



**INSIGHT JOURNAL**  
**UNIVERSITI TEKNOLOGI MARA**  
**CAWANGAN JOHOR**

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**Volume 2**

**2018**

eISSN 2600-8564

Indexed in MyJurnal MCC

 [insightjournal.my](http://insightjournal.my)

**INSIGHT JOURNAL (IJ)**  
**UiTM Cawangan Johor Online**  
**Journal Vol. 2: 2018**  
**eISSN :2600-8564**  
**Published by UiTM Cawangan Johor**  
**insightjournal.my**

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## Macroeconomic Variables and Stock Market Interactions: Indonesia Evidence

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### Abstract

The existence of semi strong-form pricing efficiency on the LQ 45 Index in the Indonesia Stock Exchanges from 2004 to 2014 for using monthly closing prices was investigated. This study provides evidence on the Indonesia Stock Exchanges (IDX) using semi strong-form efficiency test. This paper employs the integration test, which is widely used to distinguish the impact of macroeconomic factors (The consumer price index, exchange rate, gross domestic product, and interest rate) to market returns (Lq45 Index). The findings indicate that in Indonesia Stock Exchanges show mixed evidence of Semi strong form pricing efficiency characteristics for monthly return series. The results implied that the new information have impacted on the Indonesia Stock Exchanges by making exchanges becoming more price efficient.

Keywords: Semi Strong - Form EMH, the Indonesia Stock Exchanges, the Integration Test and Macroeconomic Variables

### 1. Introduction

The Aggregate performance of capital market can be easily seen by its index. Many factors influence the price movement of the stock Security market indices represented by security market prices. Factors influencing stock price might appear-internally which can be controlled by the company. Otherwise, it might come from external sources, like economic stability. Economic stability in a country could be measured by macroeconomics variables. Inflation, exchange rate, Gross Domestic Product (GDP) and interest rate are some macroeconomics variable that shows economic condition in Indonesia. Stock price index is a way of measuring the performance of a market over time, and the index used in this study is LQ45 Index. The relation between stock market

returns and fundamental economic activities in the United States is well documented (Fama, 1970, 1990, 1991).

Global crisis in 2008 which started in the United States also affected Indonesia's economic condition. Depreciating value of Indonesian currency to USD currency and lower demand of Indonesian export are some of the impacts of the crisis in 2008. Macroeconomic variables are factors that could not be controlled by the companies which might affect the volatility of the stock price.

The effect of the Macroeconomic variable on stock market can be investigated by using the efficient market hypothesis test as the semi strong form efficient market hypothesis (EMH). There is enough evidence concerning the integration of the semi strong- form efficient market hypothesis (EMH) with respect to stock markets. The semi strong-form of the EMH postulates that successive one-period stock returns are cointegrated. This paper attempts to investigate the impact of macroeconomic variables on the LQ 45 index by using the semi strong-form efficiency test.

This paper used the counteraction test. The rest of the paper is organized as follows; Section 1 describes introduction and section 2 overviews the efficiency evidence on the Indonesian market while section 3 describes the data collection procedure and methodology. Section 4 discusses the findings and section 5 concludes the paper.

## 2. Review of Literature

Relatively few evidences were available evaluating the efficiency of the Jakarta Stock Exchange. Suad (1987) and Rusiti (1990) found that the market is fairly efficient in the weak sense. However, Suad (1990), Balsius (1993) and Agus (1995) found that the sufficient conditions for weak form of efficiency were not satisfied. Further, Suad (1990) also investigates the semi strong form efficiency using earning, additional issue, and new issues announcements. The general findings indicate that the market is not efficient in semi-strong form. Further studies by Rusiti (1990) and Agus (1995) substantiated the findings of Fuad (1990). Endang (2000) found that the share price response to bond announcements procedure an average excess return significantly different from zero while Endang (2000) found that the average abnormal return is significantly positive at pre-announcement date of merger and acquisitions. Rahayu (2003), Adams et al (2004), Adisetiawan. R. (2011) investigated on the macroeconomic variables for market returns using cointegration test. The findings indicate that macroeconomic variables have impact to market return. Most Indonesian researchers used multiple regression model. Therefore, so many oversea researcher used countegartion model has been done, for example; Maysami, R. C., Howe, L. C., & Hamzah, M. A. (2004).

Gan, Lee, Yon, and Zhang (2006) conducted a research to analyze the effect of seven macroeconomics variables (inflation rate, long term interest rate, short term interest rate, the real trade weighted exchange rate index, real gross domestic product, money supply, and domestic retail oil prices) to the New Zealand Stock Index (NZSE40). Ahmad, Rehman, Raof (2010) observed the impact of interest rate and exchange rate to the Stock Return in Pakistan. Alrub, A. A., Tursoy, T., & Rjoub, H. (2016) investigates

Relationship between Macroeconomic Variables and Stock Prices during the Restructuring Period in Turkish Market, Kesik, A., Canakci, M., and Tunali, H. (2016) employ Impact of Non-Residents'holdings of Equities on Bist (Istanbul Stock Exchange) 100 INDEX.

### **3. Methodology and Data**

Data was collected from the Indonesian Stock Exchange (IDX). This study employed the cointegration test to test the semi strong-form of the EMH is proposed by Granger (1981).

#### **3.1 The Data set**

All data originates from the Indonesia Stock Exchange; the data sets used in this paper were consistent with monthly closing prices of the LQ 45 index from 2004 to 2014. Which were extracted from the computer service and IDX monthly Statistics.

#### **3.2. Methodology**

##### **3.2.1 Test of Stationary**

Any time series data can be thought of as being generated by either a stochastic or random process. A stochastic process is said to be stationary if its mean and variance are constant over time. However, according to Engle and Granger (1987), most of the financial market time series are non-stationary in nature. The regression of these financial series may give spurious results with very high R<sup>2</sup> although there is no meaningful relationship between the two. The unit root test examines whether each financial series is stationary or non-stationary. The existence of unit root in a series indicates that the series is non-stationary. A time series is integrated, denoted I(d), if the series can achieve stationary results only after differencing d time. Engle and Granger (1987) noted that an I(0) series is thus, by definition, stationary; an I(1) series contain unit root and is non-stationary.

### 3.2.2 Unit roots Analyses

Dickey and Fuller (1979, 1981) have shown that Q- statistics are less powerful than unit roots analysis developed by Dickey and Fuller (1981), and further developed by Phillip and Perron (1988) and others in testing for unit roots. The unit roots hypothesis is that, if the regressor in tests of market efficiency possesses a unit root, then the time series data is said to have a random walk. Consider the three time series models of the random walk:

$$Y_T = bY_{t-1} + e_t \quad (1)$$

$$Y_T = a_t + bY_{t-1} + e_t \quad (2)$$

$$Y_T = a_t + bY_{t-1} + c(t-1 - T/2) + e_t \quad (3)$$

The first model is the random walk with zero drift, while the second model incorporates a non-zero drift. The last model includes a time trend factor. This study will base the analysis on the model that describes the LQ 45 index series. A test of significance would use the Dickey- Fuller critical value to evaluate whether the price changes as rates of return fluctuate randomly around the value of one.

### 3.2.3 The Cointegration and Error Correction Model (ECM)

In this study the Cointegration Model will be used to examine semi - strong efficiency in the IDX for long run. This model was first put forward by Granger (1981) and pioneered by Engle and Granger (1987). Cointegration analysis allows nonstationary data to be used so that spurious results are avoided, this is once of advantage cointegration test not likes multiple regression model the data must be stationer and the result can be spurious result. It also provides applied econometricians an effective formal framework for testing and estimating long-run models from actual time-series data. Using Johansen's vector error- correction model, this study examines the dynamic relations between macroeconomic variables on the Indonesian stock market. Although Engle and Granger's (1987) two-step error-correction model may also be used in multivariate context, the VECM yields more efficient estimators of cointegration vectors. This is because the VECM is full of information on the maximum likelihood estimation model, which allows for testing of cointegration in a whole system of equations in one step and without requiring a specific variable to be normalized. This allows us to avoid carrying over the errors from the first step into the second, as would be the case if Engle-Granger's methodology is used. It also has the advantage of not requiring a priori assumptions of endogeneity or exogeneity of the variables.

Johansen's (1991) VECM, which employs the full information maximum likelihood method, is implemented in the following steps:

1. Test whether all variables are integrated of order one by applying a unit root test.

2. Find the truncated lag ( $k$ ) such that the residuals from each equation of the VECM are uncorrelated.
3. Regress  $\Delta Y_t$  against the lagged differences of  $\Delta Y_t$  and  $Y_{t-1}$ , and estimate the eigenvectors (cointegration vectors) from the canonical correlations of the set of residuals from these regression equations.
4. Determine the order of cointegration. The order of cointegration ( $r$ ) indicates the dimension of the cointegrating space and is determined by constructing the following test statistics:

$$\lambda = -T \sum_{i=r+1}^p \ln(1 - \hat{\lambda}_i) \quad (4)$$

$$\lambda_{\max} = -T \ln(\hat{\lambda}_{r+1}) \quad (5)$$

where  $\lambda$ 's are the estimated eigenvalues. These statistics do not represent regular chi-square distributions, but as Johansen shows, they weakly converge to a function of (p-r) dimensional Brownian motion. The choice of the number of maximum cointegrating relationship will be based on the  $\lambda_{trace}$  tests. The  $\lambda_{\max}$  test is used to test specific alternative hypothesis.

Having determined the order of cointegration, the relevant cointegrating vector and speed of adjustment coefficient is selected and analyzed assuming cointegrating vector does not have a full rank and are not multiple cointegrating vectors. The first eigenvector based on the largest eigenvalue, which is probably the most useful will be chosen. This study considers the natural logarithm of the share price index LQ45 index.

Test on the parameters of cointegration vector may be performed using the likelihood ratio test. Johansen (1991) has also developed test of hypothesis regarding individual elements of  $\alpha$  and  $\beta$ . The selection of lag order of the unrestricted VAR is a prerequisite for the application of the Johansen procedure in this study, the number of lags in VAR may be determined by Akaike Information criterion. In addition residual from the selected unrestricted VAR are tested for autocorrelation to verify the appropriateness of the lag order. As unit root tests, lags are not omitted if their exclusion introduces serial correlation.



## 4. The Findings

### 4.1 Result of Stationary Test

This section reports the unit root analyses using Augmented Dickey Fuller (ADF) and Philip-Peron (PP) test and discusses the findings of the relation between macroeconomics variables on the market returns series for long run and short run using cointegration and error correction model.

**Table 1: The Results of ADF and Philips Peron Test on The LQ45 Index and Macroeconomic Variables**

	Level		First Difference	
	ADF- Test statistic	P-P Test statistic	ADF- Test statistic	P-P Test statistic
R <sub>1</sub>	-5.5015***	-5.3440***		
X <sub>1</sub>	0.4594	0.8868	-4.5471***	-4.2498***
X <sub>2</sub>	0.0911	-1.6189	-7.7976***	-11.6153***
X <sub>3</sub>	-0.1175	-0.2260	-9.9463***	-32.5648***

The t-statistics is based on Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) regression with allowance for level and intercept respectively. \*\*\* implies the significance at 1% level.

R<sub>1</sub> is the LQ45 index, R<sub>2</sub>, X<sub>1</sub> is the consumer price index (CPI) or inflation rate, X<sub>2</sub> is exchange rate, X<sub>3</sub> GDP and X<sub>4</sub> is interest rate.

Unit root test is a prerequisite of cointegration for time series data. In this study, Augmented Dickey Fuller (ADF) and Philip-Peron (PP) tests are employed. The results of ADF and PP tests are shown in Table 1. The results indicate that the null hypotheses of unit root are acceptable and significant at the one percent level for the market returns (natural log return). However, the null hypotheses of unit root are acceptable at the one percent levels for all of the macroeconomics variables, except for the interest rate. Prior to testing for the number of significant cointegrating vector, the likelihood ratio (LR) tests are performed to determine the lag length of the vector autoregressive system.

### 4.2 Cointegration and Error Correction Model (ECM) Results

The  $\lambda_{\text{trace}}$  and  $\lambda_{\text{Max}}$  statistics to test for the deterministic components are shown in Table 2. The Table 2 presents that there are trends in levels of data and intercept in the cointegrating for the LQ45 index with the macroeconomic variables which comprises the Consumer Price Index (CPI), Exchange Rates (ER), Gross Domestic Product (GDP) and Interest Rates (IR).

Table 2 shows the results and critical values (CV) for  $k$  equal 2. In this case of the  $\lambda_{\text{trace}}$  test indicates that there is no more than one cointegrating relation. While the  $\lambda_{\text{Max}}$  test rejects  $r$  equal zero for alternative that  $r$  equal one at the five percent significance level. The result means there is one cointegrating vector, for example,  $r$  equal one.

**Table 2: The results of critical values the  $\lambda_{\text{trace}}$  and  $\lambda_{\text{Max}}$  Test on the LQ45 Index**

Ho	$\lambda_{\text{trace}}$	CV 5%	CV 1%	$\lambda_{\text{Max}}$	CV 5%	CV 1%
$r=0$	81.97***	68.52	76.07	33.96**	33.46	38.77
$r\leq 1$	48.01**	47.21	54.46	26.22	27.07	32.24
$r\leq 2$	21.78	29.68	35.65	15.67	20.97	25.52
$r\leq 3$	6.11	15.41	20.04	5.94	14.07	18.63
$r\leq 4$	0.17	3.76	6.65	0.17	3.76	6.65

\*\*\* denotes significance at 1% level and \*\* at the 5% level.

Normalizing with respect to the coefficient for LQ45, cointegrating vector for this case is given by  $\square_1$ . This yields the following cointegrating relationship:

$$R_1 = -2.72\text{CPI}^{***} + 0.17\text{ER} + 1.50\text{GDP}^{***} - 0.29\text{IR}^{***} + 6.94$$

(6) [-4.1562] [0.9444] [4.6220] [- 5.2467]

In equation (6) shows relationship macroeconomic variables and the LQ45 index for long run. The consumer price index (CPI) and the LQ45 index (R1) are negatively related and significant at the one percent level. This finding is consistent for the United States (Fama & Shchewert, 1977), for Japan (Mukherjee & Naka, 1995), for Indonesia Stock exchanges (Harianto and sudomo, 2001) and Adams et al (2004). Then, the effect of the exchange rate (ER) on the LQ45 index (R1) is positively related and insignificant at the one percent level, consistent with Japanese stock market by Mukherjee and Naka (1995), Ibrahim (2000), Utami dan Rahayu (2003), Karamustafa O, et al (2004). Finally, interest rate (IR) and the LQ45 index (R1) are negative related and significant at the one percent level. The negative effect of interest rate on stock prices also holds for the U.S Stock Market for Indonesia Stock exchanges Sudjono (2005).

The effects of macroeconomic variables on the LQ45 index (R1) for the short run are shown in Equation 7.

$$dR_1 = -0.0004 - 0.55 \text{ECT}^{***} - 0.20 dR_1 (-1) - 0.29 dR_1 (-2) - 2.34 d\text{CPI} (-1)$$

+  
 [-0.03] [-3.92] [-1.55] [-2.36] [-1.30]

$$\begin{aligned}
 &0.92 \text{ dCPI } (-2) - 0.33 \text{ dER } (-1)^* - 0.29 \text{ dER } (-2) + 0.48 \text{ dGDP } (-1) \text{ ***} + \\
 &[0.52] \qquad \qquad [-1.78] \qquad \qquad [-1.57] \qquad \qquad [2.44] \\
 &0.21 \text{ dGDP } (-2) - 0.38 \text{ dIR } (-1) \text{ **} + 0.33 \text{ dIR } (-2) \text{ *} \qquad \qquad \qquad (7) \\
 &[1.06] \qquad \qquad [-2.20] \qquad \qquad [1.72]
 \end{aligned}$$

Equation 7 shows lag 2 of LQ45 index and the LQ45 index (R1) is negatively related and significant at the five percent level. Then, the effect of lag 1 of the exchange rate (ER) on the LQ45 index (R1) is negatively related and significant at the ten percent level. Next, the effect of lag 1 of gross domestic product (GDP) and the LQ45 index (R1) are positively related and significant at the one percent level. Finally, lag 1 of interest rate (IR) and the LQ45 index (R1) are negative related and significant at the five percent level and lag 2 of interest rate and the LQ45 index (R1) are positively related and significant at the ten percent level. These observations seem indicate that the stock market is semi-strong form efficiency for short run.

Results of the finding shows there is cointegration between the macroeconomic variables on the LQ45 index in the long run and short run. In the long run, there is cointegration between the consumer price index, the GDP and interest rate on the market index (LQ 45 index) respectively.

In the short run, the finding also shows that there is cointegration between the macroeconomic variables on the LQ45 index. The lag 1 of exchange rate and the lag 1 of interest rate on LQ45 index are negatively related and significant. The lag 1 of gross domestic product and the lag 2 of interest rate on LQ45 index are positively related and significant. Based on analysis above, conclude of this study seem to indicate that the stock market is efficient in semi-strong form efficiency.

Interpretation of cointegration in terms of market efficiency depends on how “efficiency” is defined. By defining this term as the absence of predictability, Granger (1986), among others argues that asset prices cannot be cointegrated in efficient markets. Dwyer and Wallace (1992) however, demonstrate that cointegration does not necessarily violate the notion of information efficiency as defined by Fama (1991). By defining market efficiency as lacking of arbitrage opportunities, they show that presence of cointegration is consistent with the absence of abnormal returns.

In explanation of Dwyer and Wallace’s (1992) economic interpretation of cointegration, this study may be consistent with efficiency of the Indonesian Stock Market. Fama (1991) points out that in the presence of time-varying expected returns, predictability in stock price change maybe consistent with stock market efficiency. Poterba and Summers (1988) report evidence of time- varying expected returns in the TSE Index. If the time variation in macroeconomic condition and expected returns is predictable, the macroeconomic variables may be used to forecast future stock returns. For example, predictable business cycle variations induce predictable time-varying expected returns, which are reflected, with noise, in realized asset returns. However, such predictability may not necessarily provide arbitrage profit opportunities. Further research in the future

should extend the research period to cover longer research periods.

## 5. Conclusions

The main objective of this study is to investigate the behavior of stock prices in the Indonesian stock market especially in areas concerning the LQ45 index, with respect to semi-strong form Efficient Market Hypothesis (EMH). The study covers a ten year period, 2004 – 2014.

The semi-strong of the EMH is then investigated using publicly available information on the Indonesian stock market namely using macroeconomic variables. Using Johansen's methodology for multivariate cointegration analysis and monthly-time series data, this study has identified several macroeconomic factors that have long-run equilibrium effect on LQ45 Index. Cointegrations results which are macroeconomic variables are consumer price index (CPI), exchange rate (ER), gross domestic product (GDP), and interest rate (IR). and LQ45 index.

The findings of cointegration indicate that there is a relationship among the macroeconomic variables on the LQ45 index for the long-run the consumer price index (CPI) and the LQ45 index ( $R_1$ ) are negatively related and significant at the one percent level. Then, the effect of the exchange rate (ER) on the LQ45 index ( $R_1$ ) is positively related and insignificant at the one percent level. Finally, interest rate (IR) and the LQ45 index ( $R_1$ ) are negative related and significant at the one percent level.

Based on tests of linear restrictions for short-run it shows that there is cointegrating relationship between the macroeconomic variables on LQ45 index. Using VECM, the result for short run n the lag 2 of LQ45 index and the LQ45 index ( $R_1$ ) is negatively related and significant at the five percent level. Then, the effect of lag 1 of the exchange rate (ER) on the LQ45 index is negatively related and significant at the ten percent level. Next, the effect of lag 1 of gross domestic product (GDP) and the LQ45 index are positively related and significant at the one percent level. Finally, lag 1 of interest rate and the LQ45 index are negative related and significant at the five percent level and lag 2 of interest rate and the LQ45 index are positively related and significant at the ten percent level. These finding seem indicate that the stock market is semi-strong form efficiency for short run.

## 6. Implication of Study

The findings of this study have a number of implications. For the researchers, the study has shown that given the information that promotes transparency and openness, the behavior of the Indonesian stock market. An efficient market would also carry very negative implications for many investment strategies and actions that are taken for granted. In an efficient market, equity research and valuation would be costly which provide no benefits. The odds of finding the undervalued stock are random. At best, the benefits from information collection and equity research would cover the cost of doing research.

For information intermediaries, the degree of information efficiency has several implications for intermediaries. If the market is efficient with respect to publicly available information, an information intermediary would concentrate on gathering information that is not publicly available. The intermediary will seek out resources that are not fully reflected in prices. Hence, the intermediary will adopt different strategies depending on his perceptions of market efficiency. To the management or the policy maker, managers competing for investors' funds have incentives to provide information to investors and intermediaries, among others. Market efficiency has a potential implication for managers. In particular, managers tend to ignore the EMH, and they seem to care more about which accounting method is used to report a transaction.

In general, the market reflects information relevant for stock pricing. Current prices are best estimates of the true value of stocks. More deregulation and more disclosures may make the market prices reflect real asset of companies listed on the Indonesian stock market.

For the researcher, this study can be extended over longer period and the coverage made more comprehensive. In general, the average behavior of the Indonesian stock market as a developing stock market reflects in some respect the general behavior of developed stock markets used in our analysis.

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INSIGHT JOURNAL

**UNIVERSITI TEKNOLOGI MARA  
CAWANGAN JOHOR**

Volume 2 : 2018

eISSN 2600-8564

Indexed in MyJurnal MCC