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ResearchArticle

EMPIRICAL RELATIONSHIP AND DYNAMIC INTERACTION OF INFLATION, MARKET CAPITALIZATION AND STOCK MARKETPERFORMANCE: MALAYSIAN EVIDENCE

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Inflation is one indicator of economic growth and development in determining economic condition of a country. It also becomes an issue instock market as well. Therefore, the uncertainty of inflation probably would create fluctuation in stock market particularly in future. This paper investigates the impact of inflation on stock market performance in Malaysia using time series data for the period of 20 years from 1960 to 2012. The series are tested using unit root test-Augmented Dickey Fuller Test (ADF) and Philip Perron test (PP) to determine the stationary of the data used. Meanwhile, co-integration test is used to indicate the long-run relationship between inflation and stock market performance accordingly. The parameter involved in the series is the various measures of stock market performance, market capitalization (MC), and turnover ratio of stock traded (ST).

INTRODUCTION

Stock market has its own characteristics to promote economic growth and development of a country. In modern economy, stock market plays vital role that enables governments and industries to raise long-term capital in financing new projects, and expanding and modernizing industrial commercial concerns. Corrado and Jordan (2002) claimed that inflation rate could make changes in market performance. Instability of inflation rate could contribute to the major impact on the performance of the stock market. Continuation of stability in stock market is greatly concerned. Thus, examining the impact of inflation rate on the stock performance is critical because it holds implications to investors, global portfolio managers, and global policy makers (Geetha, Chong, Mohidin, & Chandran, 2011). Stock market is often conceived as an indicator to assess general investment climate and future rate of growth. In Malaysia, like other developing countries, the implications of stock market in finance investment needs of different economic sectors are really important.

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Nevertheless, inflation in Malaysia was relatively low at 2.2 percent in December 2010 (Geetha *et al*., 2011). Geetha *et al*. (2011) even mentionedthat stock market is well-known with speculations. It is quite easy to speculate once the trend has been traced. Hence, further research needs to be conducted to see the movement and implications of inflation in Malaysia.

This paper is structured as follows. The following section reviews the theoretical and empirical literature on inflation and stock market performance relationship. Section three explains methodological issues. Section four covers data, empirical results and with explanations, and concluding remarks are given in section five.

Primary and secondary capital markets are both influenced by inflation, including opposing selection, moral hazard and cost threat (Khan, Sanhadji&Smith, 2001). This was supported by Marquis (2000), who reasoned out positive relationship between increments of inflation rate and costly state for verification. Meanwhile, real return on assets dropped with high inflation rates. Aside from that, the comportment of high rate inflation adversely affected capital stock, equity market activity, and liquidity of the secondary capital markets.

High inflation rate could also create difficulties for the market to monitor agent with their varied output and possible associated risk. The reason is that, the barrier of price signaling process and assumption of ineffective agents are mistakenly considered as effective agents. Similarly, inflation fluctuate the number of total borrowers and lenders. The occurrence of high inflation rate creates more demand from agents to borrow rather than to lend. This is because of the reduction of real debt value, and it is gainful to have a debt. Boyd, Levine, and Smith (2001) agreed that the marginal impact of inflation accordance to the banking activity and stock market development will lessen drastically as the inflation rate arises. In other view, every changes of the inflation rate will contribute negatively to the stock prices (Fariso&Fazel, 2008; Omotor, 2010), threaten corporate profits (Geetha *et al*., 2011) and serve consistently as a negative relationship (Solnik, 1983; Adrangi, Chatrath, &Sanvicente, 1999).

Yakov (1996) asserted that the impact of inflation is in various levels because it depends on the source of inflation. In positive impact, if the source is because of aggregate demand shocks, then it results to positive impact on equity returns. Unlike negative impact, if it is because of aggregate supply shocks, then it harms liquidity stock market. Furthermore, Feldstein and Horioka (1980) found two ways of negative consequences of inflation impact on equity returns. Firstly, a decrease in distributable-profit will decrease the price as well as return on equity. This can be explained by the increase of inflation where the price will go up together with taxable-profit, while distributable-profit decreases accordingly. Secondly, the source of inflation impact is in a way of tax system. Real and nominal gained capitalscannot be differentiated by tax system and frequently impose taxes on nominal capital gains. Therefore, this action causes the price and return on equity to decline.

Boyd, Levine, and Smith (1996) showed that high inflation rate has negative consequences for stock market development. They used time-averaged data of 51 countries for the period of 1970 to1993 and seven indicators of stock market development. Log of Gross Domestic Product (GDP), secondary school enrolment, revolution, black market premium and government final expenditures were used as control variables. They found that there is a statistically significant and economically substantial negative relationship between inflation and stock market performance. Their results are consistent to various modifications in the specification of the regression equation, sample period, and set of countries considered. Their empirical finding supported the hypotheses that the increase in inflation rate is deleterious to stock market performance. Boyd *et al*. (2001) again gauged the impact of inflation on stock market development and used the same set of data and methodology to gauge the impact of inflation on stock market growth. The results reinforced that inflation is deleterious to financial sector development.

Geetha *et al*. (2011) confirmedthe influence of inflation on the stock performance in a Malaysian case. They found a steep fell in the local stocks retrieved from Bursa Malaysia data which showed foreigner purchasing of local stocks dropped from RM 2.6 billion in December to RM 100 million in January. However, in a recovery stage after global financial crisis in 2008/2009, Malaysian market revenue gained a 31 percent returns in US dollar currency in 2010.

Stock market indexing is one of the most widely used measures of stock performance. Investors hold portfolios of many assets but it is cumbersome to follow progress on each security in the portfolio. Thus, it is prudent to observe the entire market under the notion that their portfolios moved in the same direction as the aggregate market. According to Kithinji and Ngugi (2009) the assumption is that randomly selecting a large number of stocks from the total market should enable the investor to generate a rate of return comparable to the market. A study by Geetha *et al*. (2011) showed that Malaysian stock market has no exception of risk to foreign investors. Therefore, this study is important not only forthe local investors but also foreigners.

MC is another measure of stock market performance. It measures market movements by determining the total value of stock in a particular stock market which is done by aggregating the market value of the quoted stocks. Changes in MC occur due to fluctuations in share prices or issuance of new shares and bonus issues. The implication is that increased level of activity at the market may signal more investments in the market. On the other hand, market turnover indicates inflows and outflows of the stock market and it is based on the actively traded shares. Kithinji and Ngugi (2009) stated that a change occurs due to the actively traded shares and owes to fluctuations in share prices or number of shares traded in a given day. Inflation affects the performance of stock markets but the amounts of effects need to be identified.

EMPIRICAL APPROACH

This paper uses time series data available for a period of 52 years from 1960 to 2012taken from The World Bank. The population of the studyis the Malaysian stock market.The first measure of stock market performance is stock traded turnover ratio (%) (ST) which is the total value of shares traded during the period divided by the average MC for the period. Average MC is calculated as the average of the end-of-period values for the current and previous periods.The second measure is MC of listed companies (% of GDP).MC (also known as market value) is the share price times the number of outstanding shares. Listed domestic companies are the domestically incorporated companies listed on the country stock exchange at the end of the year. Listed companies do not include investment companies, mutual funds, or other collective investment vehicles.

While another important variationis inflation, consumer prices (annual %) are explained as inflation as measured by the consumer price index which reflects the annual percentage change in the cost of the average consumer in acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. Time series dimension is important to explain the variation in the inflation rate over a period that can also explain variation in stock market performance.

Regression of the series inflation and stock market performance can be run empirically by using bivariate regression as shown in the equation (1) and (2). Equation (1) will regress the inflation index (INF) and the stock traded, while equation (2) will regress between INF and the MC.

$$\ln(ST)_t = \beta_0 + \beta_1 \ln(INF) + \epsilon_t \quad (1)$$

where

ST = Stock traded
INF = Inflation index

$$\text{Ln(MC)}_t = \alpha_0 + \alpha_1 \ln(\text{INF}) + \epsilon_t (2)$$

Where
MC= Market capitalization
INF = Inflation index

For the next step, this study runs the ADF test and PP test to identify and detect any stationarity of the data used in the series. The regression equations (3), (4) and (5) are used to test the null and alternate hypothesis by using ADF unit root test; H_o: Z is non-stationary or contains unit root; and H_1: Z is stationary or unit root does not exist.The ADF unit root test is based on the following three regression equations. Eq. (3) is without constant and trend, (4) with constant, and (5) with constant and trend.

$$Z_t = Z_{t-1} + u_t \quad (3)$$

$$\Delta Z_t = \alpha + \theta Z_{t-1} + u_t \quad (4)$$

$$\Delta Z_t = \alpha + \beta T + \theta Z_{t-1} + u_t \quad (5)$$

The unit root test PP in eq. (6) and (7) arealso used to test the hypothesis, H_o: Z is non-stationary or contains unit root; and H_1: Z is stationary where the unit root does not exist.

$$\Delta Z_t = \alpha + \theta t + (\varphi - 1) Z_{t-1} + u_t \quad (6)$$

$$\Delta Z_t = \alpha + \theta t + \lambda Z_{t-1} + u_t \quad (7)$$

Johansen Co-integration test is used to identify the long-run relationship between variables. The report is in a form of trace test and eigenvalue test because there is a probability of different inferences. The trace test and eigenvalue test results will provide the answer to the null hypothesis (Trace test; *r = 0, r ≤ 1, r ≤ 2, and r ≤ 3,* ANDMaximum Eigenvalue; *r = 0, r = 1, r = 2, and r = 3*)and alternate hypothesis (Trace test; *r ≥ 1, r ≥ 2, r ≥ 3, and r = 4,* AND Maximum Eigenvalue; *r = 1, r = 2, r = 3, and r = 4*)

RESULTS

Regression Analysis for Equation (1) and (2)

This paper addresses the issue of correlation between INF and ST of turnover ratio, and the correlation between INF and MC of listed companies. Therefore, it runs the regression analysis of equation (1) and (2) to determine the correlation of the parameters. The resultsare shown in Tables1 and 2 below.

Table 1. Regression result for INF and ST

Variables	Coefficient	t-statistic
Constant	3.451485	19.71986
LINF	0.108905	0.659639

R^2 = 0.019395, F-stat = 0.435123, Prob (F-stat) = 0.516332.

Based on Table 1, the R-Squared value is very low at 0.019395 and this implies that around 1.9% of the variation in ST can be explained by the other variables in the model.

The analysis reveals that INF is responsible for 1.9% variation in ST in Malaysia.

Table 2. Regression result for INF and MC

Variables	Coefficient	t-statistic
Constant	4.913250	31.44267
LINF	0.071758	0.484725

R^2 = 0.010112,F-stat = 0.234958, Prob(F-stat) = 0.632456.

Based on Table 2 the R-Squared value is very low at 0.010112 and this implies that around 1% of the variation in MC can be explained by the other variables in the model. The analysis reveals that INF is responsible for 1% variation in MC in Malaysia.

Augmented Dickey-Fuller Unit Root Test (ADF)

The next test is the time series data for INF, MC and ST appliedto determine the result of Dickey Fuller test in a graph form to see whether the data is non-stationary or stationary.

While the hypotheses to be testedare*H_0: α = 0, non-stationary (unit root), and H_1: $\alpha \neq 0$, stationary.* Therefore we regression the equation (3) and the result is shown in figure 1 to 3 below. The result indicates that the series data is non-stationary since it fluctuates over the long run.

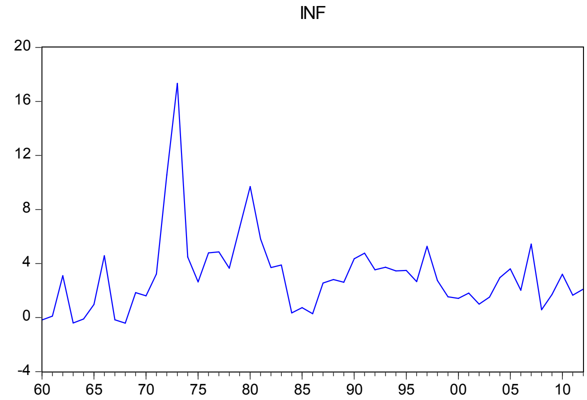

Figure 1. Unit root test Dickey Fuller for Inflation (INF)

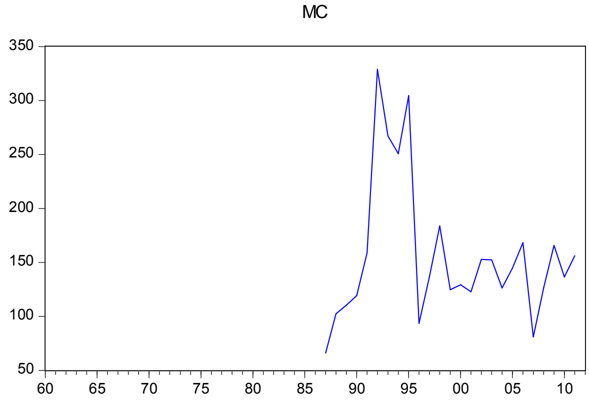

Figure 2. Unit root test Dickey Fuller for MC.

The regression analysis on the series data for equation (3)is done for all the parameters at “Level” and “None” and the result is shown in Table 3.

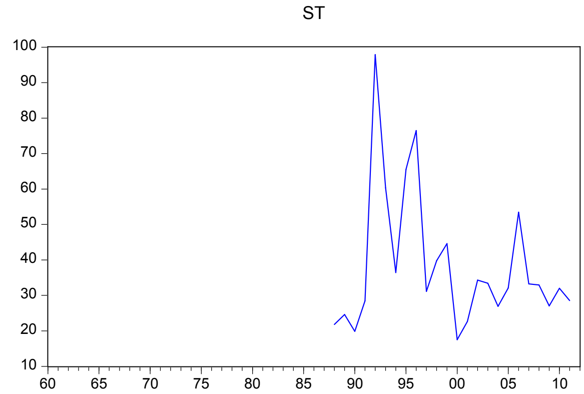

Figure 3. Unit root test Dickey Fuller for Stock Traded (ST)

Since the value of t-statistics exceeds the critical value, H_0 cannot be rejected. Except for INF where the null hypotheses can be rejected at 1%, 5% and 10% level.In eq. (4) the regression was also conducted with similar steps as the regression in eq. (3).

The resultsare shown in the Table 4.However this time the analysis intercepts the test equations. The null hypotheses can be rejected for INF at 1%, 5% and 10% level, but for MC the null hypotheses can only be rejected at5% and 10% level. While for ST we cannot conclude to reject the null hypotheses at the 1% level since the value of t-statistics is greater than the "tau" value, but the null hypotheses is rejected at 5% and 10% level. For eq. (5),the regression test is also similar with both regressionsabove particularly. The result is shown in the Table 5. However, this time the test uses trend and intercept in the test equation. Based on the table it is found that the value of t-statistics for INF is smaller than the "tau" value and the null hypotheses can be rejected at 1%, 5%, and 10% level respectively. While for MC the null hypotheses can only be rejected at 10% level. The value for ST is also similar with MC where the null hypotheses is rejected at 10% level.Based on Tables 3, 4 and 5 we can conclude that the parameters are non-stationary series and some of them are stationary. However this result is not reliable since the Durbin-Watson statistics is very small that means the parameter series havean autocorrelationproblem.

Table 3. Unit root test equation (3) for INF, MC, and ST for the "Level" and "None"

Equation	Variables	Dickey Fuller Level/Nonet-stat	Critical Value at [1%][5%][10%]
$Z_t = Z_{t-1} + u_t$	INF	-2.748839	-2.617364*
			-1.948313**
			-1.612229***
	MC	0.219402	-2.664853
			-1.955681
			-1.608793
	ST	0.207876	-2.669359
			-1.9564.6
			-1.608495

* Significant at 1% level respectively.
** Significant at 5% level respectively.
*** Significant at 10% level respectively.
All testsare conducted using the selection of Schwarz Info Criterion.

Table 4. Unit root test equation (4) for INF, MC, and ST for the "Level" and "Intercept"

Equation	Variables	ADF Levelt-stat	Critical Value at [1%][5%][10%]
$\Delta Z_t = \alpha + \theta Z_{t-1} + u_t$	INF	-5.651611	-3.584743*
			-2.928142**
			-2.602225***
	MC	-3.518635	-3.737853
			-2.991878**
			-2.635542***
	ST	-3.254042	-3.752946
			-2.998064**
			-2.638752***

* Significant at 1% level respectively.
** Significant at 5% level respectively.
*** Significant at 10% level respectively.
All the test is conducted by using the selection of Schwarz Info Criterion.

Table 5. Unit root test equation (5) for INF, MC, and ST for the "Level" and "Trend & Intercept"

Equation	Variables	ADF Levelt-stat	Critical Value at [1%][5%][10%]
$\Delta Z_t = \alpha + \beta T + \theta Z_{t-1} + u_t$	INF	-6.048216	-4.175640*
			-3.513075**
			-3.186854***
	MC	-3.530445	-4.394309
			-3.612199
			-3.243079***
	ST	-3.294837	-4.416345
			-3.622033
			-3.248592***

* Significant at 1% level respectively.
** Significant at 5% level respectively.
*** Significant at 10% level respectively.
All the test is conducted by using the selection of Schwarz Info Criterion

Table 6. ADF Test for the Level and First Difference

Variables	PP Levelt-stat	Critical Value at [1%][5%][10%]	ΔADF [First Difference]t-stat	Critical Value at [1%] [5%] [10%]
INF	-6.048216	-4.175640* -3.513075** -3.186854***	-8.581224	-4.192337* -3.520787** -3.191277***
MC	-3.530445	-4.394309 -3.612199 -3.243079***	-6.137408	-4.416345* -3.622033** -3.248592***
ST	-3.294837	-4.416345 -3.622033 -3.248592***	-6.830441	-4.467895* -3.644963** -3.261452***

* Significant at 1% level respectively.
** Significant at 5% level respectively.
*** Significant at 10% level respectively.
All testsare conducted by using the selection of Schwarz Info Criterion.

Table 7. PP Test for the Level and First Difference

Variables	ADF Levelt-stat	Critical Value at [1%][5%][10%]	ΔADF [First Difference]t-stat	Critical Value at [1%] [5%] [10%]
INF	-6.111038	-4.175640* -3.513075** -3.186854***	-9.002038	-4.192337* -3.520787** -3.191277***
MC	-3.519735	-4.394309 -3.612199 -3.243079***	-7.171466	-4.416345* -3.622033** -3.248592***
ST	-3.658885	-4.416345 -3.622033** -3.248592***	-8.002292	-4.440739* -3.632896** -3.254671***

* Significant at 1% level respectively.
** Significant at 5% level respectively.
*** Significant at 10% level respectively.
All testsare conducted by using the selection of Bartlett Kernel

Table 8. Johansen Co-integration Test (Long-Run Co-integration) INF, MC and ST

Null Hypothesis	Lag=1, r=1			
	Trace Stat	C.V (5%)	Max-Eigen Stat	C.V (5%)
r=0	32.01541*	29.79707	18.87191	21.13162
At Most 1, r=1	13.14350	15.49471	9.513253	14.26460
At Most 2, r-2	3.630248	3.841466	3.630248	3.841466

* Denotes rejection of the hypothesis at the 0.05 level.
r represents number of co-integration vector.

It is confusing to determine whether MC and STare stationary or non-stationary. Therefore, we need to adopt the Augmented Dickey Fuller ADF Test at Level and First Difference with "Trend and Intercept" which are based on the equation below;

$$\Delta Z_t = \alpha + \beta T + \theta Z_{t-1} + Yi \sum \Delta Z_{t-i} - e_t \quad (8)$$

Table 6 shows the result of ADF test for the "Level" and the "First Difference". The result applies eq. (8).The result shows that the unit root does not exist where the INF series is stationary at significant levels of 1%, 5% and 10% at both Level and the First Difference. Therefore the null hypothesis is rejected.

The parameters MC and ST show that the series is non stationary where the unit root exists at 1% and 5% levels, therefore the null hypothesis cannot be rejected. However, at the first difference regression result for all parameters show that the t-statistic value is smaller than the absolute "tau" value, therefore the null hypothesis is rejected. This situation means that the first difference of the parameter series becomes stationarity.

Philips-Perron Unit Root Test (PP)

The Philips-Perron (PP) unit root test is applied for the purpose of comparison between two types of unit root analysis. Using the equations (6)and (7) the analysis applied the PP unit root test to test the stationarity of the series use in the study. Table 7 shows the result of PP test for the "Level" and the "First Difference". The result shows that the unit root does not exist where the INF series is stationary at a significant level of 1%, 5% and 10% at both Level and the first Difference.

Therefore null hypothesis is rejected. MC shows that the series is non stationary where the unit root exists at 1% and 5% levels, therefore cannot reject the null hypotheses. While ST shows a different result with the ADF test at Level and First Difference where the unit root only exists at 1% level respectively and the series is non stationary. However at the first Difference regression result for all parameters show that the t-statistic value is smaller than the absolute "tau" value, therefore the null hypothesis is rejected. This means that the first Difference of the parameters series becomes stationarity.

Johansen Co-integration test for Long-Run Integration

Co-integration will test the group of variables. It is used to determine the co-movement of a long run series of the variables. The analysis uses co-integration test to determine if there is any co-integration relationship between variables that will contribute to the model. In other words, it could indicate whether the combined series in the group are co-integrated or otherwise. By using this sort of test it can identify the number of co-integrating vectors in the model. In the ADF unit root test at the Level proved that two of the series are non-stationary. Therefore we will proceed to the co-integration test to analyze the variables whether they are co-integrated. This co-integration series analysis will include three parameters INF, MC and ST. The analysis will be conducted by using Johansen Co-integration Test.

The hypotheses to be testedare:

H_0: *r = 0, no co-integrating vector,*
H_1: *r = 1, there exist at least one co-integrating vector.*

The Johansen Co-integration test result is shown in Table 8. The analysis begins from one, two and three to test the co-integrating vectors. Based on the result, the Trace statistics show that the null hypothesis of r=0 is 32.01541 which exceeds the 5% critical value at 29.79707, while the Max-Eigen statistic value for the null hypothesis is 18.87191 and less than critical value at 21.13162. The Trace statistics value of r=1 is at 13.14350 which is less then critical value at 15.49471, the Max-Eigen statistics shows that the value is at 9.513253 which is less than critical value at 14.26460 and lastly the Trace Statistic value of r=2 is 3.630248 which is less than critical value 3.841466 follow by the Max-Eigen statistic with 3.630248 which less then critical value 3.841466. Therefore this study concludes that there are two co-integrating relationships between parameters. Thus, the null hypothesis is rejected with two co-integrating vectors.

Conclusion

Evaluation of inflation impact on various measures shows that there is a statistically significant influence of 1.9% on ST and 1% on MC respectively. The bivariate regression series is supported by two types of tests namely ADF unit root test and PP test and the Co-integration test to identify any co-integration of parameters if the series are combined. The result of the test shows that the series is stationary where unit root does not exist and the co-integration test proofs that the series is co-integrating with two co-integrating vectors. This shows that the effect of inflation on the stock market performance in Malaysia is weak even all the empirical results show positive relationship with inflation. This analysis supports Ibrahim and Agbaje's (2013) analysis where the long-run relationship does exist between stock returns and inflation definitely.There are some issues need to be highlighted such as the need to emphasize public awareness to encourage investment and transactions in stock. Corporate governance has also playeda vital role to make sure proper enforcement has been done to increase the confidence in the market. The authorized parties should formulate and use policy instruments that could maintain inflation at a reasonably low level so that it will not spoil the real value of stock gains. Furthermore, relying on the only inflation rate in investing in stock market is really a big mistake (Fariso&Fazel, 2008) as it can be influenced by other macroeconomic activities (Geetha *et al*., 2011). For future research, it is important not only to utilize the information from the inflation rate, but also together with exchange rate, interest rate and GDP to predict the movement of stock market (Geetha *et al*., 2011).

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