

The Granger Causality Tests for the Five ASEAN Countries' Stock Markets and Macroeconomic Variables During and Post the 1997 Asian Financial Crisis

Adwin Surja Atmadja

Lecturer of Faculty Economic, Petra Christian University

Email: aplin@petra.ac.id

ABSTRACT

This study seeks to examine the existence of Granger-causality among stock prices indices and macroeconomic variables in five ASEAN countries, Indonesia; Malaysia; the Philippines; Singapore; and Thailand with particular attention to the 1997 Asian financial crisis and period onwards. Using monthly time series data of the countries, a Granger-causality test based on the vector autoregressive (VAR) analytical framework was employed to empirically reveal the causality among the variables. This research finds that there were few Granger causalities found between the country's stock price index and macroeconomic variables. This indicates that the linkages between domestic stock price movements and macroeconomic factors were very weak. Due to that, the ASEAN stock markets were relatively unable to efficiently capture changes in economic fundamentals during the observation period in most of the countries in accordance to the literature in emerging stock markets, and that the influence of specific macroeconomic factors on the domestic economies differ across countries. This also implies that the stock markets do not seem to have played a significant role in most countries' economies, and macroeconomic variables are unlikely to be appropriate indicators to predict not only the future behaviour of other macroeconomic variables, but also that of the stock market price indices.

Keywords: Granger-causality, Asian financial crisis, stock markets, macroeconomic variable, VAR.

ABSTRAK

Makalah ini mencoba untuk menganalisis keberadaan Granger-causality antara indeks harga saham dan variabel-variabel ekonomi makro di lima negara ASEAN, yaitu Indonesia; Malaysia; Filipina; Singapore; dan Thailand yang berfokus pada periode terjadinya krisis keuangan Asia pada tahun 1997 dan sesudahnya. Dengan mempergunakan data time series bulanan dari setiap negara tersebut, tes Granger-causality yang didasarkan pada kerangka analisa VAR (vector autoregressive) diaplikasikan untuk mengungkap secara empiris hubungan kausal antar variabel. Dari hasil tes diketahui bahwa hanya terdapat sejumlah kecil Granger-causality antara indeks harga saham dan variabel-variabel ekonomi makro. Hal ini mengindikasikan sangat lemahnya kaitan antara pergerakan indeks harga saham di dalam negeri dengan variabel-variabel ekonomi makro dikarenakan bahwa pasar modal di negara-negara ASEAN relatif tidak mampu secara efisien menangkap informasi perubahan besaran-besaran ekonomi makro

domestik. Dan, bahwa pengaruh dari variabel-variabel ekonomi makro tertentu dalam perekonomian domestik ternyata berbeda di tiap negara. Hal tersebut mengimplikasikan bahwa bursa saham ASEAN nampaknya tidak berperan penting dalam perekonomian domestik, dan bahwa variabel-variabel ekonomi makro negara-negara tersebut nampaknya tidak dapat dipakai sebagai indikator yang baik untuk memprediksikan bukan saja terhadap perilaku variabel-variabel ekonomi makro lainnya, tetapi juga perilaku indeks harga saham di masa yang akan datang.

Kata kunci: *Granger-causality, krisis keuangan Asia, bursa saham, variable ekonomi makro, VAR.*

INTRODUCTION

Liberalization of the five ASEAN (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) financial markets in the 1980s resulted in enormous capital inflows to this region. The countries' financial markets were overwhelmed by foreign capital in both foreign direct and portfolio investments, which gave significant support to their rapid domestic economic development. At that time the five ASEAN countries enjoyed high economic growth as well as rapid financial and capital markets expansion. However, this liberalization was not supported by appropriate regulations and adequately supervised financial systems. Moreover, this was worsened by fixed or pegged exchange rate regime that, in fact, caused domestic currency overvalues. Consequently, the competitiveness of the countries' exported commodities deteriorated leaving deficits in their current accounts.

Triggered by the sharp depreciation of the Thai baht in the middle of 1997, as a result of sudden capital outflows, Thailand fell into foreign currency crisis. The foreign currency crisis then turned into financial crisis, and rapidly spread out to its neighbouring countries starting from the Philippines, Malaysia, and Indonesia, which have similar economic characteristics, before extensively affecting the world financial and capital markets through its contagion effects.

The 1997 Asian financial crisis hit not only the ASEAN financial and capital markets, but also their macroeconomic fundamentals. The countries' exchange rates sharply depreciated; economic growth dramatically dropped; inflation rates and interest rates rocketed; and regional stock markets were in recession for a quite long period.

However, the year of 1999 became the turning point for the economies from the crisis. Initiated by the appreciation of regional currencies, the regional capital and financial markets started to recover. The appreciation of the countries' exchange rates also led to economic recovery. The ASEAN economies started to grow following the decreases in inflation and interest rates.

From the facts above, it seems that the crisis began in one country and then spread out to others through financial and capital markets, and eventually affected the countries' macroeconomic variables. This pattern indicates that there may be a causality relationship between capital market and macroeconomic variables within a

country. Hence, this study will empirically examine the Granger-causalities among stock markets and macroeconomic factors in the five ASEAN countries during and after the crisis period.

Literature Review

The Mundell-Fleming and Dornbush Sticky-Price Models

The Mundell-Fleming model provides the simple explanation of the linkage between the financial system and macroeconomic factors. The general equilibrium of Mundell-Fleming model links the internal and external balances of an economy. The major contribution of this model is to incorporate international capital movements into a formal macroeconomic model based on the Keynesian IS-LM framework.

Considering the limitations of Mundell-Fleming model, monetarists developed some alternative approaches to explaining the linkage of the financial system to economic factors. The famous approach is the Dornbush Sticky-Price model. This model assumes that uncovered interest parity holds and that domestic prices are sticky in the short run (Pilbeam, 1998:168). According to this model, a monetary expansion, such as an increase in the domestic money supply, without immediate response in the real sector (i.e. increase in domestic prices), will create an excess money supply, and then decrease the domestic interest rate in the short run. The decline in the interest rate will cause the domestic currency to jump-depreciate immediately, overshooting its long run equilibrium, since foreign exchange speculators expect an appreciation of domestic currency to compensate for the lower interest rate. However, as the domestic prices gradually increase and arrive at their new long run equilibrium, the interest rate will rise back to its previous level and the domestic currency will be at its long run equilibrium.

Exchange Rate and Interest Rate.

To give a more specific explanation of how interest rates affect exchange rate, the International Fisher Effect is presented. The International Fisher Effect states that currencies with low interest rates are expected to appreciate relative to those with high interest rates (Shapiro, 2004:214). Empirical tests lend some support to the relationship postulated by the International Fisher Effect, although considerable short-run deviations occur.

Exchange Rate and Inflation

The relative version of the Purchasing Power Parity (PPP) specifically explains the relationship between exchange rate and inflation. However, if there are deviations from the PPP, changes in nominal exchange rates cause changes in the real exchange rates, affecting the international competitive positions of countries (Eun and Resnick, 2004:108).

In the case of the Asian Financial crisis, a depreciation of the domestic currency caused a higher inflation rate, since it raised the price of imported goods. Thus, when

most of the ASEAN countries' currencies were sharply depreciated, the rate of inflation in those countries dramatically rose.

Growth and Exchange Rate

As Eun et al. (2004:109) mention, if the exchange rate of a country's currency is undervalued, this will raise the competitiveness of and then demand for the country's exported goods in international markets. It then will stimulate higher domestic production of the goods in the country in order to meet their higher export demand. Furthermore, assuming that the production capacity of the country has not been fully employed, this will increase the production of goods in the country leading to an increase in its economic growth rate.

Growth and Inflation

Inflation may have a negative impact on economic growth through the investment channel. Increase in inflation or expected inflation will increase the domestic nominal interest rate and reduce the attractiveness of new investment projects that do not generate high enough returns. Thus, high inflation will increase the uncertainty about the future returns from investments (Taylor and Moosa 1998:262). Moreover, Chatrath, Ramchander and Song (1997: 444) note that, in the case of India, increases in the growth rate have led to the decline in inflation rate rather than vice versa.

The Relationship between Stock Markets and Macroeconomic Factors

In his influential paper, Fama (1981:563) reveals that common share returns are correlated with some macroeconomic factors of a country, such as money supply, inflation, interest rate, and capital expenditure. The most important of these findings is that macroeconomic factors' movements can be used to predict the movement in stock returns.

The types of relationships between stock market returns and macroeconomic factors can be varied. As Mahdavi and Sohrabian (1991:45) report, there was an asymmetric causal relationship between those variables when they explored the relationship between stock prices index growth and GDP growth in the U.S using Granger-causality tests. The stock index growth rate caused GDP growth rate, yet no reverse causation was found. Chen (1991), however, documents that the current and future economic growth could be revealed by several domestic variables, such as the market dividend-price ratio, short run interest rates, the lagged production growth rate, the term premium, and the default premium.

Furthermore, Rousseau and Wachtel (2000:1955) reveal that equity markets have been key institutions in promoting economic activity in 47 countries. However, it is worth noting that this finding may be different in countries with less financially developed or smaller market capitalization (Minier, 2003; 1601).

Mauro (2003:129) suggests that developments in stock prices should be taken into account in forecasting output. However, it should also be considered that the relationship between stock returns and economic growth has not been stable over time (Stock and Watson 1990, 1998). For example, Cheng (1995:140) argues that a number of systematic economic factors significantly influenced the U.K security returns. Meanwhile, this result contradicts with that of Poon and Taylor (1991:631-3) who observe an interrelationship between macroeconomic factors and stock prices in the U.K

The relationship between stock prices and economic activity is not only limited to the relationship between stock price and economic growth, but may also be extended to other economic factors, as Fama (1981:563) mentioned. Abdullah and Hayworth (1993:50) argue that stock returns are positively related to inflation and growth of the domestic money supply in the U.S, but negatively related to domestic interest rate. Beenstock and Chan (1988:38) also report that interest rates, input (fuel and raw material) costs, money supply, and inflation are the significant risk factors of the London stock market.

For the Pacific region, in Australia, there was a unidirectional relationship (in negative fashion) between inflation and the nominal stock return during 1965-1979, with price levels leading the equity index (Saunders and Tress 1981:58). Other researchers (Leonard and Solt, 1987; Giovanini and Jorion, 1987; Kaul and Seyhun 1990; Randal and Suk, 1999) also support a significant relationship between inflation or expected inflation and stock market prices.

In terms of the relationship between stock market returns and exchange rate, Johnson and Soenen (1998:1-2) state depreciation may cause the cost of imports to increase, leading to domestic price level increases, which expectedly would have a negative impact on stock price. Morley and Pentecost (2000:10) also confirm that stock markets and exchange rates are linked, and note that this connection is through a common cyclical pattern rather than a common trend.

For the Asia-Pacific region, Hamao (1988:45) found a significant relationship between the Japanese share returns and several factors, such as the changes in expected inflation and the term structure of interest rate. Ibrahim (2000:36,45) also observed the Malaysian exchange rate by using bivariate and multivariate cointegration as well as Granger causality tests and found cointegration when the M2 measure of money supply and reserves are included, but no long-run relationship between the exchange rate and stock prices was found using bivariate models. These suggest that in the short run the exchange rate might play a significant role in the domestic economy, and that the Malaysian stock exchange is informationally inefficient.

However, in some cases, macroeconomic factors cannot be reliable indicators for stock market prices movement in the Asian markets because of the inability of stock markets to fully capture information about the change in macroeconomic fundamentals (Fung and Lie 1990, as is cited in Wongbangpo and Sharma, 2002:29).

In conclusion, macroeconomic variables (i.e. economic growth, inflation, interest rate, and exchange rate) of a country are related to each other. Both theoretical models,

Mundell-Fleming model and the Dornbush Sticky-Price model provide explanation for the relationship among the real sector, the monetary sector, and in the exchange rate within an economy. Thus, changes in one of those factors may have an influence on the others.

Stock price movements are, either symmetrically or asymmetrically, related to macroeconomic factors. In some cases, short run causal linkages between stock price movement and macroeconomic factors are also appear. It is worth noting that the relationship between the stock market movement and macroeconomic factors may not be direct, consistent, and stable over time.

Hypotheses

Some hypotheses that can be stated regarding the literature review are:

- A. The relationship among macroeconomic variables:
 1. There is a Granger-causality between economic growth and the inflation rate.
 2. There is a Granger-causality between economic growth and the exchange rate.
 3. There is a Granger-causality between economic growth and the interest rate.
 4. There is a Granger-causality between the inflation rate and the interest rate.
 5. There is a Granger-causality between the inflation rate and the exchange rate.
 6. There is a Granger-causality between the exchange rate and the interest rate.
- B. The relationship between the stock market and macroeconomic variables:
 1. Based on the previous research (Mahdavi et al., 1991; Mukherjee and Naka, 1995; Rousseau et al., 2000; Wongbangpo et al., 2002), it can be hypothesized that there is a causality relationship between movements in a country's stock price index and its economic growth.
 2. The stock market and the level of prices are related to each other in either positive (Abdullah et. al, 1993:50) or negative (Fama, 1981; Chen et al., 1986; Saunders et al., 1981; Wongbangpo et al., 2002) fashion. Hence, following the previous research, it is hypothesized that there is Granger-causality between the stock index and inflation rate.
 3. Considering that stock markets and banks are substitute sources for corporate finance (Arestis and Luintel., 2001:19), and that in the asset-pricing model, an increase in the interest rate will affect the present value of assets, the hypothesis that can be drawn is that, for each country, there is a causality relationship between the stock price index and interest rates.
 4. The relationship between the stock market and exchange rates has been proven by some previous research (Solnik, 1987; Mukerjee et al., 1995; Johnson et al., 1998; Wongbangpo et al., 2002). Following those studies, it is hypothesized that there is Granger-causality relationship between the stock index of a country and its exchange rate during the observation period.

RESEARCH METHODOLOGY

Variables Identification

Stock Market Price Index

In this research, the closing stock price index of the last day of trading in each month of the five ASEAN's stock market, which are IHSG of Indonesia; KLSE of Malaysia; PSE of the Philippines; STI of Singapore; and SET Composite of Thailand, are employed as measurement of the countries' monthly stock market price movements.

Economic Growth

As Jackson and McIver (2004:515) state, economic growth is the increase in real GDP or real GDP per capita that occurs over the long-term. Thus, an upward trend in real GDP means growth in the domestic economy. In this paper, the quarterly indices of GDP volume with 1995 as a base year of the five ASEAN are used to reflect domestic economic growth of the countries for every three months. The quarterly indices of the GDP will then be interpolated using the one introduced by Chow and Lin (1971:372-5) to obtain the monthly indices of GDP.

Inflation Rate

The percentage change of CPI is commonly used as one of several indicators to measure the country's inflation rate, which is a continuous and ongoing increase in the overall or aggregate price level of an economy (Kniest et al., 1998:156). Therefore, the monthly CPI of the five ASEAN will be applied as an indicator of the level of price movements in the real sector of the economies during the observation period in this study.

Interest Rate

Interest rate is the amount that lenders charge when they lend money, expressed as a percent of the amount loaned (Taylor et al., 1998:119). On the other hand, interest rates also can be considered as the cost for borrowing money. There are several types of interest rates, however money market or interbank interest rate will be used as an indicator of short-term domestic interest rate in this study.

Exchange Rate

The exchange rate is the price of one nation's currency in term of another (Shapiro, 2002:33). This study employs the end of month direct quote of nominal spot exchange rates of the five ASEAN's currencies against the US dollar.

Data Collection

All monthly data of spot exchange rate of all the five ASEAN's currencies; interest rate; and Consumer Price Index are obtained from the IFS Online. All monthly stock market index data of the five ASEAN are collected from the Capital Market Supervisory Agency (BAPEPAM) website.

However, since the IFS Online does not provide all data for the index of GDP volume (1995=100) for the whole observation period, the data are also obtained from the Central Bank of Indonesia website, Statistics Singapore website, and National Statistical Coordination Board with some base-year adjustments.

Econometric Techniques

In order to examine the hypotheses, suitable econometric models are required. Since the objective of this research is to test the Granger-causality of several variables, the test should be based on the appropriate multivariate times series models (could be VAR or VECM).

The examination procedures conducted in this paper is that, firstly, unit root test at the levels and first differences are conducted to determine whether each variable is stationary or non-stationary. Secondly, the Engle-Granger residual-based test tests the existence of cointegration among the variables for each country. Thirdly, if a cointegration relationship does not exist, VAR analysis in first difference is applied, however if the variables are cointegrated, the analysis continues in a cointegration framework. Finally, the Granger-causality test is conducted based on the chosen analytical framework.

DATA ANALYSES AND RESULT INTERPRETATION

Before conducting all the analyses, the real GDP index, CPI, and the stock price index of all countries were transformed into log forms. Hence, the notation used is LGDP, LCPI, and LSP representing of log of real GDP index, log of CPI, and log of stock price index, respectively. Exchange rates and interest rates are already in rate forms, therefore not transformed to log. The exchange rate and interest rate variables will be given the notation ER and IR, respectively. Microfit 4.0 was used to conduct all statistical analyses in this paper.

Unit Root Tests

The objective of the unit root test is to empirically examine whether a series contains a unit root. If the series contains a unit root, this means that the series is non-stationary. Otherwise, the series will be categorized as stationary. The common method to test the presence of a unit root is the Dickey-Fuller or Augmented Dickey-Fuller test (ADF test).

Table 1. The Unit Root Test Results

Countries	Variables	ADF at level	ADF at 1 st difference
Indonesia	ER	Reject Ho	Reject Ho
	IR	Reject Ho	Reject Ho
	LSP	Fail to reject Ho	Reject Ho
	LCPI	Reject Ho	Reject Ho
	LGDP	Fail to reject Ho	Reject Ho
Malaysia	ER	Reject Ho	Reject Ho
	IR	Reject Ho	Reject Ho
	LSP	Fail to reject Ho	Reject Ho
	LCPI	Fail to reject Ho	Reject Ho
	LGDP	Fail to reject Ho	Reject Ho
Thailand	ER	Fail to reject Ho	Reject Ho
	IR	Reject Ho	Reject Ho
	LSP	Fail to reject Ho	Reject Ho
	LCPI	Fail to reject Ho	Reject Ho
	LGDP	Reject Ho	Reject Ho
Singapore	ER	Fail to reject Ho	Reject Ho
	IR	Reject Ho	Reject Ho
	LSP	Fail to reject Ho	Reject Ho
	LCPI	Fail to reject Ho	Reject Ho
	LGDP	Fail to reject Ho	Reject Ho
Philippines	ER	Fail to reject Ho	Reject Ho
	IR	Fail to reject Ho	Reject Ho
	LSP	Fail to reject Ho	Reject Ho
	LCPI	Fail to reject Ho	Reject Ho
	LGDP	Reject Ho	Reject Ho

Source: calculated by the author

Table 1 reports the conclusion of ADF test results for all series (with 95 % confidence interval, the critical values of ADF statistic are -2.9055 for including intercept but not a trend and -3.4779 for including intercept and a linear trend). The table clearly shows that there are some rejections of H_0 in the series at levels. However, the majority of the series can be concluded as non-stationary, since their ADF test results fail to reject the null hypothesis. Therefore, it is necessary to continue ADF test for all series in first difference. The results of this second test are that all series are now stationary.

Engle-Granger Residual-Based Test

Based only on the results of ADF test, it cannot still be conclude that a VAR in first difference can be applied in this study, rather than a cointegration analysis framework. The reason is that a VAR in first difference is the correct specification if all variables are not cointegrated (Enders, 2004:287). Therefore, in order to examine the existence of cointegration among the variables, Engle-Granger residual-based test will be conducted for each country's equation model.

After estimating one model of each country using OLS with LSP as the dependent variable of each equation at level, the residuals were tested using Engle-Granger residual-based test using a 5% significance level and five variables. Finally, it is found that all of the residual tests fail to reject the null hypothesis (the critical value for the Engle-Granger cointegration test at 5% significant level, 5 variables, and 78 observations is - 4.557), meaning that there is no cointegration among the variables within any of the countries.

Since there is no cointegration relationship among variables of each country, VAR analytical framework in first difference model is used in this paper.

The Vector Autoregressive Analysis (VAR)

Dummy Variables

Since this study covers both during and after the crisis period, a dummy variable will be required to distinguish the both periods to prevent a bias statistical result.

The 1997 Asian financial crisis started in July 1997 for every country in the region. However, the ending period of the crisis was not the same for each of those countries. Some researchers argue that the crisis was over in 1999 (Radelet and Sachs, 1999; DFAT, 1999; Krugman and Obstfeld, 2003), however they do not mention in what month that the crisis ended for each country.

It is hard and subjective to determine when the beginning of the post-crisis period started. Therefore, to overcome this issue, some criteria have to be developed, which are:

- The stock price index and the index of real GDP start to steadily grow, or at least their fluctuation is in a range close to that of before the crisis.
- The inflation rate starts to decline to its pre-crisis rates.
- The domestic exchange rates start to appreciate to a new equilibrium and do not widely fluctuate any more.
- Domestic interest rates start to decline to at least the same rates as those before the crisis

Based on those criteria, it may be stated that the ending period of the crisis for Singapore is September 1998; the Philippines is February 1999; Malaysia is May 1999; Thailand is June 1999; and Indonesia is November 1999. It is worth noting that although Singapore did not directly suffer from a domestic currency exchange rate crisis, the Asian financial crisis in fact moderately affected Singapore's domestic financial market; stock market; and other macroeconomic factors.

Lags Order Tests

Table 2. Countries' Lag Length

Country	Lag Length
Indonesia	4
Malaysia	3
The Philippines	4
Singapore	3
Thailand	2

Source: calculated by the author

Because of the limitations of likelihood ratio test (see Enders, 2004:283), multivariate generalization of AIC and SBC become the most suitable alternatives for this study. The minimum values of AIC and/or SBC may validly indicate the appropriate lags length, as long as the model's residual has no serial correlation problem. The appropriate lags length are reported in Table 2.

Granger causality Test

After the appropriate lags lengths have been determined, the next step is to examine the existence of block causality among variables of each model. In VAR, a block causality test, which is also called multivariate generalization of the Granger-causality test, examines whether the lags of one variable (y_1) enter into the equation for another variable (y_2). More precisely, a variable (y_1) is said to Granger-cause another (y_2) if the present value of y_2 can be predicted with greater accuracy by using past values of y_1 , all other information being identical (Thomas 1997:461). If y_1 Granger-causes y_2 , the parameters of lags of y_1 , β_i 's, should not equal zero in the equation of y_2 . Thus, the null hypothesis of $\beta_i = 0$ ($i=1,2,\dots,n$) can be tested by using an F-test or Wald-statistic. If this is the case, it can be said that the variable Granger-causes the other.

In the case that y_1 Granger-causes y_2 , but not vice versa, then the causality from y_1 to y_2 is unidirectional. On the other hand, if both variables Granger-cause each other, then it can be stated as bi-directional causality or feedback (Brooks, 2002:339). However, it is worth noting that Granger-causality basically means a correlation between the current value of one variable and the past (lags) value of others. It does not mean that movements of one variable physically cause movements of another (Brooks, 2002:240). Granger causality simply implies a chronological ordering of movements of the series. Therefore, it could validly be stated that changes or movements in one variable (y_2) appear to lag those of another (y_1).

Using a 5% level of significance, the results of Granger causality tests for each country are presented as follow:

1. Indonesia.

Table 3 presents the results of Granger causality test for Indonesia. As is reported in the table that there is unidirectional causality, as follows:

- Changes in the domestic exchange rate (DER) Granger-cause changes in the domestic interest rate (DIR)
- Changes in the logarithm of the stock price index or stock index returns (DLSP) and changes in the domestic exchange rate Granger-cause the inflation rate (DLCPI).
- Changes in the domestic interest rate Granger-cause GDP growth (DLGDP).

Table 3. Granger Causality Test For Indonesia

Dependent Variables	Explanatory Variables					
	DLSP	DER	DIR	DLCPI	DLGDP	
DLSP	CHSQ	5.9043	3.8186	1.2834	1.5075	2.1659
	Probability	(0.206)	(0.431)	(0.864)	(0.825)	(0.705)
DER	CHSQ	6.4269	0.65357	6.7308	2.0172	3.9367
	Probability	(0.169)	(0.957)	(0.151)	(0.733)	(0.415)
DIR	CHSQ	4.5798	23.2148	18.3936	3.2952	1.5415
	Probability	(0.333)	(0.000)	(0.001)	(0.510)	(0.819)
DLCPI	CHSQ	15.7926	49.3425	2.7943	33.2780	3.5900
	Probability	(0.003)	(0.000)	(0.593)	(0.000)	(0.464)
DLGDP	CHSQ	0.57956	5.0027	18.5083	6.6755	5.8522
	Probability	(0.965)	(0.287)	(0.001)	(0.154)	(0.210)

Source: calculated by the author

The result indicates that none of Indonesia's macroeconomic variables Granger-cause the stock index returns. This fact implies that macroeconomic variables might not be appropriate indicators to predict stock index returns. This also indicates that investors in the stock market did not intensively use the information of changes in macroeconomic factors when deciding their transactions during the study period.

The past changes in the domestic exchange rate influenced the current changes in domestic interest rate and the inflation rate. On the other hand, the unidirectional causality between changes in the domestic exchange rate and the inflation rate may imply that the production sector was influenced by changes in the domestic exchange rate. Thus, if there were a change in the domestic exchange rate, it would be directly conveyed to the inflation rate through the real sector of the economy, instead of the financial sector, since no Granger causality was found between changes in domestic interest rates and the inflation rate.

The past changes in domestic interest rates also had an influence on current GDP growth. This may indicate that the banking or credit sector has played an important role in national development funding. Moreover, this might indicate that the stock market was an inferior source of funding compared to banking sector.

2. Malaysia

Table 4 shows that :

- GDP growth and the inflation rate Granger-cause stock index returns.
- Changes in the domestic exchange rate are Granger-caused by GDP growth.
- GDP growth and the inflation rate Granger-cause changes in domestic interest rate.
- Changes in the domestic exchange rate Granger-cause GDP growth.

In Malaysia, the past value of GDP growth appear to predict current stock index returns as well as all other macroeconomic factors included in the model, except the inflation rate. Moreover, GDP growth and changes in the domestic exchange rate show bi-directional Granger-causality.

The inflation rate influences both the stock index returns and the money market movements. This may indicate that investors in both markets consider the inflation rate when calculating their expected returns. The unidirectional causality between the inflation rate and the stock index returns confirms the research by Saunders et al. (1981: 58).

The stock index return does not Granger-cause any of the country's macroeconomic factors, included in this study. The finding that there was no relationship between the stock price index and the domestic exchange rate contradicts that of Ibrahim (2000:45) for the pre-crisis period. One possible reason is that the changes in the domestic exchange rate regime, from managed floating into fixed (the exchange rate regime changed on September 1998), eliminated the relationship. Thus, fluctuation in the stock index returns would have no impact on the domestic exchange rates after they became fixed.

Table 4. Granger Causality Test For Malaysia

Dependent Variables		Explanatory Variables				
		DLSP	DER	DIR	DLCPI	DLGDP
DLSP	CHSQ	6.3317	6.4397	1.3829	8.1217	12.5707
	Probability	(0.097)	(0.092)	(0.710)	(0.044)	(0.006)
DER	CHSQ	3.3713	16.1993	7.5759	1.8693	82.4381
	Probability	(0.338)	(0.001)	(0.056)	(0.600)	(0.000)
DIR	CHSQ	2.7573	6.4812	28.5081	11.8073	9.7449
	Probability	(0.431)	(0.090)	(0.000)	(0.008)	(0.021)
DLCPI	CHSQ	6.6633	1.1214	6.3497	1.1541	2.8944
	Probability	(0.0831)	(0.772)	(0.096)	(0.764)	(0.408)
DLGDP	CHSQ	4.8509	19.1555	2.3181	5.1675	51.9028
	Probability	(0.183)	(0.000)	(0.509)	(0.160)	(0.000)

Source: calculated by the author

3. The Philippines

In the case of the Philippines, the following results were found (Table 5) that changes in domestic interest rates Granger-cause changes in the domestic exchange rate.

Most of the country's macroeconomic variables did not show causality relationships during the sample period. Moreover, stock index returns did not show causality with the country's macroeconomic factors, included in this study. This may confirm the argument that economic growth and stock markets are not correlated in some of the less financially developed markets (Minier, 2003; 1601). Hence, these findings not only reject all the hypotheses in this study, but also contradict with several of the previous studies (Fama, 1981; Mauro, 2003; and Wongbangpo et al., 2002).

The causality between changes in the domestic interest rate and changes in the domestic exchange rate in this country suggests that changes in the domestic interest rate might be used to predict the future domestic currency movements.

Table 5. Granger Causality Test For The Philippines

Dependent Variables	Explanatory Variables				
	DLSP	DER	DIR	DLCPI	DLGDP
DLSP CHSQ	5.3544	2.15251	2.26221	4.7763	1.3693
Probability	(0.253)	(0.708)	(0.992)	(0.311)	(0.850)
DER CHSQ	5.0980	3.3843	10.5570	1.9832	1.9861
Probability	(0.277)	(0.496)	(0.032)	(0.739)	(0.738)
DIR CHSQ	1.5597	1.1177	11.0098	3.5024	3.2135
Probability	(0.816)	(0.891)	(0.026)	(0.478)	(0.523)
DLCPI CHSQ	0.59255	5.1482	2.4778	4.7993	2.9559
Probability	(0.964)	(0.272)	(0.649)	(0.309)	(0.565)
DLGDP CHSQ	2.3058	1.8772	5.0561	36590	22.7847
Probability	(0.680)	(0.758)	(0.282)	(0.454)	(0.000)

Source: calculated by the author

4. Singapore

Table 6 shows the results of Granger causality test for Singapore. The test finds that:

- Changes in the domestic interest rate and stock index returns Granger-cause GDP growth.
- GDP growth Granger-causes changes in the domestic interest rate.

The interesting finding of Singapore is that both stock index returns and changes in the interest rates Granger-cause GDP growth. This indicated that they played important roles funding sources to domestic economic growth. The fact that the Singapore stock exchange is the largest in market capitalization and the most developed market in ASEAN (Ng, 2002:357) seems support this argument.

TABLE 6. Granger causality Test for Singapore

Dependent Variables	Explanatory Variables				
	DLSP	DER	DIR	DLCPI	DLGDP
DLSP CHSQ	2.2097	5.8579	5.0535	5.1057	2.2471
Probability	(0.530)	(0.119)	(0.168)	(0.164)	(0.523)
DER CHSQ	4.0547	3.3375	4.7239	3.1662	0.96016
Probability	(0.256)	(0.342)	(0.193)	(0.367)	(0.811)
DIR CHSQ	5.2085	2.7663	22.2661	4.3853	17.9631
Probability	(0.157)	(0.429)	(0.000)	(0.223)	(0.000)
DLCPI CHSQ	1.1915	1.5131	0.40447	2.7054	3.6802
Probability	(0.755)	(0.6791)	(0.939)	(0.439)	(0.293)
DLGDP CHSQ	13.8773	0.49965	10.8369	5.6733	3.7280
Probability	(0.003)	(0.919)	(0.013)	(0.129)	(0.292)

Source: calculated by the author

Another finding is the bivariate causality between GDP growth rate and changes in the domestic interest rate. This might indicate that the country's monetary authority

might use GDP growth to target interest rates in order to guarantee the stability of its monetary sector.

5. Thailand.

In Thailand the following significant relationships were found (see Table 7.):

- Inflation rate and changes in domestic interest rate Granger-cause changes in the domestic exchange rate.
- Changes in the domestic exchange rate Granger-cause changes in the domestic interest rate.
- Changes in the domestic interest rate Granger-cause the inflation rate
- Changes in the domestic interest rate, changes in the domestic exchange rate, and stock index returns Granger-cause GDP growth.

First, we note that there is a bi-directional causality between changes in the exchange rate and changes in domestic interest rates. Second, changes in the interest rates Granger-cause all other macroeconomic variables, included in this study. Hence, the changes in the domestic interest rates could be a crucial instrument to predict and/or influence future changes in the exchange rate and the real sector of its economy.

Table 7. Granger Causality Test For Thailand

Dependent Variables		Explanatory Variables				
		DLSP	DER	DIR	DLCPI	DLGDP
DLSP	CHSQ	0.77886	1.8780	2.9407	5.0325	0.38062
	Probability	(0.677)	(0.391)	(0.230)	(0.081)	(0.827)
DER	CHSQ	1.6576	1.0963	25.3325	12.8065	4.9263
	Probability	(0.437)	(0.578)	(0.000)	(0.002)	(0.85)
DIR	CHSQ	5.7629	18.3227	57.9857	0.25819	2.2483
	Probability	(0.056)	(0.000)	(0.000)	(0.879)	(0.325)
DLCPI	CHSQ	0.011734	4.5539	8.1219	5.8293	1.7015
	Probability	(0.994)	(0.103)	(0.017)	(0.054)	(0.427)
DLGDP	CHSQ	7.0199	8.5910	14.9120	0.38738	2.3644
	Probability	(0.030)	(0.014)	(0.001)	(0.824)	(0.307)

Source: calculated by the author

The country's current GDP growth appears to be related to the past movements of the domestic exchange rates and interest rates. This may imply that the Thailand's economy depends heavily on international trade and foreign capital flows. Moreover, the fact that the Thailand's stock price returns had an influence on GDP growth is consistent with what Mahdavi et al. (1991:45) found in the US.

The findings that most of the country's macroeconomic variables do not Granger-cause their own stock index returns point out that those variables are not reliable indicators for stock index returns. This might be caused by the inability of the stock market price index to fully capture information about the changes in macroeconomic fundamentals (Fung and Lie 1990, as cited in Wongbangpo et al. 2002:29).

CONCLUSION AND POLICY IMPLICATIONS

Conclusion

The objective of this study was to observe the Granger-causalities between stock prices and macroeconomic variables in five ASEAN countries, namely Indonesia, Malaysia, the Philippines, Singapore, and Thailand, with particular attention to the 1997 Asian financial crisis and the period onwards.

The 1997 Asian financial crisis initiated by the dramatic depreciation of the Thai baht affected not only the ASEAN economies, but also the world economy through its contagion effects. During the crisis period, the five ASEAN countries experienced massive capital outflows leaving financial turmoil in their domestic economies. Following the dramatic depreciation of the regional currencies, the ASEAN's stock indices dropped dramatically, domestic interest rates increased far beyond their normal rates, inflation rates rocketed in some of the countries, and domestic economic growth rates sharply declined.

However, in 1999, the five ASEAN economies started to recover. The domestic exchange rate began to appreciate against foreign currencies, especially the US dollar. Following the appreciation in their currencies, domestic economic growth increased, domestic interest rates declined, inflation rates lowered, and the countries' stock price indices increased towards historical values.

In order to examine the existence of Granger-causalities among the stock prices and the macroeconomic variables in the five ASEAN, a multivariate time series analysis is applied in this paper. Monthly time series data of the five ASEAN countries from July 1997 until December 2003 are used.

After conducting unit root tests and Engle-Granger residual-based tests for cointegration among the variables of each country, no cointegrating relationships were found between stock price returns (measured by the first differences of the logs) and macroeconomic factors in any of the five ASEAN countries. Consequently, the VARs in first differences is used as the basic analytical framework for the causality test.

With the exception of Malaysia, Granger-causality tests did not find any significant links between the macroeconomic variables of any of the countries and their stock index returns. Malaysia's inflation and growth rate Granger-causes its stock index returns. The stock index return is found to Granger-cause the GDP growth in Singapore and Thailand, and the inflation rate in Indonesia, while no significant links are found for Malaysia and the Philippines. These results indicate that the causality relationship between the domestic stock index returns and macroeconomic factors is generally not significant, and that stock markets do not seem to have influenced important indicators of the domestic economies.

Furthermore, the changes in the domestic exchange rate show no causality with macroeconomic variables in Singapore and the Philippines, but Granger-cause the changes in the domestic interest rates in Indonesia and Thailand. The current changes in domestic exchange rates of the Philippines and Thailand and the current changes in

Indonesia's inflation rate appear to have been related to past movements of their own interest rates. The economic growth rate of Malaysia granger causes its stock index returns and all included macroeconomic variables, except the inflation rate. In Thailand, the changes in the domestic interest rate show significant Granger-causality with all the country's macroeconomic variables. Hence, all of these findings may imply that the influence of specific macroeconomic factors on the domestic economies differs across countries.

Policy Implications

The linkage between domestic stock price movements and macroeconomic factors has been found to be very weak in most of the countries. This may indicate that macroeconomic factors are unlikely to be appropriate indicators to predict the future behaviour of the stock index movements in most of the countries. This then implies that most of the stock markets are not able to fully capture information about the changes in macroeconomic variables. Therefore, this paper finds that the ASEAN stock markets were unable to efficiently capture changes in economic fundamentals during the observation period.

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