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Impact of Macroeconomic Variables on Stock Market of Malaysia

Alam Rasheed[1], Mitra Saeedi[2], Nalini Gebril[3], Kumaraseh Hariraj[4]

Abstract-- *This research examines the long run and short run relationship between selected macroeconomic variables (Interest Rate, Inflation, Money Supply and World Oil Price and Exchange Rate) and stock market of Malaysia using monthly data from 2002 to 2015. The mobilization of funds into useful economic activity increases the productivity which has great impact on the economics of a country. The research applies Autoregressive Distributed Lags (ARDL) model to examine long run and short run relationship. The results reveal that stock prices in Malaysia have a long-term relationship with the selected macroeconomic variables, however, the short run relationship is found to be weak. These findings provide insights for investors and analysts to consider these factors in portfolio selection. This research also gives policy direction to the government in implementation of monetary policy.*

Key words-- *Autoregressive Distributed Lags, Macroeconomic Variables, Portfolio, Stock Market.*

I. INTRODUCTION

Stock market has been an important avenue for investors to manage risks and mobilize funds. This mobilization of funds into useful economic activity increases the productivity of a country. Thus mobilizing unused funds into useful economic activities leads economies to grow. When economies grow it provides more opportunities for common people. These more opportunities translate into better living life style. Hence what happens in stock market have a profound effect on people's life. This increase in economic activity that stock market brings has effect on economic growth of a country. Theoretically this is motivated by the asset pricing model Arbitrage Pricing Theory (APT) [1]. APT model asserts that asset expected returns can be explained by multiple risk factors or macroeconomic variables. This means changes in economic variables may affect stock prices through its influences on expected return.

The theory supports the view that macroeconomic variables affect stock prices. Other perspective is that stock prices may as well influence economic activities of an economy. Increase in stock prices increases peoples' demand to invest in stock market. This increases the demand for real money and better interest rate. As more people demand for money increases and drive to make more savings increases, there will be less money circulating in the economy. This pushes the value of domestic currency to appreciate.

Furthermore, when stock prices increase the domestic financial assets become more attractive. This attracts investors to invest domestically rather than investing in another country. This will also attract foreign investors to invest in the country. When more capital flows into the country it pushes domestic currency to appreciate. Moreover, when more investment flows into the country it helps to grow the domestic industry. Thus this leads to have a wealth

[1]*Asia Pacific University, Kuala Lumpur, Malaysia*
[2]*Asia Pacific University, Kuala Lumpur, Malaysia*
[3]*Asia Pacific University, Kuala Lumpur, Malaysia*
[4]*Asia Pacific University, Kuala Lumpur, Malaysia*

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effect on households and creates household liquidity effect.

This paper studies the long run and short run relationship between selected macroeconomic variables *(*Interest Rate,Inflation, Money Supply and World Oil Price and Exchange Rate)and stock market of Malaysia using monthly data from January 2002 to December 2015.

This research is structured to give introduction in the first section .Second section reviews the literature followed by methodology in third section. Section four discusses the results of the findings and section five concludes the paper and provides recommendations.

II. LITERATURE REVIEW

There are many empirical evidence linking macroeconomic variables and stock market in developed countries. These relations have been evaluated empirically for developed economies more than emerging economies. The macroeconomic factors that affect performance of stock market of developed countries are well documented in the literature. [1] – [6].

Empirical evaluation on Malaysia context is not as extensive as developed markets; moreover, the existing evaluations done for Malaysia revealed mixed results. Reference [7] found no long term relation with stock market prices and real exchange rate in Malaysia. However, reference [8] found monetary policy had adverse effect on financial markets in Malaysia. Reference [9] found long run relationship between stock prices and money supply, interest rate, exchange rate, reserves and industrial production index. Reference [10] – [14] documented significant relationship between stock prices and macroeconomic variables.

There are few studies on the relationship between macroeconomic variables and stock prices for Middle East countries. Reference [15] examined the long run relationship between stock prices and five selected macroeconomic variables for Saudi Arabia. The consumer price index, industrial output, money supply, exchange rate and oil price were the five selected macroeconomic variables. The research applied Johansen cointegration test and concluded that stock prices had a long term relationship with all selected macroeconomic variables.

Reference [16] examined how Singapore stock market reacts to macroeconomic variables. The study applied Vector Error Correction Model (VECM) and studied the long term relationship between Stock Market Index (STI) and other selected indices with the selected macroeconomic variables. The interest rates, industrial production, price levels, exchange rate and money supply were the selected macroeconomic variables. The study revealed that there was short term and long term relationship between stock market and selected macroeconomic variables.Similar research results were reported from study done by [17]. This study examined relationship between Indian Stock Market Index (BSE Sensex) and five selected macroeconomic variables. The production index, wholesale price index, money supply, treasury bills rates and exchange rates were the selected macroeconomic variables. The examination applied Johansen's co-integration and vector error correction model. It is been revealed by the study that selected macroeconomic variables had long term relationship with stock market prices in India.A study on Taiwan market examined relationship between stock prices and the selected macroeconomic variables in Taiwan. The employment rate, exchange rate, GDP, Inflation and money supply were the selected macroeconomic variables. The study applied

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linear regression model. The study argued that exchange rate and GDP affects stock returns of all stocks in Taiwan stock exchange. The study further revealed that inflation rate, exchange rate and money supply only affect big and medium companies' stock returns [18].

Reference [19] explored relationship between stock prices and selected macroeconomic variables of Malaysia with other countries included in the research. The research examined relationship between stock prices and exchange rate during 1997 Asian financial crisis and immediately after crisis. Malaysia, Indonesia, Philippines and Thailand were the four selected ASEAN countries. The analysis applied bootstrap causality tests with leveraged adjustments. The study revealed that stock prices and exchange rate were significantly linked in the non-crisis period. The study further revealed that there were no link between stock prices and exchange rate during the crisis period.

III. RESEARCH METHODOLOGY

This research examines long run and short run relationship between stock market and five selected macroeconomic variables in Malaysia. The research specifies that the Stock Prices (KLCI) to be determined by five selected macroeconomic variables: Interest Rate (KLIBOR), Consumer Price Index (PI), Money Supply (M2), World Crude Oil Price (CO) and Exchange Rate (ER). The paper applies ARDL model and the error correction model (ECM) of ARDL version. The paper uses monthly data from January 2002 to December 2015; monthly data are used to avoid white noise or small random fluctuations existed in daily or weekly data. All variables have been transformed to natural logarithm.

ARDL model is implemented after determining the stochastic properties of the variables. To determine the integration order of variables,this research uses unit root tests,Augmented Dickey–Fuller (ADF) and Phillips-Perron (PP) tests. The ARDL cointegration model is specified in the following equation:

$$\Delta KLCI_t = a_0 + \sum_{i=1}^{n} a_{1i}\ \Delta KLCI_{t-i} + \sum_{i=0}^{n} a_{2i}\ \Delta KLIBOR_{t-i} + \sum_{i=0}^{n} a_{3i}\ \Delta PI_{t-i} + \sum_{i=0}^{n} a_{4i}\ \Delta M2_{t-i} + \sum_{i=0}^{n} a_{5i}\ \Delta CO_{t-i} + \sum_{i=0}^{n} a_{6i}\ \Delta ER_{t-i} + \beta_1 KLCIS_{t-1} + \beta_2 KLIBOR_{t-1} + \beta_3 PI_{t-1} + \beta_4 M2_{t-1} + \beta_5 CO_{t-1} + \beta_6 ER_{t-1} + \mu_t \quad (1)$$

The model specifies that Malaysian stock prices have relationship with Bank Interest Rate (KLIBOR), Consumer Price Index (PI), Money Supply M2, World Crude Oil Price (CO) and Exchange Rate (ER). Δ denotes first difference level. The coefficient a_{1i}, a_{2i}, a_{3i}, a_{4i}, a_{5i} and a_{6i} are the impact multipliers. The β_1, β_2, β_3, β_4, β_5 and β_6 denote the long run relationship. The μ_t denotes error term. Furthermore, the equation can be extended to include ARDL version of error correction model. This is expressed as below:

$$\Delta KLCI_t = a_0 + \sum_{i=1}^{n} a_{1i}\ \Delta KLCI_{t-i} + \sum_{i=0}^{n} a_{2i}\ \Delta KLIBOR_{t-i} + \sum_{i=0}^{n} a_{3i}\ \Delta PI_{t-i} + \sum_{i=0}^{n} a_{4i}\ \Delta M2_{t-i} + \sum_{i=0}^{n} a_{5i}\ \Delta CO_{t-i} + \sum_{i=0}^{n} a_{6i}\ \Delta ER_{t-i} + \lambda EC_{t-1} + \mu_t \quad (2)$$

Residuals obtained from the long run coefficient from previous equation are included as EC and λ is the speed of adjustment parameter.ARDL model is used in this research because this model does not require variables to be in certain order of integration. The other advantage of using this model is that the model does not require structural restrictions and the model is simple to apply and interpret. Moreover, this model allows different variables to have

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different optimal number of lags.

IV. RESULTS& DISCUSSSIONS

A. Unit Root Test

The outcomes of the unit root tests presented in Table 1 and Table 2 suggest that all series are integrated of order either one or zero (I(0) and I(1)). Furthermore the results show that neither of the variables is integrated of order two (I(2)). This confirms that Autoregressive Distributed Lag (ARDL) model is a suitable model in search of the existence of the long run and short run relationship among the variables. Table 3 provides a summary of the order of integration for the variables of the study.

Table 1: Results of Unit Root Tests in Level form

Variable	ADF tests		PP tests	
	Constant	**Constant and Trend**	**Constant**	**Constant and Trend**
LKLCI	-1.55 (1)	-2.70 (5)	-1.46	-1.09
LKLIBOR	-2.18 (1)	-2.29 (1)	-1.87	-1.92
LPI	0.17 (5)	-3.64 (1)***	0.36	-2.36
LM2	-2.49 (1)	-0.26 (1)	-2.01	-0.22
LCO	-2.16 (1)	-1.07 (1)	-2.25	-0.08
LER	-0.91 (1)	0.34 (1)	-1.25	0.766

Notes:

1. ***, **, * imply significant at 1%, 5% and 10% respectively
2. Numbers in brackets for ADF statistics represents the lag length of the dependent variable used to obtain white noise residuals.
3. The lag length for was selected using AIC
4. Critical values for ADF with Constant are 3.00534, 2.8793 & 2.727758 at 1%, 5% & 10% respectively
5. Critical values for ADF with Constant and trend are 3.582966, 3.4382 & 3.257242 at 1%, 5% & 10% respectively
6. Critical values for PP with Constant are 3.00001, 2.8788, & 2.72728 at 1%, 5% & 10% respectively

Critical values for PP with Constant and trend are 3.4374, 3.4374 & 3.25648 at 1%, 5% & 10%

Table 1: Results of Unit Root Tests in First Difference form

Variable	ADF tests		PP tests	
	Constant	**Constant and Trend**	**Constant**	**Constant and Trend**
DKLCI	-6.93 (1)***	-7.00 (1)***	-9.76***	-9.71***
DKLIBOR	-6.17 (1)***	-6.18 (1)***	-6.94***	-6.88***
DPI	-6.83 (4)***	-6.82 (4)***	-9.04***	-9.06***

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DM2	-5.36 (4)***	-6.37 (4)***	-11.88***	-11.35***
DCO	-5.71(5)***	-6.18 (5)***	-8.53***	-8.55***
DER	-3.77 (5)***	-4.16 (5)***	-11.70***	-11.66***

Notes:

1. ***, **, * imply significant at 1%, 5% and 10% respectively
2. Numbers in brackets for ADF statistics represents the lag length of the dependent variable used to obtain white noise residuals.
3. The lag length was selected using AIC
4. Critical values for ADF with Constant are 3.00064, 2.8794 & 2.72785 at 1%, 5% & 10% respectively
5. Critical values for ADF with Constant and trend are 3.58317, 3.4384 & 3.25743 at 1%, 5% & 10% respectively
6. Critical values for PP with Constant are 3.00012, 2.8789, & 2.72738 at 1%, 5% & 10% respectively
7. Critical values for PP with Constant and trend are 3.58234 , 3.4376 & 3.25667 at 1%, 5% & 10%

Table 2: Order of Integration

Variable	ADF tests	PP tests
LKLCI	I (1)	I (1)
LKLIBOR	I (1)	I (1)
LPI	I (0)	I (1)
LM2	I (1)	I (1)
LCO	I (1)	I (1)
LER	I (1)	I (1)

B. Long Run Relationship

F-statistics have been evaluated for 10 lags (Table 4). The optimal lag is selected using Akaike Information Criterion (AIC). The lag 4 is the selected optimal lag length for computation of long run coefficient estimates and short run error correction model. The F-Statistics value is higher than upper bound value of 3.250 at 90% significance level, 3.646 at 95% significance level and 4.540 at 99% significance level. This means there is a long term relationship between Stock Price andConsumer Price Index, Money Supply M2, World Oil Price and Exchange Rate. However, it should be noted that this results are preliminary findings. To explore more evidence of cointegration the research proceeds to long run coefficient estimates.The results of long run coefficient estimates is reported in Table 5.

Table 3: Results of F-Test for Cointegration

Order of Lag	F-Statistics F(KLCI|KLIBOR, PI, M2, CO, ER)
1	4.6557(***)
2	5.3043(***)

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3	5.2863(***)
4	5.3951(***)
5	2.3892
6	2.2975
7	2.2564
8	2.7857
9	2.1711
10	2.5793

Notes;

1. The critical value bounds are obtained from Pesaran and Shin (2001).

2. The bounds of 6 regressors with unrestricted incept and no trend are, 2.476 - 3.646 at 95%, 2.141 - 3.250 at 90% and 3.267 - 4.540 at 99%.

3. * denotes F statistic fall above 90% upper bound.

4. ** denotes F statistic fall above 95% upper bound.

5. *** denotes F statistic fall above 99% upper bound.

Table 4: Long Run Coefficient Estimates

Variables	**Coefficient**	**P Value**
Constant	11.4686	0.006
DLKLIBOR	0.1725	0.293
DLPI	-9.1139	0.001
DLM2	2.9827	0.000
DLCO	-0.5584	0.002
DLER	-2.0369	0.000

The results in table 5 show that Interest Rate (KLIBOR) is not a significant variable in the model. In theory it is expected that a decrease in Bank interest rates lowers the future expected return of investors. Thus, this should lead to stock prices decrease in the long run. The results also show that Consumer Price Index (PI) is a significant factor in explaining stock prices in long run andstock prices and inflation has a negativerelationship. The increase in inflation is expected to increase uncertainty on future stock return. When uncertainty increases investors tend to become reluctant to invest. The less demand for stocks should decrease the prices of the stocks.

Table 5shows a positive relationship between stock prices and Money Supply in the long run. Increase in Money Supply

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M2 increases the money circulating in the economy. This leads more people to invest in areas that can give potential return resultingin increase in demand for stocks. When more people demand for stocks increases, it results in an increase in the stock prices.

Asignificantnegative relationship between stock prices (KLCI) and World Crude Oil Prices (CO) is proposed in long run model from Table 5. This can be explained as Malaysia is an oil producing country and the economy is highly dependent on revenue generated by the oil trade. Therefore, increase in world oil price strengthens Malaysian economy. As Malaysian economy strengthens, it becomes more unattractive for foreign investors, as the strengthening economy tends to increase the cost for foreign investors. As the cost increases the foreign investors will pull out of the country. As more foreign investors pull out from the stock market, the prices of stocks tend to fall. Therefore, the finding of this research confirms this theory.

The results show that there is aninverse long run relationship between stock prices (KLCI) and Exchange Rate (ER).

Currency depreciation drives stock prices to decrease in the long run. This is because Malaysia economy is highly dependent on imports and currency depreciation increases the prices of raw materials. This decreases manufacturing companies' profit margin. Moreover, currency depreciation drives investments out of the country. As more investment is driven out of the country less demand is there for stocks from foreign investors. The less demand for stocks leads to decrease stock prices. Argument against this theory is that currency depreciation encourages exports and this will increase companies' profits. This theory argues currency depreciation should increase the stock prices. However, the net effects depend on which force is more dominant. The findings of this research show that currency depreciation in the long run drives stock prices to decrease is more dominant.

The summary of the results show that behavior of Malaysian stock prices in the long run are governed by stock prices relationship to Interest Rate (KLIBOR), Consumer Price Index (PI), Money Supply M2 (M2), World Oil Price (CO) and Exchange Rate (ER). This long run cointegration is proposed the ARDL model (1, 1, 2, 0, 4, 1) and the model can be expressed as follows:

$$KLCI_t = 11.47Constant_t + 0.17KLIBOR_t - 9.11PI_t + 2.98M2_t - 0.56CO_t - 2.03ER_t$$
$$(0.006) \quad (0.293) \quad (0.001) \quad (0.00) \quad (0.002) \quad (0.00)$$

Note: The values given in brackets are the probability values.

To further confirm existence of long term relationship between stock prices (KLCI) and selected macroeconomic variables the research applies error correction model.

C. Short Run Relationship

Table 6 shows the results of error correction representation for ARDL model (1, 1, 2, 0, 4, 1) based on AIC lag order 4 when dependent variable is KLCI.

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Table 6: Error Correction Representation of ARDL Model

Dependent Variable KLCI				
Regressors	***Coefficient***	***Standard Error***	***T Ratio***	***Probability***
dLKLIBOR	0.28	0.10	2.01	0.04
dLPI	-2.05	0.71	-2.89	0.00
dLPI1	1.25	0.75	1.68	0.09
dLM2	0.39	0.07	5.62	0.00
dLCO	0.05	0.04	1.19	0.23
dLCO1	0.08	0.04	1.99	0.05
dLCO2	-0.02	0.04	-0.56	0.58
dLCO3	0.07	0.04	1.85	0.07
dLER	-1.09	0.16	-6.93	0.00
ecm (-1)	-0.13	0.04	-3.61	0.00
R Square				0.49
F-Statistics (Probability)				14.29 (0.00)
DW Statistics				1.96
Residual Sum of Squares				0.16

The coefficient ECM of KLCI is at -0.13306 and probability value is at 0. This shows that coefficient of ECM is negative and is highly significant. This further confirms long run relationship between stock prices (KLCI) and the selected macroeconomic variables. Furthermore, coefficient of ECM term indicates that 13.306% of the disequilibrium in the stock prices (KLCI) is offset by the short term adjustment in each month. Moreover, the coefficient of ECM is close to zero in absolute terms meaning there is slow speed of convergence to equilibrium. The coefficient of ECM falls between 0 and -1 showing partial adjustment in converging to long term equilibrium.

The structural stability of the model proposed by this research has been tested and the results are plotted in Fig.1 and Fig.2.

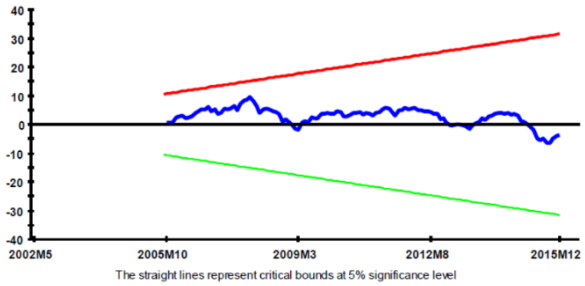

Fig.1: Plot of Cumulative Sum of Recursive Residuals

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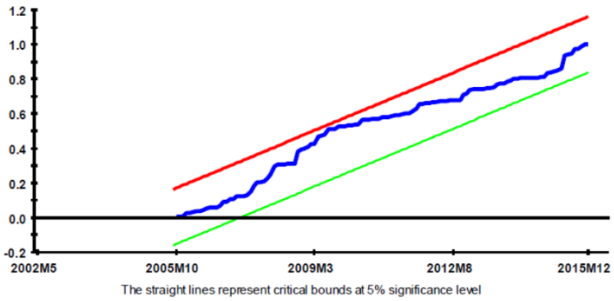

Fig. 2: Plot of Cumulative Sum of Squares of Recursive Residuals

V. CONCLUSION

The stock market provides important economic functions to the economy. These important functions provide liquidity and a mechanism for raising capital acting as a mediator between investors and savers. This research studies the long run and short run relationship between selected macroeconomic variables *(*Interest Rate,Inflation, Money Supply and World Oil Price and Exchange Rate) and stock market of Malaysia using monthly data from January 2002 to December2015 and applying Autoregressive Distributed Lags (ARDL) model. The results reveal that stock prices in Malaysia have a long run relationship with Interest Rate. Consumer Price Index, Money Supply M2, World Oil Price and Exchange Rate; however, Interest Rate is found to be not significant in long run. Moreover, the results reveal that Consumer Price Index, World Oil Price and Exchange Rate has an inverse long run relationship with stock prices while Money Supply M2 has a positive relationship with stock prices in Malaysia in long run. Regarding the short run relationship, the research finds that stock prices in Malaysia have a weak short run relationship with Consumer Price Index, Money Supply

M2, World Oil Price and Exchange Rate. The results of this research show valuable policy implications for investors and policy makers. This research provides insights for investors and analysts to consider these factors in asset allocations in portfolio selection. It also gives policy direction to the government in implementation of monetary policy.The extension of this study can include financial crisis and other macroeconomic factors in the model. Broader monetary aggregate, Money Supply M3, and real exchange rate are also recommended to replace M2 and nominal exchange rate used in the surrent model specification for further research.

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