

Analysing the Effects of Foreign Direct Investments to the Movements of the Philippine Peso Exchange Rate: A Granger Causality Test between Variables

Frederick P. Romero

De La Salle University Manila, Taft Avenue, Manila
Miriam College, Katipunan Avenue, Quezon City

Abstract— The purpose of this paper is to analyze the role of Philippine exchange rate in explaining the movement of the Foreign Direct Investments (FDI) in the Philippines. The study used time series monthly data of the Philippine FDIs and peso exchange rate from January 2005 to December 2014. Augmented Dickey Fuller (ADF) test was used in order to test the stationarity of the data. To examine the heteroscedasticity in the data, the paper utilized the LaGrange-Multiplier Test of ARCH Test and Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH). Finally, the Granger Test for Causality was used to determine if the foreign direct investments and exchange rate have long-run dynamic relationship during the period covered. The results showed that there is no significant relationship between exchange rate and FDI. The Philippine exchange rate does not Granger caused the volatility of the foreign direct investments, and vice versa. This implies that other Philippine economic variables, excluding FDIs, may influence the volatility in exchange rate. Also, it can be suggested that the exchange rate movement does not attract FDIs, thus, authorities should look at other factors in managing the levels of FDIs and how it can be increased.

Keywords- Exchange rate; Foreign Direct Investments; ARCH Test; Granger Causality test

I. INTRODUCTION (HEADING 1)

A nation's economic well-being and overall financial stability can be represented by different factors. Macroeconomic variables such as Gross National Product (GDP), balance of trade, export, import, unemployment rate and inflation are some of the factors that reflect the country's economic health. Policymakers and the central bank of countries look at these factors and find ways on how to improve them in order to have a stable and strong economy. However, theoretically speaking, some variables may affect other macroeconomic variables positively or negatively, which makes it difficult for the central banks and policymakers which factor to focus on since a change in a variable may drastically influence another factor. A careful and accurate understanding of the timing and effects of these economic variables will then be beneficial for the nation's growth and stability. Pan (2003) noted that one of the key elements in representing the well-being of a country is its exchange rate. The study further explained that a country's exchange rate is influenced by factors such as the balance of payments and the

relation between the supply and demand of currency, the interest, the purchasing power parity, the tax policy, the investments, the central bank intervention on the currency market, etc.

On the other hand, a country's foreign direct investment (FDI) is defined as an investment by a company located in one country to a company based in another country. The level of FDI of a country plays a vital and growing role in the international business. Albuquerque et al. (2005) reported that the increasing consolidation and integration of global capital markets that happened following the many reforms and liberalization programs in the 1980s had led to the FDI's significant importance in the emerging markets (e.g. ASEAN region) such as the Philippines (Chia, 1996). The investment incentives being introduced within the ASEAN countries might also have ultimately increased competition among the ASEAN countries to attract foreign direct investments.

In relation to the countries' exchange rate evolution, the more stable the local exchange rate is, the higher the foreign investments flow will be (Iavorschi, 2014). This is because the stability of a country's foreign exchange will improve the image of the country, not just on the national level but at the international level as well. Given these, the relationship between the two variables is then inferred by this study. The structure of the paper is as follows: selected literature review of FDI and exchange rate relationships is discussed in Section 2. Section 3 presents the theoretical framework of the study; the data used, data sources and methodology, are outlined in Section 4; whilst Section 5 discusses the results of the paper. Section 6 concludes the paper and lastly, Section 7 provides the limitations and recommendations for future researchers.

II. REVIEW OF RELATED LITERATURE

Numerous studies have been written on how macroeconomic variables affect each other's volatility. Kim (1998) suggested that inflation and exchange rate have volatility association. On the other hand, Sachs (1985) found out a bi-directional relationship between inflation and exchange rate using the granger causality analysis. In the Egyptian, Tunisian and Moroccan settings, Deme and Fayissa (1995) studied the association of inflation rate and exchange rate from 1964 to 1993. The results confirmed that the association of inflation and exchange rate is not present in

Egypt and Tunisia, and the relationship is only present in Morocco. Moreover, a negative effect was obtained using the exchange rate and export level for South American countries by Serenis (2013). This is also the same with the findings done by Bahmani-Oskooee and Satawatananon (2013), and Jiranyakul (2013), wherein they tested the effect of exchange rate on the movement of import level in Thailand. Verheyen (2012) also found that exchange rate affects international trade negatively in the United States and the Euro zone settings. There are other studies that shows how exchange rate adversely affects international trade confirming how important the former on the country's overall international operations (Saucer and Bohara, 2001; Grier and Smallwood, 2007; Baum and Caglayan, 2009; and Caglayan and Di, 2010).

In relation to FDIs, this topic has been well-covered by previous literatures as well. A study looked at the association between the movement of exchange rates for Canada, Japan, United States and United Kingdom and found that changes to exchange rate volatility have positive and significant impact on flow of FDI (Chowdhry and Wheeler, 2008). Gast (2005) found evidence to support that appreciation of the home country currency provide positive effect on the FDI outflows in the European economies. On the other hand, using autoregressive conditional heteroscedasticity (ARCH) and GARCH models, Coleman and Tettey (2008) found significant findings on the exchange rate volatility and foreign direct investment link for the sub Saharan African region during the period 1970 to 2002. In addition, Chakrabarti and Scholnick (2002) studied the relationship between the US outward FDI to 20 OECD countries and exchange rate volatility. The study found negative relationship between the two variables. In contrast, Gorg and Wakelin (2002) looked at the movement of exchange rate and a sample of US FDI to 12 OECD countries. The study obtained negative association between the variables used.

In the Asian region, Dhakal et al. (2010) found positive impact of exchange rate on foreign direct investments on East Asian Countries namely, Indonesia, Malaysia, China, Philippines, South Korea, Thailand and China using panel data techniques of estimation. Furthermore, Chege (2010) looked at 26 emerging market economies and studied how exchange rate volatility affects each country's FDI. Using panel analysis, the study found out that exchange rate volatilities have adverse impact on the inward foreign direct investment for these emerging economies. Lastly, Pan (2003) reported that there is a negative but insignificant relationship between the exchange rate and the inflow of FDI into China between 1984 and 1996. The study suggests that the MNEs may not take out their profits in the short-term duration thus implying that the FDI in the emerging markets may be for long-term decision.

III. THEORETICAL FRAMEWORK

Blonigen (1997) and Froot and Stein (1991) provided the most significant theories on the relationship of exchange rate and foreign direct investments. Blonigen (1997) suggested that when companies buy foreign firms, this gives them firm specific assets. The theory assumes goods market

segmentation, and suggests "that foreign and domestic firms have the same opportunity to buy, but different opportunities to generate returns on assets in foreign markets" (Phillips, S. and Ahmadi-Esfahani, 2008). The theory is then centered on FDI as an acquisition strategy of multinational companies. The MNE can enhance its profitability by having different branches across different countries and taking advantage of the currency movements. The theory suggests that these movements can change the relative asset valuations of the companies, and a depreciation of the host's currency increases FDI (inbound) (Phillips and Ahmadi-Esfahani(2008).

On the other hand, Froot and Stein (1991) based their theory on an imperfect capital markets in which exchange rates operate on wealth to affect FDI. According to this theory, the external sources for borrowing are more expensive than a company's internal cost of capital because of the presence of imperfect capital markets. Given this, it can be suggested that a decrease on the host currency may provide positive impact on the inbound FDI since this event appreciates the wealth of the foreigners making them capable of giving better offers for the local businesses and assets.

Other theories supporting the relationship between exchange rate and foreign direct investments include risk aversion and real options.

Risk Aversion

According to this theory, the timing differences between investments and profits cause the volatility of the exchange rate. Companies invest their money in a foreign country when the expected returns equal the cost plus premium for the level of risk introduced by the volatility of the exchange rate (Goldberg and Kolstad, 1995). Cushman (1985) suggested that the risk adjusted expected real exchange rate appreciation adversely affects the foreign cost of capital causing FDI's to increase.

Real Options

According to Dixit and Pindyck (1994), investment decisions are affected by the certain uncertainties in the market. Companies can have an option to invest outside their country which can be affected by the uncertainties with the exchange rate; the value of the option is also influenced by the exchange rate uncertainty. Goldberg and Kolstad (1995) explained that if a company creates different branches across different countries, this event provides the firm options to move their business operation from one country to another in adapting to exchange rate movements.

IV. METHODOLOGY

This paper studies how the movement of the Philippine Peso exchange rate influences the volatility of the foreign direct investments in the Philippines. Given this, the study used time series data of these variables on a monthly basis for the period January 2005 to December 2014. The data was obtained from Bangko Sentral ng Pilipinas website and other financial information database (e.g. Bloomberg, Factset, etc.).

Unit Root test

Causality analysis of variables requires that the time series data are stationary since non-stationary data can generate false results. To check for the stationarity, researchers need to investigate the unit root properties of the variables. This paper used the Augmented Dickey Fuller (ADF) test of unit root to test for the stationarity of data. To make the data stationary, the process of differencing will then be done if non-stationarity characteristic is present in the variables.

Autoregressive Conditional Heterskedastic (ARCH)/exponential general autoregressive conditional heteroskedastic (E-GARCH)

The ARCH and GARCH models are created to deal with time series heteroskedastic models. Their goal is to provide a volatility measure mostly used in financial decisions concerning portfolio selection, derivative pricing and risk analysis (Engle, 2001). To test the heteroscedasticity of the exchange rate and foreign direct investments, the study utilized the LaGrange-Multiplier Test of ARCH Test (ARCH errors) and Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) for the GARCH errors. The ARCH model determines the time-volatility characteristics of the chosen variables (Engle, 1982). On the other hand, the exponential general autoregressive conditional heteroskedastic or the E-GARCH model is another form of the GARCH model. Nelson (1991) introduced this model that used the logged conditional variances to relax the positiveness constraint of model coefficients.

Granger Causality Test

The Granger Causality test determines whether a time series data is vital in explaining another time series data. This test is utilized to check if the past value of a variable series (X), will help to predict the value of another variable (Y) series at present, taking into account the past value of (Y) (Granger, 1988). The Granger Causality test provides three results in the analysis, namely: uni-directional, bi-directional and non-directional (variables move in independent direction).

V. RESULTS AND DISCUSSION

TABLE 1: DESCRIPTIVE STATISTICS OF FACTORS

| | Exchange Rate | Foreign Direct Investments |
|--------------------|---------------|----------------------------|
| Original | | |
| Mean | 46.244 | 35.290 |
| Standard Deviation | 4.132 | 445.740 |
| Median | 44.941 | 17.638 |
| Minimum | 40.360 | -1070.851 |
| Maximum | 56.160 | 3680.336 |
| Transformed | | |
| Mean | - | 1.380 |
| Standard Deviation | - | 15.403 |
| Median | - | 4.200 |
| Minimum | - | -32.724 |
| Maximum | - | 60.666 |

Table 1 presents the Descriptive Statistics of the parameters of the study from Year 2005-2014. To normalize the data, the exchange rate, FDIs was transformed using square root and logarithmic methods. After the transformation, the value of median (the central tendency when extreme values were treated with caution) became nearer to the actual mean. Exchange Rate has an average of 46.244 ± 4.132 . This variable ranges from 40.360 to 56.160. For Foreign Direct Investments, the average value is 35.290 ± 445.740 (transformed: 1.380 ± 15.403) and its minimum and maximum value is -1070.851 to 3680.336

| | Without Differencing | | |
|----------------------------------|----------------------|---------|----------------|
| | T-stat | P-value | Interpretation |
| Exchange Rate (XR) | -2.143 | 0.228 | Non-Stationary |
| Foreign Direct Investments (FDI) | -11.852 | 0.000 | Stationary |

| | With Differencing | | | |
|-----|-------------------|---------|---------|----------------|
| | Order | T-stat | P-value | Interpretation |
| XR | 1 | -12.085 | 0.000 | Stationary |
| FDI | - | - | - | - |

Stationary Testing was done using Dickey-Fuller Test wherein $p < 0.05$ indicates that the data is stationary; Otherwise non-stationary. Dickey-Fuller Test without Differencing (lag zero) presents a p-value above 0.05 on Exchange Rate which means that these values are non-stationary. Therefore, the differencing will be used. On the other hand, Foreign Direct Investments was stationary with p-values of 0.000. No differencing will be done for this variable.

Using a Differencing technique, the non-stationary variable was tested again using Dickey-Fuller Test at first differencing. In STATA, the variable was converted with a "D1." next to its variable name. After using first order differencing, the p-values of exchange rate became 0.000 which means that the first order difference of exchange rate became stationary. Therefore, first order difference this variables are all stationary therefore, can be used for further analysis.

FIGURE 1: TIME SERIES LINE OF EXCHANGE RATE BEFORE THE DIFFERENCING



FIGURE 2: TIME SERIES OF EXCHANGE RATE AFTER THE DIFFERENCING

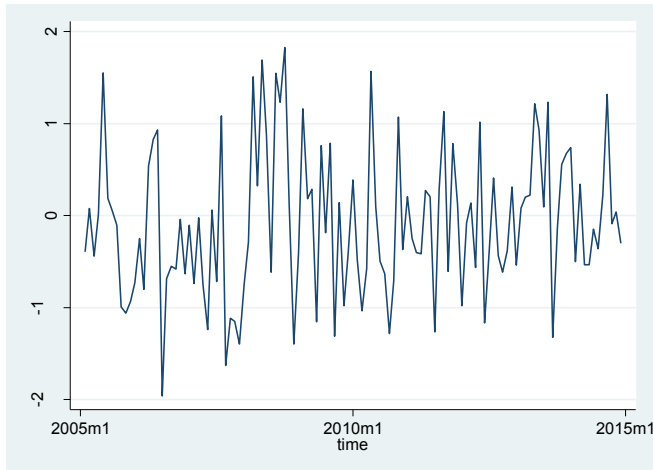
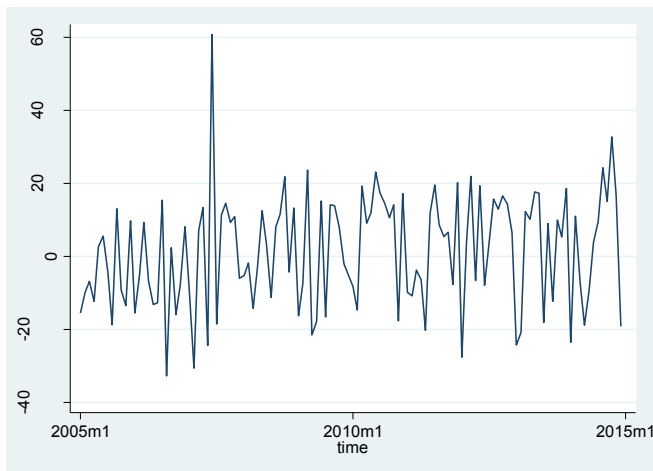


FIGURE 3: TIME SERIES LINE OF FOREIGN DIRECT INVESTMENTS



Collinearity was present on Exchange rate, that is, the current value could have been affected by the values of the previous years. Through differencing, the variables are able to satisfy the assumption of stationarity.

TABLE 2: THE LAGRANGE-MULTIPLIER TEST OF ARCH TEST FOR HETEROSCEDASTICITY.

| | Chi-square Statistic | P-value | Decision |
|-----|----------------------|---------|---------------|
| FDI | 0.003 | 0.955 | Homoscedastic |

Table 2 presents the preliminary test for heteroscedasticity of a time series model. In STATA, it is advisable to test first if the data has an ARCH effect or none. If the p-value is above 0.05, null hypothesis is rejected and therefore conclude that there is no ARCH effect in the model which means that the model is Homoscedastic. Using the differenced values, the ARCH Effect was tested. That p-value of the model is above 0.05 which means that there is no ARCH effect. However, pursuing further analysis on heteroscedasticity will be a good option to see p-values for each term and how does sudden

“news” or un-expected event affects the relationship of Exchange Rate and Foreign Direct Investments.

TABLE 3: THE EGARCH TEST
(ALL OF THE MODELS ARE AT FIRST ORDER DIFFERENCE)

| Parameters: | Foreign Direct Investments |
|-------------|----------------------------|
| Constant | -0.201 |
| Coefficient | 0.008 |
| P-value | 0.047 |
| <u>ARCH</u> | |
| EARCH | 0.330 |
| p-value | 0.000 |
| EARCH A | -0.153 |
| p-value | 0.221 |
| EGARCH | -1.025 |
| p-value | 0.000 |

The table above presents the EGARCH model of Exchange Rate and Foreign Direct Investments. Foreign Direct are significantly related to Exchange Rate with an inverse relationship. An increase in Foreign Direct or portfolio Investments leads to a decrease in Exchange Rate of about -0.201.

TABLE 4: THE GRANGE-CAUSALITY TEST

| | Coefficient | z-statistic | P-value | Decision |
|------------|-------------|-------------|---------|----------------------|
| FDI and XR | 1.938 | 1.07 | 0.284 | No Granger Causality |
| XR and FDI | -0.003 | -0.54 | 0.164 | |

Table 4 presents the Granger-Causality of Exchange Rate to Foreign Direct Investments, and vice versa. The model shows that there is no granger causality between parameters. Therefore, there is no causal effect between exchange rate and foreign direct investments

VI. CONCLUSIONS

The ultimate goal of this study is to check if the movements in the exchange rate influence the volatility of FDI (and vice versa) in the Philippines from January 2005 to December 2013. The Augmented Dickey Fuller (ADF) was used by the study in order to test the stationarity of the data. Moreover, the LaGrange-Multiplier Test of ARCH Test and Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) were used in examining heteroscedasticity in the variables. Lastly, the long-run dynamics between variables was tested using the Granger causality test. Based from the findings, the study failed to accept the hypothesis that a long-term relationship between the variables exists. Based on the analyses, foreign direct investments do not have a significant effect on the volatility of the Philippine peso exchange rate and vice versa. There is no Granger causal effect on Exchange Rate to FDIs and vice versa. This means that erratic exchange rate

behavior does not explain similar erratic movements in the FDI inflows.

For policy makers, this study implies that excluding FDIs, other macroeconomic variables can impact the changes in exchange rate. On a different perspective, it can be suggested that the exchange rate does not attract FDIs, thus, authorities should look at other factors in managing the levels of FDIs and how it can be increased. These other factors may include technology, infrastructures, political stability, improving the living standard, etc. (Nyamrunda, 2012). The policymakers need to increase their attention on the overall role of exchange rate volatility as an important factor in determining the movement of other macroeconomic variables.

VII. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The aforementioned insignificant relationship obtained in this study was not entirely suggests unimportant effect of the exchange rate to the FDI inflows. Researchers can use this study in obtaining reasons as to why the two variables significantly impact each other. Lily, et. al, (2014) suggested that insignificant relationship between FDI and exchange rate may be due to the use of aggregate FDI as opposed to FDI inflows into different types of economic sectors/industries. Different relationship direction results may be obtained if FDI inflows on individual sectors are used versus the movement of the exchange rate.

Moreover, future researchers can look at other variables that can affect the Philippine exchange rate aside from the foreign direct investments. These variables may include foreign portfolio investments, export level, import level, unemployment rate and other macroeconomic variables. In addition, further studies may also look at the short-run dynamics of the two variables in order to check if there is a significant impact in their movements on a short term basis. Quarterly or annual data can also be used on other variables in order to employ other econometric processes.

Lastly, future researchers can also use other statistical tools to measure the relationship between exchange rate and FDI aside from ARCH/GARCH and Granger Causality test in order to obtain significant results

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