IS THERE A SYNCHRONICITY BETWEEN THE PHILIPPINE STOCK EXCHANGE AND NEW YORK STOCK EXCHANGE?

Jodylyn Quijano-Arsenio, University of Santo Tomas, Philippines
Karen Corpus, University of Santo Tomas, Philippines
Young-Jin Kim, University of Santo Tomas, Philippines
Julius Rola, University of Santo Tomas, Philippines

ABSTRACT

This study examines the impact of macroeconomic variables such as real Gross Domestic Product, inflation rate, savings interest rate, foreign exchange rate, oil price and economic disturbances including the 9/11 incident and Internet bubble burst on the Philippines Stock Exchange composite price index. Using multiple linear regression analysis, monthly data from 1996 to 2006, including 119 observations were analyzed. The results indicate that rates of inflation, savings interest rate, foreign exchange rate and oil price significantly affected the Philippine Stock Exchange composite price index. The lag one first difference in the unit root test revealed stability of Philippine Stock Exchange (PSE) market and New York Stock Exchange (NYSE) market. Both were also found to be significantly affected by the two economic disturbances. Likewise, we find synchronicity between PSE and NYSE markets using Granger-causality test. Specifically, causality runs one-way from NYSE stock prices to PSE stock prices.

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INTRODUCTION

The Philippine history reveals a deep relation to USA. Consequently, there are similarities in some of their economic and political policies. Among indicators of a country's economy is the performance of the Stock Market. This measure is often referred to as a barometer of the present condition of a country. The development of the stock market is, therefore, a function of economic growth. When economic fundamentals are bullish, traders will buy more stocks. If it is bearish, they will sell stocks leading to a stock price decline, ceteris paribus. The New York Stock Exchange (NYSE), is the largest stock exchange market in the world by dollar volume and the second largest by number of companies listed. Any fluctuation in this large market could potentially influence smaller stock markets such as the Philippine Stock Exchange (PSE). Globalization has increased the interconnection of stock markets. In addition, because of this phenomenon, stock markets have easy access to each other, with some stock issues trading on multiple markets.

In theory, increasing GDP and depreciating foreign exchange rate will result in a positive impact to the economy of an exporting country if its stock market is bullish. On the other hand, the inflation rate has an adverse effect on the stock market because of its negative correlation to future output. Increasing savings interest rates also have a negative effect on the stock market. If the interest rates increase, the higher expected returns will entice investors to deposit their money instead of investing in the stock market. Lastly, increasing oil prices have a negative impact on the stock market because it slows down the investments as it makes the business operations costly.

The examination of factors affecting the stock market is an interesting subject. However, little is known about granger-causality analysis and the effect of economic disturbances in the Philippine context. This paper fills this gap in the literature. There are three objectives of this article. First is to examine the impact of selected macroeconomic factors and economic disturbances on the PSE. The macroeconomic

factors examined are real Gross Domestic Product (GDP), inflation rate, foreign exchange rate, oil price, and savings interest rate. The economic disturbances examined are the Internet bubble burst in 2000 and the 9/11 incident in 2001. The second objective is to determine the direction of the synchronicity, if there is, between the PSE and NYSE. Lastly is to project the future fluctuations in PSE. The remainder of this article is organized as follows: The following section reviews the past literature. The next two sections present the methodology and test results.   The paper closes with some concluding comments.

LITERATURE REVIEW

Studies have produced conflicting theories and empirical results regarding the relationship between stock market prices and economic variables. The study of Eun and Shim (1989) on non-economic factors carefully examines international stock market movements in recent years and suggests that there is an existing substantial degree of interdependence among international stock markets. Choi (1991) found that Gross National Product (GNP) has a positive effect on stock prices while increasing inflation and interest rates, and depreciating foreign exchange rate have negative impacts.

According to Pane (1995), certain advantages were realized as a result of the unification of the Manila and Makati Stock Exchanges in the Philippines. The combination resulted in a larger and more organized market. He found a negative relation between stock price and interest rates, inflation rate and stock transaction tax. However, he finds that there is some positive relation between the inflation rate and taxes. All variables with the exception of interest rate are strongly correlated with the stock price.

Alcaly (2003) noted in his book that neither overly inflated share prices nor seriously undervalued ones can persist. Accordingly, the economy and stock price forecasts change in a fast and unstable manner over the end of the period analyzed. Internet stocks that once rose by more than 200% fell dramatically because of the 9/11 incident. It recovered in the next three months before it fluctuated in the spring and summer of 2002. The working paper of Gupta et al. (2000) in Jakarta, Indonesia found an irregular unidirectional causality between closing stock prices and interest rates and vice versa. And, there is weak unidirectional causality from exchange rates to stock prices. However, they failed to establish a consistent causal relationships between any of the economic variables.

Ofek and Richardson (2003) point out two reasons for the decline in stock prices. First, the optimistic behavior of investors and analysts was a factor. Second, deception by business firms in an attempt to maintain their ratings and stock prices impacted stock prices. Kawamoto (2005) argued that because of the aftermath of the internet bubble burst, technology has taken a step back as investors were disheartened by the event.

Two separate studies in stock market integration have been conducted in India. Ahmad (2005) found that there is no long-term relationship between the Indian equity market and the US and Japanese equity markets. Using daily closing data from January 1999-August 2004, he found that these stock markets have no tendency to move together in the long-term but a strong causal relationship was established in 1999-2001. In the case of Greece, Floros (2008) found out that there is a long-run relation between open interest and future prices in the Greek Stock Index Future Market. Mishra (2004), on the other hand, established that both interest rates and exchange rates affect stock returns in India.

Zahid (2000) created an econometric model based on the relationship between money supply, GNP, exchange rate, inflation, interest rate, stock transaction taxes, GDP, consumer price index, growth rate and unemployment and the composite stock index in emerging Association of Southeast Asian Countries (ASEAN) countries. He categorized the fluctuation in the stock index of any emerging ASEAN countries into economic variables, non-economic variables and financial factors. Some of the non-economic factors cited are government policy, political stability, disclosure of corporate and governmental

information, and psychology of the investor. The major significant variables that positively influenced the composite stock index are foreign exchange rate, consumer price index, and GNP. Only the lending rate is found to negatively influence the composite stock index but to a less significant degree. Mishra (2004), found that the exchange rate return affects the demand for money and stock returns and that interest rate changes cause exchange rates to change.

DATA AND METHODOLOGY

Monthly observations from the period 1996 to 2006 were used in this study. Quarterly real GDP data were transformed into monthly average data using 1985 as a base year. This period was selected to capture the effects of economic disturbances that occurred during this time period. The PSE composite price index in Philippine peso are obtained from PSE. The NYSE composite price indices under the 500 base values in dollars were gathered from its website. The savings deposit interest rate, inflation rate and foreign exchange rate are in monthly weighted average format. The world's price of oil is in dollar per barrel.

The data are analyzed using multiple linear regression with the aid of Eviews version 4 and PhStat software. In determining the extent of the impact of the selected macroeconomic factors on the PSE, regression model 1 was used. The impact of the 9/11 incident and Internet bubble burst was measured in regression models 2 and 3, respectively. Both economic disturbances are dummy variables. The variables used here are PSE= Phil. Stock Exchange composite price index, GDP= gross domestic product, IR= inflation rate, Int= savings interest rate, FER= foreign exchange rate, OP= oil price, NYSE= New York Stock Exchange price index, INC= 9/11 incident, and IBB= Internet Bubble burst.

$$PSE = \beta_0 + \beta_1 GDP - \beta_2 IR - \beta_3 Int + \beta_4 FER - \beta_5 OP + \mu \qquad (1)$$
$$PSE = \beta_0 + \beta_1 NYSE - \beta_2 INC + \mu \qquad (2)$$
$$PSE = \beta_0 + \beta_1 NYSE - \beta_2 IBB + \mu \qquad (3)$$

An analysis of time series data requires a preliminary examination of their stationarity status. All variables should be integrated of order zero, *I(0)*. The unit root test ensures that the probability structure of the series is stable over time and it makes statistical sense to combine them in a regression equation. To test for stationarity, we use the Dickey-Fuller Test which is a special test of the augmented Dickey-fuller test. The former becomes the latter when the number of the lagged first difference terms in the test regression is chosen to be zero (Danao, 2005). The existence of a unit root as indicated by the Durbin-Watson *d* value justifies using the augmented Dickey-Fuller test (ADF) where its null hypothesis is that Y_t is a non-stationary series. The asymptotic distribution of the ADF test statistic qualifies for the use of MacKinnon critical values which are readily provided by Eviews at 1%, 5%, and 10% significance levels. When the ADF test statistic is greater than the MacKinnon critical value, the null hypothesis is rejected. Its formula is the *t* statistic on ζ (zeta) as seen below. The difference operator is represented by Δ. ε_t represents the stationary random error, and Y_t refers to the dependent and independent variables

$$\Delta Y_t = \beta_1 + \beta_2 t + \zeta Y_{t-1} + \alpha \sum \Delta Y_{t-1} + \varepsilon_t \qquad (4)$$

To determine the extent of synchronicity between the stock price index of NYSE and PSE, the Granger-causality test was applied. The Granger-causality test measures precedence and information content. Consequently, Y is said to be Granger-caused by X if the coefficients of X are statistically significant (Granger, 1981). The Granger-causality test is then the Wald test with the null hypothesis that Y_t does not granger-cause X_t. The bivariate regression that is run by Eviews for this study are in these forms:

$$PSE_t = \sum_{i=1}^{k} \alpha_1 PSE_{t-1} + \sum_{j=1}^{k} \beta_j NYSE_{t-j} \qquad (5)$$

$$NYSE_t = \sum_{i=1}^{k} \alpha_1 NYE_{t-1} + \sum_{j=1}^{k} \beta_j PSE_{t-j} \tag{6}$$

The PSE and NYSE are two stationary series with *i* and *j* as lag lengths. The expected outcome would be one of the following (Danao, 2005):

X Granger-causes Y (the estimated βs are jointly significantly different from 0) but *Y does not Granger-cause X* (the estimated δs are jointly not significantly different from 0).

Y Granger-causes X (the estimated δs are jointly significantly different from 0) but *X does not Granger-cause Y* (the estimated βs are jointly not significantly different from 0).

X Granger-causes Y (the estimated βs are jointly significantly different from 0) and Y Granger-causes X (the estimated δs are jointly significantly different from 0).

X does not Granger-cause Y (the estimated βs are jointly not significantly different from 0) and *Y does not Granger-cause X* (the estimated δs are jointly not significantly different from 0).

Finally, after finding the significant macroeconomic factors and economic disturbances affecting PSE stock price, we predict the future fluctuations of PSE using regression model 7.

$$PSE = \beta_0 + \beta_1 NYSE + \beta_2 GDP - \beta_3 IR - \beta_4 Int + \beta_5 FER - \beta_6 OP - \beta_7 AFC - \beta_8 IBB + \beta_9 INC + \mu \tag{7}$$

RESULTS AND DISCUSSION

We organize our results based on five propositions that are examined. The first proposition is that higher savings interest rate (IR), foreign exchange rate (FER), inflation rate (IR), oil price (OP) and real GDP influence the PSE stock price. The second proposition is that there is synchronicity between Philippine Stock Exchange and New York Stock Exchange. The third proposition is that the PSE will be affected by the internet bubble and 9/11 incident. The fourth proposition is that the presence of NYSE composite price index and Internet bubble burst will lead to more changes in PSE composite price index. Finally, notable changes in significant macroeconomic factors and economic disturbances will lead to more changes in PSE composite price index.

Proposition 1- Higher Savings Interest Rate (IR), Foreign Exchange Rate (FER), Inflation Rate (IR), Oil Price (OP) and Real GDP Influence the PSE Stock Price: In order to measure the contribution of each macroeconomic variable to PSE stock price, multiple regression analysis was used. The results show that the majority of these variables exhibited a significant impact on the PSE stock price except for real GDP. Hence, we tested a new econometric model without GDP. Table 1 presents the summary of the final regression result of all significant variables affecting the PSE. The findings show that 96% of the changes in PSE stock price can be explained by the savings interest rate, inflation rate, foreign exchange rate, and oil price. Furthermore, 95% in total variation of PSE stock price index can be explained by the delineated factors mentioned. The *p* value for F statistics is zero indicating that the regression as a whole is significant at 5% level. The results show that there is an estimated average of Php 3,914.96 in the PSE stock price index when there are no effects of savings interest rate, inflation rate, foreign exchange rate, and oil price presence. There is an estimated decrease of Php 36.43 in the average value of PSE stock price index for every one percent increase in savings interest rate, *ceteris paribus*. An estimated increase of Php 41.98 in the average value of the PSE stock price index is expected for every one percent increase in the inflation rate. An estimated decrease of Php 54.64 is expected for every one percent appreciation of the foreign exchange rate. Lastly, an estimated increase of Php 14.64 is expected for every one dollar increase in oil price per barrel.

The positive effect of inflation may be due to the notion that if inflation is increasing, people tend to buy more stocks rather than save money as a hedge against inflation. The finding is analogous to the studies made by Choi (1991), Pane (1995) and Gupta et al. (2000) but contrary to Zahid's (2000) studies on the relationship between interest rates and stock price.

Table 1: Multiple Regression Result

Delineated Factors (n = 119)	Coefficient Value	t
Intercept	3,914.958	
savings interest rate	-36.4281	
inflation rate	41.98441	10.19016*
foreign exchange rate	-54.6389	-2.72578*
oil price	14.63994	3.15978*
R^2	0.959226	-6.82426*
Adjusted R^2	0.952400	4.717079*
Durbin Watson	2.023062	
F	139.8820	

* denotes significance at 5% level

The foreign exchange rate is negatively related to stock prices. The Philippine peso continuously depreciated during the time period covered. This could partly be explained by the imbalance of trade. As oil prices increase, the general price level will increase resulting in higher inflation. Oil shocks that cannot be anticipated by nature are also an explanatory factor because a sudden increase in oil prices in the short run will lead to a lower profit among business companies. However after they have adjusted, in the long-run, they could increase their prices and recover from their losses in the previous period.

The findings in Table 2 show that oil prices and foreign exchange rates are the two factors that could influence most the PSE stock price. Oil is a necessity to countries that utilize motor related things in order to generate power (Yee, 1995). The service sector, which consumes a large portion of the total electricity consumption in the Philippines, is a substantial contributor to gross domestic product. Consequently, performance in the stock market is affected whenever there is an oil price increase. Moreover, because of the sophistication of financial markets, an investor could compare the expected returns in different currencies, leading to a separate foreign exchange effect.

Table 2: Most Influential Variables

Delineated Factors (n = 119)	Coefficient Value	p value
oil price	14.6399	0.0000*
savings interest rate	-36.4281	0.0076*
inflation rate	41.98441	0.0021*
foreign exchange rate	-54.6384	0.0000*

* denotes significance at 5% level

Proposition 2-There Is Evidence of Synchronicity between Philippine Stock Exchange and New York Stock Exchange: Our analysis continues by examining the synchronicity between the Philippine and New York Stock exchanges. Table 3 shows the results for testing unit root at the level variables of PSE and NYSE stock prices. The researchers conducted a test of stationary since the stock prices are always in random motion making it hard to calculate a specific prediction of their movement. The initial test shows that both variables have unit root correlation so the ADF was applied. The third column shows the unit root test after differencing the data once. In this case, the ADF statistic in absolute term is now greater than the critical values of MacKinnon at 1%, 5% and 10% level of significance indicating that the PSE and NYSE stock prices are now stationary. Hence, variables can now be tested using granger-causality test.

Table 3: Unit Root Test

Delineated Factors	Level Variables	First Difference
PSE	-1.681800	-6.576948*
NYSE	-0.385780	-7.684460*

The critical values for ADF are -3.4819, -2.8838,and -2.5785 for 1%, 5%** and 10%*** level of significance, respectively.*

The results of the Granger-causality test are presented in Table 4. Using 128 observations we find that there is synchronicity between PSE and NYSE. The F statistic (2.72512) reveals that NYSE granger-causes PSE and it appears that granger-causality runs one-way only from NYSE to PSE stock price. The availability of information technology makes the possibility of market interconnections. In the case of the Philippines and USA, the influence of NYSE to PSE stock price can be ascribed to the political influence of the latter.

Table 4: Granger-causality Test

Propositions (n = 128)	F-statistic	P value
NYSE does not granger-cause PSE	2.72512	0.10129*
PSE does not granger-cause NYSE	0.21046	0.64720

* denotes significance at 10% level

Proposition 3-The PSE Will Be Affected by the Internet Bubble and 9/11 Incident: Next, we examine how the PSE is affected by shocks to the system. Table 5 reveals that the NYSE and 9/11 incident explain 96% of the changes in PSE stock price index. The Durbin Watson d statistic of (2.047) indicates that there is no autocorrelation among the data. There is an estimated decrease of Php 460.43 in the PSE stock price index when the NYSE stock price index and the 9/11 incident are non-existent. Moreover, there is an estimated average increase of Php 2.99 in the PSE stock price index for every one dollar increase in the NYSE stock price index, *ceteris paribus*. The PSE stock price index after the 9/11 incident is higher by Php 238.08. The possible explanation for this is a higher demand from foreign investors as they transfer their investments to other countries like the Philippines after this incident.

Table 5: Regression Result with 9/11 Incident

Delineated Factors (n = 119)	Coefficient Value	t
intercept	-460.4317	-1.06322
New York Stock Exchange	2.99106	6.136635*
9/11 incident	238.077	2.104448*
R^2	0.95951	
Adjusted R^2	0.95411	
Durbin Watson	2.04705	
F	177.7373	

* denotes significance at 5% level

Proposition 4-The Presence of NYSE Composite Price Index and Internet Bubble Burst Will Lead to More Changes in PSE Composite Price Index: Next we examine the extent to which the PSE is explained by other economic factors. The results are presented in Table 6. The regression results indicate that the decrease in the PSE stock price by Php 557.14 can be explained by other factors not related to the NYSE stock price and Internet bubble burst. The R^2 tells that 96% of the changes in PSE stock price can be explained by these two significant factors. The p value for the F statistic of zero means that the regression model as a whole is significant at the 5% level. The value of the Durbin Watson tells that data are free from autocorrelation. The PSE stock price after the Internet bubble burst increased by Php 259.89. We attribute this change to a higher inflation rate and a greater demand for PSE than NYSE stocks because of their lower vulnerability to external shocks. Likewise, there is an estimated average increase of Php 3.06 in the PSE stock price for every one dollar increase in NYSE stock price.

Table 6: Regression Result with Internet Bubble Burst

Delineated Factors (n = 119)	Coefficient Value	t
intercept	-557.1376	-1.231702
NYSE	3.062487	6.075735*
IBB	259.8871	2.130792*
R^2	0.962119	
Adjusted R^2	0.955227	
Durbin Watson	1.991837	
F	286.9991	

denotes significance at 5% level

Proposition 5-Notable Changes in Significant Macroeconomic Factors and Economic Disturbances Will Lead to More Changes in PSE Composite Price Index: Finally, we examine how changes in significant macroeconomic factors and economic disturbances affect the PSE composite price indexes. Table 7 shows the final regression result between the PSE stock price index movement and the significant variables namely: NYSE stock price index, savings interest rate, inflation rate, foreign exchange rate, oil price and the 9/11 incident. The regression included 119 observations. The Durbin Watson *d* statistic of (2.05) indicates that there is no autocorrelation. The adjusted R^2 indicates that 96% of the total average variation of PSE stock price index can be explained by these factors. Likewise, findings show that 97% of the changes in PSE stock price are attributable to them. Since all significant variables have computed t values that are greater, in absolute value, to the tabular value of *t* that is 1.96, it is safe to say that they are all significant in explaining PSE stock price index movement prediction.

No multicollinearity was detected in the process. Also, F statistic indicates that the regression as a whole is significant at the 5% level. There is an estimated Php 2,718.62 of PSE stock price index that is not attributable to the movement of NYSE stock price index, savings interest rate, inflation rate, foreign exchange rate, oil price and the 9/11 incident. Moreover, there is an estimated average increase of Php 2.11 in the PSE stock price index for every one dollar increase in the NYSE stock price index, *ceteris paribus*. An estimated increase of Php 27.46 is also expected to take place for every one percent increase in the inflation rate. Furthermore, for every one percent increase in the savings interest rate, the PSE stock price is expected to decline by Php 29.9. PSE stock price is expected to increase by Php 6.83 for every one dollar increase in oil price per barrel. The average value of the PSE stock price index decreases by Php 54.30 for every one percent appreciation of foreign exchange rate. In addition, the PSE stock price is higher by Php 178.45 after the 9/11 incident.

Table 7: Multiple Regression Result

Delineated Factors (n = 119)	Coefficient Value	t
intercept	2,718.623	5.2749*
New York Stock Exchange	2.110957	5.5087*
savings interest rate	-29.8982	-2.3517*
inflation rate	27.4641	2.2478*
foreign exchange rate	-54.2995	-6.2940*
oil price	6.82521	2.3689*
9/11 incident	178.4454	2.0044*
R^2	0.969466	
Adjusted R^2	0.963606	
Durbin Watson	2.059496	
F	165.4342	

denotes significance at 5% level

CONCLUDING REMARKS

While there are few attempts to study the possible connection of a stock market from a developing country to a more sophisticated stock market, this study is different because it considered the effects of economic disturbances that are unpredictable and sometimes difficult to quantify. This paper provides more and new evidence to aid in the understanding of the movements in a stock market of a developing country like the Philippines. It is noteworthy that this study is a sample of the general concept as to what happens in a smaller stock market in relation to a larger stock market.

We find that there is synchronicity between the PSE and NYSE stock markets. Specifically, the NYSE price Granger-causes the PSE price. Future research could explore the synchronicity of the PSE to other stock markets in Asian developing countries. In this way, two-way direction causality might be established. The time period covered might also be extended to capture the political aspects of the country. Finally, while the NYSE composite price index granger-causes the PSE composite price index, it is noteworthy that other significant factors can influence the movement of the latter. Hence, it is very important that the Philippine government maintain healthy domestic policies in order to maintain the stability of savings interest rate, inflation rate, foreign exchange rate, and oil price.

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BIOGRAPHY

Jodylyn M. Quijano-Arsenio (e-mail : jod_econ@yahoo.com), Ph.D. is an Assistant Professor in the Department of Economic at University of Santo Tomas, España, Manila, 1015 Philippines.

Karen Corpus (e-mail: long_legs@yahoo.com), Young-Jin Kim (e-mail: luke0083@yahoo.co.kr), and Julius Rola (e-mail:juliust_34@yahoo.com) are all newly graduates with the degree of Bachelor of Science in Commerce major in Economics at University of Santo Tomas, España Manila, 1015 Philippines.