STOCK PRICE AND EXCHANGE RATE CAUSALITY: THE CASE OF FOUR ASEAN COUNTRIES

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ABSTRACT

The purpose of this study is to investigate the statistical relationship between stock prices and exchange rates using Granger causality and Johansen cointegration tests in four ASEAN countries (Indonesia, the Philippines, Singapore, and Thailand) over the period 1993–2002. Exchange rates and stock prices of four ASEAN countries will be examined. This study analyses these causal relationships using percentage changes. Using the Granger test for determining unidirectional causality, this study finds that the relationship between stock prices and exchange rates is characterized by a feedback system, with the Singapore dollar as the dominant exchange rate. The Johansen cointegration test finds that all of the stock prices and exchange rates in the four countries are cointegrated. With respect to the relationship between stock prices and exchange rates, the results are not as conclusive but causality is from exchange rates to stock prices.

INTRODUCTION

The current literature in financial economics offers differing opinions about the relationship between stock prices and exchange rates. Economic theory suggests that there should be a causal relationship between stock prices and exchange rates (Caporale, Pittis, and Spagnolo, 2002). However, there is no consensus on the nature of this relationship. The theoretical and empirical relationship between stock prices and exchange rates has been debated for many years. Although scholars and practitioners have studied the subject extensively, the effects of monetary developments on stock markets are not completely understood. It has been argued that a change in stock prices could change exchange rates or a change in exchange rates could change stock prices. This argument is based on the notion that variations in exchange rates alter firm's profits.

According to the portfolio approach to exchange rate determination, one should expect the stock market to lead the exchange rate with negative correlation (Caporale, Pittis, and Spagnolo, 2002). A decrease in stock prices reduces domestic wealth, which leads to lower domestic money demand and interest rates. The reason is that agents are assumed to allocate their wealth among alternative assets. When domestic wealth decreases, capital flows out of the country and a depreciation of the currency is necessary balance supply and demand of financial assets. From the point of view of foreign investors, the decrease in domestic stock prices leads to lower speculative demand for domestic assets, lower demand for domestic currency, and a depreciation of the exchange rate.

Aggarwal (1981) shows that there is positive effect of exchange rate changes on the stock market while Solnik (1984) concludes that exchange rate changes have no significant impact on the stock market. Fluctuations in exchange rates can substantially affect the values of firms, through the changes in the terms of competition, the changes in the input prices, and the changes in the values of foreign currency-denominated assets, Bodnar and Gentry (1993). Firms' stock prices and the stock market may both react to changes in the exchange rates. This implies that the direction of causality runs from exchange rates to stock prices.

Recently, more studies examine interactions between stock prices and exchange rates using the concept of Granger causality and cointegration techniques. For example, Abdalla and Murinde (1997) conclude that there is unidirectional causality in the case of four emerging markets: India, Korea, Pakistan, and the Philippines. Engle and Granger (1987) argue that daily data are more adequate for capturing the effects of capital movements, and that it is more appropriate to estimate unit root and cointegration models with breaks as well as computing the impulse response functions.

This study contributes to the relationship between stock prices and exchange rates in four ASEAN countries: Indonesia, the Philippines, Singapore, and Thailand using causality and cointegration testing procedures. This study examines the statistical relationship between stock prices and exchange rates in the four ASEAN countries from 1993 to 2002. Using Granger's causality test this study examines the relationship whether the stock price changes cause exchange rate changes or the reverse. Johansen's test will determine whether the relationship between stock price changes and exchange rate changes is in the short-run or the long-run. This paper is organized as follows. The following section describes the purpose of this study. Section 3 will provide a literature review. Section 4 describes the data, analysis, and

LITERATURE REVIEW

A few recent empirical studies that have used Granger-type causality tests have been particularly supportive of a positive causal relation running from exchange rates to stock prices. Bodnar and Gentry (1993) highlighted three effects of exchange rate fluctuations on the firm's value or cash flows. These include the effect of exchange rates on domestic exporters' terms of competition with foreign firms, on input prices, and on the firm's assets that are denominated in foreign currencies.

There are reasons to believe that exchange rates might lead stock prices, possibly with a positive correlation. For example, at a micro level, Jorion (1990) shows that a currency appreciation might decrease stock prices by reducing firms' profits. The response of stock prices to fluctuations is exchange rates might depend on their degree of exposure to exchange rate risk, although is not always indicative of a strong link (Bodnar and Gentry, 1993). Aggarwal (1981) argues that a change in exchange rates could change stock prices because variations in exchange rates alter firms' profits (not only for multinational and export oriented firms, but for domestic firms as well) and this in turn affects stock prices. This result implies that the direction of causality runs from exchange rates to stock prices.

Alternatively, stock prices may affect the exchange rates through money demand. Ajayi, *et al.* (1998) show that changes in stock prices lead to increases in the demand for real money and, subsequently, the value of the domestic currency. Stock prices may be employed to reflect developments in macroeconomic variables, as the market's expectations of real economic activities. Therefore, changes in stock prices can have an effect on the exchange rates, Solnik (1984). Bahmani-Oskooee and Sohrabian (1992) find bi-directional causality in the case of the United States. They find that the effect of stock prices on exchange rates and interest rates is through an increase in the real money balance.

On the other hand, an exogenous increase in domestic stock prices will lead to an increase in domestic wealth and this, in turn, will result in an increase in the demand for money and an increase in interest rates. Higher interest rates will cause capital inflows, resulting in an appreciation of the domestic currency, Krueger (1983). The causal relationship between stock prices and exchange rates could be from stock prices to exchange rates. Some research suggests that a change in the money supply upsets the equilibrium position of money with respect to other assets in the portfolios of individual investors. As investors attempt to rearrange their portfolios of financial and real assets to a new equilibrium, stock prices adjust to new levels. There is considerable research that supports the view that the stock market is a leading barometer of economic activity. Sustained upward movements in stock prices are generally indicative of economic upturns, which stimulate money growth as banks respond to increasing demand for more loans. Increasing demand for money will lead to an increase in interest rates. High interest rates will cause capital inflows and appreciation of the domestic currency. In other words, changes in stock prices may affect the inflows and outflows of capital, which will lead to changes in the domestic currency exchange rate.

This paper analyses causality links among stock prices and exchange rates in four ASEAN countries: Indonesia, the Philippines, Singapore, and Thailand. This study uses weekly data for four countries over the period 1/1/1993 – 31/12/2002 for a total of 522 observations for each country. The series were all obtained from *Datastream*. The exchange rates are the local currencies exchange rates relative to the US dollar and stock prices are measured using indices for the local stock exchange. Specifically, they are the Jakarta Composite Index (JCI) for Indonesia, the Strait Time Index (STI) for Singapore, the SET Composite Index (SCI) for Thailand, and the Manila Composite Index (MCI) for the Philippines. The local currencies are the Rupiah for Indonesia, the Baht for Bangkok, the Peso for the Philippines, and the dollar for Singapore.

We use the Engel-Granger causality test, the Johansen cointegration test, Vector Autoregression (VAR), Impulse Response, and Vector Error Correction Model to perform the analysis in this study. Before conducting these analyses, the stationarity of the data will be examined with unit root tests. All the variables in the data set are transformed into percentage changes. The data analysis will be based on the percentage changes (return data).

THE UNIT ROOT TEST

The preliminary step in the analysis is to establish the degree of integration of each variable. This study tests for the existence of a unit root in the level and the percentage changes for each variable. A data series is said to be stationary if the mean and covariances of the series do not depend on time. Any series that is not stationary is said to be nonstationary. The canonical example of a nonstationary series is the random walk: $y_t = y_{t-1} + \varepsilon_t$, where ε is a stationary random disturbance term. The series y has a constant forecast value, conditional on t, and the variance is increasing over time. The random walk is a difference stationary series since the difference of y is stationary: $y_t - y_{t-1} = (1 – L)y_t = \varepsilon_t$.

A difference stationary series is said to be integrated and is denoted as I(*d*), where *d* is the order of integration (differences). The order of integration is the number of unit roots contained in the series, or the number of differencing operations it takes to make the series stationary. A random walk has one unit root, so it is an I(1) series and a stationary series is I(0). The formal method to test the stationarity of series is the unit root test. This study uses the Augmented Dickey-Fuller procedure, Dickey and Fuller (1981) and Campbell and Peron (1991), to examine the stationary of the time series.

Table 1 presents the unit root tests for percentage changes for the exchange rates and stock price indexes for Indonesia, Thailand, the Philippines, and Singapore. The left-hand-side of the table presents the test statistics for the level of the data series and the right-hand-side presents the test statistics for their first differences of the data. As may be noted from left-hand-side, using the 5% significance level, the null hypothesis of unit roots cannot be rejected in the original data (levels). While the hypothesis of non-stationarity can be rejected for the percentage change data (rates of return data) in all variables for all countries at 1% significance level.

TABLE 1
UNIT ROOT TESTS
STOCK EXCHANGE RETURNS AND FOREIGN EXCHANGE RATE CHANGES

	ADF for Levels		**ADF First Differences**	
Variable	**Original**	**Return**	**Original**	**Return**
Indonesia				
Exchange Rate	-1.414	-9.329**	-16.908**	-20.986**
Stock Index	-2.684	-7.593**	-14.179**	-16.039**
Thailand				
Exchange Rate	-0.899	-8.916**	-14.651**	-17.002**
Stock Index	-0.707	-9.578**	-14.342**	-16.880**
Philippines				
Exchange Rate	0.087	-9.902**	-17.292**	-15.834**
Stock Index	-1.232	-9.193**	-14.460**	-15.640**
Singapore				
Exchange Rate	-0.899	-8.479**	-14.800**	-15.597**
Stock Index	-2.502	-9.792**	-15.721**	-17.296**

* denotes significance at the 5% level
** denotes significance at the 1% level
ADF – Augmented Dickey-Fuller Test Statistics

The right-hand-side of Table 1 shows that the test statistics for the hypothesis of non-stationarity of the first differences of the three types of data series can be rejected in all cases for all countries at the 1% significance level. These results indicate that all of the data are stationary in first differences. The results consistently suggest that the variables are integrated of order 1, or I(1). Subsequently, we analyse the data in return form for the other tests, Granger causality, Johansen cointegration, VAR, and the ECM.

THE JOHANSEN COINTEGRATION TESTS

Engle and Granger (1987) show that a linear combination of two or more non-stationary series may be stationary. If such a stationary, or I(0), linear combination exists, the two non-stationary time series are said to be co-integrated. The stationary linear combination is called the co-integrating equation and may be interpreted as a long run equilibrium relationship between the two variables. In this study, stock prices and exchange rates are likely to be cointegrated in the first difference. Miller (1991) and Miller and Russek (1990) note that if two variables are

TABLE 2
TEST FOR COINTEGRATION BETWEEN THE EXCHANGE RATES AND THE STOCK INDEXES USING THE JOHANSEN'S PROCEDURE FOR THE LOGARITHM AND THE PERCENTAGE CHANGE DATA

Country/Variable	Eigenvalue	Likelihood Ratio
Indonesia:		
Rupiah – JCI	0.150813	140**
Rupiah – SCI	0.164040	171**
Rupiah – MCI	0.151026	163**
Rupiah – STI	0.179205	172**
Thailand:		
Baht – SCI	0.159486	164**
Baht – JCI	0.135482	130**
Baht – MCI	0.154095	155**
Baht – STI	0.160485	163**
Philippines:		
Peso – MCI	0.177611	178**
Peso – JCI	0.170345	153**
Peso – SCI	0.201304	200**
Peso – STI	0.168255	183**
Singapore:		
Dollar Sing – STI	0.159266	156**
Dollar Sing – JCI	0.125639	123**
Dollar Sing – SCI	0.165011	160**
Dollar Sing – MCI	0.155636	157**

* denotes rejection of the hypothesis at 5% significance level
** denotes rejection of the hypothesis at 1% significance level

JCI - Jakarta Composite Index for Indonesia
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cointegrated, then there must exist temporal causality in the Granger sense between them in at least one direction. This indicates two important forces or channels that might cause changes in the variables. One channel indicates the response of one variable due to the changes in the other variable, which is viewed as the short-run interactions between them. The other channel indicates the adjustment taken by the variables to correct any deviations from an equilibrium path, Ibrahim (2000).

The residual-based test of Engle-Granger is a two-step procedure involving (a) an OLS estimation of a pre-specified cointegrating regression and (b) a unit root test of the residuals saved from the first step. The null hypothesis of no cointegration is rejected if it is found that the residuals are non-stationary. The Johansen procedure of the cointegration test is based on the maximum likelihood estimation of the VAR model. Based on the estimation, two statistics, the trace and maximal Eigenvalue, are calculated to test for the presence of "r" cointegrating vectors. The trace statistics test the null hypothesis that there are at most "r" or more cointegrating vectors. Meanwhile, the maximal Eigenvalue statistic test for "r" cointegrating vectors against the alternative of (r+1) cointegrating vectors.

Table 2 presents the results of the cointegration tests for the return data. Based on the return data, all cointegration statistics between exchange rates and composite stock indexes are statistically significant at 1% significance level. These results indicate that in the long-run there is cointegration between all of the exchange rates and all of the stock prices in the ASEAN countries.

THE ENGEL-GRANGER CASUALITY TEST

This study uses the Engle-Granger causality test to analyse the relationship between stock prices and exchange rates. Engle and Granger (1987) show that when time series are characterized by non-stationarity, cointegration is a particularly appropriate statistical technique. In the case where two series are co-integrated, I(1), a Vector Autoregressive (VAR) model can be constructed in terms of the levels of the data or in terms of their first differences with the addition of an error correction term to capture the short-term dynamics and to reduce the possibility of identifying spurious causality. The Granger causality test assumes that the information relevant to the prediction of the respective variables, stock prices and exchange rates, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions:

$$Y_t = \alpha_o + \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{i=1}^{m} b_i X_{t-i} + \varepsilon_t \qquad (1)$$

$$X_t = \gamma_o + \sum_{i=1}^{m} \beta_i X_{t-i} + \sum_{i=1}^{m} d_i Y_{t-i} + \mu_t \qquad (2)$$

where Y are the stock prices measured as the natural logarithm of the stock index or the natural logarithm of the stock return wealth relative where the stock return for period t is $\{(P_t - P_{t-1})/P_{t-1}\}$, P_t is the stock price for period t and P_{t-1} is the stock price for period t-1. Variable X is the exchange rate measured as the natural logarithm of the exchange rate or the natural logarithm of the change in the exchange rate where exchange rate change for period t is $\{(Ex_t - Ex_{t-1})/Ex_{t-1}\}$, Ex_t is the exchange rate for period t and Ex_{t-1} is the exchange rate for period t-1, while ε_t and μ_t are zero-mean, serially uncorrelated random error terms.

The hypothesis that changes in exchange rates cause changes in stock prices implies that the null hypothesis of $\sum_{i=1}^{m} b_i = 0$ should be rejected by the calculated F-value when X is excluded in the restricted form of Equation (1). If there is bi-directional causality then $\sum_{i=1}^{m} b_i \neq 0$ and $\sum_{i=1}^{m} d_i \neq 0$. To implement the Granger causality test, F-statistics values are calculated under the null hypothesis that in Equation (1) and Equation (2) all the coefficients of b_i and d_i equal 0. Because the results from the Granger causality test are sensitive to the selection of the lag length, results are presented from equations using the minimum final prediction error (FPE) criterion suggested by Akaike (1969) to determine the appropriate lag length. The present study uses optimal lags for each variable. The F-value is calculated as:

$$\mathbf{F_{(m,\, n-2m-1)} = \frac{(ESS_R - ESS_U)/m}{ESS_U \,/\, (n-2m-1)} = \frac{Mean\ Square\ Error}{Mean\ Square\ Regression}} \quad \mathbf{(3)}$$

Where ESS_R and ESS_U are the sum of squared residuals for the constrained and unconstrained causality regressions respectively, *n* is the total number of observations and *m* is the number of lags per variable.

Table 3 presents the Granger Causality test results based on the return data for all four countries. Each exchange rate is paired with each country's stock index. For example, the Rupiah/US$ rates is paired with the Jakarta Composite Index (JCI), the Set Composite Index (SCI), the Manila Composite Index (MCI), and the Strait Time Index (STI), respectively. From the test results, four alternative patterns of causality may be observed: (a) unidirectional causality from exchange rates to stock prices, (b) unidirectional causality stock index to exchange rates, (c) bi-directional causality, and (d) no causality.

Table 3 shows that there is bi-directional causality between the Rupiah/US$ rates and the JCI for the return data. For the other pairs of variables, there is unidirectional causality between the Rupiah/US$ rates and the three other countries' Composite Indexes for the return data. For instance, the SCI Granger Causes the Rupiah/US$ rates, the Rupiah/US$ rates Granger Cause the MCI, and the Rupiah/US$ rates Granger Causes the STI. For the Thailand-Baht exchange rate, there is no bi-directional Granger Causality between the Baht/US$ rate and stock index of the three other countries. There is unidirectional Granger Causality between the SCI and the Baht/US$ rates; the Baht/US$ rates and the JCI. While, there is no bi-directional Granger Causality between the Peso exchange rates and the JCI and the SCI. The Singapore Dollardoes not exhibit bi-directional Granger Causality. There is unidirectional Granger Causality between the Singapore dollar and the STI, the JCI, and the MCI.

TABLE 3
ENGEL-GRANGER CAUSALITY TESTS FOR THE PERCENTAGE CHANGE DATA

Country/Variable	F-Statistic	Country/Variable	F-Statistic
Indonesia:		**Thailand:**	
Rupiah – JCI	18.0055**	Baht – SCI	1.48745
JCI – Rupiah	5.39041**	SCI – Baht	4.73841**
Rupiah – SCI	1.57474	Baht – JCI	0.98901
SCI – Rupiah	7.81257**	JCI – Baht	9.36479**
Rupiah – MCI	4.46044**	Baht – MCI	2.82924
MCI – Rupiah	1.43057	MCI – Baht	1.91690
Rupiah – STI	11.6986**	Baht – STI	1.78041
STI – Rupiah	0.92964	STI – Baht	0.70147

Country/Variable	F-Statistic	Country/Variable	F-Statistic
Philippines:		**Singapore:**	
Peso – MCI	1.13612	$ Sing – STI	10.4462**
MCI – Peso	2.27157	STI – $ Sing	0.88625
Peso – JCI	6.62168**	$ Sing – JCI	8.31857**
JCI – Peso	2.02289	JCI – $ Sing	0.38779
Peso – SCI	2.38960	$ Sing – SCI	2.85951
SCI – Peso	4.39210*	SCI - $ Sing	2.46798
Peso – STI	1.02600	$ Sing – MCI	9.08701**
STI – Peso	0.93643	MCI - $ Sing	4.11755*

* denotes significance at the 5% level
** denotes significance at the 1% level

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MCI - Manila Composite Index for the Philippines

VECTOR AUTOREGRESSION (VAR)

The vector autoregression (VAR) is used to forecast systems of interrelated time series and for analysing the dynamic impact of random disturbances on the system of variables. The VAR approach need for structural modelling by modelling every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The mathematical form of a VAR is

$$\mathbf{Y_t = A_t\, Y_{t-i} + \ldots + A_p\, Y_{t-p} + BX_t + \varepsilon_t} \qquad \textbf{(4)}$$

where Y_t is a k vector of endogenous variables, X_t is a d vector of exogenous variables, $A_{1,\ \ldots,}$ A_p and B are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated with each other but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

TABLE 4
VECTOR AUTO-REGRESSION ESTIMATES FOR THE PERCENTAGE CHANGE DATA

	Percentage Change Data			
Variable	RJCI	RSCI	RMCI	RSTI
LJCI(-1)	-0.1294**	-0.0895*	0.0147	0.0152
LJCI(-2)	0.0479	0.0004	0.0791	0.0746*
LSCI(-1)	0.0653	-0.0381	0.1174	0.0379
LSCI(-2)	0.0460	0.0984*	0.1342*	0.0653*
LMCI(-1)	0.0878*	0.0824*	0.1085*	0.0270
LMCI(-2)	0.0550	0.0517	-0.0558	-0.0660*
LSTI(-1)	0.0158	0.2805**	0.3282**	0.0684
LSTI(-2)	0.0252	-0.0132	0.2434**	0.0222
LRUPIAH	-0.1040*	-0.0776	0.0800	0.0786
LBAHT	-0.0697	-0.1191	-0.0637	0.0293
LPESO	-0.0520	-0.0287	-0.9505**	-0.1382*
L$SING	-0.0203	-0.0302	0.0476	-0.0378*

* denotes significance at the 5% level
** denotes significance at the 1% level
JCI - Jakarta Composite Index for Indonesia
STI - Strait Time Index for Singapore
SCI - SET Composite Index for Thailand
MCI - Manila Composite Index for the Philippines
L – indicates lagged values
R – indicates return data

Since only lagged values of the endogenous variables appear on the right-hand side of each equation, there is no issue of simultaneity, and OLS is the appropriate estimation technique. Note that the assumption that the disturbances are not serially correlated is not restrictive because any serial correlation could be absorbed by adding more lagged Y's. Suppose that stock prices (STOCK) and exchange rates (EXCH) are jointly determined by a two variable VAR and let a constant be the only exogenous variable. With two lagged values of the endogenous variables, the VAR is:

$$\mathbf{STOCK_t = a_{11}\, STOCK_{t-1} + a_{12}\, EXCH_{t-1} + b_{11}\, STOCK_{t-2} + b_{12}\, EXCH_{t-2} + c_1 + \varepsilon_{1,t}} \quad \mathbf{(5)}$$
$$\mathbf{EXCH_t = a_{21}\, STOCK_{t-1} + a_{22}\, EXCH_{t-1} + b_{21}\, STOCK_{t-2} + b_{22}\, EXCH_{t-2} + c_2 + \varepsilon_{2,t}} \quad \mathbf{(6)}$$

where a, b, c are the parameters to be estimated.

Table 4 presents the estimation results of the Vector Autoregression (VAR) for the return data for all countries. All the stock indexes are explained by that index and/or combinations of the other stock composite indexes. The Jakarta Composite Index is significantly explained by its own lag 1, by the MCI lag 1 and the lag Rupiah. The Bangkok Composite Index is significantly explained by its own lag 1, by the SCI lag 2, by the MCI lag 1, and by the STI lag 1 and lag 2 and the lag Peso. The Manila Composite Index is significantly explained by all of the others countries index except the Jakarta Composite Index. The Strait Time Index is explained by the JSI lag 2, the SCI lag 2, the MCI lag 2 , and the lag Peso and the lag Singapore dollar.

THE VECTOR ERROR CORRECTION MODEL

A vector error correction (VEC) model is a restricted VAR that has cointegration restrictions built into the specification, so that it is designed for use with nonstationary series that are known to be cointegrated. The VEC specification restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short-run dynamics. The cointegration term is known as the error correction term since the deviation from the long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

As a simple example, consider a two variable system with one cointegrating equation and no lagged difference terms. The cointegrating equation is $Y_{2t} = BY_{1,t}$ and the VEC is:

$$\Delta Y_{1,t} = \gamma_1(Y_{2,t-1} - BY_{1,t-1}) + \varepsilon_{1,t} \quad (7)$$

$$\Delta Y_{2,t} = \gamma_2(Y_{2,t-1} - BY_{1,t-1}) + \varepsilon_{2,t} \quad (8)$$

In this simple model, the only right-hand side variable is the error correction term. In long run equilibrium, this term is zero. However, if Y_1 and Y_2 deviated from the long run equilibrium last period, the error correction term is non-zero and each variable adjusts to partially restore the equilibrium relation. The coefficients γ_1 and γ_2 measure the speed of adjustment.

In this VEC model, the two endogenous variables $Y_{1,t}$ and $Y_{2,t}$ will have non-zero means but the cointegrating equation will have a zero intercept. Given a group of non-stationary series, we may be interested in determining whether the stock prices and exchange rates series are cointegrated, and if they are, in identifying the cointegrating (long-run equilibrium) relationships. This study implements VAR-based cointegration tests using the methodology developed by Johansen (1991, 1995). Johansen's method is to test the restrictions imposed by cointegration on the unrestricted VAR involving the series.

The results for the two cointegration equations above are given in Table 5. This table presents error correction coefficients on percentage changes data. Table 5 shows that most of the cointegration between exchange rates and stock price indexes is not significantly corrected by reduction in exchange rate returns. The cointegration equations is significant for the MCI and the STI but not for the JCI or the SCI. The cointegration between the Peso/US$ and the Manila Composite Index is corrected by the Peso/US$ return for about 92 percent. The cointegration between the Peso/US$ and the Strait Time Index is corrected by the Peso/US$ return about five percent. There is no statistically significant correction for the cointegration between the remaining markets for exchange rates.

TABLE 5
VECTOR ERROR CORRECTION ANALYSIS RESULTS
PERCENTAGE CHANGE DATA

Error Correction	D(LJCI)	D(LSCI)	D(LMCI)	D(LSTI)
CointEq1	-0.004447	0.000242	-0.044712**	0.010396**
RRUPIAH	-0.076257	-0.060392	0.097684	0.087777
RBAHT	0.000222	-0.045782	0.007761	0.074506
RPESO	-0.003030	0.045030	-0.917704**	-0.093501
R$SING	-0.020207	-0.026756	0.028354	-0.053046**

* denotes significance at the 5% level
** denotes significance at the 1% level
JCI - Jakarta Composite Index for Indonesia
STI - Strait Time Index for Singapore
SCI - SET Composite Index for Thailand
MCI - Manila Composite Index for the Philippines
R – percentage changes

CONCLUSIONS AND IMPLICATIONS

This study uses cointegration and Granger's causality tests to investigate the empirical relationship between stock prices and exchange rates in four ASEAN countries: Indonesia, Singapore, Thailand, and the Philippines. The major result of this study is that unidirectional causality is present in regression models which relate exchange rates to stock prices or stock prices to exchange rates. Bi-directional causality is present in Thailand and Singapore. Even during a time period with a significant financial crisis, these markets still moved together.

The results from the bivariate model which uses the Johansen's procedures to test for cointegration indicate that for the percentage change data there is evidence for cointegration between stock market index and exchange rates for all countries. Results from VAR analysis indicates that each stock market index is explained by the other stock market indexes. These results indicate that there is cointegration among the stock markets in all four countries. Additionally, based on the percentage change data there is cointegration between the stock prices and the exchange rates. Finally, the error correction coefficients indicate that the stock prices and the exchanges rates do not adjust to correct for deviations from long-run relationships, except the Singapore dollar correction for the Straits Times Index and Rupiah correction for the Jakarta Composite Index.

The results of this study, thus, suggest the important role that might be played by the exchange rates and the stock prices in the ASEAN countries economy in the long-run. The movements in the exchange rates and stock prices reflect international trade, specifically in the ASEAN area. The bi-directional Granger-causality between the exchange rates and the stock prices in the certain country indicate that the economic growth in this country influenced by these variables. While, the bi-directional causality between two countries indicate that there is bilateral economy relationship closely.

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