INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 13, Issue 9, (2023) E-ISSN: 2222-6990

Analysis of Macroeconomic Indicators and IDX Composite Index: Evidence from Indonesia

Aung San Lwin[1], Jerome Kueh Swee Hui[1], Daw Tin Hla[2]

[1]Faculty of Economics and Business, Universiti Malaysia Sarawak, [2]Department of Commence, University of Co-operative and Management, Sagaing, Myanmar

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v13-i9/18518 DOI:10.6007/IJARBSS/v13-i9/18518

Published Date: *15* September 2023

Abstract

This study focuses on Indonesia stock market among the ASEAN; this paper presents the analysis of Indonesia stock market composite index (IDX) and macroeconomic indicators of Indonesia. The macroeconomic indicators utilised in this study are exchange rate denoted as IEXR, gross domestic products (IGDP), inflation (IINFR) and real interest rate (IRIR). The sample period examined in this study spans from 1988 to 2019. The data analysis includes stationary and cointegration test, models with three ways of testing of VECM (Error Correction t-test, Granger causality test and VECM. The findings reveal both long- and short-run cointegration between IDX and the independent variables mentioned above. IINFR and IRIR are found positively Granger cause IDX, suggesting their influence on stock market composite index performance over time. The results also show that all four macroeconomic factors have positive impacts on Indonesia stock market composite index (IDX). These key insights highlight importance of microeconomic factors for investors when considering investing into Indonesian stocks or other related financial products within the region.

Keywords: Macroeconomic Indicators, Stock Market Composite Index, Exchange Rate, GDP, Inflation, Real Interest Rate

Introduction

The stock market composite index, represented by the Jakarta Composite Index, serves as a vital benchmark that reflects the overall performance of the Indonesian stock market. Indonesia stock market composite index was low starting from 1988 to 2002 including Asian financial crisis period starting from July 1997. It was 376 in 1988, during the first decade of sample period, the highest index was 662 in 1996, just before Asian financial crisis. Indonesia suffered from Asian financial crisis by effecting lower stock market composite index 398 until 2002. And then stock market composite index (IDX) increased to 2447, just before world financial crisis effect in 2007. After 2008, IDX reached to maximum index 6469 in 2018 (Figure 1). The International Monetary Fund (IMF) offered a $43 billion bailout plan to boost market confidence in the Indonesian rupiah. However, it also demanded significant financial reform

measures in return, including the closure of 16 privately-owned banks and the gradual elimination of food and energy subsidies.

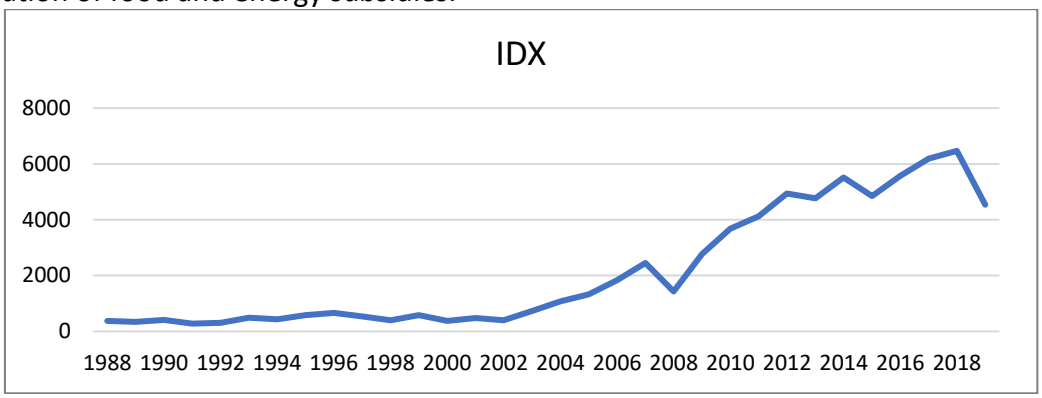

Figure 1: Indonesia composite index IDX

This paper intends to study the impact of important macroeconomic indicators such as exchange rate, gross domestic products, inflation and real interest rate on Indonesia stock market. Understanding the impact of those indicators towards stock market is essential so that the policy makers can emphasize on the critical indicators as to establish a stable stock market. Stable stock market will promote attractiveness among the investors to invest in the stock market of Indonesia.

Literature Review

This literature review aims to provide an overview of key studies investigating the influence of macroeconomic indicators on stock market composite indices.

Exchange Rate and Stock Market Association

In a study conducted by Tsai (2012), the interconnection between the stock market and foreign currency market was investigated in Taiwan, South Korea, Thailand, Malaysia, the Philippines, and Singapore during the period of 1992 to 2009. Rather than utilizing a conventional method, Tsai employed a quantile regression model. The findings indicated a negative association between exchange rates and stock markets, particularly in instances of extremely high or low exchange rates. Tang and Yao (2018) examined eleven emerging markets using cointegration and multivariate Granger causality analyses (Argentina, Brazil, China, India, Indonesia, South Korea, Mexico, Russia, Saudi Arabia, South Africa, and Turkey). They discovered that there was a positive association between the real exchange rate and the local stock market, except for Brazil and China. The influence of the exchange rate on the Pakistani stock market was studied by Suriani et al (2015), and the results show that the two factors are completely independent of one another. The findings highlight the message to postulate the following hypothesis to be tested in this study.

H_1: The stock market composite index is positively and significantly associated with foreign currency exchange rate.

Relationship between GDP and Stock Market

In research conducted by Boubakari and Jin (2010), the relationship between the stock market and economic growth was examined for the five Euronext countries, namely Belgium, France, Portugal, the Netherlands, and the United Kingdom, spanning the period from the first quarter of 1995 to the fourth quarter of 2008. The results showed that in several nations with

highly liquid and active stock markets, the stock market and economic growth are positively correlated. However, for countries with less liquid stock markets, the causality relationship was not considered significant. Masoud and Hardaker (2012) concluded that the development of the stock market holds a significant and positive influence on economic growth for the study of 42 emerging nations from 1995 to 2006. Between 1993 and 2011, Miguel et al (2013) indicated a bidirectional causal association between economic growth and Portugal's stock market, they, however, found no link between bank financing and economic growth. Regarding the review on the association between GDP and stock market, the observations from stock markets in western countries motivates the literature to postulate the following hypothesis as:

H_2: Gross domestic product is positively and significantly associated with stock market composite index.

Impact of Inflation on Stock Market

Pal and Mittal (2011) conducted a research study investigating Indian capital markets and their relationship with macroeconomic factors. They analysed quarterly data spanning from the first quarter of 1995 to the fourth quarter of 2008. They employed cointegration testing to analyse long-term relationships and ECM to detect short-term patterns. Their findings revealed that all the independent variables, except for gross domestic savings were significantly related to the dependent variable, stock prices. GDS was found to have no causal relationship with stock prices. Kwofie and Ansah (2018) investigated the impact of inflation on stock market returns in Ghana and established a positive and long-term correlation between the two variables. On the other hand, Singh and Padmakumari (2020) analysed time series data from 2012 to 2018 in India to explore how stock market returns react to inflation announcements. Their findings revealed a negative association between inflation and stock market returns. Based on the findings the following hypothesis is stated as

H_3: Inflation rate is positively and significantly associated with stock market composite index.

Association between Interest Rate and Stock Market

Eldomiaty et al (2019) discovered cointegration between stock prices and real interest rates, indicating a long-term relationship between the two variables. Moreover, their regression analysis demonstrated a positive correlation between real interest rates and stock prices, with variations in real interest rates resulting in significant fluctuations in stock prices. Jarefio et al (2016) found that fluctuations in interest rates affect the stock market performance of financial companies, resulting in either positive or negative impacts on their returns. Real interest rate risk is statistically strongly negatively associated with returns in the financial sector. The most severe market conditions and underperformance of the stock market are caused by real interest rate risk. The reason for the negative correlation is that when interest rates increase, borrowing costs increase, profits decrease, and the discount rate for investors increases. As a result, stock prices tend to decrease. Thus, rising interest rates indirectly affect stock prices (Ibrahim & Musah, 2014). Marry Hall (2019) has demonstrated that there is a negative correlation between interest rates and stock prices. Due to the findings from literature review, the following hypothesis is postulated in this research.

H_4: Real interest rate is positively and significantly associated with stock market composite index.

Data Collection and Sources of Data

The empirical analysis in this study utilizes time series data obtained from secondary sources and spans from 1988 to 2019 consisting of 120 annual observations for five variables: stock market composite index, foreign currency exchange rate, gross domestic product, inflation and real interest rates. Data on stock market composite indices were acquired from the Yahoo Finance website, while the data on other microeconomic variables were obtained from the World Bank data website. In this study, the return variables of the time series data were utilized for data analysis.

Model of Macroeconomic Indicators and IDX Composite Index

The empirical investigation in this study utilizes a general model specification to examine the impact of macroeconomic indicators on the composite index of the stock market. A base line model of macroeconomic variables and its stock market composite index (Equation 1) is constructed as follow

$$CI_t = \alpha_0 + \alpha_1 EXR_t + \alpha_2 GDP_t + \alpha_3 INFR_t + \alpha_4 RIR_t + \varepsilon_t$$

Equation 1

EXR stands for exchange rate*; GDP is* gross domestic product, INFR inflation rate and IRIR is denoted as real interest rate. As a constructing model of the impact of Indonesian Macroeconomic variables on the stock market composite index can be stated as VECM model (Equation 2)

$$IDX_t = \alpha_0 + \alpha_1 IDX_{t-1} + \alpha_2 IDX_{t-2} + \alpha_3 IEXR_{t-1} + \alpha_4 IEXR_{t-2} + \alpha_5 IGDP_{t-1} + \alpha_6 IGDP_{t-2} + \alpha_7 IINFR_{t-1} + \alpha_8 IINFR_{t-2} + \alpha_9 IRIR_{t-1} + \alpha_{10} IRIR_{t-2} + \varepsilon_t$$

Equation 2

To ensure that the variables are stationary, this study performed the unit root test before testing for cointegration. The outcome of unit root tests can be seen in Table 1.

Unit Root Tests

Table 1 displays the outcomes of both Augmented Dickey Fuller (Dickey & Fuller, 1979) and Phillips Perron (Phillips & Perron, 1988) unit root tests performed on the variables to ensure their stationarity before testing for cointegration. The results from both tests demonstrate that all the variables are stationary at first difference with a 99 percent confidence level. Thus, it can be inferred that the variables used in this study are stationary of order one, denoted as I(1). The hypothesis of unit roots in the variables IDX, IEXR, IGDP, IINFR, and IRIR is rejected upon taking the first difference, as indicated by the Augmented Dickey Fuller and Phillips Perron test statistics, which are lower than the critical values at a significant level of 1%. This confirms that all variables are significant at first difference and possess the same order of integration, I(1). Consequently, based on Table 1, it can be deduced that all variables are stationary and do not have unit roots.

Table 1

Results of Unit Root Tests for Indonesia Model

Tests / Series	Augmented Dickey Fuller		Phillips Perron	
	Level I (0)	1st Difference I (1)	Level I (0)	1st Difference I (1)
	Intercept	Intercept	Intercept	Intercept
IDX	-2.486742 (0.1289)	-7.328167*** (0.0000)	-6.623426*** (0.0000)	-15.24662*** (0.0000)
IEXR	-2.876746* (0.0604)	-6.718981*** (0.0000)	-5.659101*** (0.0001)	-21.07522*** (0.0001)
IGDP	-0.501046 (0.8772)	-5.617274*** (0.0001)	-0.655226 (0.8435)	-5.617274*** (0.0001)
IINFR	-2.019226 (0.2774)	-7.224777*** (0.0000)	-4.079522*** (0.0035)	-17.42490*** (0.0001)
IRIR	-2.980815 (0.0486)	-9.833553*** (0.0000)	-5.803595*** (0.0000)	-23.95877*** (0.0001)

Note: Asterisks (***) indicate statistically significant at 1% level, (**) indicate statistically significant at 5% level and (*) indicate statistically significant at 10% level.

Lag Length Selection

The determination of lag selection is used the lowest value as primary concern. Table 2 presents lag order selection statistics. There are three asterisks in the row of Lag 2; the lag order at two is suggested by LR, FPE, AIC and HQ. Therefore, the following tests are to be proceeding with the use of lag (2).

Table 2

Lag Length Selection

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	198.3325	NA	1.74e-12	-12.88884	-12.65530	-12.81413
1	342.1512	230.1098	6.48e-16	-20.81008	-19.40888*	-20.36182
2	378.0341	45.45168*	3.65e-16*	-21.53561*	-18.96674	-20.71380*

* indicates lag order selected by the criterion
LogL: Log likelihood, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SIC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Cointegration Test

The outcomes of the cointegration rank (r) tests, using both maximum Eigen value and trace statistics, are presented in Table 3.

Table 3

Results of Cointegration Tests for Indonesia Model

Null	Alternative	λ-max		λ-trace	
		Unadjusted	95% C.V.	Unadjusted	95% C.V.
$r = 0$	$r = 1$	45.53297**	33.87687	86.85778**	69.81889
$r \leq 1$	$r = 2$	20.64818	27.58434	41.32481	47.85613
$r \leq 2$	$r = 3$	12.66726	21.13162	20.67663	29.79707
$r \leq 3$	$r = 4$	6.239021	14.26460	8.009372	15.49471
$r \leq 4$	$r = 5$	1.770351	3.841466	1.770351	3.841466

Notes: r is the cointegration vector.
Max-eigenvalue test and Trace test indicates 1 cointegrating equation at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

If the null hypothesis of no cointegration among the variables is rejected, then the alternative hypothesis of cointegration among the variables is accepted. Conversely, if the null hypothesis is not rejected, there is no cointegration relationship between the variables. In this study, the hypothesis H_0: r = 0 was rejected because the Maximum Eigen value (λ-max) exceeded the critical value (CV) at the 5% level (45.53297 > 33.87687); and the value of the trace statistics exceeded the critical value (CV) at the 5% level (86.85778 > 69.81889). Thus, the test results rejected the null hypothesis, indicating that the variables (IDX, exchange rate, real interest rate, inflation rate, and IGDP) were cointegrated during the sample period (1988-2019) in Indonesia λ-trace. Therefore, it is now possible to estimate the vector error correction model (VECM).

Error Correction Test (ECT)

The cointegration test reveals that five series are cointegrated, indicating that error correction models are acceptable for investigating the causality link. As the series are integrated in the same order I (1), error correction model can be used to examine causality. This section explores the VEC Granger causality between Indonesia's macroeconomic variables and IDX. Given the different theoretical linkages regarding the links between macroeconomic variables and IDX, it is clear that macroeconomic data and the stock market composite index are influenced by various factors; they can interact each other. Empirical finding of the link of causation between macroeconomic indicators and IDX is both inspiring and essential. Also, the research on the relationship provides mixed evidence, in addition to the fact that the market theories that underpin both macroeconomic and stock market composite indexes are distinct. To analyse VEC Granger causality between macroeconomic variables and IDX, the following standard VECM model for the first differenced variables are specified and estimated.

VECM Granger Causality Test

While cointegration between variables does not determine the direction of a causal relationship, Granger Causality can determine at least one direction (Order & Fisher, 1993). To establish the direction of Granger Causality between IDX, IEXR, IGDP, IINFR, and IRIR, we conducted an examination. The results of estimating Granger causality between these

variables are presented in Table 4. In Table 4, the findings from the Granger Causality test suggest a unidirectional effect of Indonesia Exchange Rate (IEXR) on Indonesia Stock Market Composite Index (IDX), with χ2-statistics 6.8399 at 5% significant level. Additionally, the changes in Indonesian Gross Domestic Product (IGDP) granger caused IDX with χ2-statistics 7.0656 at 5% significant level and real interest rate IRIR granger caused IDX with χ2-statistics 5.2497 at 10% significance level as well. The results further demonstrate that stock market composite index was cointegrated with these selected economic variables. Macroeconomic variables effect on economies in the sample period (1988-2019).

Table 4

VECM Granger Causality Results

Independent Variable	Dependent Variable					ECT	
	ΔIDX	ΔIEXR	ΔIGDP	ΔIINFR	ΔTRIR		
	χ^2-statistics (*p*-value)					Coefficient	t-statistics
ΔIDX	-	1.5272 (0.4660)	3.3396 (0.1883)	1.5155 (0.4687)	0.5624 (0.7549)	-0.0804	-0.4662
ΔIEXR	6.8399** (0.0327)	-	0.1472 (0.9290)	0.1436 (0.9307)	0.1203 (0.9416)	0.0542	0.2529
ΔIGDP	7.0656** (0.0292)	0.2864 (0.8666)	-	4.3273 (0.1149)	1.1532 (0.5618)	0.5222	0.5100
ΔIINFR	3.3951 (0.1831)	1.3725 (0.5035)	1.5085 (0.4704)	-	1.2397 (0.5380)	3.5806*	1.6361
ΔIRIR	5.2497* (0.0725)	1.0140 (0.6023)	0.4305 (0.8063)	0.1794 (0.9142)	-	-6.1087	-0.7114

Notes: The χ^2-statistic tests the joint significance of the lagged values of the independent variables, and the significance of the error correction term(s). Δ is the first different operator. Figures in parentheses are the *p*-values. Asterisks (***) indicate statistically significant at 1% level, (**) indicate statistically significant at 5% level and (*) indicate statistically significant at 10% level.

Error correction test (ECT), t-statistics indicates the significant of the error correction term, IDX is jointly significant with IEXR, IGDP, IINFR and IRIR; the coefficient value is for the speed of adjustment error correction, the previous year deviation from long run equilibrium is corrected by -0.0804 for IDX with error correction test t-statistics -0.4662; it is not significant. The changes of IINFR, IDX, IEXR, IGDP and IRIR are cointegrated ECT; the table indicates the coefficient value 3.5806 with error correction test t-statistics 1.6361 at 10% significance level. IEXR, IDX, IGDP, IINFR and IRIR are cointegrated, the error correction coefficient shows 0.0542 with error correction test t-statistics 0.2529. IGDP, IDX, IEXR, IINFR and IRIR are cointegrated, the error correction coefficient shows 0.5222 with error correction test t-statistics 0.5100. IRIR, IDX, IEXR, IGDP and IINFR are cointegrated; the previous deviation from long run equilibrium is corrected by -6.1087 with error correction test t-statistics -0.7114.

VECM Model of Macroeconomic Indicators and IDX

The presence of cointegration between variables indicates presence of long-term relationship among variables, which makes the VEC model applicable. The long and short-

term relationships between the stock market composite index (IDX), exchange rate (IEXR), gross domestic products (IGDP), inflation rate (IINFR), and real interest rate (IRIR), using one cointegrating vector for Indonesia during the period of 1988-2019, are reported below (the t-statistics are presented in parentheses in Table 5). In Table 5, the coefficients of exchange rate (IEXR) explains that 1 unit of IEXR changes has a positive significant influence on the changes of IDX 1.113608 units. One unit of IGDP changes can cause 0.058923 unit increased in IDX. IINFR has a significant causality to decrease with a 0.114578 unit of IDX at 5% level. IRIR has a negative significant causality to composite index IDX; one-unit appreciation of real interest rate can cause the negative changes in composite index IDX 0.062345 unit at 5% significant level. According to the four variables in one cointegrating vector is calculated, the coefficients can be interpreted as long run elasticity. The appreciation of composite index (IDX) is related to the increasing exchange rate and gross domestic products, and inverse relationship with inflation rate and real interest rate. As a general conclusion, Indonesia with a consistently higher inflation rate and real interest rate exhibits a declining composite index; higher exchange, exchange rate and GDP exhibit a rising stock market composite index during the sample period (1988-2019).

Table 5

Normalized Cointegrating Coefficients in VECM equation

Cointegration Equation	Normalized	Standard Errors	Speed of Adjustment
Constant	- 49.30263		
IDX	-1.000000		-0.08036
IEXR	14.66674** [-4.6575]	4.46575	-0.79445
IGDP	1.180970** [7.37579]	-7.37579	-0.6168
IINFR	0.515211** [-6.39455]	-6.39455	-1.84474
IRIR	0.306698** [-5.83525]	-5.83525	1.873531

Notes: t-statistics in [ ], *Significant at α = 1% and ** Significant at α = 5%.
The estimated coefficients were obtained by normalizing the independent variables with respect to their respective dependent variable (KLCI). Asterisks (**) indicate statistically significant at 5 per cent level.

The VECM model of macroeconomic and stock market composite index over the sample period, which is the cointegrated long-run model and noted as Indonesia model, could be stated as below:

IDX = - 49.30263 + 14.66674 IEXR + 1.180970 IGDP + 0.515211 IINFR + 0.306698 IRIR
Equation 3
[-4.6575]*** [7.37579]*** [-6.39455]*** [-5.83525]***

Error correction term (ECTt-1) indicates the speed of adjustment towards the long term equilibrium; equilibriums are correlated gradually by the ECT through a series of a partial short term adjustment; speed of adjustment -0.08036 (Table 5) measures the speed at which IDX returns to equilibrium after the changes in the independent variables: IEXR, IGDP, IINFR and IRIR. ECT can be shown in the following equation.

ECT_{t-1} = 49.3026 + 1.0000 IDX - 14.6667 IEXR - 1.1810 IGDP - 0.5152 IINFR - 0.3067 IRIR Equation 4

Table 5 and Model (3) show the long run cointegrating vector based on Johansen and Juselius framework. The exchange rate is favourable that can impact positively on stock market composite index with t-statistics value -4.6575 at 1% level of significance; one unit change in exchange rate is associated with 14.66674 units change in IDX. Therefore, hypothesis that Indonesia foreign currency exchange rate is positively associated with IDX, is accepted. The exchange rate significantly appreciates stock market composite index in Indonesia during the sample period. Table 5 and Model (3) show the findings comply with theoretical predictions. IGDP positively impact on stock market composite index IDX with t-statistics value 7.37579; p-value is greater than 1% significance level; therefore, hypothesis that Indonesia GDP (IGDP) has a positive impact on IDX, is accepted. IGDP, one of the macroeconomic indicators, is positively significant on changing IDX.

Table 5 and Model (3) indicate the long run cointegration between IDX and inflation rate in Indonesia over the sample period (1988-2019). IINFR positively impact on stock market composite index IDX with t-statistics value -6.39455; p-value is greater than 1% significance level. Therefore, hypothesis that Indonesia inflation rate is positively associated with IDX, is accepted. IINFR is one of the contributing variables to determine the changes of IDX. Inflation rate significantly influences composite index of Indonesia stock market. Table 5 and Model (3) indicate the long run cointegration between IDX and real interest rate in Indonesia over the sample period (1988-2019). IRIR is positively associated with stock market composite index IDX, t-statistics value is -5.83525 at 1% significance level; one-unit change in real interest rate is cointegrated with a 0.306698 unit increases in IDX at 1% significance level. Therefore, hypothesis that Indonesia real interest rate is positively associated with IDX, is accepted. This finding highlight that the effect of microeconomic variables on stock market composite index.

Table 6

Error Correction Models of Macroeconomic Variables and IDX

	Error Correction:	**D(IDX)**	**D(IEXR)**	**D(IGDP)**	**D(IINFR)**	**D(IRIR)**
C(1)	CointEq1	-0.080360 (0.17237) [-0.46620]	0.054167 (0.21417) [0.25292]	0.522283 (1.02406) [0.51001]	3.580553* (2.18846) [1.63611]	-6.108717 (8.58655) [-0.71143]
C(2)	D(LNIDX(-1))	-0.666315*** (0.29828) [-2.23388]	-0.622687* (0.37060) [-1.68023]	2.372961 (1.77204) [1.33911]	8.745812*** (3.78692) [-2.30948]	26.09943* (14.8582) [1.75657]
		-0.366268	-0.408657	1.285124	-5.634583	19.09042

C(3)	D(LNIDX(-2))	(0.28068) [-1.30493]	(0.34873) [-1.17184]	(1.66749) [0.77069]	(3.56349) [-1.58120]	(13.9816) [1.36540]
C(4)	D(LNIEXR (-1))	-3.861743 (5.33532) [-0.72381]	6.184723 (6.62887) [0.93300]	-11.83255 (31.6967) [-0.37331]	90.31014 (67.7370) [1.33325]	-349.0773 (265.770) [-1.31345]
C(5)	D(LNIEXR (-2))	0.044828 (0.65486) [0.06845]	1.236686 (0.81363) [1.51995]	-4.423683 (3.89048) [-1.13705]	14.83113* (8.31410) [1.78385]	-58.34803* (32.6209) [-1.78867]
C(6)	D(LNIGDP (-1))	-0.230043 (0.53527) [-0.42977]	0.559735 (0.66505) [0.84164]	-1.484881 (3.18001) [-0.46694]	2.685321 (6.79580) [0.39514]	-23.84830 (26.6638) [-0.89441]
C(7)	D(LNIGDP (-2))	0.343517 (0.55711) [0.61660]	-0.524250 (0.69219) [-0.75738]	0.819517 (3.30977) [0.24761]	-8.135210 (7.07310) [-1.15016]	30.51008 (27.7518) [1.09939]
C(8)	D(LNIINFR (-1))	0.064225 (0.07117) [0.90245]	-0.148088* (0.08842) [-1.67480]	0.711340* (0.42280) [1.68247]	-1.335933 (0.90353) [-1.47857]	6.107887* (3.54506) [1.72293]
C(9)	D(LNIINFR (-2))	0.035308 (0.04024) [0.87745]	-0.042047 (0.05000) [-0.84102]	0.260717 (0.23906) [1.09061]	-0.296041 (0.51087) [-0.57948]	1.231955 (2.00444) [0.61461]
C(10)	D(LNIRIR (-1))	-0.044407 (0.07030) [-0.63164]	0.070625 (0.08735) [0.80853]	-0.067288 (0.41767) [-0.16110]	1.134492 (0.89258) [1.27102]	-4.344687 (3.50210) [-1.24059]
C(11)	D(LNIRIR (-2))	0.019580 (0.01691) [1.15760]	0.009819 (0.02101) [0.46723]	-0.014283 (0.10048) [-0.14214]	0.180783 (0.21474) [0.84188]	-0.574167 (0.84254) [-0.68147]
C(12)	C	-0.004645 (0.01184) [-0.39218]	-0.000923 (0.01471) [-0.06275]	0.061085 (0.07036) [0.86819]	0.202961 (0.15036) [1.34983]	-0.279409 (0.58995) [-0.47362]
R-squared		0.671986	0.651532	0.359509	0.637408	0.637751
Adj. R-squared		0.459741	0.426053	-0.054926	0.402789	0.403355
Sum sq. resids		0.003872	0.005977	0.136663	0.624130	9.608086
S.E. equation		0.015092	0.018751	0.089660	0.191608	0.751786
F-statistics		3.166094	2.889543	0.867467	2.716785	2.720827

Standard errors in ( ) & t-statistics in [ ]

Notes: The estimated coefficients were obtained by normalizing the independent variables with respect to their respective dependent variable (IDX). Asterisks (**) indicate statistically significant at 5 % level.

Regarding the results of the vector error correction models shown in the Table 6, there are five VEC models with lag 1 and lag 2: The results of the vector error correction model show in the Equation 3. The vector error correction model focuses on the dependent variables of IDX and the independent variables are IEXR, IGDP, IINFR and IRIR.

In Table 6 Column (2), IDX is associated with the variations of exchange rate, IGDP, inflation rate and real interest rate. IDX model, exchange rate model (IEXR), Gross domestic product model (IGDP), inflation rate model (IINFR) and real interest model (IRIR). The first error correction model focus on the dependent variable of Indonesia stock market composite index IDX and the independent variables are exchange rate, IGDP, inflation rate and real interest rate. This model is stated as below:

$IDX = - 0.080360\ ECT_{t-1} - 0.666315\ IDX(-1) - 0.366268\ IDX(-2) - 3.861743\ IEXR(-1) + 0.044828\ IEXR(-2)$

$- 0.230043\ IGDP(-1) + 0.343517\ IGDP(-2) + 0.064225\ IINFR(-1) + 0.035308\ IINFR(-2) - 0.044407\ IRIR(-1)$

$+ 0.019580\ IRIR(-2) - 0.004645$

Equation 5

The results IDX model showing that of F-statistics value is 3.166094, R-squared value is 0.671986 and adjusted R-squared value is 0.459741, indicating that the independent variables can explain a long run cointegration with IDX. It can conclude that IDX vector error correction model is fit at 5% significant level. IDX model shown in Equation 5, IDX (lag 1 and lag 2) negatively impact on IDX; one per cent changes in IDE (lag 1 and lag 2) have an effect with 93.7882% and 53.527% decreased in IDX at 5% significant level, respectively. Exchange rate (lag 1 and lag 2) negatively impact on IDX; one per cent changes in exchange rate (lag 1 and lag 2) have an effect with 45.97% and 36.63% decreased in IDX, respectively. One per cent changes in IGDP (lag 1 and lag 2) is associated with the 23.00% and 34.35% decrease in IDX, respectively. One per cent changes in inflation (lag 1) is associated with a 6.422% increase in IDX; one per cent changes in inflation (lag 2) is associated with a 3.531% increase in IDX; one per cent changes in real interest rate (lag 1) is associated with a 4.441% decrease in IDX, and one per cent changes in real interest rate (lag 2) is associated with a 1.958% increase in IDX. R-squared value 67.20%, adjusted R2 value 45.97% and F-statistics value 3.166094 indicate that the model is fit.

$IEXR = 0.054167\ ECT_{t-1} - 0.622687\ IDX(-1) - 0.408657\ IDX(-2) + 6.184723\ IEXR(-1) + 1.236686\ IEXR(-2)$

$+ 0.559735\ IGDP(-1) - 0.524250\ IGDP(-2) - 0.148088\ IINFR(-1) - 0.042047\ IINFR(-2) + 0.070625\ IRIR(-1)$

$+ 0.009819\ IRIR(-2) - 0.000923$

Equation 6

Exchange rate model is a cointegration model. Exchange rate is a dependent variable and the independent variables are IDX, IGDP, inflation rate and real interest rate (Equation 6). In Table 6 Column (3), IEXR is associated with the changes of IDX, IGDP, inflation rate and real interest rate. One per cent changes in IDX (lag 1) is associated with 62.27% decrease in IEXR on average ceteris paribus in the short run at 10% level. On average ceteris paribus, one per cent changes in IDX (lag 2) corresponds to a decrease of 40.87% in IEXR in the short run. One per cent changes in IEXR (lag 1 and lag 2) is associated with an increase of 618.47% and 123.67% in IDX, respectively. One per cent changes in IGDP (lag 1) is associated with a 55.97% increase in IEXR and IGDP (lag 2) is associated with 52.43% decrease in IEXR. One per cent changes in inflation rate (lag 1 and lag 2) are associated with a 14.81% and 4.205% decrease

in IEXR, respectively. One per cent changes in real interest rate (lag 1 and lag 2) is associated with 7.063% and 0.9819% increase in IEXR, respectively. R2 value 65.15%, adjusted R2 value 42.61% and F-statistics value 2.889543 indicate that the model is fit.

IGDP = 0.522283 ECT_{t-1} + 2.372961 IDX(-1) + 1.285124 IDX(-2) - 11.83255 IEXR(-1) - 4.423683 IEXR(-2)

- 1.484881 IGDP(-1) + 0.819517 IGDP(-2) + 0.711340 IINFR(-1) + 0.260717 IINFR(-2) - 0.067288 IRIR(-1)

- 0.014283 IRIR(-2) + 0.061085

Equation 7

Regarding the results of the vector error correction model (mainly depending on IINFR) shown in the above Equation 7. The vector error correction model focuses on the dependent variables of Indonesia IGDP and the independent variables are IDX, exchange rate, inflation rate and real interest rate. In Table 6 Column (4), IGDP is associated with the changes of IDX, exchange rate, inflation rate and real interest rate. One per cent changes in IDX (lag 1 and lag 2) are associated with a 237.30% and 128.51% increase in IGDP, respectively. One per cent changes in IEXR (lag 1 and lag 2) is associated with a 1183.26% and 442.37% decrease in IGDP, respectively. One per cent changes in IGDP (lag 1) are associated with a 148.49% decrease in IGDP and a 81.95% increase in IGDP, respectively. One per cent changes in inflation rate (lag 1 and lag 2) are associated with a 71.13% in IGDP on average ceteris paribus in the short run at 10% level and 26.07% increase in IGDP, respectively. Each one per cent changes in both real interest rate (lag 1 and lag 2) are associated with a 6.729% and 1.428% decrease in IGDP, respectively. R2 value 35.95%, adjusted R2 value -0.054926 and F-statistics value 0.867467 indicate that the model is fit.

IINFR = 3.580553 ECT_{t-1} - 8.745812 IDX(-1) - 5.634583 IDX(-2) + 90.31014 IEXR(-1) + 14.83113 IEXR(-2)

+ 2.685321 IGDP(-1) - 8.135210 IGDP(-2) - 1.335933 IINFR(-1) - 0.296041 IINFR(-2) + 1.134492 IRIR(-1)

+ 0.180783 IRIR(-2) + 0.202961

Equation 8

The vector error correction model results (mainly depending on IDX and exchange rate) shown in the above Equation 8 focusing on the dependent variables of Indonesia inflation rate (IINFR) and the independent variables are IDX, exchange rate, IGDP and real interest rate. In Table 6 Column (5), IINFR is associated with the changes of IDX, exchange rate, IGDP and real interest rate. On average ceteris, one per cent changes in IDX (lag 1 and lag 2) are associated with a 874.58% at 5% significant level decrease in IINFR and 563.46% decrease in IINFR in the short run. Each one per cent changes in IEXR (lag 1 and lag 2) is associated with a 90.31% and a 1483.11% increase at 10% significance level in IINFR, respectively. Each one per cent changes in IGDP (lag 1 and lag 2) is associated with a 268.53% increase and a 813.52% decrease in IINFR, respectively. Each one per cent changes in inflation rate (lag 1 and lag 2) is associated with a 133.59% and a 29.60% decrease in IINFR, respectively. Each one per cent changes in interest rate (lag 1 and lag 2) is associated with a 113.45% and 18.08% increase in IRIR, respectively. R2 value 63.74%, adjusted R2 value 40.28% and F-statistics value 2.716785 indicate that the model is fit.

IRIR = - 6.108717 ECT_{t-1} + 26.09943 IDX(-1) + 19.09042 IDX(-2) - 349.0773 IEXR(-1) - 58.34803 IEXR(-2)

- 23.84830 IGDP(-1) + 30.51008 IGDP(-2) + 6.107887 IINFR(-1) + 1.231955 IINFR(-2) - 4.344687 IRIR(-1)

- 0.574167 IRIR(-2) - 0.279409

Equation 9

Equation 9 displays the outcomes of the vector error correction model, which primarily depends on the real interest rate (IRIR). The model examines the impact of the independent variables, including IDX, exchange rate, IGDP, and inflation rate, on the dependent variable of the Indonesian real interest rate (IRIR). In Table 6 Column (6), IRIR is associated with the changes of IDX, exchange rate, IGDP and inflation rate. On average ceteris paribus, each one per cent changes in IDX (lag 1 and lag 2) is associated with a 26.10% increase in IRIR at 10% level and 1909.04% increase in IRIR in the short run, respectively. Each one per cent changes in IEXR (lag 1 and lag 2) is associated with a 34907.73% decrease in IRIR and 5834.80% decrease at 10% level in IRIR, respectively. Each one per cent changes in IGDP (lag 1 and lag 2) is associated with a 2384.83% decrease and 5051.01% increase in IRIR, respectively. One per cent changes in inflation rate (lag 1) is associated with a 610.79% increase at 10% significant level in IRIR; one per cent changes in inflation rate (lag 2) is associated with a 123.20% increase in IRIR. One per cent changes in real interest rate (lag 1 and lag 2) is associated with a 434.47% decrease in IRIR and a 40.34% decrease in IRIR, respectively. R2 value 63.78%, adjusted R2 value 63.78% and F-statistics value 2.720827 indicate that the model is fit.

Reviewing the five models, IRIR, IEXR, IGDP, IDX and IINFR models are significant to be the dependent variables explained by the independent variables. IRIR model is most significant to be the dependent variable explained by the independent variables. The results indicate that variations in the stock market composite index are significantly influenced by the exchange rate, gross domestic products, inflation and real interest rates in long run. The subsequent section will explain both the long- and short-term causal effects.

Conclusion

The empirical results suggest several important conclusions regarding relationship between macroeconomic variables and Indonesia Stock Market Composite Index (IDX). First, the study finds evidence of long-run and short-run cointegration between the dependent variable IDX and independent variables: Indonesia Exchange Rate (IEXR), Indonesia GDP (IGDP), inflation (IINFR), and real interest rate (IRIR). This implies a stable long-term relationship between these variables. It is observed that both IINFR and IRIR positively Granger cause IDX in the long-run, indicating that changes in these macroeconomic variables can influence the stock market composite index over time. The findings further reveal that IEXR, IGDP, IRIR all have a positive impact on (IDX) in Indonesia. During the sample period, IINFR was also found to have a significant positive effect on IDX suggesting that an increase in inflation is likely to be accompanied by an increase in the composite index IDX. Moreover, the study demonstrates a unidirectional effect from IEXR to IDX. Changes in IGDP and IRIR were also found to granger cause changes in IDX, indicating their influence on the stock market index. Indonesia model includes both long- and short-run models, within short-run integration of variables. The results suggest that these macroeconomic variables play a significant role in explaining the fluctuations and performance of the IDX over time. Through detailed empirical analysis of relevant macroeconomic indicators over time, we aim to contribute to the existing knowledge base and provide insights that can inform investment decisions, guide policy formulation, and enhance our understanding of the unique dynamics of the Indonesian stock market.

References

Boubakari, A., & Jin, D. (2010). The Role of Stock Market Development in Economic Growth: Evidence from Some Euronext Countries. *International Journal of Financial Research, 1*, 14-20.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association, 74*, 427-431.

Eldomiaty, T., Saeed, Y., Hammam, R. & AboulSoud, S. (2019). The associations between stock prices, inflation rates, interest rates are still persistent: Empirical evidence from stock duration model. *Journal of Economics, Finance and Administrative Science, 25(49)*, 149–161.

Ibrahim, M., & Musah, A. (2014). An economic analysis of the impact of macroeconomic fundamentals on stock market returns in Ghana. *Research in Applied Economics, 6(2)*, 47 - 72.

Jarefio, F., Ferrer, R., & Miroslavova, S. (2016). US stock market sensitivity to interest and inflation rates: A quantile regression approach. *Applied Economics, 48(26)*, 2469-2481.

Kwofie, C., & Ansah, R. K. (2018). A Study of the Effect of Inflation and Exchange Rate on Stock Market Returns in Ghana. *International Journal of Mathematics and Mathematical Sciences*, 1–8. https://doi.org/10.1155/2018/7016792.

Masoud, N., & Hardaker, G. (2012). The impact of financial development on economic growth: empirical analysis of emerging market countries. *Studies in Economics and Finance, 29(3)*, 148-173.

Miguel, M. L., Fuinhas, J. A., & Marques, A. C. (2013). Does the stock market cause economic growth? Portuguese evidence of economic regime change. *Economic Modelling, 32*, 316-324.

Orden, D. A. L. A. Fisher. (1993). Financial Deregulation and the Dynamics of Money, Prices and Output in New Zealand and Australia. *Journal of Money, Credit and Banking, 25(2)*, 273-292.

Pal, K., & Mittal, R. (2011). Impact of macroeconomic indicators on Indian capital markets. *The Journal of Risk Finance, 12(2)*, 84-97.

Phillips, R. C. B., & Perron, P. (1988). 'Testing for a Unit Root in Time Series Regression'. *Biometrika, 75(2)*, 335-346.

Singh, G., & Padmakumari, L. (2020). Stock market reaction to inflation announcement in the Indian stock market: A sectoral analysis. *Cogent Economics & Finance, 8(1)*, 1723827.

Suriani S., Kumar, M. D., Jamil, F., & Muneer S. (2015). Impact of Exchange Rate on Stock Market. *International Journal of Economics and Financial Issues, 5*, 385-388.

Tang, X., & Yao, X. (2018). Do financial structures affect exchange rate and stock price interaction? Evidence from emerging markets, Emerging Markets Review. *Elsevier, 34(C)*, 64-76.

Tsai, I. C. (2012). The relationship between stock price index and exchange rate in Asian markets: A quantile regression approach. *Journal of International Financial Markets, Institutions & Money, 22*, 609–621.