

## CO-MOVEMENT AND CAUSAL RELATIONSHIP BETWEEN STOCK MARKET AND MACROECONOMIC VARIABLES: LATEST EVIDENCE FROM MALAYSIA

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**Abstract:** Previous studies pertaining to the co-movement and causal relationship between Malaysian stock markets and domestic macroeconomic variables are by now quite well documented. Nonetheless, to the best of authors' knowledge, there is a void in the literature about foreign macroeconomic variables. Therefore, this paper aims to examine co-movement and causal relationship between FTSE Bursa Malaysia Kuala Lumpur Composite Index (FBMVKLCI) with foreign macroeconomic variables namely world crude oil price, gold price, and five world major stock market indices; Singapore's Straits Times Index (STI), Chinese Shanghai A-Share Index (SHAI), the US's Dow Jones Industrial Average (DJIA), Hong Kong's Hang Seng Index (HSI) and Japanese Nikkei 225 Index (NIK). We also include domestic macroeconomic variables namely private sector domestic credit, gross international reserves and foreign currency assets, and an exchange rate of Malaysian ringgit (MYR) to the US dollar (USD) in this study. Using 9-year monthly data series from 2010 to 2018, the Augmented Dickey-Fuller (ADF) test reveals that data series have unit root in level order, but become integrated when converted into the first difference. The t-statistics of the Trace test suggests that FBMVKLCI co-moves with Malaysian gross international reserves and

*foreign currency assets, world gold price and STI in the long run, respectively. Further, the VECM notes the absence of long-run or short runs causal relationships except Singapore's STI to FBMKLCI in the short run. The pairwise Granger causality test indicates a one-way causal relationship running from FBMKLCI to gross international reserves and foreign currency assets. The findings benefit stock market investors, diversified portfolio fund managers, market regulators, and policymakers besides enriching the existing literature.*

**Keywords:** *Co-movement, Causal Relationship, Stock Markets, Macroeconomic Variables*

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## **Introduction**

The performance of stock market is significantly related to the economic activities. When a country's economy shows stability and consistent growth, the country's stock market will also follow suit. This is very true because the positive economic growth that is mainly manifested by businesses success in term of favourable financial performance will be reflected in the stock market in the form of investors' confidence, which will in turn attract more capital or investment funds into the economy. And, it is undeniable that the stock market performance also acts as one of the main economic indicator of a country's economic growth in future (Liu & Sinclair, 2008). It implies that the real economic activities or growth and stock market performance are relating to each other or causing one another in short or long run (Oscooe, 2010; Paramati & Gupta, 2011). On one hand, macroeconomic fundamentals play pivotal roles in stimulating the stock market performance and on the other hand robust stock market will catalyse the growth of a country's economy (Lee, Boon & Baharumshah, 2001).

Malaysia, as an emerging market, has been encountered with economic ups and downs particularly since its first vast industrial transformation in early 1990s. The country's well performing economy with strong Gross Domestic Product (GDP) that averaged out around positive 9 to 10 percent between the year 1990 to 1996, had plummeted to its worst ever in history to negative 7.4 percent in 1998 in the aftermath of the 1997/1998 Asian financial crisis (AFC). Since then, the country's economy has regained its momentum to maintain its GDP roughly above 5 percent on average due to its strong economic fundamentals and financial liberalization strategies taken, except in the year 2009 that recorded GDP of negative 1.5 percent as a consequence of the 2008 global financial crisis.

Following the 1997/1998 AFC, the Stock Exchange of Malaysia, which is currently known as Bursa Malaysia, had frozen USD4.47 billion worth of shares that belonged to 172,000 investors in attempt to deal with the crisis. The intense impacts of the AFC could also be witnessed at the other Asian stock markets. Thailand had suffered the most, where its stock market had dropped by 80 percent and followed by Korean stock market that fell by 65 percent whilst Indonesian and Singapore stock markets were down by 60 percent, respectively. Whereas, the developed stock market of Japan had declined by 38 percent. This proves that the economic or financial crisis has direct and significant impact on the performance of stock markets.

If we look back few years prior to the AFC, the United States (US) had been in recession commencing the third quarter of 1990 till the first quarter of 1991, after which the recession was relatively mild following the unemployment recovery. In late 1994, one of the world's most severe international financial crises had sparked namely the Tequila crisis, which was brought about by capital flight. The crisis that witnessed sudden devaluation of Mexican peso

against the US dollar had caused economic damaging consequences particularly relating to rapid capital outflows, investors' declining confidence in the economy and sovereign debt crisis. In early third quarter of 1997, another currency crisis was triggered that gripped much of East Asia and raised fears of a worldwide economic meltdown. The AFC or the Asian financial contagion had rapidly spread throughout the Asian markets, which later on resulted in sharp declines in the stock markets.

The technological development in supporting industrial liberalization and globalization created the dot-com bubble, which was a historic speculative bubble covering roughly from the year 1997 to 2000. Consequently, the stock price increased rapidly in the Internet-related sectors and fields. Over the last decade, another financial crisis known as subprime mortgage crisis, which started in 2007 had caused great depression and brought about total collapse of large financial institutions that needed financial assistance from the governments. The worldwide stock markets declined and created volatilities and uncertain performance. The mortgage crisis was then followed by global economic turmoil in 2008 that led to the Asian market's great recession. Another financial crisis was sovereign debt crisis that involved countries of the euro zone in early 2009, where a group of 10 central and eastern European banks had asked for bailout.

In the aftermath of the 2007/2008 global financial crisis, the "bull" of Malaysian stock market has had a solid run over the last decade. Nonetheless, according to Bloomberg, the Malaysian benchmark FBMKLCI was one of the best performing stock indices in the world, where it had risen by approximately 118 percent since the recovery from the 2007/2008 global financial crisis. FBMKLCI was traded tremendously low at 838 points in March 2009. Since then, the Malaysian stock market has recouped, where the index closed outstandingly higher at 1,691 points in December 2018. In spite of that, the last two quarters of 2018, Malaysian stock market was seen to continue its downtrend as a consequence of declining trading volume. This was in line with the global performance due to fluctuations in world commodities prices particularly crude oil, crude palm oil and gold.

In addition, investors' confidence or belief was moderated when the new government of Malaysia took office in May 2018, where Bursa Malaysia was adjusting to government policy shifts. The investors now are waiting for economic and financial policies introduced by the new government that will affect the capital market. On top of that, Malaysian stock market is predicted to be affected by among others, the US-China trade war, China's economic surge and the US slower economic growth. Nevertheless, Malaysian stock market will continue to be resilient, given the country's sound economic fundamentals, continued growth of the domestic corporate sectors, diversified economic sectors and investor base and the inflow of foreign investments into Malaysian stock market as the international investors diversifying or shifting their funds from developed economies to developing or emerging economies.

### **Literature Review**

The study on co-movement and causality between the stock markets and macroeconomic variables is very crucial. This is because from the study we could find out whether both are moving together or not in long and short runs besides discovering their causal relationships. The findings would be very useful to stock market participants, financial analysts, fund managers and business firms in making well informed and best investment and economic decisions. In addition, those parties could improve their planning and forecasting for future. As a result, the parties concerned will be able to maximize their return and minimize the risk.

### ***Malaysian Stock Market and Macroeconomic Variables***

Ibrahim (1999) found that the stock market of Malaysia co-moves with the consumer price index (CPI), domestic credit aggregates and official reserves (excludes gold) whilst the stock market does not co-move with the industrial production index (IPI), money supply and foreign exchange rate. Mahmood and Dinniah (2007) also noted the co-movement between the stock market with IPI and foreign exchange rate, respectively. Meanwhile, Ibrahim (2000) and Asmy et al. (2009) disclosed the co-movement between the stock market with money supply and foreign exchange rate. Further, both revealed that there is one-way causal relationship running from the foreign exchange rate and official reserves to the stock prices in short run, respectively. Latest study by Hamidi et al. (2018) reported there is co-movement between Malaysian stock index with foreign exchange rate, money supply, inflation rate and IPI. Their study also concluded Malaysian stock market is more affected by domestic than foreign macroeconomic variables.

Ibrahim and Yusoff (2001) showed that the stock market is negatively associated with money supply in long run. Whereas, the stock prices are positively affected by money supply in short run. Vejzagic and Zarafat (2013) discovered that Hijrah Shariah index has significant relationship with interest rates, foreign exchange rate and money supply. The Shariah index is found to pose negative impacts on interest rate and foreign exchange rate, whereas money supply is positively affected by the index. Hussin et al. (2012) concluded that the Shariah index has significant positive relationship with CPI whilst the index has negative relationship with money supply and foreign exchange rate. However, the Shariah index is found to have insignificant negative relationship with Islamic Interbank Rate (IIR).

### ***Asian Stock Markets and Macroeconomic Variables***

The changes in stock prices of five ASEAN stock markets namely Indonesia, Malaysia, Singapore, Thailand and the Philippines are caused by the changes in their respective interest rate, money supply and gross national product (Wongbangpo & Sharma, 2002). This finding implies that the historical values of macroeconomic variables are useful to predict future movement of stock market prices. Kurihara (2006) reported that the Japanese stock prices are caused by exchange rate and the US stock prices, whereas no effect is found by interest rate on the Japanese stock prices. Meanwhile, Mahmood and Dinniah (2007) revealed that the stock prices of Japan, Korea, Hong Kong and Australia co-move with the exchange rate, CPI and IPI in long run, respectively. In addition, there is causal relationship in short run between the stock prices and the macroeconomic variables, except for Hong Kong.

Brahmasrene and Jiranyakul (2007) found the co-movement between Thailand stock index and IPI, money supply, exchange rate and oil price for both periods of pre and post financial crisis. Money supply poses positive impact on the stock index whilst IPI, exchange rate and oil price have negative impacts for pre-crisis period, whereas money supply affects the stock index positively for post-crisis period. Valadkhani and Chancharat (2008) concluded that there is opportunity for the investment portfolio diversification across borders of countries in long run. They also found one-way causal relationships in short run running from the stock markets of Hong Kong, the Philippines and the UK to Thailand stock market, respectively. Meanwhile, there is one-way causal relationship running from Thailand stock market to the markets of Indonesia and the US in short run. Notable finding is that there are two-way causal relationships between Thailand stock market with Malaysia, Singapore and Taiwan stock markets, respectively.

Ray (2012) found one-way causal relationship between Indian stock price and inflation, FDI, GDP, exchange rate, and gross fixed capital formation, respectively. Meanwhile, the study discovered two-way causal relationship between the stock price and foreign exchange reserve, money supply, crude oil price and whole price index, respectively. The study also reported that crude oil price and gold price have significant negative impacts on the stock price, whereas foreign exchange reserve has positive impact on the stock price. Further, the study concluded no causal relationship between the stock price and interest rate and IPI. Patel (2012) revealed co-movement between interest rate, inflation, exchange rate, IPI, money supply, gold, silver and crude oil prices with the two Indian stock market indices namely Sensex and S&P CNX Nifty. This study supports Ray (2012) on the one-way causality from exchange rate to stock market indices. However, he found one-way causal relationship between crude oil price and IPI with the Indian stock indices. Global gold, silver and crude oil prices are found to be major determinants for the Indian stock markets. Agrawal et al. (2010) showed one-way causal relationship from Indian Nifty index to the exchange rate particularly when there is hike in the stock return, which results the exchange rate to depreciate.

Kalyanaraman and Tuwajri (2014) proved co-movement in long run between the CPI, industrial output, money supply, exchange rate, oil prices with Saudi all share stock index. All the tested macroeconomic variables, except the US S&P 500 index, are found to cause the changes in the Saudi stock prices. The presence of long run causal relationship is also spotted from the macroeconomic variables to the Saudi stock prices. However, short run two-way causal relationship is only discovered between the stock prices and oil prices. Majid (2018) revealed the co-movement between the Indonesian Islamic stock index with the Islamic stock indices of Japan, the UK and the US, where the Japanese index poses more impact on the Indonesian index than the other two stock indices.

#### ***Other World Stock Markets and Macroeconomic Variables***

Hondroyiannis and Papapetrou (2001) spotted IPI, interest rate, exchange rate and foreign stock markets only explain partially the Greece stock market behaviour. Whereas, oil price affects the stock price movements and has negative impact on the Greece economy. Buyuksalvarci and Abdioglu (2010) found one-way causal relationship running from Turkey's stock price to foreign exchange rate, gold price, money supply, IPI and inflation rate in long run. The study also noted that future changes in the macroeconomic variables can be caused by the changes in its stock index. Kalyanaraman and Tuwajri (2014) revealed co-movement between the Saudi's CPI, industrial output, money supply, exchange rate, oil prices, and stock prices with the US S&P 500 index. All the tested macroeconomic variables are found to affect the US stock index. Nevertheless, the US index does not cause the Saudi index. The study further indicated long run causal relationship from the macroeconomic variables to the stock indices. Two-way causal relationship is only discovered between stock indices and oil prices in short run.

Barakat et al. (2016) found co-movement between the Egyptian and Tunisian stock markets with the CPI, money supply, exchange rate and interest rate, respectively. The study proved causal relationship exists between both stock markets and the selected macroeconomic variables except for CPI in Tunisia that indicated no causality with its stock market. Parsva and Lean (2018) suggested two-way causal relationship between Jordan, Kuwait and Saudi Arabia stock markets with their respective exchange rates, inflation rates and oil prices for the period after the 2007/2008 global financial crisis. However, the study found no causal relationship for the Iranian stock market. Meanwhile, the study noted two-way causal

relationship for Oman stock market with the selected variables for both periods of pre and post crisis. These findings imply that even though the countries are geographically located in the same region and sharing almost similar economic fundamentals, but there are conflicting results when it comes to co-movement and causal relationship between their stock markets and the macroeconomic variables, respectively.

### Data and Methodology

In this study, we use monthly data from January 2010 to December 2018. We decide to test starting the year 2010 because we want to exclude the impacts of the global financial crisis during 2007 to 2009. To the best of our knowledge and search, our study presents the latest data up to the year 2018 as previous researches on Malaysian stock market were covered the data for the year 2014 and before. The Augmented-Dickey Fuller (ADF) test is employed to examine the unit root or stationarity of the data series. Then, Vector Autoregressive (VAR) test is performed to select the optimal lag length. Once the data is integrated in same order, the Johansen co-integration test is conducted to investigate the co-movement in long run between the Malaysian stock index and the selected macroeconomic variables. Further, we run the Vector Error Correction Model (VECM) to examine long run and short run causal relationship between the stock index and the variables. Finally, we perform the pairwise Granger causality test to determine short run causal relationship between the stock index and the independent macroeconomic variables. All the tests are run in the EViews 10 software. The results produced are then analysed in sequence of the tests explained above. Table 1 below summarizes the variables used in this study.

**Table 1: Summary of Variables**

Dependent Variable	Independent (Macroeconomic) Variables	
	Domestic	Foreign
FTSE Bursa Malaysia KLCI (FBMKLCI) as the proxy for Malaysian stock market. FBMKLCI composes of the 30 largest companies by market capitalization listed on the Main Market in Bursa Malaysia	1. Gross international reserves & foreign currency assets (held by Bank Negara Malaysia or the Central Bank of Malaysia) 2. Private sector domestic credit (loans and debt securities held by local businesses) 3. Foreign exchange rate (Malaysian ringgit to the US dollar)	4. World crude oil price (based on West Texas Intermediate-WTI) 5. World gold price 6. Five world's major stock markets: Singapore, China, the US, Hong Kong and Japan (represent Malaysia's top 5 trading partners in 2018 that constitute 51.3% or USD126.9 billion of total Malaysian exports)

Source: Datastream (Thomson Reuters)

### Analysis of Results and Discussion

#### ADF Test

*Null hypothesis: The data series have unit root or not stationary*

The Augmented Dickey Fuller (ADF) test shows that the data series are not stationary or having unit root in level order,  $I(0)$ . The  $p$ -values of all variables are more than 0.05 and all the absolute values of  $t$ -statistics are lower than the test critical values (-2.888932, -2.889753), at 5% significance level. So, we cannot reject the null hypothesis. However, when we converted the data series into first difference,  $I(1)$ , all the data series become stationary or

integrated, where  $p$ -values are less than 0.05 and the absolute values of  $t$ -statistics are higher than the test critical values. These results fulfil the assumption and prerequisite prior to running the Johansen co-integration test, which all data series must be stationary and integrated in the same order and in this case in first difference.

### ***Vector Autoregression (VAR)***

The results of VAR from all the five criterion namely sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQIC) are unanimous, where each criteria selects lag 8 as the optimal lag. The optimal lag length is very important in conducting the co-integration and other tests because if we use too many lags, it will result in loss in degree of freedom, statistically insignificant coefficients and multi-collinearity problem, whereas if too few lags are used in the tests, it most probably would lead to specification errors. In this study, we use the optimal lag as suggested by the criterion.

### ***Bivariate Johansen Co-integration Test***

The test reveals that only three series that co-move with one another namely between the FBMKLCI with gross international reserves and foreign currency assets, FBMKLCI with world gold price, and FBMKLCI with Singapore's STI. The three series indicate Trace statistics larger than the test critical value and  $p$ -values less than 0.05. These findings imply that the FBMKLCI is co-moving with the gross international reserves and foreign currency assets, world gold price and STI in long run, respectively. In other words, the findings suggest that the series are moving in tandem towards the same direction in long run. This means FBMKLCI could be used as a leading indicator in predicting the future movement of the gross international reserves and foreign currency assets, world gold price and STI. Likewise, the three macroeconomic variables could be used to predict the changes in FBMKLCI in future. Meanwhile, we do not find existence of co-movement for the FBMKLCI with the other macroeconomic variables. Hence, we could say that the FBMKLCI and the other macroeconomic variables are not moving towards the same equilibrium in long run. Table 2 summarizes the results of bivariate or pairwise Johansen co-integration test that has significant findings.

**Table 2: Bivariate Johansen Co-integration Test Results**

Series	Trace Test		Maximum Eigenvalue Test	
	Trace Stat.	Prob.	Max-Eigen Stat.	Prob.
FBMKLCI INT_RSRV	16.29711	0.0378*	12.20577	0.1031
FBMKLCI GOLD	19.61850	0.0113*	14.20292	0.0511
FBMKLCI STI	16.93303	0.0302*	11.66680	0.1238
Test Critical Value	15.49471		14.26460	

### ***Vector Error Correction Model (VECM)***

Further, we have performed the VECM test on the four co-moving variables to see their causal relationship in long run and short run. First, we test for long run causal relationship among the variables. Each one of the four variables will act as dependent variable and is tested against the other three, which act as independent variables. In order for a long run causal relationship to exist, the two conditions must be met namely the coefficient must be negative and the probability or  $p$ -value must be significant or below 0.05. Based on the

results, we found no long run causal relationship among the four variables. Despite the FBMKLCI, gross international reserves and foreign currency assets, and world gold price show negative coefficients but the  $p$ -value is not significant, whereas STI indicates significant  $p$ -value but the coefficient is not negative. What we could conclude here is that even though the FBMKLCI is co-moving with the other three variables, respectively but the changes in FBMKLCI do not cause the changes in the other three variables in long run or vice versa.

**Table 3: VECM Long Run Causality Test Results**

<b>Dependent Variable</b>	<b>Coefficient</b>	<b><math>p</math>-value</b>
FBMKLCI	-0.074459	0.2668
INT_RSRV	-5.886060	0.1846
GOLD	-0.023299	0.7762
STI	0.403658	0.0209*

***Wald test***

Then, we check the short run causal relationship among the four variables using the Wald test. We only found one-way short run causal relationship that is running from the Singapore's STI to the FBMKLCI, where the Chi-square  $p$ -value is 0.0115 that is significant below 0.05. This finding implies that the changes in FBMKLCI in short run is caused or influenced by the STI, but not the other way around. Whereas, the other variables do not reveal any short run causal relationship among each other.

**Table 4: Wald Test Results**

<b>Running from</b>	<b>FBMKLCI</b>	<b>INT_RSRV</b>	<b>GOLD</b>	<b>STI</b>
FBMKLCI	-	0.1059	0.1497	0.0115*
INT_RSRV	0.0652	-	0.0875	0.1113
GOLD	0.1215	0.0524	-	0.3677
STI	0.6730	0.0538	0.0654	-

***Pairwise Granger Causality Test***

In addition, we have also performed the pairwise Granger Causality test to determine the causality among the variables. We spotted that only one-way causality exists between each pair of variables. Table 5 summarizes the results of pairwise Granger causality test. Malaysia's international gross reserve and foreign currency asset is Granger-caused by FBMKLCI, private sector gross domestic credit, the US's DJIA and Japanese Nikkei 225, respectively. Malaysia's MYR-to-USD exchange rate is found to Granger-cause the private sector domestic credit.

Meanwhile, Shanghai Index is found to be Granger-caused by Malaysia's gross international reserve and world crude oil price. The US's DJIA is observed to be Granger-caused by Singapore's STI and Hong Kong's HSI. The result also reveals that there is one-way causality running from the Japanese Nikkei 225 to Singapore's STI.

**Table 5: Pairwise Granger Causality Test Results**

<b>Null Hypothesis</b>	<b>F-Statistic</b>	<b>Prob.</b>
FBMKLCI does not Granger Cause INT_RSRV	3.02771	0.0049*
PRIVATE_CR does not Granger Cause INT_RSRV	2.41682	0.0213*
EXCHANGE_R does not Granger Cause PRIVATE_CR	2.06295	0.0488*
PRIVATE_CR does not Granger Cause GOLD	2.19889	0.0356*
INT_RSRV does not Granger Cause SHANGHAI	2.42406	0.0209*



DJIA does not Granger Cause INT_RSRV	2.22949	0.0331*
NIKKEI225 does not Granger Cause INT_RSRV	3.73295	0.0009*
CO_WTI does not Granger Cause SHANGHAI	3.32226	0.0024*
STI does not Granger Cause DJIA	2.08433	0.0464*
NIKKEI225 does not Granger Cause STI	2.09640	0.0451*
HANGSENG does not Granger Cause DJIA	2.24955	0.0316*

\*Denote the 5% Significance Level

### Conclusion and Recommendation

This paper examines the co-movement and causal relationship between Malaysia's FBMKLCI with selected domestic and foreign macroeconomic variables. ADF test proves that the data series are integrated in first difference,  $I(1)$ . Using the optimal lag 8 suggested, the Trace statistics of pairwise Johansen co-integration test reveals the co-movement between FBMKLCI with Malaysia's gross international reserve and foreign currency assets, world gold price and Singapore's STI. With this finding, we conclude that Malaysia's FBMKLCI could act as an important leading indicator to predict the changes in the three variables. So are the three variables could be used as good predictor for the changes in FBMKLCI in future. In term of stock investment, we note that Malaysian investors and Singaporean investors could not take advantage or opportunity to diversify their investments in respective countries. This is because there is presence of co-movement between the Malaysian and Singaporean benchmark stock indices in long run. Whereas, Malaysian stock investors could reap better return by diversifying their investments in China, Hong Kong, the US and Japan due to no co-movement of the markets in long run. Despite of the existence of co-movement, VECM discloses that there is no causal relationship in long or short runs among the variables except a one-way short run causality running from the Singapore's STI to the FBMKLCI. This shows that the changes in FBMKLCI in short run is affected by the changes in STI but not vice versa.

Finally, the pairwise Granger causality test reveals that the Malaysia's gross international reserve and foreign currency asset is Granger-caused by FBMKLCI, private sector domestic credit, the US's DJIA and Japanese Nikkei 225, respectively. The gross international reserve represents the prosperity of an economy and wealth of a country. Here, we could conclude that the Malaysian reserve rise or fall is mainly attributable to stock market performance of the country and the investment by and growth of the domestic private sector. In addition, the country's reserve is also influenced by the viability of economy of its two main trading partners namely the US and Japan. This paper merely focused on Malaysian stock market with several domestic and foreign macroeconomic variables for the period post the 2007/2008 global financial crisis. Further research could be conducted on other countries that have similar economic fundamentals such as Indonesia and Thailand, where the findings could be compared with Malaysian context. Besides, future study could test on other macroeconomic variables covering the period of pre or during financial crisis. Other types of test could be employed such as logit, probit and multiple linear regressions as robustness. Future research could also extend the objectives of study including market efficiency or informational asymmetry of stock markets towards the changes in macroeconomic variables.

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