Impact of Macroeconomic Factors on Stock Market: Empirical Evidence from the Philippines

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Abstract

The study analyzes the short and long-run relationship between the Philippine Stock Exchange Index and macroeconomic variables industrial production rate, inflation rate, interest rate and foreign exchange rate. In particular, the paper examines secondary data from January 2009 to December 2019 with the use of Autoregressive Distributed Lag (ARDL) to estimate causality function; F-Bounds Test and Wald Test to confirm long-run relationship; and Error Correction Term (ECT) to determine the adjustment of short-run errors towards long-run equilibrium. The results show that industrial production rate and interest rate have a significant negative long-run and positive short-run relationship, respectively, while the foreign exchange rate has both significant positive short-run and negative long-run correlation with the stock market.

Keywords: ARDL; Philippine Stock Exchange Index, Industrial Production Rate; Inflation Rate; Interest Rate; Foreign Exchange Rate;

1. Introduction

The stock or equity market is among the leading indicators of economic growth. It provides a venue for companies to raise capital and for both domestic and foreign investors to participate. It also captures the performance of the business sectors and in general, the confidence to do business in a country (Rogers, 1998; Mohr, 1998). Moreover, a stock market is represented by an index that measures an aggregate worth of multiple high value and growth companies derived from different sectors to represent the overall health of the stock market. In the Philippines, the Philippine Stock Exchange Index (PSEI) is composed of the top 30 companies from financial, holding firms, mining and oil, industrial, property, and services sectors.

Various economic factors are known to stimulate sentiments among the community of investors and impact the fundamental valuations of companies' stock prices. For example, the level of manufacturing output for both food and non-food products is significant to investors since it translates to growing demands and business

expansion. The increase in prices of basic commodities is also important since it affects the purchasing power. On the other hand, the data on interest rates imposed by the Bangko Sentral ng Pilipinas is a deal-breaker since investors are very keen on the spread between borrowing and investing interest rates. Nevertheless, the interest rate differential between Philippine Peso over US Dollar and other currencies is imperative for investors with a multi-currency portfolio. Furthermore, various empirical studies from both developing and emerging economies documented that a few of the macroeconomic variables are linked with the stock market performance (Chen, 2009; Laopodis, 2006; Park & Rati, 2000; Pilinkus, 2010; Rogers,1998; and Tsai & Lee, 2000).

This study is anchored to the rudiments of finance theories, Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The CAPM is a multi-factor model used to calculate the required return of an asset or stock using the market risk as beta and the government's treasury bond yield as the risk-free rate (Lintner, 1965; and Sharpe, 1964) while APT is a framework that explains the rate of return is a linear function of company-specific and economic risk factors (Ross, 1976). Both theories suggest that macroeconomic variables influence the companies' financial position and therefore the stock market performance in total. The same theories were adopted by Basher and Sadorsky (2006), and Naik and Padhi (2012).

While there are existing studies on examining the factors leading to the stock market appreciation and depreciation, no similar study in the Philippines adopted the set of variables in one equation. Further, a review of the literature shows that the relationship between each macroeconomic factor is still contentious. Thus, this study contributes to the existing debate by investigating the correlation and causality estimation of macroeconomic variables industrial production rate, inflation rate, interest rate and foreign exchange rate to the Philippine Stock Exchange Index.

2. Literature Review

2.1. Industrial Production Rate and the Stock Market

Using VECM, Rahman, Sidek and Tafri (2009) observed that industrial production index is among the determinants of Malaysian stock market development. In the US, industrial production rate, inflation, term structure spread and default risk premium have a systematic influence on stock market returns (Chen, Roll & Ross, 1986). A study in India also highlighted that macroeconomic variables and stock market index are co-integrated and that the latter is positively related to money supply and industrial production (Naik & Padhi, 2012). While Ray and Vani (2003) determined the same findings for the Indian stock market using VAR model and artificial neural network, Ahmed (2008) presented a perspective that movement in stock prices influences industrial production.

Nevertheless, Bhattacharya and Mukherjee (2006) established that causal relationship is not present between stock market returns and money supply, industrial production index, GNP, real effective exchange rate, foreign exchange reserve and trade balance.

2.2 Inflation Rate and the Stock Market

Nominal stock returns and inflation rate have a positive correlation in high inflationary economies (Barnes, Boyd & Smith, 1999; Boyd, Levine & Smith, 2001). Using ANOVA, Pushpakumara and Anthony (2009) determined that inflation and exchange rates have a marginally positive impact on stock market capitalization in Sri Lanka. Akosah (2016) also explained that financial debts, foreign direct investments and inflation rates are positive determinants of stock market development in Ghana. In the same way, economic variables including real activity and inflation have a strong positive connection with stock prices (Fama, 1981; Kaneko & Lee, 1995). The same results were underscored by Adam and Tweneboah (2008), Anari and Kolari (2001), Darrat (1990), Firth (1979), Gultekin (1983), and Luintel and Paudyal (2006). Further, Rapach (2002) added that the increase in inflation does not necessarily result in a downward bias on share prices.

On the other hand, numerous studies argued that inflation rate has a negative non-linear relationship with stock market returns (Azariada & Smith, 1996; Bayar, 2016; Ben Naceur, Ghazouani & Omran, 2007; Choi, Smith & Boyd, 1996; Fama, 1981; Kaul 1990). Comparably, Ho and Iyke (2017) noted that inflation and weak currency rates slowdown stock market development. Huyben and Smith (1999) pointed out that the two variables are negatively correlated in a long run scenario. While Acquah-Sam (2016) discussed that FDI and inflation have an insignificant influence in Ghana, Ayunku and Etale (2013) stated that high inflation negatively impacted the stock market in Nigeria.

2.3. Interest Rate and the Stock Market

Lee (1997) argued that the relationship between the two is not stable over time and that it gradually changes from significantly negative to insignificant positive correlation while Harasty and Roulet (2000) claimed that the two variables are cointegrated. Aburgi (2008) affirmed that the exchange rate and interest rate are negative and significant predictors of stock market returns in Brazil. In New Zealand, the works of Gan, Lee, Yong & Zhang (2006) determined that the value of the stock market is influenced by interest rate, money supply and real GDP. Moreover, Dev and Shakeel (2013) disclosed that discount rates have an insignificant positive impact on stock market growth in Pakistan.

Conversely, the stock market returns and both short-term and long-term interest rates have an inverse relationship (French, Schwert & Stambaugh, 1987). The studies of Jefferis and Okeahalam (2000) showed that an increase in discount rate reduces the expected future returns, and Uddin and Alam (2007) presented that

interest rate has a significant negative relationship on Dhaka Stock Exchange share price. Likewise, the paper of Bulmash and Trivoli (1991) found a negative relationship between the US Treasury Bill rate and stock prices. Hsing (2004) used a structural VAR model and found an inverse relationship between interest rate and stock prices. The same findings were publicized by Arango (2002), Kaul (1990), Pushpakumara and Anthony (2009), Shrestha and Subedi (2014), Spyrou (2001), Wongbampo & Sharma (2002), Zafar (2013) and Zordan (2005).

2.4. Foreign Exchange Rate and the Stock Market

The scientific works of Phylaktis and Ravazzolo (2005) revealed that the foreign exchange rate has a positive relationship with stock market performance. Further, Ho and Odhiambo (2018) explained that foreign exchange rate has a positive and significant impact on stock market development, particularly in the short run. The same conclusions were presented in the US by Jorion (1990) and Aggarwal (1981), in Japan by Mukherjee and Naka (1995), and in Nepal by Joshi (2008).

In contrast, many studies suggested that the impact could be negative or positive depending on the international trade position of a country. A stronger currency is positive leverage for importing countries while negative leverage for exporting countries (Ma & Kao, 1990). The discussion on the two-way effects of foreign exchange rate to the stock market was supported by Dornbusch and Fisher (1980), Jorion (1991) and Gavin (1989). An inverse relationship was established by Rahman *et al.* (2009) in examining the relationship of money supply and exchange rate on stock market returns in Malaysia. The articles of Soenen and Hennigar (1988) disposed that the US Dollar effective exchange rate adversely affect the stock market. Nevertheless, the studies of Naik and Padhi (2012), and Robert (2008) affirmed that interest rate has no significant relationship with stock market returns.

3. Methodology

A quantitative non-experimental research was designed for this study to determine association and the influence of macroeconomic factors industrial production rate, inflation rate, interest rate, foreign exchange rate and money supply on the Philippine Stock Exchange Index. The industrial production rate and inflation rate were from Philippine Statistics Authority (PSA); interest rate and foreign exchange rate were from Bangko Sentral ng Pilipinas (BSP); and stock market index from Philippine Stock Exchange (PSE) online databank. The unit of analysis is 132 monthly values of the variables from January 2009 to December 2019. The list of variables is presented in Table 1.

Table 1. Variable Identification

Abbreviation	Description	Unit of Measure
PSEI	Philippine Stock Exchange Index	Points
IPR	Industrial production is the measure of output from the manufacturing sector	Percentage
INF	Inflation is the increase in prices of basic commodities over a period	Percentage
INT	Interest rate is the overnight reverse repurchase facility of BSP	Percentage
FX	Foreign exchange rate is the conversion of one US Dollar to Philippine Peso	Peso

The Augmented Dickey-Fuller and Phillips-Perron tests were used to determine if the variables are stationary at a certain level while the Akaike Info Criterion (AIC) was used for optimal lag selection. The Autoregressive Distributed Lag (ARDL) model was employed to test the short run while F-Bounds and Wald Tests for a long-run relationship between macroeconomic factors and the Philippine stock market. A similar methodology was applied by Azam and Ibrahim (2014), Chia and Lim (2015), and Ho and Odhiambo (2018) in studying the impact of macroeconomic factors on stock market performance.

4. Empirical Results

4.1 Test for Unit Root

Table 2 shows the results of the unit root test using Augmented Dickey-Fuller and Phillips-Perron. The variables INF, INT and IPR, without considering the trend and intercept, rejected the null hypothesis of non-stationarity at level while the variables PSEI and FX became stationary after taking the first difference. This exhibits that the variables are integrated in combined orders of I(0) and I(1), thus ARDL cointegration technique is preferable (Perasan *et al.* 2001; Nkoro & Uko, 2016).

Table 2. Results of Unit Root Test

Variables	Augmented Dickey-Fuller				Phillips-Perron			
	With Trend		Without Trend		With Trend		Without Trend	
	at Level	1st Diff.	at Level	1st Diff.	at Level	1st Diff.	at Level	1st Diff.
PSEI	-1.8905	-11.0162*	-2.1407	-10.8713*	-1.8905	-11.0090*	-2.1261	-10.8614*
FX	-2.1473	-13.7038*	-0.9043	-13.6235*	-2.0164	-13.9875*	-0.6827	-13.8433*
INF	-3.2691***	-6.5745*	-3.3634**	-6.5440*	-3.1349	-6.3303*	-3.2746**	-6.2854*
INT	-3.8848**	-5.7097*	-4.1783*	-5.5077*	-3.6671**	-9.4219*	-3.9683*	-9.1672*
IPR	-3.6984**	-13.2897*	-3.6647*	-13.3102*	-3.5607**	-13.4534*	-3.6026*	-13.3772*

Notes: *Denotes significant at 1%
**Denotes significant at 5%
***Denotes significant at 10%

4.2 Model Specification

As pointed out by Nkoro and Uko (2016), the model with the least values of Akaike Info Criterion (AIC) and highest Adjusted R^2 should be selected, thus Model (1,4,1,3,0) out of the 2,500 auto-tested models at four lags was considered for further analysis. The ARDL model in Table 3 shows that FX has both significant short-

run and long-run relationship with $B = 90.00, p < .05$ at lag one and $B = -163.66, p < .05,$ respectively. The two-way effect of foreign exchange rate to stock market returns was also recorded by Dornbusch and Fisher (1980), Jorion (1991), and Gavin (1989). While INF posted a non-significant relationship, INT displayed a significant positive relationship in the short run. Moreover, IPR showed a significant negative relationship in the long run with $B = -4.40, p < .05$. The positive effect of interest rate was confirmed by Aburgi (2008) while the negative effect of the industrial production rate disconfirms the findings of Bhattacharya and Mukherjee (2006). All significant coefficients indicate a corresponding increase or decrease in points of PSEI per unit change in each macroeconomic variable. Moreover, Table 4 indicates that the residuals of the model are normally distributed, with no serial correlation, and homoscedastic.

Table 3. ARDL Regression Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
PSEI(-1)	0.979107	0.015073	64.95635	0.0000
FX	-163.6576	26.38077	-6.203670	0.0000
FX(-1)	90.00075	32.43054	2.775185	0.0064
FX(-2)	10.31906	32.09457	0.321520	0.7484
FX(-3)	8.306010	32.48019	0.255725	0.7986
FX(-4)	50.89544	25.88428	1.966268	0.0516
INF	-84.10660	45.60979	-1.844047	0.0677
INF(-1)	85.17786	43.93702	1.938636	0.0549
INT	-269.6119	137.3238	-1.963329	0.0520
INT(-1)	47.19038	198.4063	0.237847	0.8124
INT(-2)	461.0491	196.0503	2.351687	0.0203
INT(-3)	-397.4054	135.5535	-2.931724	0.0040
IPR	-4.398702	2.180870	-2.016948	0.0460
C	990.3846	325.2607	3.044895	0.0029
Adjusted R-squared	0.987796	Akaike info criterion		13.59666
S.E. of regression	206.3118	Schwarz criterion		13.90241
F-statistic	816.6204	Hannan-Quinn criterion		13.72090
Prob(F-statistic)	0.000000	Durbin-Watson stat		2.115723

Note: **p-values* and any subsequent tests do not account for model selection

Table 4. Residual Diagnostics

Test	Statistics	*p-value*	Null Hypothesis (H_0)	Interpretation
Jarque-Bera	0.7568	0.6849	Normal distribution	Accept H_0
Breush-Godfrey LM, Obs*R^2	0.2656	0.2101	No serial correlation	Accept H_0
White, Obs*R^2	0.2458	0.0817	No heteroscedasticity	Accept H_0

4.3 Test for Cointegration

The F-Bounds test result in Table 5 shows an F-statistics of 3.11 which is higher than the I(1), 3.09 upper bound of 10% level indicating long-run cointegration (Pesaran *et al.*, 2001). Likewise, the Wald Test with X^2 of 42.61 is lower than the alpha critical value of 5% which rejects H_0, thus the coefficients of $PSEI_{t-1}$, FX_{t-1}, INF_{t-1}, INT_{t-1}, and IPR are not equal to zero.

Table 5. F-Bounds Test

Test Statistic	Value	Significance if.	I(0)	I(1)
F-statistic	3.1153	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Note: H_0 = No levels of relationship

Table 6. Wald Test

Test Statistic	Value	df	Probability
Chi-square	42.60548	5	0.0000

Note: H_0 = $PSEI_{t-1}$, FX_{t-1}, INF_{t-1}, INT_{t-1}, and IPR are equal to zero

4.4 Test for Stability

The graphical representation of CUSUM is shown in Figure 1 which confirms the acceptance of H_0, thus the regression equation is correctly specified since the statistical plot is within the 5% significance bounds (Bahmani-Oksooee & Kantipong, 2001).

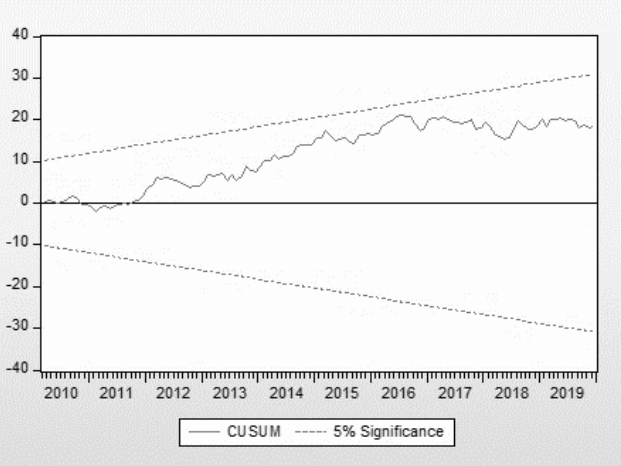

Figure 1. CUSUM Curve

4.5 Error Correction Form

The short-run error correction coefficients are presented in Table 7. All the coefficients are significant except for INT at lag one with $B = -63.64$, $p > .05$. The error correction term is represented by CointEq at lag one with

$B = -0.02$, $p < .05$. suggesting the presence of short-run error correction towards long-run equilibrium at the speed of 2% each period.

Table 7. Error Correction Model Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FX)	-163.6576	24.98948	-6.549058	0.0000
D(FX(-1))	-69.52051	25.17708	-2.761261	0.0067
D(FX(-2))	-59.20145	25.23228	-2.346258	0.0206
D(FX(-3))	-50.89544	24.81452	-2.051035	0.0425
D(INF)	-84.10660	39.81981	-2.112180	0.0368
D(INT)	-269.6119	126.2378	-2.135746	0.0348
D(INT(-1))	-63.64366	126.1746	-0.504409	0.6149
D(INT(-2))	397.4054	127.4434	3.118289	0.0023
CointEq(-1)*	-0.020893	0.004733	-4.414018	0.0000
Adjusted R-squared	0.307997	Akaike info criterion		13.52090
S.E. of regression	202.0749	Schwarz criterion		13.71745
Sum squared residual	5022616.	Hannan-Quinn criterion		13.60077
Log likelihood	-883.3794	Durbin-Watson stat		2.115723

Note: **p-value* incompatible with t-Bounds distribution.

5. Conclusion and Recommendation

The study confirmed the existence of short and long-run correlation between the Philippine Stock Exchange Index and the set of macroeconomic variables. The massive uptrend direction of the PSEI from 1,825.09 points in January 2009 to 7,815.26 points in December 2019 is a function of industrial production rate, inflation rate, interest rate, foreign exchange rate and other factors not covered in the study. The effect of USD/PHP exchange rate from PHP 46.48 in January 2009 to PHP 50.66 in December 2019 is illustrated by about 90 points increase in the short run and 163.66 points decrease in the long run for PSEI per one peso depreciation each month. If the peso weakens, foreign demand for goods and services increases, thereby creating more jobs and profits for domestic companies in the short run. Likewise, the cost of imported goods and services may increase and offset earnings in the long run. On the other hand, if the peso strengthens, imports are cheaper and local investment returns grow but tourism and trade exports may slow down. The BSP's interest rate did not register a significant long-run relationship, but the positive short-run relationship is explained by the return differential that investors may benefit from investing in Philippine assets. The significant impact of inflation rate was not recorded in this paper. Nevertheless, no existing body of literature referenced by the researcher that discussed the negative long-run relationship between industrial production rate and the stock market performance.

Furthermore, the study may serve as a reference for investors to maintain a resilient investment portfolio while exploiting market opportunities. The results may be utilized by policymakers to promote a balance of stability and profitability among retail and wholesale market participants. All the same, the existing model may be reviewed by researchers to explore moderating and mediating effects among the predictor variables and innovate other rigorous statistical approaches to improve future derivative models.

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