

# Causality Effect between Equity Market and Exchange Rate Volatility in Malaysia

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**Abstract.** Equity market and exchange rates issue has often been discussed by economists since they both play important roles in influencing a country's economic development. Thus, the objective of this study is to determine the Granger causality effect between the equity market and exchange rate volatility in Malaysia. The study focused on the overall and sectoral performance of the Malaysian stock market with Malaysian ringgit exchange rate volatility. In order to capture the interactions between equity market performance and exchange rate volatility, the multivariate vector autoregression (VAR) framework estimations were utilized. The results showed that there was a bi-directional causality between equity market and exchange rate volatility in Malaysia in the overall market. However, in terms of the sectoral market performance, only the Industrial and Finance sectors that showed similar results as the overall market. Based on the findings, the Malaysian government must be cautious in their implementation of equity market and exchange rate policies especially those related to the Industrial and Finance sectors because such policies would impact these sectors.

**Keywords:** exchange rate volatility, equity market, Granger causality effect, GARCH model

## 1. Introduction

In the financial markets, the equity markets and foreign exchange markets have been regarded as sensitive segments due to the impact of any policy changes gets quickly reflected in both markets. And thus, the issue of inter-relation between stock returns and exchange rates has often been discussed by economists since they both play important roles in influencing the development of a country's economy. Changes in stock prices may influence the movements in the exchange rate, via firm's portfolio adjustments [1]. And foreign exchange rates is considered as one of the many factors that would have an impact on the equity market [2].

Foreign exchange rates have been highly volatile since the abandonment of the fixed exchange rate system in 1973. The volatility is considered as the risk in exchange rate and the risk has certain implications on the economic growth of a country. This is because the exchange rate changes affect the competitiveness of companies through their impact on input and output price [3]. When currency appreciates, the sales and profits of exporters will decline and stock prices will drop due to the fact that exporters lose their international competitiveness. On the other hand, importers' competitiveness in domestic market will increase which would lead to the increase in profit and stock prices. The scenarios would be opposite in the case of currency depreciation.

When Malaysia foreign currency market was affected by the 1997 Asian financial crisis, so too was the equity market. Therefore, it is important to analyze the interactions between the foreign exchange rate volatility and equity market in Malaysia. The interactions will be determined using a multivariate framework which will be focusing on the exchange rate volatility and the overall and sectoral performance of the Malaysian equity market. Thus, the specific objective of this study is to identify the Granger causality effect between the stock market and exchange rate volatility in Malaysia.

## 2. Literature Reviews

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Traditional views are that exchange rate volatility affects stock prices. However, classical economic theory suggests intermediate variables (such as wealth, demand for money and interest rates), play a vital role in establishing the relationship between exchange rate behavior and stock market performance. For instance, flow-oriented models of exchange rates determination, [see 4], posit that currency movements affect international competitiveness and balance of trade positions and, consequently, the real output or income of the country. This in turn affects the current and future expected cash flows of firms and their stock prices. While the stock-oriented models of exchange rates determination [see 5], contends that innovations in the stock market affect exchange rates via the capital account. This model is based on the notion that agents should allocate their entire wealth among domestic and foreign assets. Hence, the exchange rate plays the role of balancing the demand for and supply of assets. In addition, the traditional money demand equation proposes that changes in domestic economic activities (proxied by stock returns) lead to changes in demand for real currency balances and, consequently, to changes in exchange rates [6].

There are also well-documented empirical studies that attempt to determine the relationship between stock prices and exchange rate volatility or exchange rate values. The findings, however, are not uniform across the various studies. Some studies reported on the positive impact of exchange rate volatility on stock prices, for example [7] [8] and [9], while those reporting a negative impact include [10] [11] and [12].

On the issue of causation, most of the studies had mixed results. Among the relevant studies are [13] [14] [15] and [16]. Most past studies on the relationship between stock prices and exchange rates are based on bivariate estimation. However, the theoretical explanations indicate the existence of some other variables, which may interact with exchange rates and stock prices. Thus, multivariate estimation is necessary. In fact, further studies have been carried out employing a multivariate framework, including [17] [18] and [19].

### 3. Data and Methodology

Our data set consists of monthly observations from January 1990 to December 2010. Monthly data on the Malaysian stock market indexes were obtained from Datastream International, while data on other economic variables were obtained from the IMF International Financial Statistics (IFS). All the series are expressed in logarithm form except for the money market interest rate. In our overall market performance investigation, the variable used as a proxy for the whole stock market barometer is the Kuala Lumpur Composite Index (KLCD). For the sectoral study, the sectoral stock market indexes variables are: Industrial Index (IND), Finance Index (FIN), Properties Index (PRP), Tin & Mining Index (TIN) and Plantation Index (PLN). We did not include other sectoral indexes such as Consumer Product Index, Industrial Product Index, Construction Index and Trading/Services Index since data from these sectors only become available from October 1993 onwards.

In order to capture the interactions between stock market performance and exchange rate volatility, the Granger causality effect test within the multivariate framework estimations will be utilized. Granger causality effect says that one variable helps to forecast the other variable at least in one direction. Testing for causality between two variables has been coined by [20]. If the null hypothesis is not rejected, then it can be concluded that the independent variable does not cause dependent variable.

We adopt the multivariate vector autoregression (VAR) model to test the Granger causality amongst the variables because the VAR system consists of a set of regression equations in which all the variables are considered to be endogenous. In general, there are no exogenous variables in the model.

In our four-variable multivariate VAR system, the variables considered are the stock price index ( $SP$ ), exchange rate volatility ( $V$ ), money supply ( $M2$ ) and money market interest rate, which is expected to serve as the proxy for the interest rate ( $R$ ). The causality model is being expressed as:

$$S_t = \alpha + \sum_{i=1}^{k1} \delta_i S_{t-i} + \sum_{i=1}^{k2} \phi_i V_{t-i} + \sum_{i=1}^{k3} \theta_i M2_{t-i} + \sum_{i=1}^{k4} \gamma_i R_{t-i} + \varepsilon_t \quad (1)$$

The exchange rate volatility is not directly observed and in this study we employ the GARCH model developed by [21] to measure the exchange rate volatility.

### 4. Empirical Analysis and Results

#### 4.1. Unit Root Testing and Exchange Rate Volatility

As a prerequisite for later analysis, we first examine the stationarity properties of the data series. It is important to check the time series properties of data in order to make sure that the drawn inference is not spurious and misleading. In this study, we utilize the Augmented Dickey-Fuller (ADF) tests for detecting unit root in the data. We conducted the intercept test equation in carrying out the unit root tests and the results confirm that all the series are non-stationary in their level but stationary in their first difference except for exchange rate volatility. Thus, we could conclude that most of the time series are not characterised by the presence of a unit root.

Before applying the GARCH estimation procedure to calculate the exchange rate volatility, we first test for the stationarity of the exchange rates, as well as for the presence of ARCH effects in the exchange rate process. In addition, we add a dummy variable to capture the effects of the July 1997 Asia financial crisis and found that the dummy variable was significant. Therefore we add the dummy variable into our equation of the GARCH model. We test the adequacy of these GARCH results for no remaining ARCH effects using the ARCH-LM testing and the results successfully indicate that all the ARCH effects have been accounted for. The diagnostic checks indicate that the GARCH models estimation is adequate. Thus, the fitted values of this GARCH models are used to approximate the exchange rate volatility in this study. We found that the exchange rates volatility is specified as GARCH (1,1) model.

#### 4.2. Granger Causality Results

The VAR system consists of a set of regression equations in which all the variables are considered to be endogenous. In VAR methodology, each endogenous variable is explained by its lagged or past values and the lagged values of all other endogenous variables included in the model. In general, there are no exogenous variables in the model. According to VAR methodology, ordering the variables in the system will give a different result. Therefore, our ordering of the variables in the multivariate study is as follows:

$$\{M2, R, SP, V\} \tag{2}$$

The Granger causality results for the multivariate VAR estimations framework in this study are presented in Table 1.

##### 4.2.1. Overall Stock Market Performance

The results of the Granger causality effects between stock price index and exchange rate volatility have shown that there are bi-directional causality effects running between these two variables. Our results are consistent with [13] and [19], which showed that stock prices are causally linked, in the Granger sense, to exchange rate volatility with feedback interactions. This relationship is not unexpected, because when stock market is bullish, foreign investors would come and invest in Malaysia and ringgit values would appreciate and vice versa. And when ringgit values are volatile, foreigners would not want to hold Malaysian stock fearing the foreign exchange risk incurred and thus would affect the equity market in Malaysia. We also found bi-directional effects running between money supply and exchange rate volatility, which contradicts the results found in [19] that showed no Granger causality between money supply and exchange rate volatility. The difference could be due to the different time periods for both studies.

In addition we also found a unidirectional causality effect running from interest rates to exchange rate volatility. This relationship happened because even though the Malaysian government practiced floating exchange rates (except in the six years following the 1997 Asian financial crisis where ringgit was pegged to the US dollar), it was never a free float. Thus, the central bank would use the interest rate as a way to correct exchange rates, if they are desired. The results also indicate a unidirectional causality effect running from money supply to stock market and interest rates. These results are consistent with the economics theories that stated the stock market activities are affected by the amount of money supply in the market. And interest rates in the economy also depend on the money supply in the economy at any points of time.

##### 4.2.2. Sectoral Stock Market Performance

We found that only the Industrial and Finance sectors have results similar to the overall market's results, that is, a bi-directional causality effect running between stock prices and exchange rate volatility. There is no causal relationship between stock prices and exchange rate volatility in the Plantation and Tin & Mining sectors, while there is a uni-causal effects running from exchange rate volatility to stock prices in the Properties sector. These indicate that commodities market does not influenced by any changes in the exchange rate. We also found bi-directional effects running between money supply and exchange rate volatility in all sectors, which is the same as in the overall market performance. The results showed feedback

interactions between interest rate and exchange rate volatility in the Finance and Properties sectors, while a uni-causal effect running from interest rates to exchange rate volatility in the other three sectors. As mentioned earlier, the central bank would use the interest rate as a way to correct exchange rates, if they are desired.

As per the overall market results, we also found uni-causal effects running from money supply to stock prices in all sectors, except in Properties and Tin & Mining sectors that showed no causal relationship. These results are consistent with the economic theories that stated the stock market activities are affected by the amount of money supply in the market. The results also indicate unidirectional effects running from the money supply to interest rates in all sectors (except Finance and Properties). There is a bi-causal relationship in the Finance sector while no causal relationship in the Properties sector. Lastly, the findings of Granger causality also stated that equity market has a unidirectional relationship with interest rates that runs from equity market to interest rates in all sectors (except Industrial and Tin & Mining). This is consistent with economic theories. For example, when equity market is bullish, investors would want to borrow to invest and this could result in the increase in interest rates when more money is needed.

Table 1. Granger causality results based on multivariate VAR estimation

$\chi^2$ – statistics (p-value)				
Dependent Variable	(M2)	(R)	(SP)	(V)
<b>KLCI Index</b>				
(M2)	-	5.51(0.06)***	3.86(0.14)	7.82(0.02)**
(R)	8.86(0.01)**	-	5.19(0.07)***	4.17(0.12)
(SP)	6.27(0.04)**	0.92(0.63)	-	6.28(0.04)**
(V)	18.45(0.00)*	22.40(0.00)*	8.16(0.02)**	-
<b>IND Index</b>				
(M2)	-	4.74(0.09)***	3.80(0.14)	6.41(0.04)**
(R)	14.42(0.00)*	-	11.22(0.00)*	5.31(0.07)***
(SP)	5.81(0.05)**	2.09(0.35)	-	5.94(0.05)**
(V)	23.80(0.00)*	27.03(0.00)*	10.72(0.00)*	-
<b>FIN Index</b>				
(M2)	-	6.19(0.04)**	3.15(0.21)	7.53(0.02)**
(R)	10.05(0.00)*	-	7.12(0.03)**	6.44(0.04)**
(SP)	7.34(0.02)**	1.53(0.46)	-	7.39(0.02)**
(V)	17.21(0.00)*	17.71(0.00)*	10.61(0.00)*	-
<b>PLN Index</b>				
(M2)	-	4.90(0.09)***	2.73(0.26)	7.76(0.02)**
(R)	10.47(0.00)*	-	6.21(0.04)**	4.68(0.10)***
(SP)	6.10(0.05)**	0.97(0.61)	-	1.20(0.55)
(V)	16.97(0.00)*	24.51(0.00)*	4.30(0.12)	-
<b>PRP Index</b>				
(M2)	-	4.32(0.12)	1.26(0.53)	6.84(0.03)**
(R)	2.11(0.35)	-	6.75(0.03)**	6.08(0.05)**
(SP)	1.39(0.50)	2.37(0.31)	-	6.27(0.04)**
(V)	7.64(0.02)**	21.57(0.00)*	5.49(0.06)**	-
<b>TIN &amp; MIN Index</b>				
(M2)	-	4.55(0.10)	4.54(0.10)	6.65(0.04)**
(R)	6.45(0.04)**	-	5.21(0.07)***	5.42(0.07)***
(SP)	1.49(0.48)	0.45(0.80)	-	3.44(0.18)
(V)	14.96(0.00)*	22.56(0.00)*	4.22(0.12)	-

Note: The  $\chi^2$  — statistic tests the joint significance of the lagged values of the independent variables. The \* = 1%, \*\* = 5% and \*\*\* = 10% significance levels.

## 5. Conclusion

In this study, the links between stock prices and exchange rate volatility in Malaysia have been examined using the Granger causality effects in a multivariate VAR framework. The study was focused on the overall and sectoral performances of the Malaysian equity market. The results showed that there was a bi-directional Granger causality between stock market and exchange rate volatility in the overall market. However, in terms of the sectoral market performance, only the Industrial and Finance sectors that showed similar results as the overall market. The results showed a unidirectional relationship from exchange rate volatility to stock prices in the Properties sector, while no causal relationship in the Plantation and Tin & Mining sectors. Based on these Granger causality effects findings, we should caution the Malaysian government to be more cautious in their implementation of any financial markets policies especially those related to the Industrial and Finance sectors because such policies would impact these sectors.

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