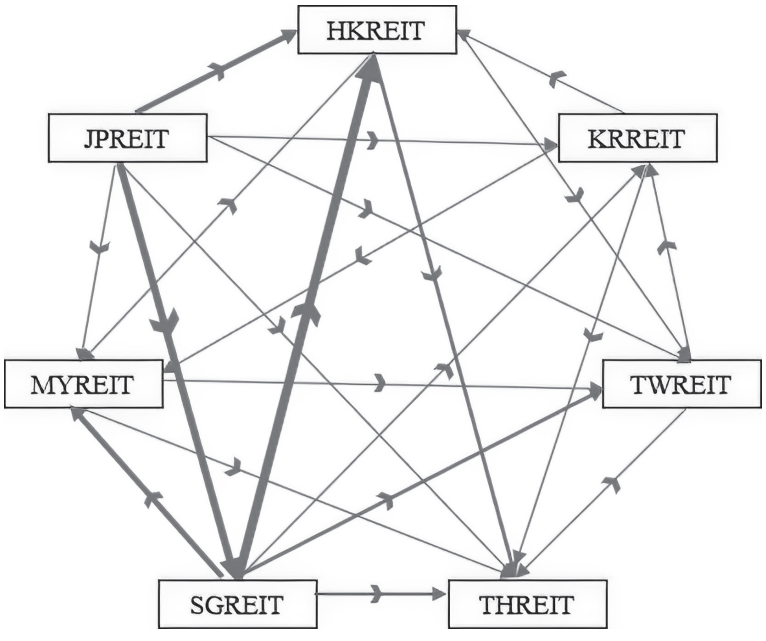

Table 11. Results of Regression of Total Return Spillover Factors in Local Stock Markets and REITs

Variable	MYREIT Coeff	SGREIT Coeff	THREIT Coeff	TWREIT Coeff
Unexpected Inflation	0.03	0.00	0.00	-0.10
Interest Rate	-0.06	-0.78	-0.01	0.04
Total Spillover Local	0.02**	-0.02	-0.01	-0.02***
Total Spillover Local (-1)	-0.01	-0.03	0.00	0.00

Source: Author's works (2019).

Table 12. Results of Regression of Net Return Spillover Factors Received by REITs Markets

Variable	MYREIT Coeff	SGREIT Coeff	THREIT Coeff	TWREIT Coeff
Unexpected Inflation	0.04	0.00	0.00	-0.09
Interest Rate	-0.05	-0.77	-0.01	0.03
Net Spillover REIT	0.01***	-0.02	-0.01	0.00***
Net Spillover REIT (-1)	0.00	-0.02	0.00	0.00

Source: Author's works (2019).

positively affected Malaysia and was negative in Taiwan. Transmission and recipient of return spillover from inter-market Asian REITs are not proven to affect REIT returns in South Korea. Likewise, spillover from Asian REIT markets and two classes of domestic assets has not been shown to affect REIT returns in Singapore.

Discussion

The above figures are summarized into the direction and intensity of the return spillover on the Asian REITs (Figure 2). Each line and arrow describes the direction and magnitude of net pairwise returns spillover between assets, whereas the thickness of the line represents the strength of the relationship. Net pairwise spillover from SGREIT to HKREIT, JPREIT to SGREIT and JPREIT to HKREIT having the strongest intensity. In a research conducted by Li and Yung (2007), a similar relationship was also found, the transmission of volatility from Japanese REITs to Singapore and from Singapore to Hong Kong.

Of every REIT market in Asia, Japan, and Singapore as two markets with the largest REIT markets capitalization are a net transmitter to other markets. Even though Hong Kong is a net

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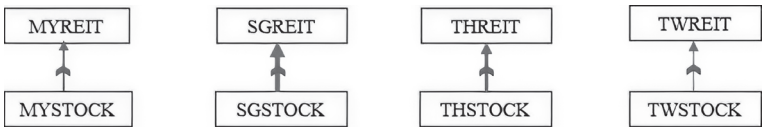
Figure 3. Net Pairwise Return Spillover of Stock and REIT Markets



receiver, Hong Kong has a significant influence on the market in developing countries. With the total return spillover in the whole sample being 14.08%, the first hypothesis cannot be rejected because it is proven that there is a low connectedness of return spillover returns on the REIT markets in Asia in the period 2010-2018, where the total return spillover is below 50%.

To understand the connectedness according to the maturity stage of the REIT markets, a test was conducted by distinguishing the calculation of return spillover based on advanced markets (Hong Kong, Singapore and Japan) and developing markets (South Korea, Malaysia, Thailand and Taiwan). The result shows that the total return spillover in the advanced markets is quite high at 18.6%, while only reaching 2.9% in the developing markets. This finding is consistent with Pham's (2012) finding regarding the correlation between REIT markets; the developed market has a lower correlation relatively to the advanced REIT markets.

Figure 3 shows that all REIT markets consistently receive return spillover from the stock market, where the relationship of return on stock to REITs in Singapore is the largest (54%). This result is consistent with research from Liow and Huang (2018), which found that the local stock market is the primary source of connectedness shock in 80 percent of the total research period on the REIT markets, as measured by the net group directional total connectedness index. In addition, research from Damianov and Elsayed (2018) also proves that the stock market sends a high return spillover to REITs in the United States.

The Malaysian, Singapore, Thailand, and Taiwan markets show low connectedness between local stock returns and REITs, with the total return spillover below 50%. Thus, the second hypothesis cannot be rejected because the connectedness of local stock returns and REITs in Asia 2010-2018 is proven to be low. Research from Pham (2013) supported this finding that the Asian REIT markets have a negative correlation with stocks, property companies and bonds, therefore it is good to include REITs in a mixed-asset portfolio. By including REIT, it will increase the overall rate of return and reduce the risk of the portfolio.

In general, net return spillover in lag 1 of the Asian REIT markets most significantly affects REIT yields in Asia. The regression results are not in accordance with Chiang, Sing and Tsai (2017) which prove the influence of the effect of return spillover factors on equity REIT, mortgage REIT, stocks, and bonds in the United States. Thus, the third hypothesis cannot be rejected, because not all return spillover factors of the Asian REIT markets significantly affect REIT yields in Asia in the period 2010-2018.

Monetary policy from the Japanese central bank has an important role in the growth of REITs in Japan. The quantitative easing program conducted by the Bank of Japan (BOJ) involves purchasing Japanese REITs to support the market while under pressure. The policy of the negative interest rate from the BOJ also encouraged the Japanese REITs to be an attractive investment instrument, moreover, REITs offer relatively high dividend rates. The low amount of loans issued by banks makes REITs attractive investment choice for banks and other institutional investors.

The Singapore government applies tax rules that are beneficial for REITs and encourages good governance practices. The rule that allows REITs to invest in overseas real estate assets has become a major boost for significant REITs' growth in Singapore. With a small area, Singapore has succeeded in becoming a large REIT market on a regional and international scale. Unlike REITs in other countries which usually focus on investing in domestic property, more than two-thirds of REITs in Singapore have overseas property investments (Ernst & Young,

2016). The two Singapore REITs whose property assets are in Indonesia are FIRST REIT, most of which are Siloam hospitals and Lippo Mall Indonesian Retail Trust, which most of the assets are shopping centers owned by Lippo Group.

The real estate market has great potential in Asia, with an estimated market size of 1,975 billion USD (MSCI, 2018), an increase in the number of REITs is expected to happen. The plan to merge REITs in Singapore to become one of the world's largest REITs and the issuance of 4 DDIRE in Indonesia in 2019 is expected to attract many investors to purchase REITs. Emerging countries such as India, Vietnam, Pakistan, and the Philippines are expected to strengthen the development of REITs in Asia in the next few years. To optimize the potential of REITs a country that is currently not developing REITs, market restructuring needs to be done, including implementing regulations that are more market friendly.

Conclusions and Implications

Conclusions

This research examines the return spillover on the REITs markets in Asia and their relationships with the local stock markets. The results can be concluded as follows. Firstly, the connectedness between the Asian REIT markets was still low at only 14.08%. When testing the calculation of return spillover based on the maturity stage of the market, advanced REIT markets have a much higher connectedness (18.6%) than the developing market (2.9%).

Secondly, Japan and Singapore--countries with the most advanced REIT market--have the most substantial influence in sending strong transmission spillover to other developing markets. The development of the Japanese and Singapore REIT markets was driven by demand, supply, and policy as well as government incentives that supported the reasons why Japanese and Singaporean REITs were the most influential markets in the movement of return spillover in Asia. The role of government is vital in the development of REITs in Asia to create market-friendly conditions. The more flexible the government policy, the higher the urge to issue and invest in the REIT markets. There are still obstacles in some developing countries that make the growth of Asian REITs tend to be slow.

Thirdly, when investing in REITs and local stocks, stock market movements must always be monitored because they have a significant influence on the REIT markets, especially in Singapore. From two asset classes in Malaysia, Singapore, Thailand and Taiwan, the value of total return spillover in all markets is low. Combining the two assets in one portfolio will not be detrimental because it is proven that there is no strong connectedness between the two assets. However, net pairwise return spillover values from shares to positive REITs are quite strong in some countries.

Finally, the return spillover factor of the Asian REIT markets has a stronger influence on REIT returns compared to the local market. When investors invest in REITs, net return spillover received by each market from other countries must be considered, especially from countries that send the most spillover contributions. However, the coefficient of the spillover factor is relatively small, so the effect might not be strong enough to drive the movement of the REIT returns.

Implications

Although REITs are standard instruments for a diversification strategy, this research reveals that due to inter-market dependency, there should be tailored between developed and developing markets. A diversification strategy might be less effective in advanced markets compared to the strategy in developing REIT markets. Global investors should be aware that combining REITs across developed countries creates less benefit than mixing REITs in developed and developing countries.

The potential of REIT markets in Asia can be expanded to other countries where real estate assets are abundant, such as in China, India, and Indonesia. However, this research warns that the size of real estate markets alone is important but not sufficient. There must be an en-

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vironment to provide more attractive incentives for securitized assets such as REITs to flourish, such as lower bond yields, flexible regulations, among others. Otherwise, the real estate assets in such countries might be flown and issued as REITs in other countries.

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