

A Mathematical Model for Estimating Imports and Exports in the Philippines: A Normal Estimation Equation for Multiple Linear Regression

JACKIE D. URRUTIA¹

MERRILL LYNCH T. OLFINDO²

JOSEPH MERCADO³

AARON VITO M. BAYGAN⁴

EDCON B. BACCAY⁵

Polytechnic University of the Philippines
Parañaque Campus
The Philippines

Abstract:

In this study, the researchers aim to formulate a Mathematical Model for Imports and Exports in the Philippines. The researchers examined the monthly data of Imports and Exports from January 1995 to May 2013. The gathered data were from National Statistical Coordination Board, Department of Labor and Employment, and Banko Sentral ng Pilipinas with a total of 221 observations. The factors that said to be affecting Imports (y_1) and Exports (y_2) are: Exchange Rate (x_1), Monthly Domestic Crude Oil (x_2), Inflation Rate (x_3) and Interest Rate (x_4). The researchers used Regression Analysis, to test if the data satisfy the assumptions, and Matrices, to formulate a

¹ Main author

² Main author

³ Co-author

⁴ Co-author

⁵ Co-author

mathematical model for both the Dependent Variables. Upon satisfying the assumptions, there are only two significant factors that affect Imports. These are: Exchange Rate (x_1), Monthly Domestic Crude Oil (x_2). The study showed that the logarithmic transformation of the two Independent variables, which are Exchange Rate ($\ln x_1$) and Monthly Domestic Crude Oil ($\ln y_2$), are the only significant factors that affect Exports (y_2). A mathematical model was formulated for both Imports (y_1) and Exports (y_2) using Matrices through MATLAB and it is written as:

$$\begin{aligned}\widehat{y}_1 &= 1529172628.02 + 17936900.2752 x_1 \\ &\quad + 14215459.8761 x_2 \\ \widehat{y}_2 &= -5824275287.72 + 663252303.938 \ln x_1 \\ &\quad + 941801773.483 \ln x_2\end{aligned}$$

*There are 88%, coefficient of determination, of the Independent variables that can predict the Dependent Variable, which is Imports (y_1). Meanwhile, there are 81.5% (coefficient of determination) of the Independent variables that can actually predict Exports (y_2). Paired *t*-test signifies that there is no significant difference between the predicted and actual value of both Import and Export. This study will be of significance for estimating future Imports and Exports of the Philippines in order to be prepared for the expected changes and to take realistic and accurate decisions.*

Key words: Imports, Exports, Matrices, Regression Analysis, MATLAB

Introduction

Foreign Trade is an exchange of goods and services between countries. The inclination for one country to trade with another is based in large part on the idea of comparative advantage--which says that any country, no matter how technologically disadvantaged it might be, can always find some sort of good that will let it enter the game of foreign trade. In this sense, foreign trade is just an extension of the production, exchange, and consumption that's a fundamental part of life. The only

difference with foreign trade is that producers and consumers reside in separate countries [1]. Export is a process of shipping out products from a country to another while Import is a process wherein a country brings the products to another country across international borders.

There are several factors that affect Import and Export. Only four explanatory factors were considered. These are: Exchange Rate (x_1), Domestic Crude Oil (x_2), Inflation Rate (x_3), and Interest Rate (x_4).

This study will be of significance to determine significant factors that will affect both Imports and Exports. This will also signify the estimated future Imports and Exports. Increasing exports is generally considered to be beneficial to the economy. It increases production and GDP, and (all else remaining the same) improves the balance of trade. However, the increase in production will increase demand for inputs which may have negative effects on other sectors; and the increase in exports could cause the exchange rate to appreciate [2]. On the other hand, Rising Imports will give a negative effect on domestic currency versus foreign currency, or known as Exchange Rate.

Objective of the Study

The particular objective of this study is to formulate a Mathematical Model for both Imports and Exports of the Philippines by using Matrices through MATLAB to be prepared for the upcoming changes and maintaining the status quo of balance trade. This study also aims to analyze which of these Independent variables: Exchange Rate, Domestic Crude Oil, Inflation Rate and Interest Rate can be significant to Imports and Exports using Normal Estimation Equation through Multiple Linear Regression. It will accommodate the

government to determine what economic variables they should really focus on.

Statement of the Problem

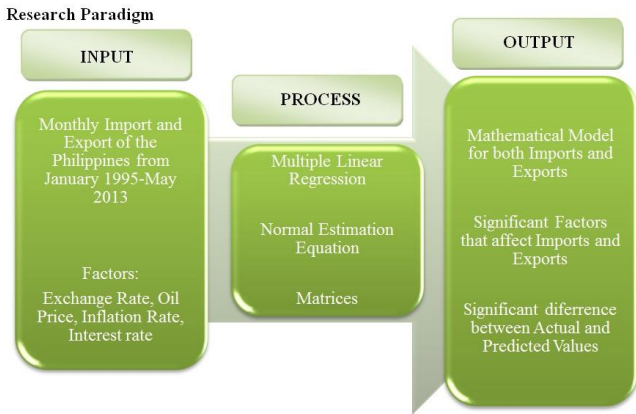
The study aims to formulate a Mathematical Model for both Imports and Exports using Matrices through MATLAB and to determine its significant factors through Multiple Linear Regression. The intention of this study is to answer these questions:

1. What will be the behavior of the graph to the following variables?
 - 1.1 Exchange Rate (x_1)
 - 1.2 Domestic Crude Oil (x_2)
 - 1.3 Inflation Rate (x_3)
 - 1.4 Interest Rate (x_4)
 - 1.5 Import (y_1)
 - 1.6 Export (y_2)
2. Is there a significant relationship among the Independent and Dependent Variables?
3. What mathematical model that can be formulated for both Imports and Exports using Matrices through MATLAB?
4. Which of the following Independent Variables that can actually affect Imports and Exports?
 - 4.1 Exchange Rate (x_1)
 - 4.2 Domestic Crude Oil (x_2)
 - 4.3 Inflation Rate (x)
 - 4.4 Interest Rate (x_4)
5. Is there a significant different the Actual and Predicted Value of the Dependent Variables?

Scope and Limitation

The researchers gathered a monthly data of Imports and Exports of the Philippines along with the Independent variables from National Statistical Coordination Board, Department of Labor and Employment, and Banko Sentral ng Pilipinas. It considered 221 observations from January 1995 up to May 2013. The researchers used multiple linear regression for determining which of the independent variables are significant to the dependent variables.

Framework



Review Related Literature

Muhammad Akbar Ali Shah, Muhammad Aleem and Nousheen Arshed (2014), analyzed the factors affecting inflation in Pakistan. Stepwise linear Regression, backward elimination and forward selection procedure has been applied through SPSS statistical package to test the significance of relationship of producer price index, money supply, durable goods, electricity, exchange rate, import, export, natural gas, oil products, crude petroleum, capital goods export, capital goods import, food export, food import, agricultural products export and wages on CPI inflation. Principal component analysis is

performed to remove the multicollinearity among explanatory variables. It is found that durable goods, electricity, import, natural gas, steel mills product, capital goods export, food import and government sector borrowing has affect on inflation in Pakistan. The more the government borrows, the more the money supply increases and hence inflation increases. [3]

According to Sajid Gul, Fakhra Malik & Nasir Razzaq (2013), this article aims to investigate different factors affecting the demand of Pakistani exports. Factors affecting the demand of exports include real effective exchange rate, nominal exchange rate, world production capability and world export price variable. The period of the study is from 1990 to 2010. Data is gathered from various sources including State Bank of Pakistan, Karachi Stock Exchange, Handbook of statistics on Pakistan Economy, Economic Survey of Pakistan and International Financial Statistics (IFS). Two Stage Least Square (2-SLS) Method was applied in the study. Results showthat, export demand decreases with increase in Real Effective Exchange Rate. Insignificant relationship was found between the demand of Pakistani exports and export price variable and nominal exchange rate. The study also found positive and significant association between the demand of Pakistani export and World Income. [4]

Yuhong Li, Zhongwen Chen, and Xiaoyin Wang (2010), their study analyze the development of foreign trade greatly impacts on GDP growth. Adapting simple regression for researching the relationship between foreign trade including total export and total import and GDP growth of Jiangxi province, with the collected 30-year statistical data from 1978 to 2007. The result indicates that foreign trade has contributed a lot to the GDP growth of foreign trade and still has great potential to be tapped. There is a positive correlation between the foreign trade and GDP. And import has influenced Jiangxi province's economic growth more and more. Finally, the paper

points out that in order to maintain the economic growth, Jiangxi must unswervingly implement the opening-up policy and be aware of trade protectionism. [5]

Dr Alam Raza, Dr Asadullah Larik, and Mr Muhammad Tariq (2013), this research paper is aimed to investigate the effect of currency depreciation on the Trade Balances of South Asian Countries. The analysis was based on Marshal-Lerner Model developed by Lerner, A. P. (1944) and J-curve. The Marshal-learner model is the extension of model of Marshall, A. (1923), which stated that devaluation or depreciation of currency makes exports relatively cheaper and imports relatively expensive. Making textual analysis of the available data from South Asian countries, the study makes predictions on the devaluation of currency, its causes and the consequences. The cross sectional data was tested via multiple regression analysis. Effects of currency depreciation on the trade balances of each individual country were then subjected to a comprehensive analysis. The study supports and confirms Marshal-Lerner Model highlighting that devaluation of currency does not always help improve balance of trade. [6]

According to Mohammad A. N. Nassr (2013), this study aims to identify the determination variables on imports demand in Palestine. This occurs via studying the independent variables which affect import demand in Palestine as Gross Domestic Product (GDP), Consumer Price Index (CPI) and Exchange rate (EX)¹. The researcher followed a descriptive analytic method, which depends on data gathering and analysis; studying period covers the quartile of 1997-2010, data collected from the Palestinian Central bureau of Statistics. SPSS statistical package & EvIEWS programs are used to analyze the data. The statistical analysis results shows that there is no relationship between import demand in Palestine and exchange rate, This caused by high dependent on trade with Israel represented more than 59.9% in 2011, In addition,

to use only one currency which yields that the exchange rate does not affect the foreign trade in Palestine. [7]

K.N.Marimuthu Ph.D (SRF) and Dr. P. S. Velmurugan (2012), this research paper concentrates on the India's export and its recovering stage aftermath of global meltdown. Global economic meltdown has affected all over the world in the mid of 2008-09. The effect was more or less across all the countries. India has been influential in recovering the ill effects of recession. The main reason being Indian companies have major outsourcing deals with the US firms and large volume of exports to the US as well as to other countries. From the meltdown effect India faced the challenges like rising inflation, increasing costs, drying cash flow, exchange rate, falling sales, unemployment etc. In the recent period, most of the export industries have been recovered as well as exporting successfully in the foreign market. Further a new outlook is warranted for Indian policy makers, especially in foreign trade, to diversify beyond traditional export and export destinations. Suitable continuous amendments should be given to the foreign trade policy, so that Indian exporters continue to engage in their business actively. [8]

Djoni, Dedi Darusman, Unang Atmaja, and Aziz Fauzi (2013), this research was intended to know the export development of Indonesia's Crude Coconut Oil (CCO) and to analyze the determinants of its demand. Descriptive and quantitative method by panel data regression model were explored to process secondary data of range year 2000 to 2011 as time series data and China, Netherland, Malaysia, Singapore as cross section data. The result demonstrated that Indonesia's CCO export volume fluctuated as well as its export price, while its market share varied in four analyzed countries. The determinants of Indonesia's CCO export demand were Indonesia's CCO export price, importing country's population

and GDP real per capita, real exchange rate of IDR to currency of importing country and Philippine's CCO export price. [9]

Muhammad Bachal Jamali, Asif Shah, et.al. (2011), the current research investigates the relationship between changes in crude oil prices and Pakistan and the macro-economy. A multivariate VAR analysis is carried out among five key macroeconomic variables: real gross domestic product, short term interest rate, real effective exchange rates, long term interest rate and money supply. From the VAR model, the impulse response functions reveal that oil price movements cause significant reduction in aggregate output and increase real exchange rate. The variance decomposition shows that crude oil prices significantly contribute to the variability of real exchange rate long term interest rate in the Pakistan economy while oil price shocks are found to have significant effects on money supply and short term interest rate in the economy. Despite these macro econometric results, caution must be exercised in formulating energy policies since future effects of upcoming oil shocks will not be the same as what happened in the past. Explorations and development of practicable alternatives to imported fuel energy will cushion the economy from the repercussions of oil shocks. Oil price shock has negative impact on the GDP and as well as economy of Pakistan. [10]

According to Pamela F. Resurreccion (2014), unemployment is among the major problems not only in less developed and developing countries but in developed countries as well. It spells out the extent of poverty a household will have to sustain. Strongly influenced by the premises of the Okun's Law and Phillips Curve, this study sought to determine the link between unemployment and inflation and economic growth. An additional explanatory variable, age dependency ratio, was introduced to investigate this facet of unemployment which is based on the premise that a high age dependency ratio would result to lower unemployment. Unit root tests were employed to

the data series prior to testing the hypothesized relationships which employed ordinary least squares (OLS) regression technique. Tests for heteroskedasticity and collinearity were done using White's test and VIF, respectively. It was found that unemployment is negatively related to inflation and economic growth, confirming Okun's Law and Philips Curve in the Philippines for the period covering 1980 to 2009. Moreover, age dependency ratio was found to be positively related with unemployment albeit, the relationship is not significant. The coefficient of determination obtained for the model was 72.7% hence overall, the regression line relatively describes the data well. [11]

According to Lucun Yang (2011), limited empirical work has been done to the diverging current account balances of the individual emerging Asian economies. Based on the intertemporal approach to current account, this paper empirically examines both the long-run and short-run impacts of initial stock of net foreign assets, degree of openness to international trade, real exchange rate and relative income on current account balances for eight selected emerging Asian economies over the period 1980-2009, making use of the cointegrated VAR (Vector Autoregression) methodology. This paper finds that current account behaviours in emerging Asian economies are heterogeneous. Initial stock of net foreign assets and degree of openness to international trade are important factors in explaining the long-run behaviour of current accounts. Moreover, the current accounts of all sample economies have a self-adjusting mechanism except China. Short-run current account adjustment towards long-run equilibrium path is gradual, with the disequilibrium term being the main determinant of the short-run current account variations. [12]

Methodology

Statistical Tool

For satisfying the assumptions of the Imports and Exports of the Philippines, the researchers used EViews7, statistical spreadsheet software Econometrics Views 7, also to determine which of the independent variables that can affect both dependent variables. In addition, MATLAB was used to formulate a mathematical model for each of the dependent variables.

Statistical Treatment

Multiple Linear Regression

Multiple regression is a statistical technique to understand the relationship between one dependent variable and several independent variables. The purpose of multiple regression is to find a linear equation that can best determine the value of dependent variable Y for different values independent variables in X. [13] Define the multiple linear regression model as:

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k$$

where there are k predictors (explanatory variables). It interprets the estimate for the intercept (β_0) as the expected value of y when all predictors are equal to 0, on average. The estimate for a slope (say β_1) as all else held constant, for each unit increase in x_1 , we would expect y to increase/decrease on average by β_1 ." Collinearity as explanatory variables being highly correlated with each other, which is something we want to avoid in multiple linear regression.

Stepwise Multiple Linear Regression

Stepwise regression is a modification of the forward selection so that after each step in which a variable was added, all candidate variables in the model are checked to see if their significance has been reduced below the specified tolerance level. If a nonsignificant variable is found, it is removed from the model.

Stepwise regression requires two significance levels: one for adding variables and one for removing variables. The cutoff probability for adding variables should be less than the cutoff probability for removing variables so that the procedure does not get into an infinite loop. [14]

Normal Estimation Equation using Matrices

For a Multiple Linear Regression Model, a knowledge of the matrix theory can manipulate the mathematical model. The matrix notation was formulated and it is written as:

$$y = X\beta + c$$

$$y = \begin{bmatrix} y_0 \\ y_1 \\ \vdots \\ y_k \end{bmatrix}, \quad X = \begin{bmatrix} 1 & x_{11} & x_{21} & \dots & x_{k1} \\ 1 & x_{12} & x_{22} & \dots & x_{k2} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ 1 & x_{xn} & x_{2n} & \dots & x_{kn} \end{bmatrix}, \quad \beta = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix}, \quad \epsilon = \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \vdots \\ \epsilon_n \end{bmatrix}$$

So least squares method was involve for the estimation of β for finding b where $SSE = (y - Xb)'(y - Xb)$ is minimized. This process, called minimization process, helps solve for $\mathbf{b}$ which written in this equation: $\frac{\partial}{\partial b} (SSE) = \mathbf{0}$. This will result to the solution of b in $(X'X)b = X'y$. The i th row represents the x -values that will give rise to response of y_i through examining the X matrix. It is written as:

$$A = X'X = \begin{bmatrix} n & \sum_{i=1}^n x_{1i} & \dots & \sum_{i=1}^n x_{2i} & \sum_{i=1}^n x_{ki} \\ \sum_{i=1}^n x_{1i} & \sum_{i=1}^n x_{1i}^2 & \dots & \sum_{i=1}^n x_{1i}x_{2i} & \sum_{i=1}^n x_{1i}x_{ki} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ \sum_{i=1}^n x_{ki} & \sum_{i=1}^n x_{ki}x_{1i} & \dots & \sum_{i=1}^n x_{ki}x_{2i} & \sum_{i=1}^n x_{ki}^2 \end{bmatrix}; g = X'y = \begin{bmatrix} g_0 \\ g_1 \\ \vdots \\ g_k \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^n y_i \\ \sum_{i=1}^n x_{1i}y_i \\ \vdots \\ \sum_{i=1}^n x_{ki}y_i \end{bmatrix}$$

Which allows normal equation to be in matrix form $Ab=g$.

Results and Discussions

Behavior of the graph of the Dependent and Independent Variables

Figure 1. Imports (y_1)

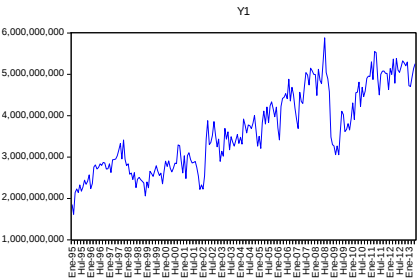


Figure 2. Exports (y_2)

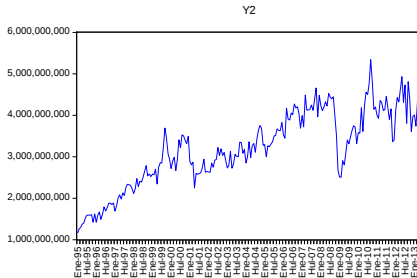


Figure 3. Exchange Rate (x_1)

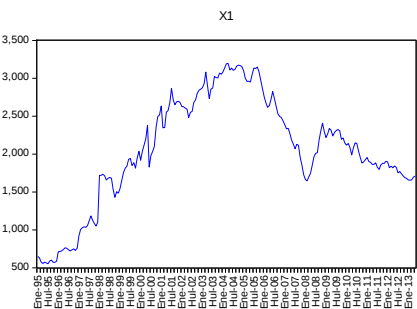


Figure 4. Domestic Crude Oil (x_2)

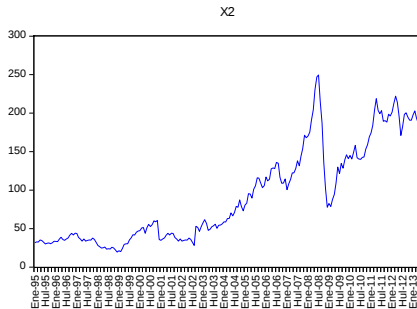


Figure 5. Inflation Rate (x₃)

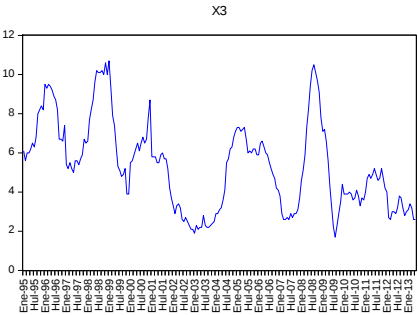
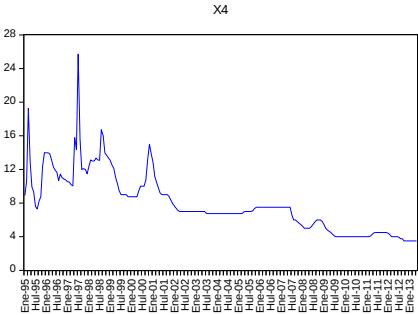


Figure 6. Interest Rate (x₄)



In figure 1, the graph shows that Imports increase around January 1995 to October 1997 and slightly fell for the next two years. The graph goes up and down around February 2002 at faster pace then hits its highest point in July 2008 which follows by a gradual decline. In figure 2, there's an increase in Exports from January 1995 up to September 1999 also same from April 2001 up to June 2008 then fluctuates around February 2009 but continues to rise for the following year. For figure 3, the graph of Exchange Rate gradually increased in January 1995 to September 2005 and slightly fell for the next 3 years. It rise again in November 2008 then remained fluctuating for the following months. The next graph shows that the Domestic Crude Oil goes up and down from January 1995 to August 2006. At around June 2008, it rises then fluctuates for the next six months then continuously rises. For Inflation Rate, the graph show that the data rises and fluctuates from January 1995 up to August 2008. It also shows that it fluctuates and rises around October 2011 then continuously fluctuates. In figure 6, Interest Rate rises then fluctuates in August 1995. Around July 1997, it rises and remained fluctuating wildly.

Significant relationship between the Dependent and Independent Variables

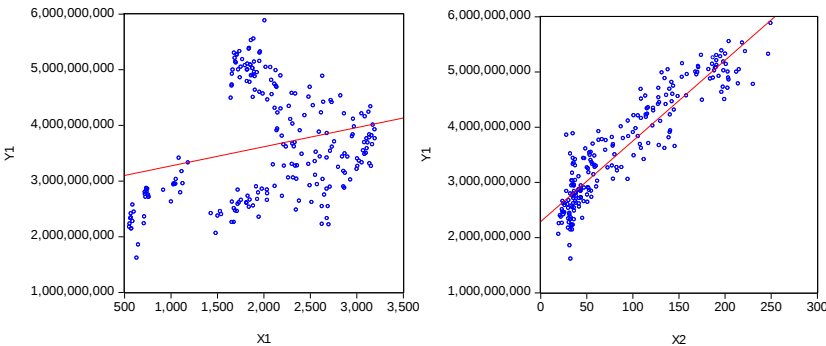
The relationships of the Independent variables to Imports (y_1) and Exports (y_2) using the original data were ascertained by Pearson’s coefficient correlation as shown in Table 1.

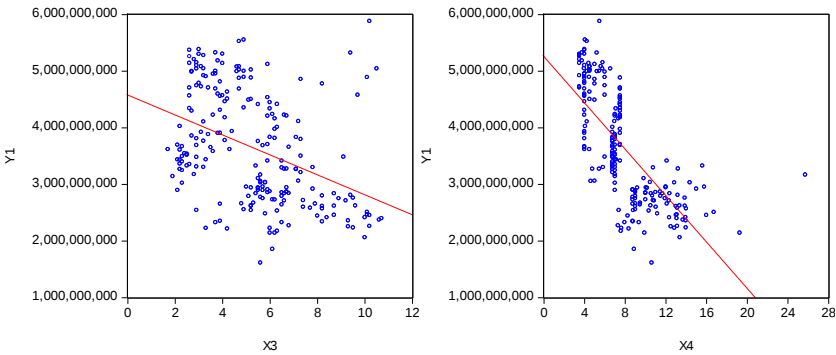
TABLE 1

	Exchange Rate (x_1)	Domestic Crude Oil (x_2)	Inflation Rate (x_3)	Interest Rate (x_4)
Import (y_1)	0.251042	0.942657	-0.401709	-0.719140
p-value	0.0000	0.0000	0.0000	0.0000
Export (y_2)	0.451842	0.818931	-0.407566	-0.700653
p-value	0.0000	0.0000	0.0000	0.0000

The table shows that all of the Independent Variables are significantly correlated to both Imports (y_1) and Exports (y_2) at $\alpha = 0.01$. According to the Scatter Diagram below, two of the Independent variables, namely Exchange Rate and Domestic Crude Oil, are positively correlated. On the other hand, Inflation Rate and Interest Rate has a negative correlation to Imports. The Scatter Diagram of the Independent Variables to Import have a significant Linear relationship.

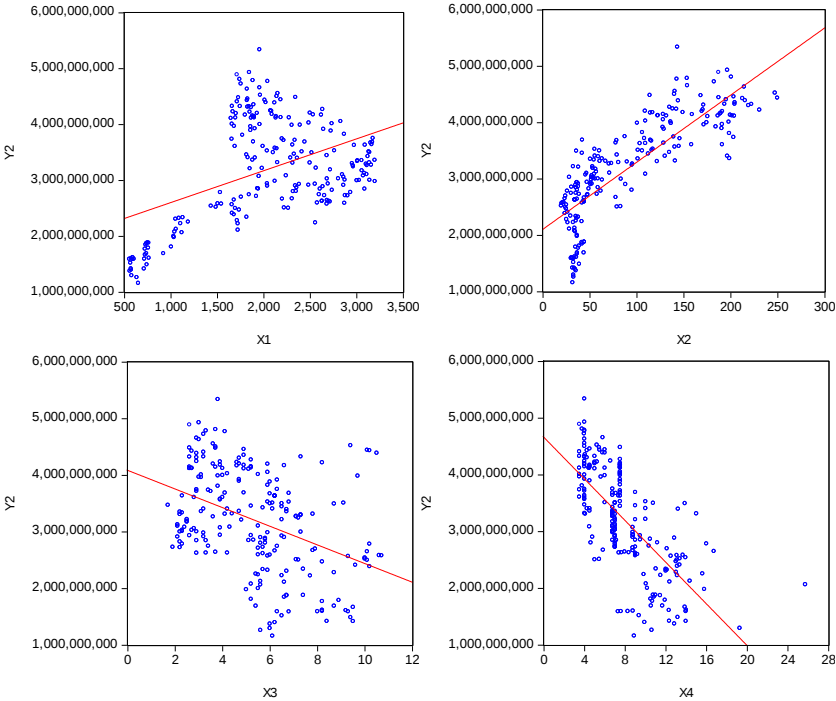
SCATTER DIAGRAM 1





In Exports, the Scatter Diagram shows that Exchange Rate and Domestic Crude Oil has a positive correlation to the Dependent variable while Inflation and Interest Rate both have a negative correlation to the Dependent variable. The scatter plots also shows that the Independent variables are significantly linear to Export at $\alpha = 0.01$.

SCATTER DIAGRAM 2



Mathematical Model formulated using Matrices through Normal Estimation Equation

The matrix theory was used to facilitate the mathematical manipulations since the researchers have more then two variables to fit Multiple Linear Regression. According to the multiple linear regression assumptions, these are the mathematical model that will predict the Dependent variables.

The least squares estimating equations $(X'X) b=X'y$

Imports (y₁)

$$\begin{bmatrix} 221 & 9,825 & 20,349 & 1,750 \\ 9,825 & 453,838 & 923,784 & 74,931 \\ 20,349 & 923,784 & 2,738,373 & 125,815 \\ 1,750 & 74,931 & 125,815 & 16,524 \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ b_2 \\ b_4 \end{bmatrix} = \begin{bmatrix} 803,451,125,882 \\ 36,297,081,502,812 \\ 86,613,934,597,939 \\ 5,817,457,907,221 \end{bmatrix}$$

Exports (y₂)

$$\begin{bmatrix} 221 & 1,667 & 945 & 350 & 438 \\ 1,667 & 12,618 & 7,154 & 2,621 & 3,284 \\ 945 & 7,154 & 4,156 & 1,472 & 1,815 \\ 350 & 2,621 & 1,472 & 597 & 715 \\ 438 & 3,284 & 1,815 & 715 & 906 \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ b_2 \\ b_3 \\ b_4 \end{bmatrix} = \begin{bmatrix} 708,739,947,916 \\ 5,397,926,575,797 \\ 3,153,072,916,230 \\ 1,086,653,417,394 \\ 1,340,759,662,601 \end{bmatrix}$$

Thus, using $b=(X'X)^{-1}X'y$ to form the estimated regression coefficients as:

For Imports

$$\begin{aligned} b_0 &= 1701535913.57; & b_1 &= 235974.045084; \\ b_2 &= 14789418.2525; & b_4 &= 11067822.3757 \end{aligned}$$

For Exports

$$\begin{aligned} b_0 &= -6426658579.74; & b_1 &= 656926482.951; \\ b_2 &= 1029470376.45; & b_3 &= 87112994.3622; \\ b_4 &= 208553220.498 \end{aligned}$$

Therefore using these regression equation the researchers can predict the Imports and Exports.

$$\begin{aligned} \hat{y}_1 &= 1701535913.57 + 235974.045084 x_1 + 14789418.2525 x_2 + 11067822.3757 x_4 \\ \hat{y}_3 &= -6426658579.74 + 656926482.951 \ln x_1 + 1029470376.45 \ln x_2 + 87112994.3622 \ln x_3 \\ &\quad + 208553220.498 \ln x_4 \end{aligned}$$

One of the Independent variables is not significant to Imports which is Interest Rate while in Exports, there are two non-significant variables which are Inflation Rate and Interest Rate. Then the researchers used MATLAB to formulate a mathematical model for Imports (y_1) using its significant factors same as Exports (y_2). To estimate Imports and Exports more precisely, the non-significant variables are excluded to the equation and a new mathematical model was formed:

Using the least squares estimating equations $(X'X) b = X'y$

Imports (y_1)

$$\begin{bmatrix} 221 & 9,825 & 20,349 \\ 9,825 & 453,838 & 923,784 \\ 20,349 & 923,784 & 2,738,373 \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} 803,451,125,882 \\ 36,297,081,502,812 \\ 86,613,934,597,939 \end{bmatrix}$$

$$b_0 = 1529172628.02; b_1 = 17936900.2752; b_2 = 14215459.8761$$

Therefore Imports can be predicted through this regression equation:

$$\widehat{y_1} = 1529172628.02 + 17936900.2752x_1 + 14215459.8761x_2$$

Exports (y_2)

$$\begin{bmatrix} 221 & 1,667 & 945 \\ 1,667 & 12,618 & 7,154 \\ 945 & 7,154 & 4,156 \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} 708,739,947,916 \\ 5,397,926,575,797 \\ 3,153,072,916,230 \end{bmatrix}$$

$$b_0 = -5824275287.72; b_1 = 663252302.938; b_2 = 941801773.483$$

Therefore Exports can be computed through these regression equations:

$$\widehat{y_2} = -5824275287.72 + 663252302.938\ln x_1 + 941801773.483\ln x_2$$

Significant factors that can predict Imports (y_1) and Exports (y_2)

To identify the significant factors that affect the Dependent variables, the researchers used Eviews in conducting Multiple Linear Regression. Among the five (5) Independent variables namely: Exchange Rate (x_1), Domestic Crude Oil (x_2), Inflation Rate (x_3) and Interest Rate (x_4), only two Independent variables are significant to Import (y_1). These are Exchange Rate (x_1) and Domestic Crude Oil (x_2). While the transformed data of only two independent variables are significant to Exports (y_2) namely, Exchange Rate ($\ln x_1$) and Domestic Crude Oil ($\ln x_2$).

Significant difference of the Predicted Values from the Actual Values of Imports (y_1) and Exports (y_2)

Paired T-test was used to analyze the difference between Actual and Predicted Values of Imports and Exports in the Philippines (See Appendix C: Table 10 & 12). The p-value of Imports and Exports results to 1.0000, which determine that there are no significant difference between the Actual and Predicted Value and the mathematical model will essentially predict the Imports and Exports in the Philippines.

Summary of Findings, Conclusions and Recommendations

Summary of Findings

Behavior of the Graph of the Dependent and Independent Variables

In Imports and Exports the graph shows that it has a continuous increase except for the following months: December 1998, January 2002 and February 2009, for Imports; April 2001 and February 2009 for Exports. For Exchange Rate, it shows that from January 1995 to September 2005 then continuously

fluctuates same goes for Inflation Rate and Interest Rate. But in Interest Rate it luctuates wildy. In the graph for Domestic Crude Oil, it noted its peak in June 2008 and fluctuates in February 2009 but then it continuously rises.

Significant Relationship between Dependent and Independent Variables

Upon using the Original data, the Independent variables are significantly correlated to both Imports and Exports based on Pearson's coefficient of correlation. Since the null hypothesis of noramlity was rejected, the researchers used logarithmic transformation to transform the Independent variables. According to the result of Pearson's coefficient correlation, the transformed Independet variables are still significantly correlated to Export.

Mathematical Model Formulated through Normal Estimation Equation

$$\widehat{y_1} = 1529172628.02 + 17936900.2752x_1 + 14215459.8761x_2$$
$$\widehat{y_2} = -5824275287.72 + 663252302.938\ln x_1$$
$$+ 941801773.483\ln x_2$$

The first model estimate the Imports while the second model estimates Exports and both significant with a p-value of 0.0000. The coefficient of determination, also caled R-squared, of Imports (y_1) is 0.880120 while Exports (y_2) has 0.814517.

Significant Factors that Can Predict Imports (y_1) and Exports (y_2)

Out of four Independent variables, only two significant factors affect Imports (y_1). These are: Exchange Rate (x_1) and Domestic Crude Oil (x_2) with both a p-value of 0.0000. On the other hand, Exports (y_2) also have the same significant factors as Imports (y_1) but these are logarithmic transformations of the factors.

Significant Difference of the Predicted Values from the Actual Values of Imports (y_1) and Exports (y_2)

Paired t-test results to 1.000 for both Imports (x_1) and Exports (x_2) which is greater than the level of significance 0.01. Therefore, there is no significant difference between the Actual and Predicted Value of both Imports and Exports

Conclusions

The assumptions of Multiple Linear Regression were all satisfied. In the mathematical model of both the dependent variables, it shows that only two independent variables are significant to Imports (y_1). These are: Exchange Rate (x_1) and Domestic Crude Oil (x_2). On the other hand, in Exports (y_2), the logarithmic tranformation of only two independent variables are significant namely: Exchange Rate ($\ln y_1$) and Domestic Crude Oil ($\ln y_2$). The mathematical model also shows that there are no significant difference between the Actual and Predicted value of both Import and Export.

Recommendations

The researchers propose looking for more independent variables such as: Foreign Direct Investment (FDI), Tariff Rate, Transportation costs and Number of Employed. It also suggests in adding more series of data to assess Imports and Exports in the Philippines more accurately.

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Data Sources

National Statistical Coordination Board
Department of Labor and Employment
Banko Sentral ng Pilipina

Appendices

Appendix A

TABLE 1
Original Data

Date	Import (y ₁)	Export (y ₂)	Exchange Rate (x ₁)	Domestic Crude Oil (x ₂)	Inflation Rate (x ₃)	Interest Rate (x ₄)
Jan-95	1,855,579,497	1,160,748,394	25.493714	31.67	6.1	8.886
Feb-95	1,615,887,292	1,263,768,380	25.133296	32.72	5.6	10.608
Mar-95	2,142,537,620	1,298,577,283	24.018913	32.55	6.0	19.266
Apr-95	2,229,563,126	1,377,417,699	23.601298	35.19	6.0	12.850
May-95	2,143,626,871	1,400,580,633	23.953675	34.55	6.2	9.909
Jun-95	2,328,664,433	1,521,691,870	23.763707	32.5	6.5	9.353
Jul-95	2,175,487,584	1,592,693,716	23.520389	30.1	6.3	7.585
Aug-95	2,273,585,811	1,591,446,955	24.260739	30.9	6.8	7.298
Sep-95	2,444,224,628	1,594,970,078	24.546892	31.42	8.0	8.250
Oct-95	2,342,361,497	1,601,650,105	23.923923	30.32	8.2	8.761
Nov-95	2,414,722,228	1,422,627,417	23.8939	31.51	8.4	12.342
Dec-95	2,571,385,721	1,621,013,605	24.250414	33.62	8.2	14.000
Jan-96	2,236,094,895	1,420,447,244	26.655576	33.34	9.5	13.975
Feb-96	2,359,578,155	1,594,005,715	26.739125	33.11	9.3	13.968
Mar-96	2,760,472,686	1,670,603,477	26.889452	36.4	9.5	13.870
Apr-96	2,811,146,347	1,491,866,914	27.229662	38.82	9.4	13.173
May-96	2,712,349,002	1,612,182,193	27.64238	35.76	9.2	12.320
Jun-96	2,750,550,811	1,793,390,815	27.499508	34.76	8.9	11.925
Jul-96	2,838,704,800	1,693,694,307	27.118984	36.63	8.7	11.666
Aug-96	2,799,675,243	1,773,892,603	26.851109	37.83	8.2	10.683
Sep-96	2,870,062,593	1,875,570,991	27.150647	41.47	6.7	11.450
Oct-96	2,858,505,702	1,883,709,477	27.380093	43.92	6.7	11.000
Nov-96	2,711,554,979	1,849,914,761	26.983619	41.73	6.6	10.857
Dec-96	2,718,238,732	1,883,267,902	27.560201	44.05	7.4	10.750
Jan-97	2,837,888,446	1,692,263,113	30.334677	43.63	5.4	10.543
Feb-97	2,626,538,787	1,812,415,070	31.678593	38.45	5.2	10.500
Mar-97	2,935,163,641	2,001,018,452	32.086308	36.4	5.5	10.170
Apr-97	2,942,077,383	2,082,429,845	32.2533	33.7	5.2	10.048
May-97	2,954,365,646	1,982,879,342	32.155345	36.52	5.0	15.788
Jun-97	3,032,341,153	2,129,077,284	32.488124	33.82	5.6	14.363
Jul-97	3,169,204,752	2,067,142,448	33.430851	34.59	5.6	25.720
Aug-97	3,327,943,486	2,257,973,088	34.428764	35.25	5.4	15.608
Sep-97	2,956,476,409	2,337,468,892	33.576302	35.13	5.7	12.000
Oct-97	3,413,800,271	2,326,046,764	32.964121	37.74	5.9	12.095
Nov-97	2,945,288,406	2,308,430,580	32.411972	35.96	6.7	12.000
Dec-97	2,792,733,044	2,230,557,752	33.212996	32.33	6.5	11.489
Jan-98	2,837,901,972	2,114,812,034	41.487237	28.18	6.6	12.370
Feb-98	2,585,234,573	2,227,202,908	41.486371	26.52	7.7	13.118
Mar-98	2,613,595,753	2,474,181,862	41.643433	24.74	8.2	13.000
Apr-98	2,457,455,132	2,284,501,468	41.40417	25.02	8.7	13.016
May-98	2,624,021,365	2,414,739,055	40.735119	26.17	9.6	13.349

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Jun-98	2,260,740,554	2,389,568,281	40.994605	23.39	10.2	13.125
Jul-98	2,465,592,507	2,501,374,868	41.146064	23.84	10.1	13.097
Aug-98	2,508,465,350	2,652,454,948	40.992774	23.44	10.1	16.734
Sep-98	2,454,452,775	2,786,324,139	39.132333	25.88	10.2	16.000
Oct-98	2,417,414,425	2,542,295,807	37.827966	24.89	10.0	13.945
Nov-98	2,373,400,659	2,585,815,298	38.781773	22.31	10.6	13.677
Dec-98	2,061,612,032	2,523,082,200	38.533371	19.54	10.0	13.375
Jan-99	2,399,845,062	2,580,780,826	39.283486	21.22	10.7	13.082
Feb-99	2,256,560,130	2,569,328,986	40.697939	20.14	9.3	12.500
Mar-99	2,656,303,584	2,702,330,690	41.909115	24.09	7.9	12.115
Apr-99	2,599,207,956	2,345,945,316	42.608674	29.49	7.4	11.018
May-99	2,533,475,252	2,746,896,905	42.915114	30.22	6.3	10.338
Jun-99	2,670,938,322	2,857,196,085	43.949121	30.45	5.3	9.476
Jul-99	2,791,640,360	2,851,061,303	44.069318	35.17	5.1	9.000
Aug-99	2,661,455,290	3,211,535,584	43.01561	37.92	4.8	9.000
Sep-99	2,555,295,681	3,693,275,081	43.436773	41.98	4.9	9.000
Oct-99	2,612,624,199	3,459,665,969	42.602214	41.66	5.2	9.000
Nov-99	2,351,642,775	3,075,370,095	44.122375	45.46	3.9	8.750
Dec-99	2,653,469,947	2,943,505,820	45.124302	46.91	3.9	8.750
Jan-00	2,900,849,185	2,716,571,560	43.806518	47.23	5.5	8.750
Feb-00	2,775,144,920	2,902,308,122	45.148686	50.85	5.6	8.750
Mar-00	2,908,071,277	2,988,516,721	46.038576	51.48	5.9	8.750
Apr-00	2,728,169,303	2,667,587,635	46.897639	43.95	6.2	8.750
May-00	2,641,931,449	2,930,834,998	48.793117	51.06	6.5	9.468
Jun-00	2,730,329,347	3,410,273,546	42.769928	55.5	6.1	10.000
Jul-00	2,855,651,733	3,219,402,685	44.515095	52.78	6.5	10.000
Aug-00	2,842,449,582	3,529,461,791	45.115379	55.12	6.8	10.000
Sep-00	3,294,233,553	3,502,006,958	45.829419	60.14	6.5	10.761
Oct-00	3,276,141,087	3,398,137,887	48.566885	58.93	6.7	13.198
Nov-00	2,919,802,695	3,316,782,069	49.9514	60.6	7.8	15.000
Dec-00	2,618,099,089	3,496,365,822	50.158102	35.76	8.7	13.881
Jan-01	3,031,155,224	2,888,995,982	51.343668	34.76	5.8	12.843
Feb-01	2,482,110,685	2,805,471,748	48.45399	36.63	5.8	11.172
Mar-01	3,037,402,171	2,869,640,382	48.496592	37.83	5.8	10.462
Apr-01	3,105,061,460	2,245,694,300	50.549373	41.47	5.5	9.829
May-01	2,939,857,616	2,599,971,007	50.734209	43.92	5.5	9.213
Jun-01	2,856,881,764	2,578,163,835	51.746767	41.73	5.9	9.000
Jul-01	2,873,159,620	2,594,446,005	53.554883	44.05	6.0	9.000
Aug-01	2,893,639,222	2,620,764,527	52.08795	43.63	5.7	9.000
Sep-01	2,752,002,754	2,731,019,845	51.489018	38.45	5.7	9.000
Oct-01	2,540,952,151	2,940,767,411	51.882151	36.4	5.2	8.803
Nov-01	2,216,795,607	2,629,794,168	51.942137	33.7	4.2	8.357
Dec-01	2,328,142,161	2,645,473,482	51.774882	36.52	3.7	7.951
Jan-02	2,225,785,816	2,631,435,355	51.246655	33.82	3.3	7.644
Feb-02	2,543,971,218	2,627,871,195	51.254533	34.59	2.9	7.386
Mar-02	3,435,733,641	2,849,061,701	51.044663	35.25	3.3	7.134
Apr-02	3,881,243,822	2,748,802,011	50.931722	35.13	3.4	7.000
May-02	3,302,515,506	2,918,058,836	49.824462	37.74	3.2	7.000
Jun-02	3,353,373,336	2,936,411,423	50.51119	35.96	2.6	7.000
Jul-02	3,520,285,337	3,222,741,781	50.613476	32.33	2.5	7.000
Aug-02	3,857,012,732	3,032,171,349	51.777253	28.18	2.7	7.000

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Sep-02	3,536,524,609	3,191,393,763	52.116933	53.05	2.5	7.000
Oct-02	3,247,166,736	3,033,181,410	52.9387	51.64	2.3	7.000
Nov-02	3,436,504,924	3,103,283,089	53.335651	46.49	2.1	7.000
Dec-02	2,896,396,477	2,913,746,779	53.45466	52.27	2.1	7.000
Jan-03	3,142,485,095	2,732,849,831	53.622681	57.64	1.9	7.000
Feb-03	3,021,435,800	2,787,824,284	54.148417	61.6	2.3	7.000
Mar-03	3,694,218,185	3,128,981,051	55.518177	56.83	2.1	7.000
Apr-03	3,432,718,138	2,726,211,859	53.869483	47.75	2.2	7.000
May-03	3,609,650,172	2,827,660,315	52.290712	48.85	2.2	7.000
Jun-03	3,175,460,334	3,060,470,078	53.457274	52.26	2.8	7.000
Jul-03	3,491,615,410	3,009,494,255	53.592786	53.59	2.3	6.761
Aug-03	3,360,194,190	3,003,210,820	55.009914	55.63	2.2	6.750
Sep-03	3,265,383,065	3,353,950,818	54.857617	50.42	2.2	6.750
Oct-03	3,401,221,235	3,339,920,475	54.832716	54.41	2.3	6.750
Nov-03	3,545,748,924	3,085,491,785	55.405825	54.61	2.4	6.750
Dec-03	3,330,381,135	3,175,139,873	55.276958	56.14	2.5	6.750
Jan-04	3,481,404,008	2,849,366,652	55.544329	58.74	2.9	6.750
Feb-04	3,313,652,857	3,004,810,087	56.017334	58.65	2.9	6.750
Mar-04	3,921,992,789	3,361,747,792	56.509691	63.02	3.1	6.750
Apr-04	3,764,804,339	2,982,491,297	56.536454	63.16	3.2	6.750
May-04	3,583,997,105	3,267,549,867	55.777748	70.37	3.6	6.750
Jun-04	3,778,070,418	3,317,928,115	55.994516	66.64	4.1	6.750
Jul-04	3,760,773,676	3,108,881,144	55.741021	70.96	5.5	6.750
Aug-04	3,687,633,143	3,430,059,627	55.846452	78.83	5.7	6.750
Sep-04	3,816,873,705	3,641,425,821	56.232977	77.73	6.2	6.750
Oct-04	4,007,923,809	3,753,434,618	56.342479	87.38	6.3	6.750
Nov-04	3,657,579,571	3,685,405,864	56.285678	78.61	6.8	6.750
Dec-04	3,264,507,024	3,277,419,596	56.175847	73.02	7.1	6.750
Jan-05	3,501,396,118	3,294,323,624	55.687054	80.38	7.3	6.750
Feb-05	3,211,228,572	3,000,164,622	54.774704	83.2	7.3	6.750
Mar-05	3,832,010,849	3,267,571,826	54.401201	95.37	7.1	6.750
Apr-05	4,112,555,946	3,245,696,520	54.432355	94.94	7.2	6.956
May-05	3,797,998,517	3,304,994,276	54.329855	89.71	7.3	7.000
Jun-05	4,210,263,190	3,358,573,683	55.259998	101.1	6.7	7.000
Jul-05	3,832,986,991	3,503,070,371	56.001773	105.71	6.0	7.000
Aug-05	4,238,873,900	3,512,640,841	55.943745	115.97	6.1	7.000
Sep-05	4,337,202,046	3,674,931,488	56.119012	115.58	6.0	7.082
Oct-05	4,159,123,833	3,634,525,359	55.581563	109.02	6.2	7.342
Nov-05	3,975,165,387	3,631,007,906	54.520688	103.18	6.2	7.500
Dec-05	4,209,377,205	3,827,182,953	53.521415	105.83	5.9	7.500
Jan-06	3,707,182,989	3,532,749,442	52.541075	117.1	5.9	7.500
Feb-06	3,415,251,347	3,448,303,896	51.745293	112.09	6.5	7.500
Mar-06	4,226,604,784	4,173,597,607	51.164396	114.32	6.6	7.500
Apr-06	4,416,675,003	3,917,884,768	51.399936	127.6	6.3	7.500
May-06	4,447,840,897	3,885,116,437	52.170252	128.85	6.0	7.500
Jun-06	4,533,998,702	4,055,141,466	53.170687	128.15	5.9	7.500
Jul-06	4,412,450,654	4,016,282,591	52.265336	135.97	5.5	7.500
Aug-06	4,883,658,015	4,273,802,974	51.292676	134.81	5.2	7.500
Sep-06	4,355,481,743	4,178,404,907	50.30806	116.62	4.9	7.500
Oct-06	4,686,409,641	4,207,335,417	49.974162	108.78	4.7	7.500
Nov-06	4,509,656,431	4,031,033,192	49.829101	109.22	4.2	7.500

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Dec-06	4,178,473,968	3,690,464,643	49.401492	114.52	4.1	7.500
Jan-07	3,904,161,111	3,991,848,889	48.891518	100.52	3.8	7.500
Feb-07	3,690,137,256	3,721,345,093	48.314726	108.08	2.9	7.500
Mar-07	4,566,515,375	4,487,333,472	48.384367	113.85	2.6	7.500
Apr-07	4,342,796,679	4,124,048,820	47.664218	122.28	2.6	7.500
May-07	4,296,137,369	4,127,864,486	46.72586	122.52	2.7	7.500
Jun-07	4,706,535,408	4,147,420,772	46.181655	128.08	2.6	7.500
Jul-07	5,041,563,307	4,248,793,462	45.51051	138.12	2.9	6.552
Aug-07	4,986,612,367	4,121,450,834	46.149121	131.63	2.7	6.000
Sep-07	4,743,796,494	4,389,378,756	45.999243	144.05	2.9	6.000
Oct-07	5,150,645,086	4,659,530,169	44.207622	153.84	2.9	5.799
Nov-07	5,084,213,106	3,964,806,575	43.091168	171.38	3.1	5.613
Dec-07	5,000,629,663	4,481,902,591	41.561263	168.05	3.7	5.445
Jan-08	4,995,763,280	4,230,559,185	40.821496	170.25	4.6	5.232
Feb-08	4,491,460,270	4,112,011,705	40.5793	175.34	5.1	5.000
Mar-08	5,123,010,793	4,200,129,457	41.234754	191.1	5.9	5.000
Apr-08	4,856,957,640	4,327,475,585	41.770219	204.24	7.3	5.000
May-08	4,775,682,154	4,225,382,102	42.997373	230.52	8.2	5.000
Jun-08	5,322,249,868	4,527,022,129	44.302383	247.01	9.4	5.212
Jul-08	5,882,357,556	4,437,234,124	44.827868	249.66	10.2	5.490
Aug-08	5,044,108,186	4,394,497,148	44.95862	215.3	10.5	5.778
Sep-08	4,891,088,820	4,445,618,966	46.70882	187.06	10.1	6.000
Oct-08	4,577,741,128	3,990,058,305	47.977344	136.34	9.7	6.000
Nov-08	3,484,679,377	3,512,973,480	49.087992	101.24	9.1	6.000
Dec-08	3,300,961,298	2,674,578,323	47.998288	77.71	7.8	5.825
Jan-09	3,269,937,726	2,512,962,951	47.101828	82.58	7.1	5.450
Feb-09	3,058,781,168	2,506,323,003	47.584664	78.83	7.2	5.000
Mar-09	3,269,832,510	2,906,745,064	48.362602	87.89	6.6	4.781
Apr-09	3,057,230,958	2,803,772,063	48.115128	94.55	5.6	4.616
May-09	3,616,585,310	3,088,029,755	47.328023	109.28	4.3	4.475
Jun-09	4,106,944,174	3,406,912,732	47.82949	129.99	3.2	4.250
Jul-09	4,025,962,245	3,313,362,062	48.07349	121.64	2.2	4.071
Aug-09	3,617,293,198	3,472,893,225	48.222279	134.68	1.7	4.000
Sep-09	3,669,908,170	3,637,638,407	48.053827	128.47	2.3	4.000
Oct-09	3,808,286,396	3,748,094,991	46.852989	139.21	2.9	4.000
Nov-09	3,654,514,062	3,717,828,961	47.041493	145.82	3.5	4.000
Dec-09	3,936,259,964	3,321,242,946	46.331693	140.86	4.4	4.000
Jan-10	4,310,255,692	3,579,440,238	46.038862	144.95	3.9	4.000
Feb-10	3,906,250,414	3,570,228,465	46.26492	140.4	3.9	4.000
Mar-10	4,555,823,918	4,181,803,677	45.692763	148.94	3.9	4.000
Apr-10	4,568,356,276	3,611,608,900	44.599005	158.13	4.0	4.000
May-10	4,811,756,231	4,241,422,444	45.625736	142.15	3.9	4.000
Jun-10	4,224,948,879	4,556,729,367	46.358678	140.45	3.6	4.000
Jul-10	4,687,766,029	4,505,187,660	46.255086	139.96	3.7	4.000
Aug-10	4,461,161,269	4,774,445,446	45.172882	142.57	4.1	4.000
Sep-10	4,597,217,542	5,340,846,922	44.216796	143.08	3.8	4.000
Oct-10	4,904,460,728	4,788,452,359	43.378653	153.57	3.3	4.000
Nov-10	4,955,778,246	4,146,073,638	43.557046	158.91	3.7	4.000
Dec-10	4,949,141,763	4,201,275,491	43.91113	169.33	3.6	4.000
Jan-11	5,302,439,096	4,001,933,656	44.228191	174.28	4.0	4.000
Feb-11	4,876,579,960	3,927,751,788	43.634701	184.1	4.7	4.000

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Mar-11	5,552,507,651	4,356,350,530	43.485661	204.42	4.9	4.062
Apr-11	5,525,435,059	4,306,444,209	43.18256	218.82	4.7	4.250
May-11	4,892,571,282	4,118,691,412	43.179919	203.62	4.9	4.462
Jun-11	4,503,899,301	4,134,781,698	43.41677	199.35	5.2	4.500
Jul-11	5,001,324,831	4,460,269,870	42.737966	203.23	4.9	4.500
Aug-11	5,076,381,479	4,172,903,202	42.414871	189.5	4.6	4.500
Sep-11	5,082,890,815	3,896,952,089	43.090347	190.27	4.7	4.500
Oct-11	5,024,485,134	4,155,662,784	43.352412	188.44	5.2	4.500
Nov-11	5,024,010,143	3,366,029,692	43.33757	198.51	4.7	4.500
Dec-11	4,633,315,515	3,407,157,204	43.661404	196.31	4.2	4.500
Jan-12	5,139,403,837	4,123,420,986	43.560124	201.32	4.0	4.410
Feb-12	4,998,181,721	4,430,449,373	42.663933	212.38	2.7	4.250
Mar-12	5,371,483,010	4,324,619,800	42.901125	222.03	2.6	4.000
Apr-12	4,788,116,423	4,635,171,810	42.657951	214.36	3.0	4.000
May-12	5,385,843,569	4,931,595,660	42.941953	196.28	3.0	4.000
Jun-12	5,103,026,146	4,314,231,994	42.720077	171.02	2.9	4.000
Jul-12	5,047,279,934	4,727,394,926	41.87161	182.28	3.2	3.960
Aug-12	5,183,825,724	3,809,977,241	42.074267	198.42	3.8	3.750
Sep-12	5,326,588,737	4,810,795,438	41.717493	200.48	3.7	3.750
Oct-12	5,276,855,131	4,410,108,337	41.383135	195.06	3.2	3.500
Nov-12	5,207,737,397	3,611,009,789	41.096239	190.93	2.8	3.500
Dec-12	5,300,315,989	3,970,745,308	41.004599	190.81	3.0	3.500
Jan-13	4,727,031,391	4,010,779,236	40.717713	197.91	3.1	3.500
Feb-13	4,707,488,493	3,740,782,025	40.688326	202.94	3.4	3.500
Mar-13	4,921,836,577	4,328,976,422	40.739739	193.35	3.2	3.500
Apr-13	5,141,343,971	4,121,281,122	41.186047	186.21	2.6	3.500
May-13	5,257,805,111	4,893,276,517	41.361491	186.98	2.6	3.500

TABLE 2
Transformed Data

Date	LNX1	LNX2	Date	LNX1	LNX2
Jan-95	6.48	3.46	Jan-98	7.45	3.34
Feb-95	6.45	3.49	Feb-98	7.45	3.28
Mar-95	6.36	3.48	Mar-98	7.46	3.21
Apr-95	6.32	3.56	Apr-98	7.45	3.22
May-95	6.35	3.54	May-98	7.41	3.26
Jun-95	6.34	3.48	Jun-98	7.43	3.15
Jul-95	6.32	3.4	Jul-98	7.43	3.17
Aug-95	6.38	3.43	Aug-98	7.43	3.15
Sep-95	6.4	3.45	Sep-98	7.33	3.25
Oct-95	6.35	3.41	Oct-98	7.27	3.21
Nov-95	6.35	3.45	Nov-98	7.32	3.11
Dec-95	6.38	3.52	Dec-98	7.3	2.97
Jan-96	6.57	3.51	Jan-99	7.34	3.05
Feb-96	6.57	3.5	Feb-99	7.41	3
Mar-96	6.58	3.59	Mar-99	7.47	3.18
Apr-96	6.61	3.66	Apr-99	7.5	3.38
May-96	6.64	3.58	May-99	7.52	3.41
Jun-96	6.63	3.55	Jun-99	7.57	3.42
Jul-96	6.6	3.6	Jul-99	7.57	3.56

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Aug-96	6.58	3.63	Aug-99	7.52	3.64
Sep-96	6.6	3.72	Sep-99	7.54	3.74
Oct-96	6.62	3.78	Oct-99	7.5	3.73
Nov-96	6.59	3.73	Nov-99	7.57	3.82
Dec-96	6.63	3.79	Dec-99	7.62	3.85
Jan-97	6.82	3.78	Jan-00	7.56	3.86
Feb-97	6.91	3.65	Feb-00	7.62	3.93
Mar-97	6.94	3.59	Mar-00	7.66	3.94
Apr-97	6.95	3.52	Apr-00	7.7	3.78
May-97	6.94	3.6	May-00	7.78	3.93
Jun-97	6.96	3.52	Jun-00	7.51	4.02
Jul-97	7.02	3.54	Jul-00	7.59	3.97
Aug-97	7.08	3.56	Aug-00	7.62	4.01
Sep-97	7.03	3.56	Sep-00	7.65	4.1
Oct-97	6.99	3.63	Oct-00	7.77	4.08
Nov-97	6.96	3.58	Nov-00	7.82	4.1
Dec-97	7.01	3.48	Dec-00	7.83	3.58
Date	LNX1	LNX2	Date	LNX1	LNX2
Jan-01	7.88	3.55	Mar-04	8.07	4.14
Feb-01	7.76	3.6	Apr-04	8.07	4.15
Mar-01	7.76	3.63	May-04	8.04	4.25
Apr-01	7.85	3.72	Jun-04	8.05	4.2
May-01	7.85	3.78	Jul-04	8.04	4.26
Jun-01	7.89	3.73	Aug-04	8.05	4.37
Jul-01	7.96	3.79	Sep-04	8.06	4.35
Aug-01	7.91	3.78	Oct-04	8.06	4.47
Sep-01	7.88	3.65	Nov-04	8.06	4.36
Oct-01	7.9	3.59	Dec-04	8.06	4.29
Nov-01	7.9	3.52	Jan-05	8.04	4.39
Dec-01	7.89	3.6	Feb-05	8.01	4.42
Jan-02	7.87	3.52	Mar-05	7.99	4.56
Feb-02	7.87	3.54	Apr-05	7.99	4.55
Mar-02	7.87	3.56	May-05	7.99	4.5
Apr-02	7.86	3.56	Jun-05	8.02	4.62
May-02	7.82	3.63	Jul-05	8.05	4.66
Jun-02	7.84	3.58	Aug-05	8.05	4.75
Jul-02	7.85	3.48	Sep-05	8.05	4.75
Aug-02	7.89	3.34	Oct-05	8.04	4.69
Sep-02	7.91	3.97	Nov-05	8	4.64
Oct-02	7.94	3.94	Dec-05	7.96	4.66
Nov-02	7.95	3.84	Jan-06	7.92	4.76
Dec-02	7.96	3.96	Feb-06	7.89	4.72
Jan-03	7.96	4.05	Mar-06	7.87	4.74
Feb-03	7.98	4.12	Apr-06	7.88	4.85
Mar-03	8.03	4.04	May-06	7.91	4.86
Apr-03	7.97	3.87	Jun-06	7.95	4.85
May-03	7.91	3.89	Jul-06	7.91	4.91
Jun-03	7.96	3.96	Aug-06	7.88	4.9
Jul-03	7.96	3.98	Sep-06	7.84	4.76
Aug-03	8.02	4.02	Oct-06	7.82	4.69
Sep-03	8.01	3.92	Nov-06	7.82	4.69

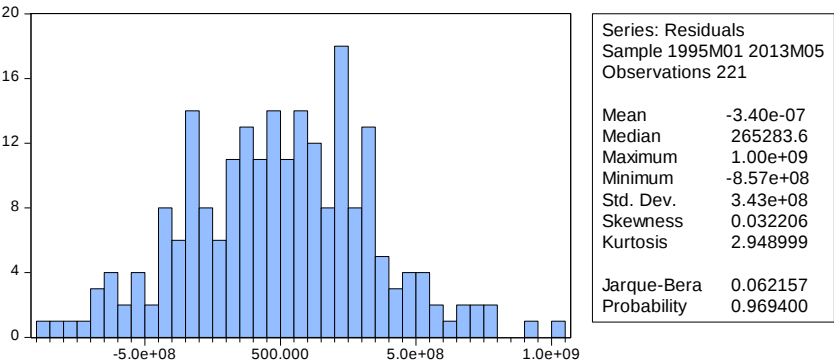
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Oct-03	8.01	4	Dec-06	7.8	4.74
Nov-03	8.03	4	Jan-07	7.78	4.61
Dec-03	8.02	4.03	Feb-07	7.76	4.68
Jan-04	8.03	4.07	Mar-07	7.76	4.73
Feb-04	8.05	4.07	Apr-07	7.73	4.81
Date	LNX1	LNX2	Date	LNX1	LNX2
May-07	7.69	4.81	Jun-10	7.67	4.94
Jun-07	7.67	4.85	Jul-10	7.67	4.94
Jul-07	7.64	4.93	Aug-10	7.62	4.96
Aug-07	7.66	4.88	Sep-10	7.58	4.96
Sep-07	7.66	4.97	Oct-10	7.54	5.03
Oct-07	7.58	5.04	Nov-10	7.55	5.07
Nov-07	7.53	5.14	Dec-10	7.56	5.13
Dec-07	7.45	5.12	Jan-11	7.58	5.16
Jan-08	7.42	5.14	Feb-11	7.55	5.22
Feb-08	7.41	5.17	Mar-11	7.54	5.32
Mar-08	7.44	5.25	Apr-11	7.53	5.39
Apr-08	7.46	5.32	May-11	7.53	5.32
May-08	7.52	5.44	Jun-11	7.54	5.3
Jun-08	7.58	5.51	Jul-11	7.51	5.31
Jul-08	7.61	5.52	Aug-11	7.49	5.24
Aug-08	7.61	5.37	Sep-11	7.53	5.25
Sep-08	7.69	5.23	Oct-11	7.54	5.24
Oct-08	7.74	4.92	Nov-11	7.54	5.29
Nov-08	7.79	4.62	Dec-11	7.55	5.28
Dec-08	7.74	4.35	Jan-12	7.55	5.3
Jan-09	7.7	4.41	Feb-12	7.51	5.36
Feb-09	7.73	4.37	Mar-12	7.52	5.4
Mar-09	7.76	4.48	Apr-12	7.51	5.37
Apr-09	7.75	4.55	May-12	7.52	5.28
May-09	7.71	4.69	Jun-12	7.51	5.14
Jun-09	7.74	4.87	Jul-12	7.47	5.21
Jul-09	7.75	4.8	Aug-12	7.48	5.29
Aug-09	7.75	4.9	Sep-12	7.46	5.3
Sep-09	7.74	4.86	Oct-12	7.45	5.27
Oct-09	7.69	4.94	Nov-12	7.43	5.25
Nov-09	7.7	4.98	Dec-12	7.43	5.25
Dec-09	7.67	4.95	Jan-13	7.41	5.29
Jan-10	7.66	4.98	Feb-13	7.41	5.31
Feb-10	7.67	4.94	Mar-13	7.41	5.26
Mar-10	7.64	5	Apr-13	7.44	5.23
Apr-10	7.6	5.06	May-13	7.44	5.23
May-10	7.64	4.96			

Appendix B

Imports (y₁)

GRAPH 1
Testing for Normality



H₀: The data have a normal distribution
H_a: The data does not have a normal distribution

Rejection Rule: If p-value < $\alpha = 0.01$, then reject the null hypothesis.

Conclusion

Since the p-value, 0.969400, is greater than 0.01, then FAIL TO REJECT the null hypothesis for the Jarque-Bera Test. Therefore, the data have a normal distribution.

TABLE 3
Testing for Homoscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.130421	Prob. F(2,218)	0.8778
Obs*R-squared	0.264116	Prob. Chi-Square(2)	0.8763
Scaled explained SS	0.250440	Prob. Chi-Square(2)	0.8823

Test Equation:

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Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/15 Time: 10:21
Sample: 1995M01 2013M05
Included observations: 221

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.02E+17	3.59E+16	2.831879	0.0051
X1	4.37E+12	1.54E+13	0.283057	0.7774
X2	7.01E+13	1.78E+14	0.394373	0.6937
R-squared	0.001195	Mean dependent var		1.17E+17
Adjusted R-squared	-0.007968	S.D. dependent var		1.64E+17
S.E. of regression	1.65E+17	Akaike info criterion		82.13531
Sum squared resid	5.90E+36	Schwarz criterion		82.18144
Log likelihood	-9072.952	Hannan-Quinn criter.		82.15393
F-statistic	0.130421	Durbin-Watson stat		1.357477
Prob(F-statistic)	0.877794			

H₀: The variables are Homoscedastic
H_a: The variables are Heteroscedastic

Rejection Rule: If p-value < $\alpha = 0.01$, then reject the null hypothesis

Conclusion

Since the p-value, 0.877794, is greater than 0.01, then FAIL TO REJECT the null hypothesis for the Breusch-Pagan-Godfrey Heteroscedasticity Test. Therefore, the variables are Homoscedastic.

TABLE 4
Testing for Multicollinearity

Variance Inflation Factors
Date: 04/20/15 Time: 10:27
Sample: 1995M01 2013M05
Included observations: 221

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
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C	5.66E+15	10.52809	NA
X1	1.04E+09	9.204268	1.010292
X2	1.39E+11	3.199333	1.010292

General Rule: For satisfying Multicollinearity, the Variance Inflation Factor should be less than 10.

Conclusion

Since the VIF (Variance Inflation Factor) of the following independent variables are less than 10 therefore the Assumption, Multicollinearity, was satisfied.

TABLE 5
Testing for Linearity

Dependent Variable: Y1
Method: Least Squares
Date: 04/20/15 Time: 20:06
Sample: 1995M01 2013M05
Included observations: 221

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.86E+09	75211624	24.79644	0.0000
X1	218424.5	32310.87	6.760094	0.0000
X2	14357624	372468.7	38.54720	0.0000
R-squared	0.880120	Mean dependent var		3.64E+09
Adjusted R-squared	0.879021	S.D. dependent var		9.91E+08
S.E. of regression	3.45E+08	Akaike info criterion		42.16711
Sum squared resid	2.59E+19	Schwarz criterion		42.21324
Log likelihood	-4656.465	Hannan-Quinn criter.		42.18573
F-statistic	800.2456	Durbin-Watson stat		0.766682
Prob(F-statistic)	0.000000			

H₀: No Independent variables that is significant to the Dependent variable.
H_a: At least one of the Independent variables will be significant to the Dependent variable.

Rejection Rule: If $p\text{-value} < \alpha = 0.01$, then reject the null hypothesis

Conclusion

Since the p-value, 0.000000, is less than 0.01, then REJECT the null hypothesis. Therefore, at least one of the Independent variables will be significant to the Dependent variables.

Exports (y₂)

TABLE 6
Testing for Multicollinearity

Variance Inflation Factors
Date: 04/20/15 Time: 10:47
Sample: 1995M01 2013M05
Included observations: 221

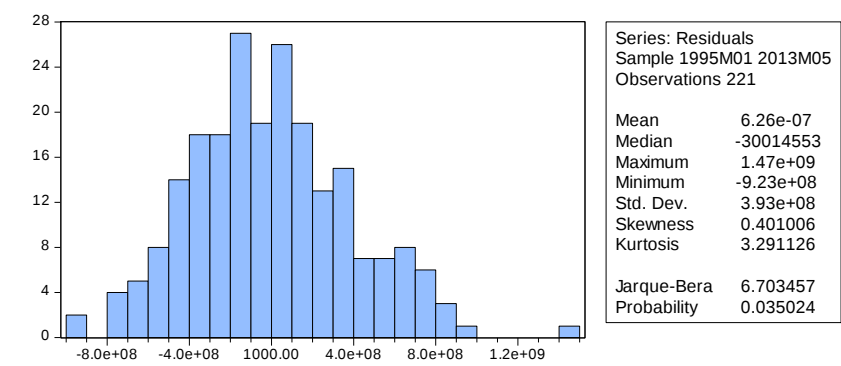
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.97E+17	279.0873	NA
LNx1	3.86E+15	312.9747	1.122523
LNx2	1.56E+15	41.53851	1.122523

General Rule: For satisfying Multicollinearity, the Variance Inflation Factor should be less than 10

Conclusion

Since the VIF (Variance Inflation Factor) of the following independent variables are less than 10 therefore the Assumption, Multicollinearity, was satisfied.

GRAPH 2
Testing for Normality



H₀: The data have a normal distribution
H_a: The data does not have a normal distribution

Rejection Rule: If p-value < $\alpha = 0.01$, then reject the null hypothesis

Conclusion

Since the p-value, 0.035024 is greater than 0.01, then **FAIL TO REJECT** the null hypothesis for the Jarque-Bera Test. Therefore, the data have a normal distribution.

TABLE 7
Testing for Homoscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.570955	Prob. F(2,218)	0.5658
Obs*R-squared	1.151593	Prob. Chi-Square(2)	0.5623
Scaled explained SS	1.283649	Prob. Chi-Square(2)	0.5263

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/15 Time: 10:48

Sample: 1995M01 2013M05

Included observations: 221

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.79E+16	2.62E+17	-0.106226	0.9155
LNx1	1.30E+16	3.68E+16	0.353757	0.7239
LNx2	1.95E+16	2.33E+16	0.834855	0.4047
R-squared	0.005211	Mean dependent var		1.54E+17
Adjusted R-squared	-0.003916	S.D. dependent var		2.33E+17
S.E. of regression	2.33E+17	Akaike info criterion		82.83476
Sum squared resid	1.19E+37	Schwarz criterion		82.88089
Log likelihood	-9150.241	Hannan-Quinn criter.		82.85338
F-statistic	0.570955	Durbin-Watson stat		1.018068
Prob(F-statistic)	0.565828			

H₀: The variables are Homoscedastic

H_a: The variables are Heteroscedastic

Rejection Rule: If p-value < $\alpha = 0.01$, then reject the null hypothesis

Conclusion

Since the p-value, 0.565828 is greater than 0.01, then FAIL TO REJECT the null hypothesis for the Breusch-Pagan-Godfrey Heteroscedasticity Test. Therefore, the variables are Homoscedastic.

TABLE 8
Testing for Linearity

Dependent Variable: Y2

Method: Least Squares

Date: 04/20/15 Time: 10:44

Sample: 1995M01 2013M05

Included observations: 221

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.82E+09	4.43E+08	-13.13535	0.0000
LNx1	6.63E+08	62141910	10.67319	0.0000

LNx2	9.42E+08	39446723	23.87529	0.0000
R-squared	0.814429	Mean dependent var	3.21E+09	
Adjusted R-squared	0.812726	S.D. dependent var	9.12E+08	
S.E. of regression	3.95E+08	Akaike info criterion	42.43798	
Sum squared resid	3.39E+19	Schwarz criterion	42.48411	
Log likelihood	-4686.397	Hannan-Quinn criter.	42.45661	
F-statistic	478.3762	Durbin-Watson stat	0.580259	
Prob(F-statistic)	0.000000			

Ho: No Independent variables that is significant to the Dependent variable.
Ha: At least one of the Independent variables will be significant to the Dependent variable.

Rejection Rule: If p-value < $\alpha = 0.01$, then reject the null hypothesis

Conclusion

Since the p-value, 0.000000, is less than 0.01, then REJECT the null hypothesis. Therefore, at least one of the Independent variables will be significant to the Dependent variables.

APPENDIX C

Difference between Actual and Predicted Value

TABLE 9 (Imports)

Actual Value	Predicted Value	Difference of Actual and Predicted Value
1855579497	2461647006	-606067508.8
1615887292	2472736940	-856849647.8
2142537620	2458332067	-315794446.9
2229563126	2491892398	-262329272.2
2143626871	2486363723	-342736851.7
2328664433	2454950626	-126286192.6
2175487584	2417979340	-242491755.8
2273585811	2437192158	-163606346.6
2444224628	2447708739	-3484110.555
2342361497	2425319843	-82958345.8
2414722228	2442091836	-27369607.8
2571385721	2476135487	95250233.76

Jackie D. Urrutia, Merrill Lynch T. Olfindo, Joseph Mercado, Aaron Vito M. Baygan, Edcon B. Baccay- **A Mathematical Model for Estimating Imports and Exports in the Philippines: A Normal Estimation Equation for Multiple Linear Regression**

2236094895	2498858647	-262763752
2359578155	2496530802	-136952647.3
2760472686	2545528282	214944404.1
2811146347	2584295334	226851013
2712349002	2545307602	167041400
2750550811	2529229179	221321631.8
2838704800	2551538272	287166527.6
2799675243	2565609602	234065640.9
2870062593	2621404494	248658099.1
2858505702	2659313568	199192133.7
2711554979	2623162493	88392485.56
2718238732	2663341412	54897319.97
2837888446	2692396317	145492129.4
2626538787	2636227479	-9688692.402
2935163641	2612472937	322690704
2942077383	2576054154	366023229
2954365646	2615164576	339201069.8
3032341153	2581097744	451243409
3169204752	2605726808	563477944.1
3327943486	2629994119	697949367.4
2956476409	2615608747	340867661.8
3413800271	2644184661	769615609.9
2945288406	2610743542	334544863.6
2792733044	2570107340	222625704.5
2837901972	2645528811	192373161
2585234573	2621679462	-36444889.41
2613595753	2598974763	14620990.05
2457455132	2598654751	-141199619.4
2624021365	2603162408	20858956.52
2260740554	2567880506	-307139952.4
2465592507	2577058846	-111466338.5
2508465350	2568565598	-60100247.86
2454452775	2571038062	-116585286.7
2417414425	2534897570	-117483145.1
2373400659	2513815392	-140414732.6
2061612032	2469849879	-408237847.5
2399845062	2506720481	-106875418.9
2256560130	2515924624	-259364493.5
2656303584	2594490988	61812595.94
2599207956	2684936548	-85728592.15
2533475252	2701142067	-167666814.6
2670938322	2724062836	-53124513.96
2791640360	2794141650	-2501290.165
2661455290	2813582010	-152126719.8
2555295681	2879826919	-324531237.9

2612624199	2859548582	-246924382.6
2351642775	2942903637	-591260862.3
2653469947	2983253430	-329783483
2900849185	2962250331	-61401145.73
2775144920	3040303263	-265158343.4
2908071277	3067072992	-159001714.7
2728169303	2976398695	-248229392.3
2641931449	3118099198	-476167748.7
2730329347	3061385506	-331056159.4
2855651733	3055604734	-199953000.9
2842449582	3100953635	-258504052.8
3294233553	3187213010	107020542.7
3276141087	3226282678	49858409.14
2919802695	3280053042	-360250346.5
2618099089	2927929520	-309830430.6
3031155224	2939856476	91298747.75
2482110685	2903715249	-421604564.3
3037402171	2921846553	115555617.6
3105061460	3018518332	86543128.06
2939857616	3057783603	-117925987.4
2856881764	3049005886	-192124121.5
2873159620	3123903102	-250743481.8
2893639222	3084023421	-190384198.6
2752002754	2996100839	-244098084.6
2540952151	2975544189	-434592037.6
2216795607	2938138957	-721343350
2328142161	2974838399	-646696237.8
2225785816	2924186419	-698400602.7
2543971218	2935418167	-391446949
3435733641	2940204723	495528918.4
3881243822	2935966142	945277679.8
3302515506	2949071363	353444143.3
3353373336	2938564975	414808361.1
3520285337	2888706110	631579226.9
3857012732	2855149454	1001863278
3536524609	3219931906	316592703.1
3247166736	3218544533	28622203.18
3436504924	3153817176	282687748.4
2896396477	3239580196	-343183718.5
3142485095	3320610360	-178125265.3
3021435800	3389842301	-368406501.1
3694218185	3354167520	340050665
3432718138	3184408121	248310016.7
3609650172	3163592956	446057215.6
3175460334	3239497662	-64037327.94

3491615410	3261761892	229853517.7
3360194190	3324667856	35526333.71
3265383065	3246209852	19173212.55
3401221235	3302900162	98321072.98
3545748924	3319571473	226177451.1
3330381135	3338423166	-8042031.402
3481404008	3382224995	99179012.81
3313652857	3392458909	-78806052.32
3921992789	3467303204	454689584.5
3764804339	3469974105	294830233.6
3583997105	3554879844	29117261.32
3778070418	3506618046	271452372.1
3760773676	3562456228	198317447.7
3687633143	3678020437	9612706.375
3816873705	3671689536	145184168.9
4007923809	3812933168	194990641.3
3657579571	3685619469	-28039897.6
3264507024	3602662428	-338155404.4
3501396118	3696391551	-194995432.5
3211228572	3714867256	-503638683.7
3832010849	3880692706	-48681856.75
4112555946	3875259519	237296427.2
3797998517	3797734126	264390.601
4210263190	3983532400	226730790.2
3832986991	4067747890	-234760899.1
4238873900	4213638218	25235682.33
4337202046	4212328803	124873243.5
4159123833	4105030031	54093802.29
3975165387	3995668481	-20503094.22
4209377205	4010134278	199242927.3
3707182989	4149233478	-442050489
3415251347	4059174897	-643923550
4226604784	4078134984	148469799.6
4416675003	4274080917	142594085.8
4447840897	4309454253	138386644.4
4533998702	4322422985	211575717
4412450654	4413849517	-1398862.536
4883658015	4375193471	508464544.3
4355481743	4092177611	263304132.2
4686409641	3972300110	714109530.8
4509656431	3975455208	534201223.2
4178473968	4042282436	136191532.4
3904161111	3830326771	73834339.76
3690137256	3926623812	-236486555.8
4566515375	4010938215	555577160.3

4342796679	4116864694	225931984.7
4296137369	4100964283	195173085.8
4706535408	4169748954	536786454.2
5041563307	4300457907	741105399.8
4986612367	4220062391	766549976.2
4743796494	4395367399	348429095.4
5150645086	4500627492	650017594.3
5084213106	4731171415	353041690.7
5000629663	4655072315	345557348.3
4995763280	4673347402	322415878.4
4491460270	4742121470	-250661200.3
5123010793	4980110703	142900090.4
4856957640	5178478024	-321520383.5
4775682154	5578517512	-802835358.3
5322249868	5840159189	-517909321
5882357556	5888437160	-6079603.941
5044108186	5397673499	-353565312.5
4891088820	5027257491	-136168670.9
4577741128	4325274220	252466907.6
3484679377	3844869027	-360189650.5
3300961298	3483925861	-182964563.2
3269937726	3535226027	-265288301.4
3058781168	3491370891	-432589723.5
3269832510	3637754394	-367921883.7
3057230958	3728161112	-670930154.4
3616585310	3923240008	-306654697.7
4106944174	4231009238	-124065064.5
4025962245	4116234298	-90272052.73
3617293198	4306587232	-689294033.7
3669908170	4213884005	-543975834.9
3808286396	4343191513	-534905117.3
3654514062	4441961403	-787447341.4
3936259964	4356271219	-420011255
4310255692	4409085735	-98830043.33
3906250414	4348316203	-442065789
4555823918	4459438055	96385863.32
4568356276	4569813567	-1457291.381
4811756231	4360612862	451143369.1
4224948879	4350930928	-125982049.4
4687766029	4341800117	345965911.8
4461161269	4357661765	103499503.9
4597217542	4346316659	250900882.9
4904460728	4480891925	423568802.6
4955778246	4560949117	394829128.5
4949141763	4717320394	231821369.1

5302439096	4794494622	507944474.4
4876579960	4924096559	-47516598.84
5552507651	5213007334	339500316.7
5525435059	5414019254	111415804.7
4892571282	5195733571	-303162288.6
4503899301	5138906524	-635007222.6
5001324831	5181840149	-180515318.1
5076381479	4978700591	97680888.22
5082890815	5002371453	80519361.96
5024485134	4981045113	43440020.73
5024010143	5125345337	-101335193.9
4633315515	5099912294	-466596779.4
5139403837	5169914465	-30510628.04
4998181721	5311831394	-313649672.8
5371483010	5454815457	-83332447.06
4788116423	5340148004	-552031580.7
5385843569	5085872208	299971360.8
5103026146	4719047204	383978942
5047279934	4865036986	182242947.8
5183825724	5100484905	83340819.44
5326588737	5123531863	203056874.2
5276855131	5039644540	237210591
5207737397	4975178975	232558422.1
5300315989	4971812694	328503295
4727031391	5068630852	-341599460.5
4707488493	5140327161	-432838667.8
4921836577	5003551986	-81715408.68
5141343971	4909025068	232318902.6
5257805111	4923243767	334561344.4

TABLE 10

Hypothesis Testing for DIFF1
Date: 04/29/15 Time: 17:27
Sample: 1 221
Included observations: 221
Test of Hypothesis: Mean = 0.000000

Sample Mean = -0.002154
Sample Std. Dev. = 3.43e+08

Method	Value	Probability
t-statistic	-9.33E-11	1.0000

TABLE 11 (Exports)

Actual Value	Predicted Value	Difference Actual and Predicted Value
1160748394	1726002037	-565253643.2
1263768380	1737852730	-474084349.7
1298577283	1672829438	-374252155.3
1377417699	1723039880	-345622180.9
1400580633	1725395022	-324814389.1
1521691870	1657221716	-135529846
1592693716	1571314932	21378783.55
1591446955	1637105302	-45658347.09
1594970078	1668368862	-73398783.82
1601650105	1600724151	925954.2799
1422627417	1635323649	-212696232.4
1621013605	1716011686	-94998081.2
1420447244	1833483994	-413036750.4
1594005715	1831111369	-237105653.8
1670603477	1927780340	-257176862.8
1491866914	2005078903	-513211988.6
1612182193	1947677063	-335494870
1793390815	1914090835	-120700019.6
1693694307	1944980796	-251286489.2
1773892603	1962187012	-188294409.3
1875570991	2063430619	-187859628
1883709477	2128655165	-244945687.7
1849914761	2061138208	-211223446.7
1883267902	2140130269	-256862367
1692263113	2258251007	-565987894
1812415070	2196659023	-384243953
2001018452	2161999138	-160980685.5
2082429845	2096280250	-13850405.12
1982879342	2167948478	-185069135.6
2129077284	2109244423	19832860.78
2067142448	2168367501	-101225052.9
2257973088	2225160651	32812436.98
2337468892	2188714370	148754522.1
2326046764	2231830696	94216067.78
2308430580	2163929145	144501435
2230557752	2096052045	134505707.2
2114812034	2261500883	-146688849.3
2227202908	2204282066	22920842.48
2474181862	2143843808	330338053.6
2284501468	2146807112	137694355.7
2414739055	2167543728	247195326.8

2389568281	2070170898	319397383.1
2501374868	2093010009	408364858.8
2652454948	2072123195	580331753.4
2786324139	2103837247	682486891.8
2542295807	2022158952	520136854.9
2585815298	1952084818	633730480.1
2523082200	1818686755	704395445.4
2580780826	1921938346	658842479.8
2569328986	1919621553	649707432.7
2702330690	2127193901	575136789.4
2345945316	2339658674	6286642.016
2746896905	2372192021	374704883.8
2857196085	2410893670	446302415.3
2851061303	2550261265	300800037.9
3211535584	2589099613	622435971.1
3693275081	2697828696	995446385.1
3459665969	2664904807	794761161.9
3075370095	2793607021	281763074.2
2943505820	2852947407	90558413.33
2716571560	2820064275	-103492715.1
2902308122	2929634012	-27325890.3
2988516721	2967105692	21411029.2
2667587635	2842645610	-175057974.5
2930834998	3036416261	-105581263.4
3410273546	2940313823	469959723.5
3219402685	2945991289	273411396.2
3529461791	3004610499	524851292.3
3502006958	3107531633	394475324.9
3398137887	3165288691	232849195.8
3316782069	3228871547	87910522.45
3496365822	2737480587	758885235.2
2888995982	2741730315	147265666.6
2805471748	2714305517	91166231.47
2869640382	2745835269	123805113.2
2245694300	2887326954	-641632654.1
2599971007	2946234629	-346263621.8
2578163835	2924247434	-346083599.3
2594446005	3020739777	-426293772.2
2620764527	2974900196	-354135668.7
2731019845	2840515883	-109496038
2940767411	2798987032	141780379
2629794168	2727918963	-98124795.23
2645473482	2799343891	-153870408.9
2631435355	2713398819	-81963463.62
2627871195	2734808840	-106937644.7

2849061701	2747174408	101887292.6
2748802011	2741026020	7775990.533
2918058836	2779398077	138660759
2936411423	2752032823	184378599.8
3222741781	2654476066	568265715.4
3032171349	2555196899	476974449.5
3191393763	3159786387	31607376.25
3033181410	3155148780	-121967370.4
3103283089	3066086634	37196454.65
2913746779	3179428097	-265681318.2
2732849831	3275708891	-542859060
2787824284	3351232168	-563407884
3128981051	3308424991	-179443939.7
2726211859	3104478459	-378266599.7
2827660315	3086503457	-258843141.7
3060470078	3179312684	-118842606
3009494255	3206341925	-196847670.2
3003210820	3276130191	-272919371.4
3353950818	3179825300	174125518.5
3339920475	3250965196	88955278.61
3085491785	3268204101	-182712315.8
3175139873	3291145994	-116006121.1
2849366652	3340188092	-490821440.1
3004810087	3349984053	-345173965.9
3361747792	3429279361	-67531568.67
2982491297	3431997312	-449506014.7
3267549867	3515913106	-248363238.7
3317928115	3469752084	-151823968.7
3108881144	3522904935	-414023791.1
3430059627	3624485368	-194425741.1
3641425821	3620391062	21034759.48
3753434618	3733205890	20228727.54
3685405864	3632237314	53168550.05
3277419596	3560162075	-282742479.1
3294323624	3639038673	-344715048.6
3000164622	3649623136	-649458514.2
3267571826	3769150282	-501578455.8
3245696520	3765652380	-519955859.6
3304994276	3709778261	-404783985.3
3358573683	3844873674	-486299991.1
3503070371	3904551257	-401480886.3
3512640841	3990435166	-477794324.6
3674931488	3991408334	-316476845.9
3634525359	3923610651	-289085291.6
3631007906	3846203210	-215195303.9

3827182953	3845570491	-18387538.38
3532749442	3916389137	-383639695.2
3448303896	3854969421	-406665525.2
4173597607	3858561089	315036517.5
3917884768	3968172608	-50287839.82
3885116437	3997073899	-111957462.4
4055141466	4017121037	38020429.06
4016282591	4050152674	-33870082.96
4273802974	4017180830	256622143.8
4178404907	3854951300	323453606.6
4207335417	3780568255	426767161.5
4031033192	3780517474	250515718.3
3690464643	3813729443	-123264800.2
3991848889	3677146360	314702528.5
3721345093	3729723474	-8378380.63
4487333472	3780625564	706707908.1
4124048820	3828035560	296013260.2
4127864486	3803526365	324338121.1
4147420772	3829803471	317617301
4248793462	3881487902	367305560.3
4121450834	3854623124	266827710.1
4389378756	3935245827	454132929.3
4659530169	3944522769	715007400.3
3964806575	4012322747	-47516171.88
4481902591	3945921274	535981316.8
4230559185	3934366538	296192647
4112011705	3954228530	157783175
4200129457	4056545014	143584442.6
4327475585	4136288606	191186978.6
4225382102	4288690283	-63308181.47
4527022129	4393406526	133615603.4
4437234124	4419088911	18145212.62
4394497148	4283471927	111025221
4445618966	4201649305	243969661.3
3990058305	3939239361	50818943.86
3512973480	3689185677	-176212197.1
2674578323	3410263393	-735685070.5
2512962951	3442529362	-929566410.9
2506323003	3412270513	-905947509.5
2906745064	3536247036	-629501972.2
2803772063	3598252000	-794479936.7
3088029755	3712773399	-624743643.5
3406912732	3890220707	-483307975.2
3313362062	3834425711	-521063649.3
3472893225	3934449886	-461556661.1

3637638407	3885343724	-247705316.7
3748094991	3927428392	-179333400.5
3717828961	3976448984	-258620023
3321242946	3923696705	-602453759.4
3579440238	3942254092	-362813853.8
3570228465	3918703713	-348475248.1
4181803677	3957830904	223972772.7
3611608900	3982115376	-370506475.9
4241422444	3911931265	329491179.4
4556729367	3921722693	635006674.4
4505187660	3915465196	589722464.1
4774445446	3901488008	872957437.6
5340846922	3876495144	1464351778
4788452359	3917775679	870676679.7
4146073638	3955414307	190659331.3
4201275491	4025973369	175302121.7
4001933656	4062652291	-60718635.02
3927751788	4096380358	-168628569.6
4356350530	4190468751	165881779.1
4306444209	4245320757	61123452.19
4118691412	4177422344	-58730931.96
4134781698	4164709476	-29927777.67
4460269870	4161979264	298290606.2
4172903202	4086028831	86874370.51
3896952089	4110792357	-213840267.6
4155662784	4109725832	45936952.13
3366029692	4158311593	-792281900.8
3407157204	4157681866	-750524661.8
4123420986	4178342115	-54921128.86
4430449373	4201165017	229284355.7
4324619800	4250371604	74248195.88
4635171810	4209720518	425451291.6
4931595660	4135513545	796082114.9
4314231994	3998877155	315354838.8
4727394926	4032349621	695045304.8
3809977241	4118669813	-308692572.3
4810795438	4117111006	693684432
4410108337	4080626854	329481483.4
3611009789	4051246399	-440236609.6
3970745308	4047695039	-76949731.07
4010779236	4072803043	-62023806.69
3740782025	4095487978	-354705953.1
4328976422	4051561850	277414572.1
4121281122	4030560362	90720760.3
4893276517	4040082137	853194380.1

TABLE 12

Hypothesis Testing for DIFF2		
Date: 04/29/15 Time: 17:35		
Sample: 1 221		
Included observations: 221		
Test of Hypothesis: Mean = 0.000000		
Sample Mean = 0.002800		
Sample Std. Dev. = 3.93e+08		
<u>Method</u>	<u>Value</u>	<u>Probability</u>
t-statistic	1.06E-10	1.0000