FINANCIAL INTEGRATION AND DIVERSIFICATION AMONG ASEAN EQUITY MARKETS: A MALAYSIAN PERSPECTIVE

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ABSTRACT

The paper analyzes the degree of financial integration and benefits of portfolio diversification among ASEAN equity markets from Malaysian perspective. In the analysis, the ASEAN equity returns are adjusted for exchange rate fluctuations using Ringgit-based exchange rates. We also add the U.S. market in the analysis, since the U.S. is considered as the world's dominant economy. The results obtained suggest the long-run comovements among the ASEAN and U.S. equity markets. Moreover, the short-run interactions between ASEAN markets are mostly contemporaneous. Lastly, in line with existing studies, the U.S. market exerts significant influence on ASEAN markets. We take these results to indicate that the ASEAN markets are highly integrated. Accordingly, we tend to conclude that there seems to be limited benefits from diversifying among these markets. Additionally, for financial stability in the region, coordination of policies among the countries seems important. Lastly, policymakers of these markets also need to incorporate disturbances in the U.S. market in their information set.

INTRODUCTION

The interactions among national equity markets have recently been given an increasing emphasis in finance literature. Generally, the analysis has focused on testing the efficiency of equity markets and evaluating the degree of integration among these markets. These focuses have important implications for investment decisions related to potential benefits of international diversification and for financial stability of a country. Early studies on the interactions between international financial markets document low correlations among national stock index returns (Grubel, 1968; Levy and Sarnat, 1970; Lessard, 1973; and Solnik, 1974) and, thus, suggest the potential benefits of international financial diversification. Recent studies, however, note the increasing integration among these markets especially after the

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October 1987 global market crash (Lee and Kim, 1993; Arshanapalli and Doukas, 1993; Meric and Meric, 1997).

The interest in the financial integration has also motivated some researchers to focus only on a group of regional markets. In the context of the member states of the Association of Southeast Asian Nations (ASEAN), the studies by Palac-McMiken (1997) and Roca et al. (1998) are notable. Using monthly data from January 1987 to October 1995, Palac-McMiken (1997) examines the efficiency of five ASEAN equity markets (i.e. Indonesia, Malaysia, Philippines, Singapore, and Thailand). The results of the analysis using standard ADF unit root tests suggest that these markets are weak form efficient. However, with the exception of Indonesia, the results from pairwise ADF cointegration tests indicate that these markets are linked to each other in the long run. Unlike Palac-McMiken (1997), Roca et al. (1998) investigate the long-run co-movements between the five ASEAN markets using multivariate cointegration tests of Johansen (1988). Employing weekly data from 1988 to 1995, they find evidence indicating non-cointegration among the five markets. Yet, with the exception of Indonesia, these markets have significant short-run interactions with each other based on Granger causality tests. Interestingly, their results note the Malaysian stock market as being the most influential.

The presence of comovements between the Malaysian equity market and other ASEAN equity markets suggests that these markets are essentially one whole market or that they are integrated. From investors' point of view, the extent of these comovements limits the potential benefits of international diversification. To policymakers, financial integration makes the implementation of independent monetary policies less effective. Instead, coordination or harmonization of the policies between the countries concerned is required. Accordingly, if the results from Palac-McMiken (1997) and Roca et al. (1998) are taken as evidence for financial integration among the ASEAN markets, two main conclusions from a Malaysian perspective may be drawn. First, for the purpose of financial diversification, investors should diversify by investing in Indonesia since Indonesia is found to be independent from Malaysia by both studies. The evidence for cointegration and short-run interactions between the equity markets of Malaysia and Singapore indicate that no benefits can be obtained by diversifying in the two markets. And second, the results suggest the importance of policy coordination between the ASEAN-4 excluding Indonesia.

The purpose of the present paper is to revisit the issue from the Malaysian perspective. For diversification into international markets, we contend that investors are concerned not only with the expected capital gains from investment but also with the expected changes in the currency value vis-à-vis the foreign currency. This means that, in evaluating the interactions between two national markets, the exchange rate risk needs to be incorporated. Palac-McMiken (1997) does not adjust for the exchange rate risk or the changes in the currency value. Roca et al. (1998), however, utilize the Morgan Stanley Capital International (MSCI) stock price indices. The indices are constructed on a consistent basis and are comparable across countries. Moreover, they are expressed in terms of the US dollar. Accordingly, in line with the present work, they take into consideration of the exchange rate risks. However, from the Malaysian perspective, the change in the value of the Ringgit vis-à-vis the other ASEAN's currencies may be more relevant for investment decision purpose of the Malaysian investors. Additionally, in the construction of the MSCI indices, equity prices are adjusted for dual-listings. This procedure may filter out a possible source of price co-movements between markets and, thus, affects the results accordingly. Lastly, it needs to be noted that the incorporation of the exchange rate in the analysis is consistent with a stock return parity, a notion suggested by Dwyer and Hafer (1988). According to Dwyer and Hafer (1988), given no transaction costs and perfectly competitive markets, the expected returns from holding domestic firms' stocks should be the same as the exchange-rate-adjusted expected returns from holding the foreign firms' stocks.

Unlike Palac-McMiken (1997) and Roca et al. (1998), we also incorporate equity prices of a major market, i.e. the United States, into the analysis. While our focus is on the ASEAN markets, the inclusion of the U.S. market is motivated by the following reasons. After World War II, the U.S. is viewed as the world's dominant economy. With increasingly integrated global financial markets, various empirical studies have documented the importance of the U.S. on emerging markets including equity markets of the ASEAN (Cheung and Mak, 1992; Hung and Cheung, 1995; Arshanapalli et al., 1995; and Janakiramanan and Lamba, 1998). Accordingly, the absence of the U.S. market from the analysis may result in omitted variable bias since it is considered to be an important driving force of the global economies. Besides, the addition of the U.S. equity prices can provide side results on the spillovers of disturbances from the major market to ASEAN markets.

The rest of the paper is organized as follows. In the next section, we outline the empirical methodology used in the paper, which is based on cointegration and error-correction models. Then, section 3 describes the data and evaluates their stationarity properties. Section 4 reports the results. Lastly, section 5 concludes.

EMPIRICAL METHODOLOGY

The present analysis employs the standard methods of cointegration and error-correction modeling to evaluate the degree of financial integration between the Malaysian equity market and other ASEAN markets. In the analysis, we express the foreign stock prices in the Malaysian Ringgit to account for the currency risk from investing abroad (Hung and Cheung, 1995). The inclusion of the exchange rates can also be motivated using the return parity condition, as suggested by Dwyer and Hafer (1988), which equates the expected returns of a domestic firm and a foreign firm when expressed in the same currency. It is also in line with the uncovered interest rate parity condition.

2.1 Cointegration Tests

To test for cointegration or the long-run relationship between ASEAN equity markets, we employ the maximum likelihood approach of Johansen (1988) and Johansen and Juselius (1990).[1] The approach resolves the problem of endogeneity in that we do not need to normalize the cointegrating vector on one of the variables as in the case of the traditional two-step Engle-Granger (1987) test. The JJ test also has a significant power advantage over the EG test (Cheung and Lai, 1993).[2]

Basically, the JJ test is based on a vector autoregressive model:

$$X_t = \alpha + \beta_1 X_{t-1} + ... + \beta_k X_{t-k} + \varepsilon_t \quad (1)$$

where X is an n x 1 vector of equity prices expressed in terms of the Malaysian Ringgit. All prices are in logarithms. The error term ε is an n x 1 Gaussian white noise residual vector. For the purpose of testing, equation (1) can be equivalently written as:

$$\Delta X_t = \alpha + \Gamma_1 \Delta X_{t-1} + ... + \Gamma_k \Delta X_{t-k+1} + \Pi X_{t-k} + v_t \quad (2)$$

The presence of a long-run relationship between the five markets is tested based on an n X n matrix Π which can be expressed as $\Pi = \alpha\beta'$, where α is a matrix of loading and β is a matrix of cointegrating vectors. The number of the cointegration vectors is determined by the rank of Π. Note that if rank(Π) =

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1 *Since the tests are now well known, we only describe them briefly here. Interested readers may refer to Johansen and Juselius (1990) for details.*

2 *For comparisons of alternative cointegration tests, see Hall (1989), Gonzalo (1994), Haug (1996) and Gonzalo and Lee (1998). Performing a Monte Carlo comparison of ten alternative tests, Haug (1996) concludes that the JJ maximal eigenvalue test and the EG test have the least size distortions.*

where $n = 6$ in our case, then the variables in X are stationary. However, if rank(Π) = 0, then the variables are non-stationary and they are not cointegrated. Lastly if rank(Π) = $r < n$, then the data series are I(1) and have r cointegrating vectors. Johansen (1988) and Johansen and Juselius (1990) developed two test statistics – the trace test and the maximal eigenvalue test – to determine the number of the cointegrating vectors.

The presence of cointegration (i.e. rank(Π) = $r < n$)suggest that, although the variables are individually non-stationary, they can not drift farther away from each other arbitrarily. Thus, in the analysis of international financial interactions, it is taken as evidence for the long-run comovements between markets. An important requirement for implementing the cointegration test is that the variables are non-stationary integrated of the same order. Accordingly, prior to the test, we conduct standard augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine the order of integration for each variable[3].

Another estimation issue of the test is the determination of the lag length k in VAR model (1). According to Hall (1991), the JJ results are sensitive to the lag length chosen. While there is no generally accepted method for choosing the lag length, the main concern is that it should be high enough such that the errors are uncorrelated. Moreover, it is necessary to ensure that they are normally distributed. Accordingly, in the present analysis, the lag length is chosen by adding lags until the Box-Pierce Q Statistics at lag=12, Q(12), indicate no sign of auto correlation and the Jaque-Bera Statistics, J-B (2), suggest normality in the error terms.

2.2 Dynamic Model

In the analysis, we also evaluate the dynamic interactions between the variables using a Granger-style causality framework modeled in accordance with the cointegration properties of the variables. In particular, according to Granger's representation theorem, the dynamic relations between cointegrated series should be modeled using an error correction model (ECM). Thus, the dynamic causal link from foreign equity prices to Malaysian prices can be represented as:

$$\Delta s_{M,t} = \alpha + \sum_{i=1}^{k1}\beta_i \Delta s_{M,t-i} + \sum_{i=0}^{k2}\phi_i \Delta s_{I,t-i} + \sum_{i=0}^{k3}\varphi_i \Delta s_{P,t-i} + \sum_{i=0}^{k4}\lambda_i \Delta s_{S,t-1} + \sum_{i=0}^{k5}\eta_i \Delta s_{T,t-i} + \sum_{i=0}^{k6}\theta_i \Delta s_{U,t-i} + \gamma w_{t-1} + v_t \quad (3)$$

[3] *Briefly stated, a variable is integrated of order d, written I(d), if it needs differencing d times to achieve stationarity. Accordingly, any variable that is integrated of order 1 or higher is non-stationary.*

where w is the error correction term obtained from the cointegrating regression and k_is (i=1,...,6) are the optimal lag lengths. The subscripts refer to the markets: I = Indonesia, M = Malaysia, P = the Philippines, S = Singapore, T = Thailand, and U - the United States. The regression allows for contemporaneous impacts since the interactions among the ASEAN and U.S. markets may be immediate. In the case that they are not cointegrated, the error-correction term is omitted from the regression.

In the analysis we employ the commonly used Hsiao's (1981) sequential procedure together with the Final Prediction error (FPE) criterion to determine the lag lengths. For each equation, we first regress the changes of a price index on its own lags. Thus, using (3) as an example, we implement the following regression:

$$\Delta s_{M,t} = \alpha + \sum_{i=1}^{k1} \beta_i \Delta s_{M,t-i} + \gamma w_{t-1} + v_t \quad (4)$$

Varying the lag length $k1$ from 1 to 8, we choose the lag that minimizes the FPE as the appropriate lag (denoted $k1^*$) for the autoregressive terms. That is, $k1 = k1^*$. Then, fixing $k1$ at $k1^*$, a set of bivariate regressions are estimated:

$$\Delta s_{M,t} = \alpha + \sum_{i=1}^{k1^*} \beta_i \Delta s_{M,t-i} + \sum_{i=0}^{k} \phi_i \Delta s_{F,t-i} + \gamma w_{t-1} + v_t \quad (5)$$

where Δs_F stands for the equity returns of, alternatively, Indonesia, The Philippines, Singapore, Thailand and the U.S. For each bivariate regression, we again vary the lag length k from 1 to 8 and choose the lag that minimizes the FPE, denoted k^*. Hsiao (1981) shows that if the FPE is reduced after including a second variable, i.e. FPE($k1^*$, k^*) < FPE($k1^*$), then that variable is said to Granger cause the "effect" or the dependent variable, i.e the Malaysian equity prices. However, if there is no reduction in the FPE the variable has no causal link to the Malaysian prices and, accordingly, is omitted as being insignificant. For the set of the bivariate regressions, we rank them according to the FPE and then include first the stock return that results in the minimum FPE to form the bivariate regression.[4] Given the bivariate model, we then proceed to higher-system regressions successively (3-variable, 4-variable and so on) using similar steps until all variables are considered, added as being important or dropped as being unimportant in the dynamics of the ASEAN markets. In this sequential procedure, we retain the error correction term throughout even if it turns to be insignificant.

4 *This ranking criterion is suggested by Caines et al. (1981) and is know as the specific gravity technique.*

With the specification, the changes in the domestic stock prices will depend not only on the changes in the foreign stock prices (i.e. through the standard Granger causality channel) but also on the long run relationship between them. The latter allows for any previous disequilibrium, measured by the error correction term to exert potential influences on the movement of the domestic stock prices. According to Toda and Phillips (1994), the former may be termed as "short-run causality" while the latter may be termed as "long-run causality." The inclusion of the lagged foreign returns and/or the error correction term suggests the causal link from the foreign equity markets to the Malaysian market. The possible feedback from the domestic market to any foreign market can also be evaluated by reversing the roles of the two variables in (3). From these tests, one of the following four patterns of causality between any pair of the variables (x and y) can be noted: (1) unidirectional causality from x to y; (2) unidirectional causality from y to x; (3) bi-directional causality; and (4) no causality. Based on these tests, inferences can be drawn on the long-run relationship and short-run interactions between ASEAN equity markets and, as a side result, on the influences of the U.S. market on ASEAN markets.

DATA AND THEIR STATIONARITY PROPERTIES

The study uses monthly data for the period 1988.1 to 1997.6. We do not include data from the recent crisis to avoid the results being confounded by the crisis. With the rapid propagation of financial shocks observed among these markets during the crisis, the inclusion of observations from the crisis period may bias the results towards finding strong interactions among the markets.

We employ monthly data instead of higher frequency data due to the following reasons. First, the high frequency data such as daily data contain too much noise and are subject to the problems of non-synchronous and infrequent trading, which might lead to erroneous conclusions in the lead-lag relationships among the variables. Second, the problem of day-of-the-week effects is generally inherent in the daily data. For weekly data, we need to select a day of the week to represent weekly prices. Though there seems to be general criteria for the purpose, the presence of different holidays across countries complicates the matter. Third, it is now acknowledged that stock return series possesses clustering property or is leptokurtic. The distribution of the return series, however, converges to normal distribution under temporal aggregation. Accordingly, given our framework, monthly data seems more appropriate. Lastly, the number of observations is irrelevant for the application of unit root and cointegration tests. Accordingly to Shiller and Perron (1995), the power of these tests depend primarily on the length of time and not on the number of observations.

Having said these, it is worth mentioning that monthly data may be too aggregated, while th transmissions of shocks may take place within a month and can not be captured by employing monthl data. This point needs to be taken into account when interpreting our results.

The five ASEAN equity prices are end-of-the-month values of the price indices from Indonesia (Jakart Composite Stock Price Index), Malaysia (KLSE Composite), the Philippines (PSE Composite), Singapor (Singapore All-Shares), and Thailand (SET Index). We use the Standard & Poor 500 Index for the U. S As we have noted, the exchange rates are in terms of the Malaysian Ringgit, which are also represente by the end-of-the-month rates. Using the exchange rates, we express (in logs) the foreign stock price (s_F) in terms of the Ringgit as $s_F + e_F$, where $F = (I, P, S, T, U)$ and e is the corresponding exchange rat The stock price data are retrieved from Datastream while the exchange rate series are from the Ban Negara, the Malaysia's Central Bank.

Table 1 reports summary statistics for the six stock returns in Malaysian Ringgit. From the table, w may note that the price index of Indonesia exhibits the highest return (i.e. 1.57% monthly) while th Stock Exchange of Thailand has the lowest return (i.e. 0.46%). The price index of Indonesia seems t be volatile compared to the other markets, as indicated by the standard deviation. The standard deviatio of the Philippines and Thailand's markets are also high. The Stock Exchange of Singapore has th lowest volatility among the ASEAN markets. Note that, while recording comparatively high return the U. S. market is substantially less volatile than ASEAN markets. This feature captures a stylized fa that emerging stock markets are highly volatile.

As a pre-requisite for evaluating the long-run relationship and short run dynamics between the equi prices, we conduct the ADF and PP unit root tests to determine their orders of integration. The resul from these tests, given in Table 2, indicate that the six equity prices are integrated of order 1, i.e. I(The PP tests, in particular, can not reject the null hypothesis of a unit root for each price in level wh they reject the null hypothesis when it is expressed in first differences. The ADF tests furth substantiate the I(1) process of the PSE Composite, Singapore All-Shares and SET index. These resul thus, provide justification for us to proceed and evaluate the possible cointegration between these fi markets and the dynamic interactions between them.

RESULTS

4.1 Cointegration Tests

Before applying the JJ cointegration tests, we need to determine the lag length k in the VAR model. As we have noted, k should be high enough to ensure that the residuals are serially uncorrelated and normally distributed. However, it should not be too high as to make the estimation inefficient. By adding lags successively up to the maximum lags of 8, we note the Box-Pierce Q statistics testing up to twelfth-order serial correlation, Q(12), to be insignificant at k=2 and higher in all equations. The Jarque-Bera test for normality, however, indicates that the residuals from the regressions are normally distributed at $k = 5$ and higher, except for s_I (Indonesia) equation. For Indonesia, the problem of non-normality persists up until the maximum lags allowed. Based on these results, we contend with $k = 5$ as the most appropriate lag length.

The results from the JJ cointegration tests using $k = 5$ are reported in Table 3. They indicate that the null hypothesis of $r = 0$ can be rejected at 5% significance level by both test statistics. However, both tests can not reject the null hypothesis of $r \leq 1$. Thus, it appears that there is a unique cointegrating vector among the five ASEAN and U.S. equity markets. This contradicts the finding of no cointegration among these markets by Roca et al. (1998). Perhaps, this difference may be due to different natures of the data employed - namely, the currency used to adjust stock returns, data frequency, and sample period. While the stock returns are expressed in U.S. dollar in Roca et al. (1998), they are in Malaysian Ringgit in the present study. As we have explained, the use of the Ringgit-adjusted returns enhances the relevancy of the results for Malaysian investors. Moreover, given that our sample period is longer, we believe that the results from the present study are more convincing.[5]

Palac-McMiken (1997) documents that the Indonesian market is not linked to any other ASEAN markets in a pairwise cointegration test. Furthermore, Roca et al. (1998) note the absence of the causal nexus in Granger sense between the Indonesian market and other ASEAN markets. Accordingly, these studies indicate that the Jakarta Stock Exchange has no relevance in the ASEAN region. To evaluate the importance of the Indonesian market in the present context, we implement the JJ cointegration test

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[5] Roca et al. (1998) do not include the U.S. stock prices. It needs mentioning that, excluding the U.S. from the cointegration test, we find evidence that thhe ASEAN equity markets share a long run equilibrium relationship. Accordingly, the finding of cointegration is not due to adding the equity market of the U.S.

omitting the Indonesian market from the regression.[6] Our finding indicates no cointegration betwee the remaining five ASEAN markets - Malaysia, the Philippines, Singapore, Thailand, and the U.S. Indeed the likelihood ratio statistics testing the exclusion of the Indonesian market (Johansen and Juselius 1990), is 12.43, which is significant at even 1% level. We take these results as providing support for th important role of the Indonesian market in the cointegration space, contradicting the finding o Palac-Mc-Miken (1997). Whether the Indonesian market is important in the dynamic interactions amon the markets in the short run remains to be seen. In the next subsection, we report the results from th error-correction model focusing primarily on the dynamic interactions between ASEAN markets.

4.2 Dynamics of ASEAN Markets

In this subsection, we estimate the dynamic interactions among the five ASEAN markets by estimatin the Granger causality model incorporating the error correction term (i.e. the error correction models The results of the estimation are provided in Table 4. For each return equation, the F statistics testing th significant of the included returns of the markets appear significance at conventional levels. Thu they reaffirm the Hsiao's procedure that any variable that results in the reduction in the FPE (and, thu is included in the regression) Granger causes the dependent variable under consideration.

The results from the table indicate significant short-run interactions among ASEAN markets, where t interactions are found to be contemporaneous in most cases. In particular, the causal interactions betwe the equity prices appear to be in both directions between the following pairs of the markets: Indones and the Philippines, Malaysia and Singapore, Malaysia and Thailand, Singapore and the Philippin and Thailand and the Philippines. Among these pairs of the markets, we find the lagged effects o from Singapore to Malaysia, Singapore to Philippines, and Thailand to the Philippines. For t remaining cases, the effects are contemporaneous. Additionally, we also find the evidence suggestin unidirectional causality from Singapore to Indonesia and the Philippines to Malaysia. Scanning throu these short run interactions, an equity market in ASEAN drives and is driven by at least one ASEA market. Accordingly, there appears to be no single market that is not causally linked to other ASEA markets and that is dominant in ASEAN.

The coefficients of the error correction terms are significant in two equations - Indonesia and t Philippines. The results substantiate our early findings of cointegration among the ASEAN mark

[6] *The results of the test are not reported. They are available upon request from the author*

Among the three markets, the Indonesian equity market does the most adjustment toward the long-run equilibrium path. Namely, about 11.2% of the disequilibrium is corrected by the Indonesian equity prices the next month. The market of the Philippines corrects about 5.3% of the deviations the next month. The significant and sizeable responses of the Indonesian prices to the changes in other equity prices (i.e. Singapore and the Philippines) and to the disequilibrium may explain the high variability of the market compared to other ASEAN markets.

The results also suggest the significant role of the U.S. in the dynamic behavior of the ASEAN markets. In particular, we may observe significant contemporaneous response of the Singapore market to changes in the U.S. equity prices. Accordingly the equity market of Singapore acts as a short-run channel through which disturbances in the U.S. market affects the ASEAN markets. In the long run, disturbances in the U.S. affect the ASEAN markets through the adjustment in the markets of Indonesia and the Philippines.

In a nutshell, the results we obtain do conform to existing studies in certain respects. The evidence for cointegration is consistent with Palac-McMiken (1997) while the evidence for significant short run interactions is in line with Roca et al. (1998). However, contradicting these two studies, we find Indonesia to be integral in the ASEAN markets.

CONCLUSION

In the paper, we asses the integration among ASEAN equity markets from a Malaysian perspective using time-series techniques of cointegration and error-correction modeling. We add the U.S. market into the analysis since it is the world's dominant market. The analysis incorporates Ringgit-based exchange rate changes in the calculation of equity returns. We find evidence for cointegration among the ASEAN and U.S. markets, suggesting the long-run comovements among them. Additionally, our dynamic models indicate significant short-run, mostly contemporaneous, interactions among the ASEAN markets. The results, thus, suggest that these markets are integrated and can be treated as one whole market, which is consistent with international investors' perception of the regional markets. Additionally shocks from the U.S. market are absorbed first by the stock market of Siingapore and, then, are propagated to other markets of Indonesia and the Philippines reacts for dis-equilibrium in the long run relationship, which may arise from disturbances of the U.S. markets.

From Malaysian perspective, these findings suggest no potential benefits for Malaysian investors t diversify in ASEAN markets. Alternatively, they mean that there is no difference in terms of return between investing all funds in Malaysian equity market and allocating the funds to various ASEAN markets. The findings also provide support for the importance of policy coordination or harmonizatio among the ASEAN for achieving financial stability. Lastly, for the stability of the markets in the regior consideration needs to be given by policymakers to disturbances in the U.S.market.

Table 1: Descriptive Statistics of Equity Returns

Market	Mean	Median	Std. Dev.	Skewness	Kurtosis
Indonesia	0.0157	0.0105	0.1004	2.6039	19.9581
Malaysia	0.0118	0.0154	0.0649	-0.1555	4.3461
Philippines	0.0088	0.0082	0.0953	-0.3248	5.3799
Singapore	0.0083	0.0089	0.0531	-0.2603	5.3577
Thailand	0.0046	0.0071	0.0908	-0.2431	3.9166

Table 2: ADF and PP Unit Root Tests

Equity Prices	Levels		First Differences	
	ADF	PP	ADF	PP
Indonesia	-2.9169	-2.8115	-2.7304	-8.2986*
Malaysia	-2.7288	-2.6321	-2.9436	-11.644*
Philippines	-1.9907	-2.2185	-3.3829***	-9.8789*
Singapore	-1.9681	-2.1047	-4.2321*	-9.6996*
Thailand	-0.1381	-0.8137	-3.7440**	-9.2922*

Note: the tests include a time trend. *, **, and *** denote significance at 1%, 5%, and 10% leve respectively.

Table 3: Johansen-Juselius Cointegration Tests

Null Hypothesis	Test Statistics		10% Critical Values	
	Trace	Eigenvalue	Trace	Eigenvalue
r=0	71.717	32.393	66.0	30.8
r≤1	39.324	20.093	45.2	24.9
r≤2	19.232	13.703	28.4	19.0
r≤3	5.528	5.390	15.6	12.8
r≤4	0.138	0.138	6.7	6.7

Note: Critical values are from Johansen and Juselius (1990), Table A2.

Table 4: Error-Correction Model and Causality Results

Coefficients	Equation Δs_I	Δs_M	Δs_P	Δs_S	Δs_T
ε_{t-1}	0.1477^{*} (3.102)	-0.0064 (0.3047)	-0.0785^{**} (2.0820)	0.0276^{***} (1.769)	0.0051 (0.1512)
Δs_I	0.0699 (0.5653) [1]	—	0.1556^{**} (4.1624) [0]	—	—
Δs_M	—	-0.0596 (1.4541) [3]	—	0.5052^{*} (81.831) [0]	0.6790^{**} (3.9217) [0]
Δs_P	0.2841^{**} (6.1868) [0]	0.0819 (2.6216) [0]	—	0.1517^{*} (15.774) [0]	0.2226^{*} (32.618) [0]
Δs_S	0.8037^{**} (2.7121) [2]	0.6374^{*} (17.051) [2]	1.0643^{*} (13.862) [1]	—	—
Δs_T	—	0.1661^{*} (9.8142) [0]	0.1034^{**} (3.327) [1]	—	0.1391^{*} (7.511) [1]
Constant	0.0025 (0.2940)	0.0059 (1.530)	-0.0009 (0.1266)	0.0005 (0.1565)	-0.0081 (1.250)
Adjusted-R^2	0.2407	0.6667	0.4445	0.6449	0.4388

Note: numbers in parentheses under the error correction coefficients and the constant terms ar t-statistics. Meanwhile, the numbers in parentheses for other coefficients are Granger-F statistics. Th numbers in squared brackets are the lag lengths. The lag length of zero means that only con temporaneous returns are included.

*, **, and *** denote significance at 1%, 5% and 10% respectively.

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