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Application of Seasonal Autoregressive Integrated Moving Average (SARIMA) in Modeling and Forecasting Philippine Real Gross Domestic Product

JACKIE D. URRUTIA
CHRISTINE INGRID V. RIVERA
JUDY ANN C. QUITE
JULIE ANN D. BELAMIDE
JOCELYN Q. QUINTO
Polytechnic University of the Philippines
The Philippines

Abstract:

The purpose of the study is to formulate a mathematical model to forecast the Real Gross Domestic Product from 1st Quarter of 2014 to 4th Quarter of 2020 and to analyze its relationship with its five (5) Independent Variables namely: Consumer Spending (x_1), *Government Spending* (x_2), *Capital Formation* (x_3), *Exports* (x_4) *and Imports* (x_5)*.This paper takes into account the quarterly data from year 1990 to 2013 gathered from National Statistical Coordination Board (NSCB) resulting to a total of 96 observations for each variable. The researchers employed four main statistical treatment which are subjected at 1% level of significance in completing the paper: (1) Seasonal Autoregressive Integrated Moving Average (SARIMA), to formulate a model that will help generate forecasts; (2) Stepwise Multiple Linear Regression Analysis, to identify the significant factors that can actually affect the Dependent Variable Real Gross Domestic Product; (3) Johansen Cointegration Test, to test the existence of cointegration between the five Independent Variables and the Dependent Variable Real Gross Domestic Product; and (4) Pairwise*

Granger Causality Test, to check for the granger causal relationship between the Variables. In forecasting the Real Gross Domestic Product, the best-fitted model obtained is: ***SARIMA (5, 2, 1) x (0, 1, 1)$_4$****. Predicted Values obtained from the model with 99% coefficient of determination reveals no significant difference between the Actual Values of Real Gross Domestic Product examined through Paired T-Test. The Stepwise Multiple Linear Regression results shows that all the five Independent Variables are significant factors of Real GDP particularly indicating a positive significant relationship between the Real Gross Domestic Product (y) and Independent Variables: Consumer Spending (x_1), Government Spending (x_2), Capital Formation (x_3) and Imports (x_5); but have a negative significant relationship on Exports (x_4). The Johansen Cointegration Test results imply that a cointegration exists between the Variables indicating a long run relationship. The Pairwise Granger Causality test suggests a uni-directional relationship having Real Gross Domestic Product granger causes Government Spending and Exports. This study will be of importance in assessing future changes in Real GDP to assist the Government on deciding what economic policy should be implemented in order to be equipped for unforeseen events.*

Key words: SARIMA, Pairwise Granger Causality, Real GDP, Stepwise regression and Cointegration

Introduction

Real Gross Domestic Product is vital in finding out a country's standard of living and measures its productivity and robustness. It is one of the necessary economic indicators that investing countries or individuals tend to look for, so they may decide whether such country's economy is a profitable investment place or not. In regards to this, a lot of countries monitor and survey their Real Gross Domestic Product for the purpose of attracting investors and Philippines as an emerging industrialized country in Asia, also keeps its eye on its Real GDP so that it can prevent economic problems that may arise. Real GDP can determine through measuring the value of all goods and services produced in a country for a given year at constant prices.

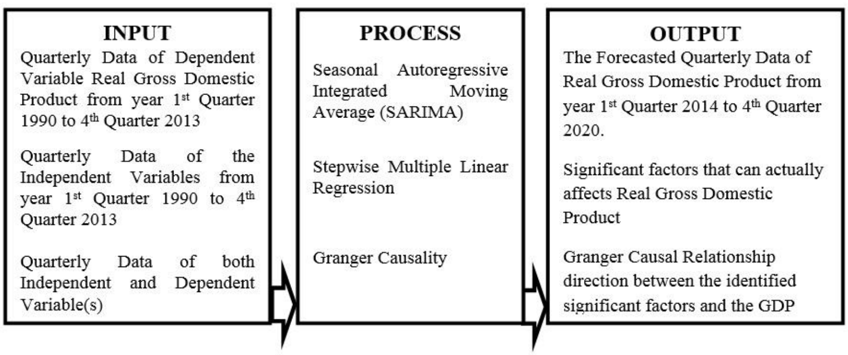
This study is made for the purpose of forecasting the Real Gross Domestic Product (RGDP) using seasonal autoregressive moving average (SARIMA) modeling and testing its granger causal relationship between the significant factors identified using the regression analysis. It deals on the relationship between the economic variables considering the Quarterly Data collected from 1st Quarter of 1990 up to the 4th Quarter of 2013 of Real Gross Domestic Product (y), Consumer Spending (x_1), Government Spending (x_2), Capital Formation (x_3), Exports (x_4) and Imports (x_5) by employing four statistical methods namely: (1) Seasonal Autoregressive Integrated Moving Average (SARIMA), used for estimating model in forecasting RGDP for the next 6 years from 2014 to 2020, (2) Stepwise Multiple Linear Regression, used to identify the significant factors of the Dependent Variable Real GDP and (3) Granger Causality Test to test the Granger Causal relationship between the dependent and independent variables as well as its direction.

1.1. Objective of the Study

The objective of the study is to forecast the Real Gross Domestic Product using Seasonal Autoregressive Integrated Moving Average modeling from 1st Quarter of 2014 to 4th Quarter of 2020 and analyze the relationship and predictivity of the Independent Variables (Consumer Spending, Government Spending, Capital Formation, Exports and Imports) to the Dependent Variable (Real Gross Domestic Product) through Regression Analysis, Johansen Cointegration Test and Granger

Causality Test that will help assess future values of Real GDP that can assist the Government on deciding what economic policy should be implemented in order to be equipped for unforeseen events.

Figure 1: Research Paradigm



1.2. Statement of the Problem

This study was conducted to formulate mathematical model through Seasonal Autoregressive Integrated Moving Average (SARIMA), to identify the significant factors that can actually predict the Dependent Variable Real GDP and to identify the Granger cause between the variables. In particular, the point of the study was to answer the following questions:

1. What is the behavior of graph of the following variables?
    1.1. Consumer Spending (x_1)
    1.2. Government Spending (x_2)
    1.3. Capital Formation (x_3)
    1.4. Exports (x_4)
    1.5. Imports (x_5)
    1.6. Real Gross Domestic Product (y)

2. Is there a significant relationship between the Dependent and the Independent Variables?
3. What mathematical model can be formulated through Seasonal Autoregressive Integrated Moving Average to forecast Real GDP from 1st Quarter 2014 to 4th Quarter 2020?
4. What are the significant factor(s) that can actually affect(s) the Real Gross Domestic Product (y)?
5. Is there a significant difference between the Actual and Predicted value of Real Gross Domestic Product (y)?
6. Is there a Cointegration between the Dependent and the Independent Variables?
7. Is there a Granger Causal relationship between the Dependent and the Independent Variables?

1.3. Scope and Limitation

The scope of the study covers the data from 1st Quarter of 1990 to 4th Quarter of 2013 considering the Independent Variables: Consumer Spending (x_1), Government Spending (x_2), Capital Formation (x_3), Exports (x_4) and Imports (x_5) with Dependent Variable Real Gross Domestic Product (y) (See Appendix A: Table 1) gathered from National Statistical Coordination Board. In addition, this study will forecast the Dependent Variable Real Gross Domestic Product (y) from 1st Quarter of 2014 to 4th Quarter of 2020.

Review of Related Literature

Mishra, P.K. (2011) attempts to investigate the dynamics of the relationship between real consumption expenditure and economic growth for the sample period of 1950-51 to 2008-09 in a developing country like India. It is a general consensus that the economic growth in developing countries is necessarily consumption-led instead of production / investment-led. The reason might be that the share of consumption (private) in Gross Domestic Product (GDP) in these economies usually ranges between 70 to 75 percent. Consumption expenditure with its dominant share in GDP is bound to contribute the most in real GDP growth. [1]

Komain Jiranyakul (2013). The main objective of this study is to examine the relationship between government expenditures and economic growth of Thailand. Several researchers use Granger causality test to see whether government expenditures cause economic growth or economic growth causes government expenditures. However, empirical results give different conclusions. The main results show that aggregate government expenditures cause economic growth, but economic growth does not cause government expenditures to expand. Therefore, there is a unidirectional causality between government expenditures and economic growth. [2]

Vinothiny Subramaniam, Dr Lim Hock-Eam, Ramesh Kumar Moona Hj Mohd, Charles Ramendran SPR & Rajaletchumy Mani (2012). This study explores the relationship between Malaysia's capital outflows and real GDP during the time period of 1971 to 2010. The capital outflows have negative relationship with real GDP, and the real GDP by disaggregate sectors with significant p-values based on multiple regression results and Pearson correlation analysis. As a conclusion, this study concludes that capital outflows has significant and strong negative relationship with real GDP, and disaggregate sectors. The relationship between real GDP and capital outflow are based on capital flows data which is combination of capital inflows and capital outflows. The capital flows data are used to analyze in this research due to unavailability of capital outflow data. [3]

Shafaqat Mehmood (2012). This study investigates by using the multiple regression models for effect of some factors on the GDP and found that in Pakistan Gross National: Expenditures, Goods Exports, Gross Saving and Final Consumption Expenditure have a positive effect on the GDP. But the factors such as External Debts Total Stock and Services Exports have a negative effect on the GDP of Pakistan. In case of Bangladesh, this study found that factor such as Gross National Expenditures, External Debts Stock Total, Goods Imports and Goods Exports have positive effect on the GDP of Bangladesh but the factor as Final Consumption Expenditure has negative effect on the GDP of Bangladesh. [4]

Gomez-Zaldivar (2009) further investigated the causality between consumption and GDP for Mexico and US. The results reveal that there is no evidence of either causality or cointegration between the Mexican series for consumption and GDP, but in case of the US series, the evidence of causality from consumption to GDP is there along with the evidence of cointegration. [5]

I. Szarowská (2011) aims to provide direct empirical evidence on business cycle relations between economic growth and government spending in the Czech Republic from 1995 to 2008. The results of Johansen cointegration test proved the existence of long run positive relationship between GDP and total government spending, public order and safety and economic affairs spending functions. As findings verify, they tend to follow GDP and adapt to GDP changes. Tests indicated no cointegration between GDP and other government spending functions. [6]

Mohsen Mehrara and Bagher Adabi Firouzjaee (2011). The results indicate that there are long-run equilibrium relationships between export and GDP in both groups of oil and nonoil developing countries in bi- and tri-variate models. Also, we found strong evidence of bidirectional long-run causality between export and GDP growth in both groups of countries and models. Although, it is shown that there is no short-run causality relationship between export growth and economic growth in oil-rich countries in any bi- and tri- variate models. But for nonoil developing countries, the results show a bidirectional short-run causality between export and GDP growth in bi-variate model. Overall, the joint F-statistics for the short- and long- sun causalities implies bidirectional causality between export and GDP for sample developing countries. In summary, export-based growth theory where, export growth is one of the fundamental reasons for economic growth in developing countries is accepted at least in long run. Moreover, GDP growth through improvement of human capital, labor force skills and technology development prepares required institutional backgrounds for more export. [7]

Methodology

3.1. Statistical Tool

The statistical spreadsheet software Econometrics Views 7 (EViews7) was utilized by the researchers in assessing time series forecasting procedures as well as dealing with cointegration and causal relationships between the variables. In addition, Statistical Package for the Social Sciences (SPSS), a software package for statistical analysis, was also used to identify the significant factors that can actually affect the Dependent Variable.

3.2. Statistical Treatment

3.2.1. Seasonal Autoregressive Moving Averages (SARIMA) Modeling

The researchers used the Seasonal Autoregressive Moving Averages (SARIMA) model in forecasting the Philippine Real Gross Domestic Product (RGDP) from the First Quarter of 2014 to Fourth Quarter of 2020 by applying the Box-Jenkins Approach.

SARIMA modeling is a special case of ARIMA modeling applied to time series data with seasonal components. The general form of seasonal model is ***SARIMA (p, d, q) x (P, D, Q)$_n$*** denoted as: [8]

$$\boldsymbol{\Phi_P(B^s)\phi(B)\nabla_s^D\nabla^d x_t = \Theta_Q(B^s)\theta(B)w_t}$$

where, $\boldsymbol{w_t}$ is the non-stationary time series and $\boldsymbol{s}$ is the period of time series of order *n*; $\boldsymbol{\phi(B)}$ and $\boldsymbol{\theta(B)}$ are the ordinary autoregressive and moving average components of orders *p* and *q*; $\boldsymbol{\Phi_P(B^s)}$ and $\boldsymbol{\Theta_Q(B^s)}$ are the seasonal autoregressive and moving average components of orders *P* and *Q*; $\boldsymbol{\nabla^d}$ and $\boldsymbol{\nabla_s^D}$ are the ordinary and seasonal difference components of orders *d* and *D*; and $\boldsymbol{B}$ is the backshift operator.

3.2.2. Box-Jenkins Methodology

Box-Jenkins methodology is a method developed by G.E.P. Box and G.M. Jenkins that "uses an approach to describe the trend and seasonal effects in time series data that is quite different from the approach taken by regression and exponential smoothing". It is effective at modeling stochastic trend and seasonal components. In Box-Jenkins modeling, the forecasted time series values are predicted by using the past values of the time series and/or past random shocks. [9]

This methodology is composed of three phases: (1) model identification, (2) model estimation, and (3) verification (diagnostic checking). [10]

1. Model Identification. Autoregressive and Moving Average orders as well as the integrated orders were tentatively identified to create a combination of models. Before identifying the orders, the researchers first

looked for the existence of the seasonality in the time series by examining its correlogram as well checked for the stationarity of the time series through Unit Root Test using Augmented Dickey Fuller test (ADF). A time series is stationary when its mean, variance and autocorrelation are all constant over time. [11]. When the time series contains seasonality, a seasonal differencing was applied to eliminate its existence. And when the time series is nonstationary, a regular differencing was applied to make it stationary. In identifying the possible models to be used, the correlogram of deseasonalised and stationary data was viewed to identify the significant spikes representing the orders. Using these significant spikes, combinations of models were formed.

2. Model Estimation. The best fitted model was chosen by estimating and examining the parameters of all the possible models by means of R-squared and Durbin-Watson Test.
3. Verification (Diagnostic Checking). The predicted values forecasted though the chosen best-fitted model were subjected into Paired T-Test with the actual values to verify the accuracy of the model.

3.2.2.1. *Augmented Dickey-Fuller Test*

Augmented Dickey-Fuller Test (ADF) is a statistical test for a unit root that was utilized in checking for the stationarity of the time series data. It is expressed as: [12]

$$Y_t = \alpha + \rho Y_{t-1} + \beta_t + e_t$$

where, t is the time index, α is an intercept constant, β_t is the coefficient on a time trend, ρ is the coefficient presenting process root, and e_t is the residual term.

3.2.2.2. Correlogram

Correlogram is the graphical representation of the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PCF). The overall behavior of correlogram and significant spikes of the ACF and PCF is used to identify the orders of AR and MA respectively. [13]

ACF is the correlation between series values that are k intervals apart. It is examine to identify the MA orders [13]. It is formulated as: [14]

$$\rho_k = \frac{\sum_{t=k+1}^{r}(Y_t - \bar{Y})(Y_{t-k} - \bar{Y})}{\sum_{t=1}^{r}(Y_t - \bar{Y})^2}$$

where, ρ_k is the ACF coefficient in lag k, t is the amount of observed periods, Y_t is the observation in t period, $\bar{Y}$ is the mean, and Y_{t-k} is the observation in t – k period.

PCF is the correlation between series values that are k intervals apart, accounting for the values of the intervals between. It is examine to identify the AR orders. [13]

3.2.2.3. Paired T-Test

Paired T-Test is a statistical test that examines two related sample means for the purpose of finding out whether these samples varies from each other in a significant manner based on the assumption that the paired differences are independent and normally distributed. It is formulated as: [15]

$$t = \frac{\bar{d} - \mu_d}{\frac{S_d}{\sqrt{n}}}, \quad df = n - 1$$

where, $\bar{d}$ is the mean of the paired difference, μ_d is the hypothesized difference, S_d is the standard deviation of the paired difference, and n is the size of the time series.

3.2.3. Multiple Linear Regression

Multiple Linear Regression (MLR) is a statistical approach wherein the independent variables are used to predict the future value of the dependent variable. It also models the relationship between two or more variables through fitting a linear equation to the observed data. It is expressed as [16]:

$$\boldsymbol{y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_p x_p + e_i}$$

where, $\boldsymbol{\beta_0}$ is the intercept, $\boldsymbol{\beta_{1,\ldots,}}$ $\boldsymbol{\beta_2}$ are the parameters representing the contribution of independent variables, and $\boldsymbol{x_1,\ldots,x_2}$ are the independent variables.

3.2.3.1. Stepwise Multiple Linear Regression

Stepwise Multiple Linear Regression is a regression method used to find out the best combination of independent variable to predict the dependent variable. It eliminates the unnecessary independent variable one step at a time based on statistical criteria [17].

3.2.4. Johansen Cointegration Test

Johansen Cointegration Test is a statistical test used to detect the presence of cointegration between the independent variables and the dependent variable. [18]

3.2.5. Granger Causality Test

Granger Causality Test is a statistical test that measures only the precedence and information content but not indicates the common use of them. It is based on the idea that variable x granger causes variable y if variable y can be better predicted by the historical values of both x and y than it can be predicted using the historical value of y. [19]

By using the following model the causality between two variables can be tested. [20]

$$Y_t = b_0 + \Sigma^m_{j=0} a_j X_{t-j} + \Sigma^m_{i=1} b_i Y_{t-i} + u_t$$
$$X_t = c_0 + \Sigma^m_{i=1} c_i X_{t-1} + \Sigma^m_{j=0} d_j Y_{t-j} + v_t$$

where, $\mathbf{u_t}$ and $\mathbf{v_t}$ are mutually uncorrelated white noise series. Testing the null hypotheses that $a_j = d_j = 0$ for all j (j=0, 1…m) against the alternative hypotheses that $a_j \neq 0$ and $d_j \neq 0$ for atleast some js will determine the direction of the relationship between X and Y.

Results and Discussions

4.1. Behavior of the graph of Dependent and Independent Variables.

1.1. Consumer Spending (X_1)

The graph of Consumers Spending (See Appendix B: Figure 1) exhibits an upward trend and seasonal pattern with the highest Consumer Spending in every Fourth Quarter of the years. This may be an effect of the customary celebration of the Filipinos wherein they spend more every Fourth Quarter (particularly during All Soul's Day, Christmas Season and New Year's Eve) and spend less during the First Quarter as result of too many disbursements they incurred on the last Quarter. Based on quarter analysis, in First Quarter of every year, the highest increase of 6.85 percent was noted in year 2012 while the lowest one with 1.85 percent in year 2009. For the Second Quarter, the highest growth was recorded in year 1998 having 7.06 percent and lowest growth of 1.92 percent in year 2010. In Third Quarter, maximum boost was observed in year 2011 with 6.81 percent while its minimum having 0.63 percent only in 2009. For the last Quarter, it obtained the climax of 6.22 percent at year 2012 and dip of 0.81 percent in year 1991.

1.2. Government Spending (x_2)

The graph of Government Spending (See Appendix B: Figure 2) reveals minimal changes from First Quarter of 1990 to Third Quarter of 1999 having its lowest point in Third Quarter of 1992. It was followed by slight increase of 8.45 percent in Second Quarter of 1997 with consecutive minor changes until Fourth Quarter of 2004. The remaining years shows significant changes until it reach its peak in Second Quarter of 2013. The expansion of Government Spending started with the double-digit growth of 13.2 percent in the First Quarter of 2013 due to release of allotments to different departments/agencies for the implementation of their programs/projects.

1.3. Capital Formation (x_3)

The graph of Capital Formation (See Appendix B: Figure 3) exhibits a fluctuating trend caused by the recessions experienced by the Philippines during the past decades; this recession affects the country's economic activity, thus being the cause of economic instability. It can be illustrated in here that capital formation dropped on the Fourth Quarter of 1998. It reached its lowest level with a negative 44.75 percent decrease, since in that time the Philippines was affected by the widespread effect of the "1997-98 Asian Financial Crisis" which is caused by the severe decline on the value of currencies and equities of different Asian countries. Then on the Second Quarter of 2001, it reached its peak with an increase of 52.86 percent due to the efforts of Former President Gloria Macapagal-Arroyo to draw reforms for the economic recovery of the Philippines.

1.4. Exports (x_4)

It can be noted from the graph of Exports (See Appendix B: Figure 4) that from First Quarter of 1990 to Fourth Quarter of

2013, the Exports reached its highest growth of 32.21 percent on First Quarter of 2012 after two consecutive negative growths on Third and Fourth Quarter of 2011 with 4.39 percent and 21.93 percent, respectively. The two consecutive declines can be the effect of the United States Debt Ceiling crisis since US is one of the major trade partners of the Philippines side by side with Japan. However, the Exports reached its lowermost growth of negative 27.53 percent on Fourth Quarter of 2010 after 3 continuous declines on the growth of First, Second and Third Quarter of the same year with 28.44 percent, 17.30 percent and 7.01 percent respectively.

1.5. Imports (x_5)

It can be noted from the graph of Imports (See Appendix B: Figure 5) that from First Quarter of 1990 to Fourth Quarter of 2013, the Imports reached its highest growth of 31.69 percent on First Quarter of 2000 after a sharp decrease of negative 22.93 percent on the Fourth Quarter of 1999. However, the Imports reached its lowermost growth of negative 25.65 percent on Fourth Quarter of 1998.

1.6. Real Gross Domestic Product (y)

The Real Gross Domestic Product (See Appendix B: Figure 6) exhibits an upward trend and seasonality with short-term regular variations that represents the decrease of goods produced every First Quarter and boosts every Fourth Quarter wherein the needs for goods are greater. It indicates a great fall on the Fourth Quarter of 1998 with a decrease of negative 3.11 percent caused by Asian Financial Crisis that was still felt during those times. However, on the Second Quarter of 2010 Real GDP reached its peak at an increase of 8.91 percent as an effect of the continuous rise of exports and remittances in the Philippines as well as numerous business gains were accomplished during this time. Based on the quarterly breakdown, it can be seen that on the first quarter of every year, RGDP attained its lowest, with a negative 0.137 on the year of 1991 and its highest increase on the year 2010 with 8.41 percent. And on the Second Quarter of every year, it achieved its peak on the year 2010 with 8.91 percent and dropped down with a negative 1.26 percent decrease on the year 1991. For the Third Quarter, it is observed that on the year 1991 it sink down up to -1.90 percent and ascend up to 7.34 percent on the year 2012. Then on the Fourth Quarter, it had declined up to negative 3.11 percent on the year 1998 and escalated up to 7.07 percent on the year 2012.

4.2. Significant relationship of the Dependent to the Independent Variables

The significant relationship of the Dependent to the Independent Variables was ascertained by Pearson's coefficient of correlation and a Scatter Diagram through the use of the statistical software SPSS.

The result of Pearson's coefficient of correlation (See Appendix C: Table 2) reveals that there is a significant correlation and linear relationship between the Dependent and Independent Variables at 1 percent level of significance. The correlation coefficient of the Real GDP with itself results to 1 showing a perfect positive correlation. The Government Spending and Capital Formation show a positive correlation with Real GDP, having a correlation coefficient of 0.804 and 0.790 respectively. The Consumer Spending, Exports and Imports show a strong positive correlation with Real GDP having a correlation coefficient of 0.992, 0.900 and 0.903 respectively.

The scatter plot (See Appendix C: Figure 7) shows a positive significant correlation and linear relationship between Dependent Variable Real Gross Domestic Product (y) and

Independent variables: Government Spending (x_2) and Capital Formation (x_3). As well as a strong positive significant correlation and linear relationship between Dependent Variable Real Gross Domestic Product (y) and Independent Variables: Consumer Spending (x_1), Exports (x_4) and Imports (x_5) given that the resulted p-value of the Independent Variables were all less than $\alpha = 0.01$.

4.3. Proposed mathematical model through Seasonal Autoregressive Integrated Moving Average to forecast Real GDP from 1st Quarter 2014 to 4th Quarter 2020.

In formulating a mathematical model for Real Gross Domestic Product using Seasonal Autoregressive Integrated Moving Average, the researchers performed statistical tests in Eviews7 to arrive for the best fitted model.

1. Model Identification. The Real Gross Domestic Product exhibits a seasonal pattern and nonstationarity (See Appendix D: Figure 8) indicating the existence of seasonality and a constant mean, variance and autocorrelation over time. A seasonal differencing was applied that eliminated the seasonal component of the time series. The removal of seasonality was achieved using seasonal differencing (See Appendix D: Figure 9). A Unit Root Test was conducted after deseasonalising the time series, indicating that it still exhibits nonstationarity. (See Appendix D: Table 3). A regular differencing was applied at deseasonalised time series that made it stationary. Stationarity was obtained at second regular differencing and proved by Augmented-Dickey Fuller Test a kind of Unit Root Test (See Appendix D: Table 4). The correlogram of deseasonalised and stationary data (See Appendix D: Figure 10) was viewed to aid the researchers in identifying the significant spikes to be used in building combination of models. The significant spikes identified by the researchers are ar(1) ar(2) ar(5) ar(9) ma(1) ma(12) ma(45) and sma(12).

2. Model Estimation. Out of 160 combinations of models, only 18 of these were of candidate (See Appendix D: Table 5) to be the best-fitted model. And the chosen best-fitted model was ar(1) ar(2) ar(5) ar(9) ar(11) ma(1) sma(12) with an R-squared of 0.989052 and a Durbin-Watson Coefficient of 2.165376.

4.4. Significant factor(s) that can actually affect(s) the Real Gross Domestic Product (y).

In identifying the significant factors, the researchers conduct a regression analysis through SPSS.

The result of Regression Analysis (See Appendix E: Table 6) reveals that all of the five Independent Variables: Consumer Spending (x_1), Government Spending (x_2), Capital Formation (x_3), Exports (x_4) and Imports (x_5) are significant factors of the Dependent Variable Real Gross Domestic Product (y) at 1 percent level of significance.

4.5. Significant difference between the Actual and Predicted value of Real Gross Domestic Product (y).

The Actual Values and Predicted Values obtained using the best fitted model (See Appendix F: Table 7) was subjected into a Paired T-Test that tested their significant difference, verifying the accuracy of the model in forecasting. The result of the Paired T-Test (See Appendix F: Table 8) shows a p-value of 0.6735 indicating that there is no significant difference between the Actual and Predicted Values. Having verifying its accuracy, the best fitted model was then used to forecast the Philippine Real Gross Domestic Product for First Quarter of 2014 to Fourth Quarter of 2020 and presented in a graph together with the Actual Data from First Quarter of 1990 to Fourth Quarter of 2013 (See Appendix F: Figure 11).

4.6. Existence of Cointegration between the Dependent and Independent Variables.

The Johansen Cointegration Test between the Dependent and Independent Variables was tested in Eviews 7. In analyzing the results, the Trace Test and Maximum Eigenvalue were taken into account.

Under Trace Test (See Appendix G: Table 9), the Null Hypothesis: Hypothesized No. of Cointegration Equation(s) was rejected at None, with a p-value of 0.0017. While under Maximum Eigenvalue (See Appendix G: Table 10), the Null Hypothesis: Hypothesized No. of Cointegration Equation(s) was rejected at None, with a p-value of 0.0055.

The result of Johansen Cointegration Test under both the Trace Test and Maximum Eigenvalue indicates that a long-run relationship exists between the Dependent and the Independent Variables.

4.7. Granger Causal relationship between the Dependent and Independent Variables.

Pairwise Granger Causality Test was performed to examine Granger Causal relationship between the Dependent and Independent Variables.

The result of Pairwise Granger Causality Test (See Appendix H: Table 11) reveals that Real GDP granger causes Government Spending as well as the Imports having a p-value 0.0017 and 0.0039, respectively. This indicates that there exists a Unidirectional Granger Causality between the Real Gross Domestic Product and the Government Spending and Imports.

Conclusions and Recommendations

5.1. Conclusions

Based on the presented findings, the following conclusions were drawn:

The graph of Real Gross Domestic Product and Consumer Spending both exhibit seasonality and upward trend while, Government Spending, Capital Formation, Exports and Imports have fluctuating trend. It implies that Consumer Spending is a key indicator of Philippine Real Gross Domestic Product. The proposed mathematical model obtains from Seasonal Autoregressive Integrated Moving Average for Real Gross Domestic Product is: Combination of best fitted Model: ar(1) ar(2) ar(5) ar(9) ar(11) ma(1) sma(12) and Best fitted SARIMA Model: *SARIMA (5,2,1) x (0,1,1)*$_4$ The Paired T-Test results to 0.8102 showing that there is no significant difference between the Actual and Predicted Value. All the five Independent Variables: Consumer Spending (x_1), Government Spending (x_2), Capital Formation (x_3), Exports (x_4) and Imports (x_5) are significant factors of Dependent Variable Real Gross Domestic Product (y) all having p-values of 0.000. The Government Spending and Capital Formation show a positive correlation with Real GDP at a p-value of 0.804 and 0.790 respectively while Consumer Spending, Exports and Imports show a strong positive correlation with Real GDP having a p-value of 0.992, 0.900 and 0.903 respectively. Significant values of Independent Variables indicate a significant correlation and linear relationship with the Dependent Variable. Unidirectional granger causality exists between the variables where in Real GDP granger cause Government and Real GDP granger cause Imports with p-value of 0.0017 and 0.0039 respectively.

5.2. Recommendation

Since this paper conclude that all of the five (5) Independent Variables: Consumer's Spending, Government's Spending, Capital Formation, Exports and Imports are significant factors of Real Gross Domestic Product, the government should focus on implementing programs to improve these factors. As for the analysis of the behavior of the graphs of each variable, it shows that the Philippine is a consumer-driven economy because it's the most influential factor of Real GDP as verified by the research done by Ken Karl Chua and his team, wherein they have concluded that higher growth of the economy was brought by high private consumption and construction. Thus, for the government to aim for a greater growth on Real GDP it must work on achieving greater growth on the following independent variables with more concentration in uplifting the Consumer's spending.

References

[1] Mishra, P.K. (2011). Dynamics of the relationship between real consumption expenditure and economic growth in India. ISSN: 0972-5784
http://www.freepatentsonline.com/article/Indian-Journal-Economics-Business/278509633.html

[2] The Relation between Government Expenditures and Economic Growth in Thailand; Komain Jiranyakul; National Institute of Development Administration; May 2, 2013
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2260035

[3] Vinothiny Subramaniam, Dr Lim Hock-Eam, Ramesh Kumar Moona Hj Mohd, Charles Ramendran SPR & Rajaletchumy Mani (2012). "The relationships between capital outflows and real GDP product of Malaysia"; Electronic copy

available at: http://ssrn.com/abstract=2121763
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2121763

[4] Shafaqat Mehmood Resource Mentors (Pvt,) Ltd., Lahore, Pakistan (2012) "Effect of Different Factors on Gross Domestic Product: A Comparative Study of Pakistan and Bangladesh" http://aocrj.org/wp-content/uploads/2013/04/AOCRJ-V1I1P2-Effect-of-Different-Factors-on-Gross-Domestic-Product.pdf

[5] Gomez-Zaldivar, M., Ventosa-Santaularia, D., (2009), "The Bilateral Relationship between Consumption and GDP in Mexico and the US: A Comment", Applied Econometrics and International Development, Vol. 9, No. 1, pp. 77-90.

[6] I. Szarowská; August 29, 2011 "RELATIONSHIP BETWEEN GOVERNMENT SPENDING AND ECONOMIC GROWTH IN THE CZECH REPUBLIC"

[7] Granger Causality Relationship between Export Growth and GDP Growth in Developing Countries: Panel Cointegration ApproachInternational Journal of Humanities and Social Science Vol. 1 No. 16; November 2011 http://www.ijhssnet.com/journals/Vol_1_No_16_November_2011/25.pdf

[8] Chang Xinghuaet. al., 2012,"SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE MODEL FOR PRECIPITATION TIME SERIES" thescipub.com/pdf/10.3844/jmssp.2012.500.505

[9]http://canmedia.mcgrawhill.ca/college/olcsupport/bowerman/2ce/Appendices/End%20of%20Text%20Appendices%20Coursewide/bow02371_OLC_appI.pdfzzzz

[10] O. D Anderson; The Box-Jenkins approach to time series analysis;https://www.youtube.com/watch?v=FK-jydmaK8http://archive.numdam.org/ARCHIVE/RO/RO_1977__11_1/RO_1977__11_1_3_0/RO_1977__11_1_3_0.pdf

[11] Stationarity and differencing http://people.duke.edu/~rnau/411diff.htm

[12] http://prr.hec.gov.pk/Chapters/370S-5.pdf

[13] Autocorrelation and Partial Autocorrelation Functions
http://pic.dhe.ibm.com/infocenter/spssmodl/v15r0m0/index.jsp?topic=%2Fcom.ibm.spss.modeler.help%2Ftimeseries_acf_pacf.htm

[14] Correlogram Overview
http://www.zaitunsoftware.com/book/export/html/46

[15] Statistics Tutorial; Paired t-test
http://www.gla.ac.uk/sums/users/jdbmcdonald/PrePost_TTest/pairedt2.html

[16] http://www.stat.yale.edu/Courses/1997-98/101/linmult.htm

[17]http://www.oswego.edu/Documents/psychology/spss/mregress.pdf

[18] Panel Cointegration Analsis of Government Spending, Exports, Imports and Economic Growth. Rabia Nazir
http://www.academia.edu/6690867/Panel_Cointegration_Analsis_of_Government_Spending_Exports_Imports_and_Economic_Growth

[19] How Non-Financial Customer Based Metrics are Associated with Company Performance? An Analysis of Customer Satisfaction, Customer Retention and Net Promoter Score in Telecommunications Industry
http://epub.lib.aalto.fi/en/ethesis/pdf/12685/hse_ethesis_12685.pdf

[20] Anwer, M.S. & Sampath, R.K. 1999. Investment and Economic Growth.
http://ageconsearch.umn.edu/bitstream/35713/1/sp99an01.pd

APPENDICES

Figure 1 Exchange rate (x_1)

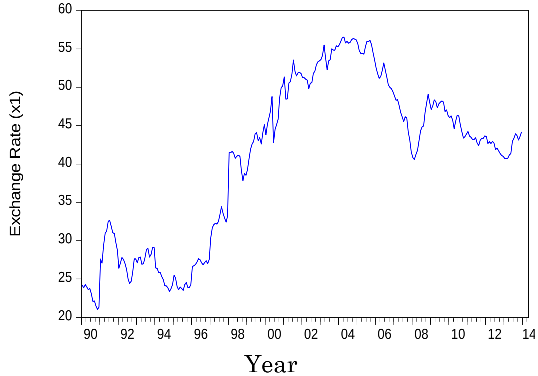


Figure 2 Crude Oil Price (x_2)

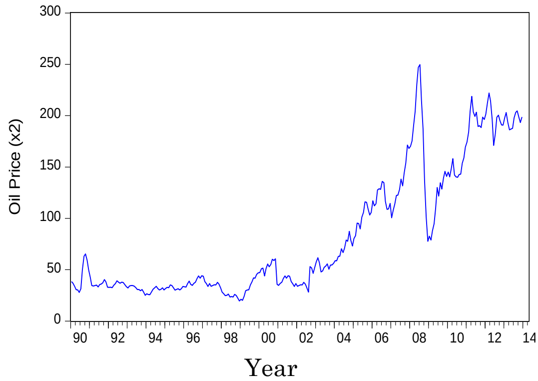


Figure 3 Inflation Rate (x_3)

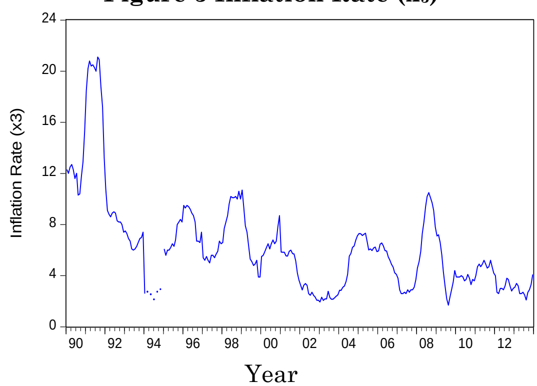


Figure 4 Interest Rate (x_4)

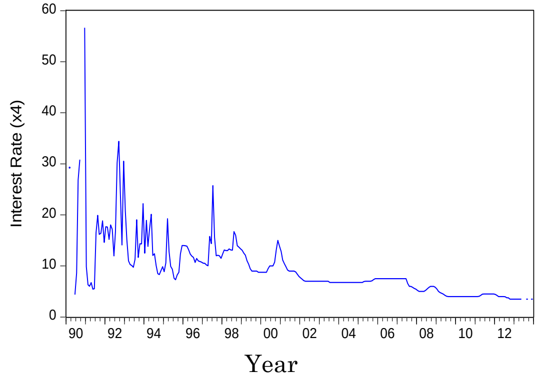


Figure 5 Imports (y_1)

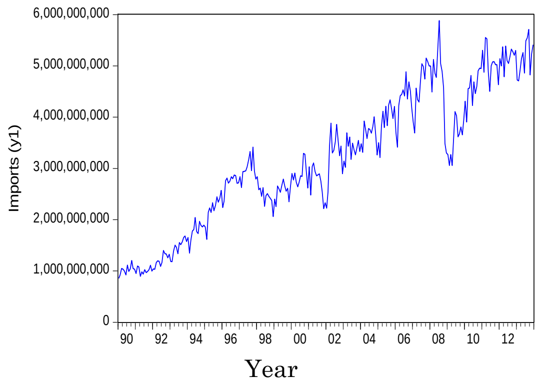


Figure 6 Exports (y_2)

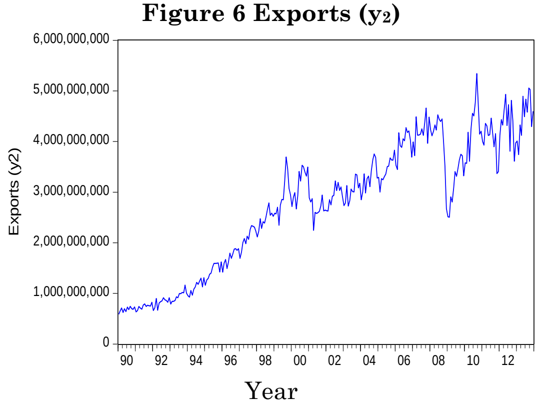


Figure 7 Graph of Import (Seasonally Differenced)

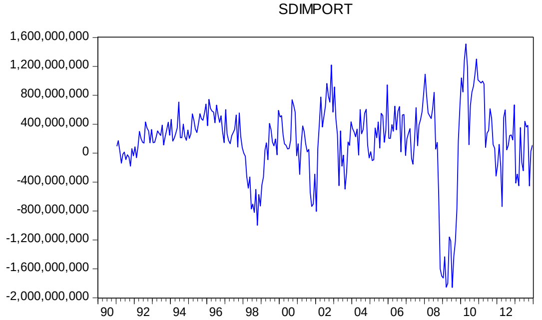


Figure 8 Graph of Export (Seasonally Differenced)

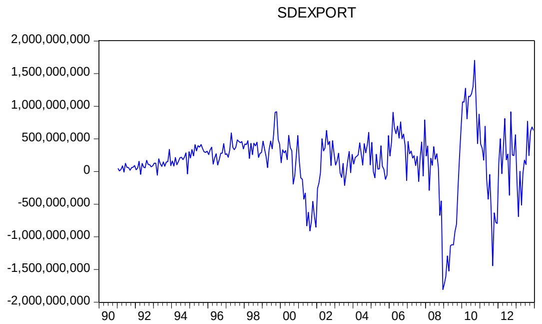


Figure 9 Graph of Export (Seasonally Differenced with 1st Regular Differencing)

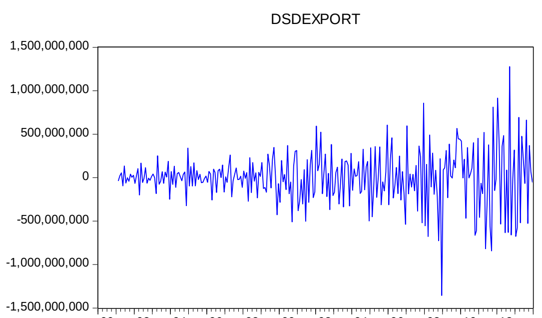


Figure 8 Graph of Export (Seasonally Differenced with 2nd Regular Differencing)

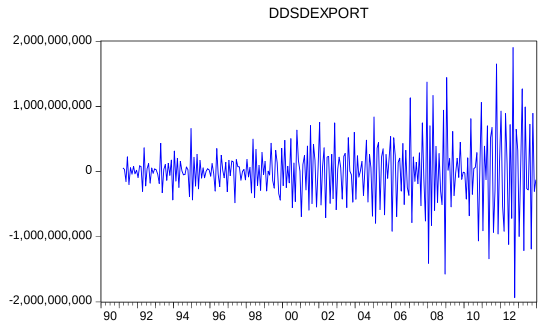
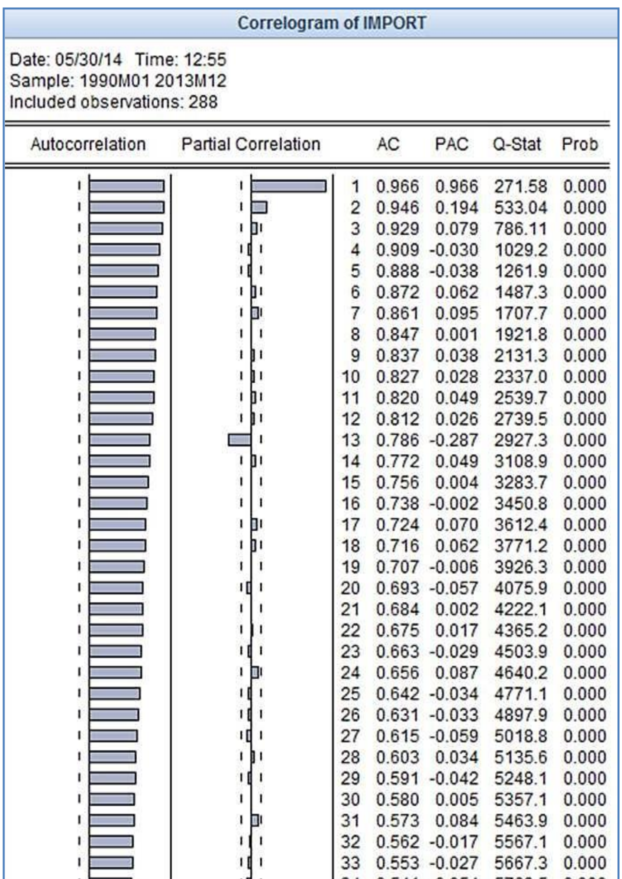


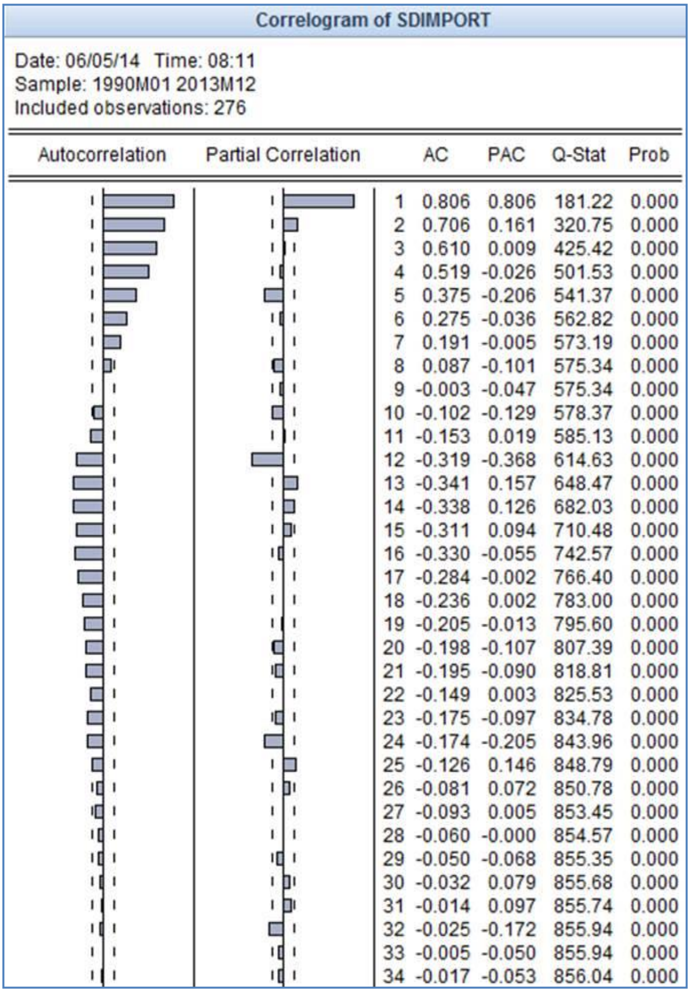
Figure 9 Correlogram of Import


Correlogram of IMPORT

Date: 05/30/14 Time: 12:55
Sample: 1990M01 2013M12
Included observations: 288

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.966	0.966	271.58	0.000
		2	0.946	0.194	533.04	0.000
		3	0.929	0.079	786.11	0.000
		4	0.909	-0.030	1029.2	0.000
		5	0.888	-0.038	1261.9	0.000
		6	0.872	0.062	1487.3	0.000
		7	0.861	0.095	1707.7	0.000
		8	0.847	0.001	1921.8	0.000
		9	0.837	0.038	2131.3	0.000
		10	0.827	0.028	2337.0	0.000
		11	0.820	0.049	2539.7	0.000
		12	0.812	0.026	2739.5	0.000
		13	0.786	-0.287	2927.3	0.000
		14	0.772	0.049	3108.9	0.000
		15	0.756	0.004	3283.7	0.000
		16	0.738	-0.002	3450.8	0.000
		17	0.724	0.070	3612.4	0.000
		18	0.716	0.062	3771.2	0.000
		19	0.707	-0.006	3926.3	0.000
		20	0.693	-0.057	4075.9	0.000
		21	0.684	0.002	4222.1	0.000
		22	0.675	0.017	4365.2	0.000
		23	0.663	-0.029	4503.9	0.000
		24	0.656	0.087	4640.2	0.000
		25	0.642	-0.034	4771.1	0.000
		26	0.631	-0.033	4897.9	0.000
		27	0.615	-0.059	5018.8	0.000
		28	0.603	0.034	5135.6	0.000
		29	0.591	-0.042	5248.1	0.000
		30	0.580	0.005	5357.1	0.000
		31	0.573	0.084	5463.9	0.000
		32	0.562	-0.017	5567.1	0.000
		33	0.553	-0.027	5667.3	0.000
		34	0.541	-0.054	5763.5	0.000

Figure 10 Correlogram of Import (Seasonally Differenced)

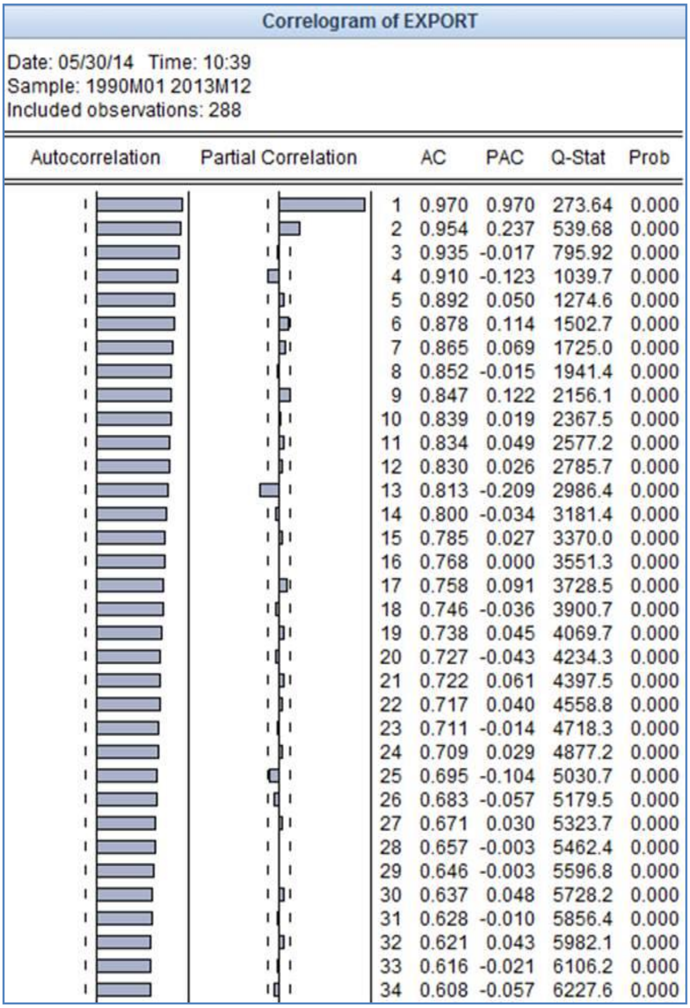


Correlogram of SDIMPORT

Date: 06/05/14 Time: 08:11
Sample: 1990M01 2013M12
Included observations: 276

	AC	PAC	Q-Stat	Prob
1	0.806	0.806	181.22	0.000
2	0.706	0.161	320.75	0.000
3	0.610	0.009	425.42	0.000
4	0.519	-0.026	501.53	0.000
5	0.375	-0.206	541.37	0.000
6	0.275	-0.036	562.82	0.000
7	0.191	-0.005	573.19	0.000
8	0.087	-0.101	575.34	0.000
9	-0.003	-0.047	575.34	0.000
10	-0.102	-0.129	578.37	0.000
11	-0.153	0.019	585.13	0.000
12	-0.319	-0.368	614.63	0.000
13	-0.341	0.157	648.47	0.000
14	-0.338	0.126	682.03	0.000
15	-0.311	0.094	710.48	0.000
16	-0.330	-0.055	742.57	0.000
17	-0.284	-0.002	766.40	0.000
18	-0.236	0.002	783.00	0.000
19	-0.205	-0.013	795.60	0.000
20	-0.198	-0.107	807.39	0.000
21	-0.195	-0.090	818.81	0.000
22	-0.149	0.003	825.53	0.000
23	-0.175	-0.097	834.78	0.000
24	-0.174	-0.205	843.96	0.000
25	-0.126	0.146	848.79	0.000
26	-0.081	0.072	850.78	0.000
27	-0.093	0.005	853.45	0.000
28	-0.060	-0.000	854.57	0.000
29	-0.050	-0.068	855.35	0.000
30	-0.032	0.079	855.68	0.000
31	-0.014	0.097	855.74	0.000
32	-0.025	-0.172	855.94	0.000
33	-0.005	-0.050	855.94	0.000
34	-0.017	-0.053	856.04	0.000

Figure 11 Correlogram of Export

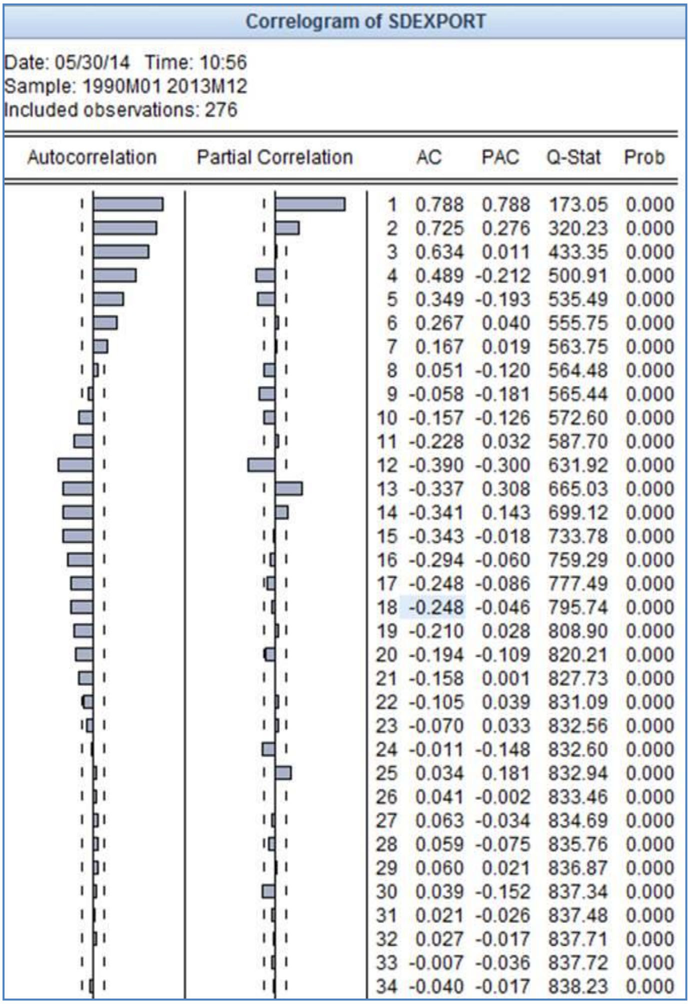


Correlogram of EXPORT

Date: 05/30/14 Time: 10:39
Sample: 1990M01 2013M12
Included observations: 288

Lag	AC	PAC	Q-Stat	Prob
1	0.970	0.970	273.64	0.000
2	0.954	0.237	539.68	0.000
3	0.935	-0.017	795.92	0.000
4	0.910	-0.123	1039.7	0.000
5	0.892	0.050	1274.6	0.000
6	0.878	0.114	1502.7	0.000
7	0.865	0.069	1725.0	0.000
8	0.852	-0.015	1941.4	0.000
9	0.847	0.122	2156.1	0.000
10	0.839	0.019	2367.5	0.000
11	0.834	0.049	2577.2	0.000
12	0.830	0.026	2785.7	0.000
13	0.813	-0.209	2986.4	0.000
14	0.800	-0.034	3181.4	0.000
15	0.785	0.027	3370.0	0.000
16	0.768	0.000	3551.3	0.000
17	0.758	0.091	3728.5	0.000
18	0.746	-0.036	3900.7	0.000
19	0.738	0.045	4069.7	0.000
20	0.727	-0.043	4234.3	0.000
21	0.722	0.061	4397.5	0.000
22	0.717	0.040	4558.8	0.000
23	0.711	-0.014	4718.3	0.000
24	0.709	0.029	4877.2	0.000
25	0.695	-0.104	5030.7	0.000
26	0.683	-0.057	5179.5	0.000
27	0.671	0.030	5323.7	0.000
28	0.657	-0.003	5462.4	0.000
29	0.646	-0.003	5596.8	0.000
30	0.637	0.048	5728.2	0.000
31	0.628	-0.010	5856.4	0.000
32	0.621	0.043	5982.1	0.000
33	0.616	-0.021	6106.2	0.000
34	0.608	-0.057	6227.6	0.000

Figure 12 Correlogram of Export (Seasonally Differenced)

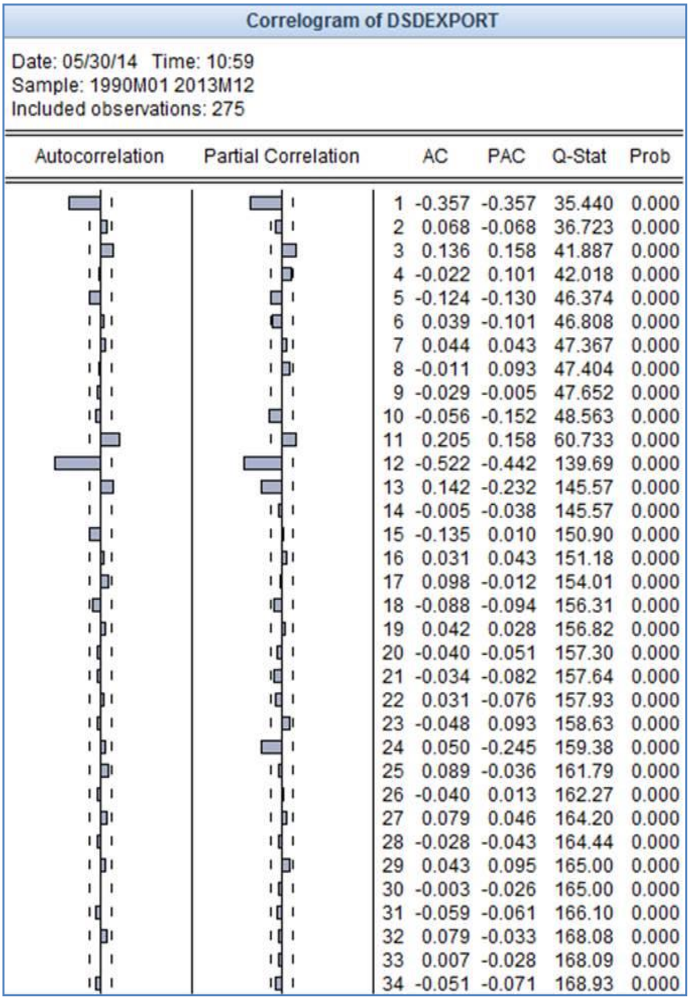


Correlogram of SDEXPORT

Date: 05/30/14 Time: 10:56
Sample: 1990M01 2013M12
Included observations: 276

	AC	PAC	Q-Stat	Prob
1	0.788	0.788	173.05	0.000
2	0.725	0.276	320.23	0.000
3	0.634	0.011	433.35	0.000
4	0.489	-0.212	500.91	0.000
5	0.349	-0.193	535.49	0.000
6	0.267	0.040	555.75	0.000
7	0.167	0.019	563.75	0.000
8	0.051	-0.120	564.48	0.000
9	-0.058	-0.181	565.44	0.000
10	-0.157	-0.126	572.60	0.000
11	-0.228	0.032	587.70	0.000
12	-0.390	-0.300	631.92	0.000
13	-0.337	0.308	665.03	0.000
14	-0.341	0.143	699.12	0.000
15	-0.343	-0.018	733.78	0.000
16	-0.294	-0.060	759.29	0.000
17	-0.248	-0.086	777.49	0.000
18	-0.248	-0.046	795.74	0.000
19	-0.210	0.028	808.90	0.000
20	-0.194	-0.109	820.21	0.000
21	-0.158	0.001	827.73	0.000
22	-0.105	0.039	831.09	0.000
23	-0.070	0.033	832.56	0.000
24	-0.011	-0.148	832.60	0.000
25	0.034	0.181	832.94	0.000
26	0.041	-0.002	833.46	0.000
27	0.063	-0.034	834.69	0.000
28	0.059	-0.075	835.76	0.000
29	0.060	0.021	836.87	0.000
30	0.039	-0.152	837.34	0.000
31	0.021	-0.026	837.48	0.000
32	0.027	-0.017	837.71	0.000
33	-0.007	-0.036	837.72	0.000
34	-0.040	-0.017	838.23	0.000

Figure 13 Correlogram of Export (Seasonally Differenced with 1st Regular Differencing)

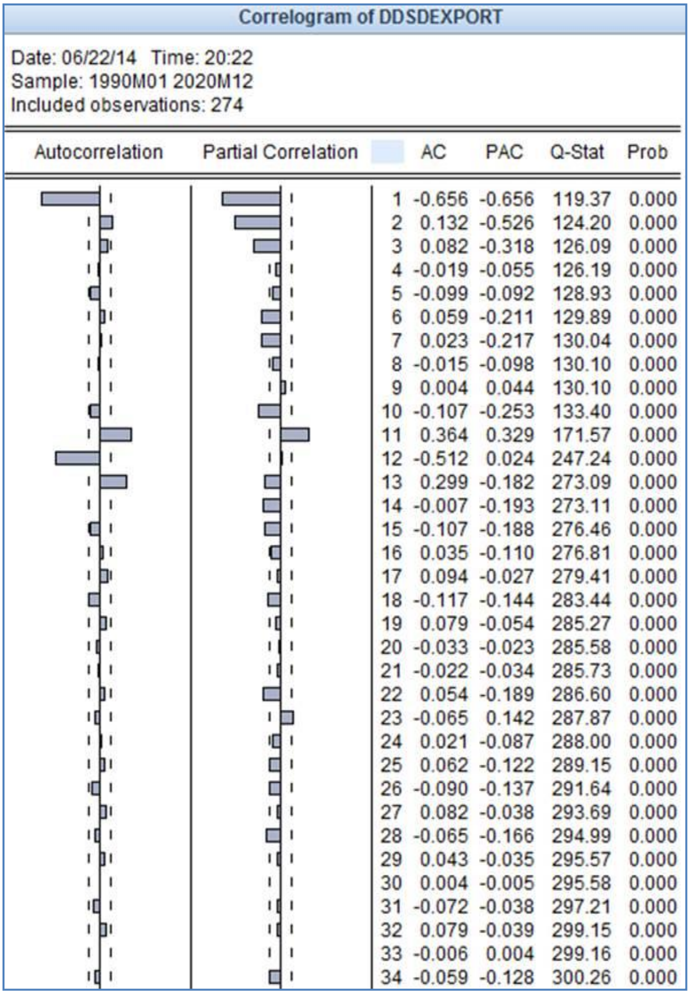


Correlogram of DSDEXPORT

Date: 05/30/14 Time: 10:59
Sample: 1990M01 2013M12
Included observations: 275

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.357	-0.357	35.440	0.000
		2	0.068	-0.068	36.723	0.000
		3	0.136	0.158	41.887	0.000
		4	-0.022	0.101	42.018	0.000
		5	-0.124	-0.130	46.374	0.000
		6	0.039	-0.101	46.808	0.000
		7	0.044	0.043	47.367	0.000
		8	-0.011	0.093	47.404	0.000
		9	-0.029	-0.005	47.652	0.000
		10	-0.056	-0.152	48.563	0.000
		11	0.205	0.158	60.733	0.000
		12	-0.522	-0.442	139.69	0.000
		13	0.142	-0.232	145.57	0.000
		14	-0.005	-0.038	145.57	0.000
		15	-0.135	0.010	150.90	0.000
		16	0.031	0.043	151.18	0.000
		17	0.098	-0.012	154.01	0.000
		18	-0.088	-0.094	156.31	0.000
		19	0.042	0.028	156.82	0.000
		20	-0.040	-0.051	157.30	0.000
		21	-0.034	-0.082	157.64	0.000
		22	0.031	-0.076	157.93	0.000
		23	-0.048	0.093	158.63	0.000
		24	0.050	-0.245	159.38	0.000
		25	0.089	-0.036	161.79	0.000
		26	-0.040	0.013	162.27	0.000
		27	0.079	0.046	164.20	0.000
		28	-0.028	-0.043	164.44	0.000
		29	0.043	0.095	165.00	0.000
		30	-0.003	-0.026	165.00	0.000
		31	-0.059	-0.061	166.10	0.000
		32	0.079	-0.033	168.08	0.000
		33	0.007	-0.028	168.09	0.000
		34	-0.051	-0.071	168.93	0.000

Figure 14 Correlogram of Export (Seasonally Differenced with 2nd Regular Differencing)



Correlogram of DDSDEXPORT

Date: 06/22/14 Time: 20:22
Sample: 1990M01 2020M12
Included observations: 274

	AC	PAC	Q-Stat	Prob
1	-0.656	-0.656	119.37	0.000
2	0.132	-0.526	124.20	0.000
3	0.082	-0.318	126.09	0.000
4	-0.019	-0.055	126.19	0.000
5	-0.099	-0.092	128.93	0.000
6	0.059	-0.211	129.89	0.000
7	0.023	-0.217	130.04	0.000
8	-0.015	-0.098	130.10	0.000
9	0.004	0.044	130.10	0.000
10	-0.107	-0.253	133.40	0.000
11	0.364	0.329	171.57	0.000
12	-0.512	0.024	247.24	0.000
13	0.299	-0.182	273.09	0.000
14	-0.007	-0.193	273.11	0.000
15	-0.107	-0.188	276.46	0.000
16	0.035	-0.110	276.81	0.000
17	0.094	-0.027	279.41	0.000
18	-0.117	-0.144	283.44	0.000
19	0.079	-0.054	285.27	0.000
20	-0.033	-0.023	285.58	0.000
21	-0.022	-0.034	285.73	0.000
22	0.054	-0.189	286.60	0.000
23	-0.065	0.142	287.87	0.000
24	0.021	-0.087	288.00	0.000
25	0.062	-0.122	289.15	0.000
26	-0.090	-0.137	291.64	0.000
27	0.082	-0.038	293.69	0.000
28	-0.065	-0.166	294.99	0.000
29	0.043	-0.035	295.57	0.000
30	0.004	-0.005	295.58	0.000
31	-0.072	-0.038	297.21	0.000
32	0.079	-0.039	299.15	0.000
33	-0.006	0.004	299.16	0.000
34	-0.059	-0.128	300.26	0.000

Table 1 Unit Root Test of Import (Seasonally Differenced)

Null Hypothesis: SDIMPORT has a unit root			
Exogenous: Constant			
Lag Length: 12 (Automatic - based on SIC, maxlag=15)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.326924	0.0000
Test critical values:	1% level	-3.455096	
	5% level	-2.872328	
	10% level	-2.572592	
*MacKinnon (1996) one-sided p-values.			

R-squared	0.329937	Mean dependent var	96345.27
Adjusted R-squared	0.294953	S.D. dependent var	3.42E+08
S.E. of regression	2.87E+08	Akaike info criterion	41.83929
Sum squared resid	2.05E+19	Schwarz criterion	42.02944
Log likelihood	-5487.866	Hannan-Quinn criter.	41.91570
F-statistic	9.431281	Durbin-Watson stat	2.030556
Prob(F-statistic)	0.000000		

In formulating a model, data should be stationary. The researchers made use of the Augmented Dickey-Fuller of the Unit Root Test to test for the stationarity. It is expressed as:

$$\Delta y_t = \alpha + \beta t + \delta y_{t-1} + \gamma_i \sum \Delta y_{t-I} - e_t$$

The hypothesis is:
H_o: *Import is non- stationary.*
H_a: *Import is stationary.*

The original data demonstrates the presence of seasonality, seasonal differencing was utilized and Augmented Dickey Fuller was used to test the stationarity. Since p- value is less than alpha we reject the null hypothesis therefore the data have stationarity.

Table 2 Unit Root Test of Export (Seasonally Differenced)

Null Hypothesis: SDEXPORT has a unit root
Exogenous: Constant
Lag Length: 13 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.489163	0.0090
Test critical values:	1% level	-3.455193	
	5% level	-2.872370	
	10% level	-2.572615	

*MacKinnon (1996) one-sided p-values.

R-squared	0.467757	Mean dependent var	2200195.
Adjusted R-squared	0.437590	S.D. dependent var	3.18E+08
S.E. of regression	2.39E+08	Akaike info criterion	41.47470
Sum squared resid	1.41E+19	Schwarz criterion	41.67900
Log likelihood	-5418.186	Hannan-Quinn criter.	41.55681
F-statistic	15.50528	Durbin-Watson stat	1.985137
Prob(F-statistic)	0.000000		

In formulating a model, data should be stationary. The researchers made use of the Augmented Dickey-Fuller of the Unit Root Test to test for the stationarity. It is expressed as:

$$\Delta y_t = \alpha + \beta t + \delta y_{t\text{-}1} + \gamma_i \sum \Delta y_{t\text{-}I} - e_t$$

The hypothesis is:
H_o: *Export is non- stationary.*
H_a: *Export is stationary.*

The original data demonstrates the presence of seasonality, seasonal differencing was utilized and Augmented Dickey Fuller was used to test the stationarity. The failure to reject the null hypothesis led the researchers to transforming the data into stationary through differencing.

Table 3 Unit Root Test of Exports (Seasonally Differenced with 1st Regular Differencing)

Null Hypothesis: DSDEXPORT has a unit root			
Exogenous: Constant			
Lag Length: 12 (Automatic - based on SIC, maxlag=15)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.279029	0.0000
Test critical values:	1% level	-3.455193	
	5% level	-2.872370	
	10% level	-2.572615	
*MacKinnon (1996) one-sided p-values.			

R-squared	0.794139	Mean dependent var	-304512.1
Adjusted R-squared	0.783348	S.D. dependent var	5.24E+08
S.E. of regression	2.44E+08	Akaike info criterion	41.51518
Sum squared resid	1.48E+19	Schwarz criterion	41.70586
Log likelihood	-5424.489	Hannan-Quinn criter.	41.59182
F-statistic	73.59188	Durbin-Watson stat	2.007596
Prob(F-statistic)	0.000000		

After applying the first seasonal difference, its stationarity was checked and it showed that the data have stationarity.

Table 4 Unit Root Test of Exports (Seasonally Differenced with 2nd Regular Differencing)

Null Hypothesis: DDSDEXPORT has a unit root			
Exogenous: Constant			
Lag Length: 14 (Automatic - based on SIC, maxlag=15)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.503676	0.0000
Test critical values:	1% level	-3.455486	
	5% level	-2.872499	
	10% level	-2.572684	
*MacKinnon (1996) one-sided p-values.			

R-squared	0.929872	Mean dependent var	-1883630.
Adjusted R-squared	0.925543	S.D. dependent var	9.58E+08
S.E. of regression	2.62E+08	Akaike info criterion	41.66165
Sum squared resid	1.66E+19	Schwarz criterion	41.88137
Log likelihood	-5379.183	Hannan-Quinn criter.	41.74999
F-statistic	214.8057	Durbin-Watson stat	2.059770
Prob(F-statistic)	0.000000		

Table 5 Candidate SARIMA Terms for Import

MODELS	R-squared	P-value
AR(1)AR(2)AR(5)AR(10)AR(25)MA(1)MA(2)MA(3)MA(4)MA(5)MA(6)MA(7)MA(11)SMA(132)	**0.956291**	**0.000000**
AR(1)AR(2)AR(5)AR(10)AR(12)MA(1)MA(2)MA(3)MA(4)MA(5)MA(6)MA(7)MA(11)SMA(24)	0.965007	0.000000
AR(1)AR(2)AR(5)AR(10)AR(12)MA(1)MA(2)MA(3)MA(4)MA(5)MA(6)MA(7)MA(11)SMA(132)	0.966671	0.000000
AR(1)AR(2)MA(1)MA(14)AR(10)MA(2)MA(21)MA(24)AR(13)MA(128)SMA(132)	0.960704	0.000000
AR(1)AR(2)MA(1)MA(14)AR(10)MA(2)MA(21)MA(24)AR(13)MA(128)SMA(24)	0.958395	0.000000
AR(1)AR(2)MA(1)MA(14)AR(10)MA(2)MA(21)MA(24)AR(13)MA(128)SMA(12)	0.96022	0.000000
AR(1)AR(2)AR(13)MA(1)MA(14)AR(10)MA(111)MA(2)MA(21)MA(24)SMA(12)	0.96079	0.000000
AR(1)AR(2)AR(13)MA(1)MA(14)AR(10)MA(111)MA(2)MA(21)MA(24)SMA(24)	0.959338	0.000000
AR(1)AR(2)AR(13)MA(1)MA(14)AR(10)MA(111)MA(2)MA(21)MA(24)SMA(132)	0.962041	0.000000
AR(1)AR(2)AR(13)MA(1)MA(14)AR(10)MA(111)MA(2)MA(21)MA(24)SMA(132)	0.957685	0.000000
AR(1)AR(2)AR(13)MA(1)MA(14)AR(10)MA(80)MA(2)MA(21)MA(24)SMA(132)	0.961692	0.000000
AR(1)AR(2)AR(13)MA(1)MA(14)AR(10)MA(111)MA(2)MA(21)MA(24)	0.958674	0.000000
AR(1)AR(2)MA(1)MA(14)AR(10)MA(2)MA(21)AR(13)MA(150)SMA(132)	0.961442	0.000000
AR(1)AR(2)AR(10)AR(13)AR(14)MA(1)MA(2)MA(11)SMA(132)	0.95913	0.000000

Table 6 Candidate SARIMA Terms for Export

MODELS	R-Squared	P-value
AR(1)AR(2)AR(3)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)MA(57)	0.850827	0.000000
AR(1)AR(2)AR(3)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)MA(13)MA(57)	0.851988	0.000000
AR(1)AR(2)AR(3)AR(6)AR(99)SMA(12)MA(1)MA(2)MA(46)	0.851805	0.000000
AR(1)AR(2)AR(3)AR(6)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(46)	0.851794	0.000000
AR(1)AR(2)AR(3)AR(6)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(56)	0.865681	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(56)	0.867046	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(99)SMA(12)MA(1)MA(2)MA(58)	**0.883599**	**0.000000**
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)MA(57)	0.852549	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(11)	0.878021	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(57)	0.852491	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)	0.878521	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(13)	0.881130	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(46)	0.879493	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(58)	0.885900	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)MA(13)	0.879850	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(13)AR(99)SMA(12)MA(1)MA(2)MA(57)	0.854440	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(13)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(46)	0.863536	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(13)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)MA(57)	0.878159	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(10)AR(11)AR(13)AR(99)SMA(12)MA(1)MA(2)MA(11)MA(12)MA(18)MA(46)	0.881779	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(25)AR(99)SMA(12)MA(1)MA(2)MA(58)	0.883526	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(28)AR(99)SMA(12)MA(1)MA(2)MA(58)	0.882860	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(34)AR(99)SMA(12)MA(1)MA(2)MA(58)	0.883950	0.000000
AR(1)AR(2)AR(3)AR(6)AR(7)AR(43)AR(99)SMA(12)MA(1)MA(2)MA(58)	0.883560	0.000000

Table 7 SARIMA Model Estimation for Import

Dependent Variable: IMPORT
Method: Least Squares
Date: 06/13/14 Time: 14:04
Sample (adjusted): 1992M02 2013M12
Included observations: 263 after adjustments
Convergence achieved after 150 iterations
MA Backcast: OFF (Roots of MA process too large)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.40E+09	3.96E+09	0.856515	0.3925
AR(1)	-0.283680	0.058572	-4.843281	0.0000
AR(2)	0.531259	0.042876	12.39048	0.0000
AR(5)	0.410071	0.070288	5.834125	0.0000
AR(10)	0.339852	0.058988	5.761364	0.0000
AR(25)	0.019336	0.050775	0.380820	0.7037
MA(1)	1.063597	0.084344	12.61020	0.0000
MA(2)	0.327425	0.107830	3.036493	0.0026
MA(3)	0.420437	0.099805	4.212569	0.0000
MA(4)	0.604043	0.097019	6.226056	0.0000
MA(5)	-0.235439	0.100177	-2.350232	0.0195
MA(6)	-0.066954	0.097410	-0.687348	0.4925
MA(7)	0.328177	0.082847	3.961215	0.0001
MA(11)	-0.013358	0.050738	-0.263280	0.7926
SMA(132)	0.443160	0.109370	4.051918	0.0001

R-squared	0.956291	Mean dependent var	3.40E+09
Adjusted R-squared	0.953823	S.D. dependent var	1.21E+09
S.E. of regression	2.60E+08	Akaike info criterion	41.64501
Sum squared resid	1.68E+19	Schwarz criterion	41.84875
Log likelihood	-5461.319	Hannan-Quinn criter.	41.72689
F-statistic	387.5595	Durbin-Watson stat	1.937589
Prob(F-statistic)	0.000000		

Table 8 SARIMA Model Estimation for Export

Dependent Variable: EXPORT
Method: Least Squares
Date: 06/25/14 Time: 10:06
Sample (adjusted): 1998M04 2013M12
Included observations: 189 after adjustments
Convergence not achieved after 500 iterations
MA Backcast: OFF (Roots of MA process too large)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.16E+09	4.83E+08	10.69953	0.0000
AR(1)	0.999131	0.060659	16.47133	0.0000
AR(2)	-0.892102	0.057863	-15.41746	0.0000
AR(3)	0.639587	0.053463	11.96327	0.0000
AR(6)	-0.097177	0.069567	-1.396896	0.1642
AR(7)	-0.142446	0.060698	-2.346794	0.0200
AR(10)	0.070270	0.052390	1.341295	0.1815
AR(99)	0.218297	0.054786	3.984500	0.0001
MA(1)	-0.347028	0.026108	-13.29175	0.0000
MA(2)	1.132424	0.032517	34.82535	0.0000
MA(58)	-0.259928	0.047110	-5.517428	0.0000
SMA(12)	0.264536	0.078909	3.352439	0.0010

R-squared	0.883599	Mean dependent var	3.55E+09
Adjusted R-squared	0.876365	S.D. dependent var	7.08E+08
S.E. of regression	2.49E+08	Akaike info criterion	41.56443
Sum squared resid	1.10E+19	Schwarz criterion	41.77025
Log likelihood	-3915.838	Hannan-Quinn criter.	41.64781
F-statistic	122.1458	Durbin-Watson stat	2.196476
Prob(F-statistic)	0.000000		

Table 9 Hesteroskedasticity Test: White Test for Import

Heteroskedasticity Test: White			
F-statistic	1.758672	Prob. F(21,241)	0.0237
Obs*R-squared	34.94791	Prob. Chi-Square(21)	0.0286
Scaled explained SS	40.68544	Prob. Chi-Square(21)	0.0061
R-squared	0.132882	Mean dependent var	6.37E+16
Adjusted R-squared	0.057324	S.D. dependent var	1.03E+17
S.E. of regression	1.00E+17	Akaike info criterion	81.21134
Sum squared resid	2.42E+36	Schwarz criterion	81.51015
Log likelihood	-10657.29	Hannan-Quinn criter.	81.33142
F-statistic	1.758672	Durbin-Watson stat	1.671110
Prob(F-statistic)	0.023685		

To test the variability of the best fitted model for Import, Heteroskedasticity Test was utilized to test the variances of the model.
The Hypothesis is:

H_o: *The best fitted model has equal variances.*
H_a: *The best fitted model has unequal variances.*

Since the p- value of 0.0286 is greater than the critical value of 0.01, fail to reject the null hypothesis therefore, it can be concluded that the best fitted model for import has equal variances.

Table 10 Hesteroskedasticity Test: White Test for Export

Heteroskedasticity Test: White			
F-statistic	1.491215	Prob. F(19,169)	0.0939
Obs*R-squared	27.13662	Prob. Chi-Square(19)	0.1015
Scaled explained SS	33.40527	Prob. Chi-Square(19)	0.0216
R-squared	0.143580	Mean dependent var	5.80E+16
Adjusted R-squared	0.047296	S.D. dependent var	9.75E+16
S.E. of regression	9.51E+16	Akaike info criterion	81.12582
Sum squared resid	1.53E+36	Schwarz criterion	81.46887
Log likelihood	-7646.390	Hannan-Quinn criter.	81.26480
F-statistic	1.491215	Durbin-Watson stat	1.802653
Prob(F-statistic)	0.093928		

To test the variability of the best fitted model for Export, Heteroskedasticity Test was utilized to test the variances of the model.

The Hypothesis is:

H_o: *The best fitted model has equal variances.*

H_a: *The best fitted model has unequal variances.*

Since the p- value of 0.1015 is greater than the critical value of 0.01, fail to reject the null hypothesis therefore, it can be concluded that the best fitted model for export has equal variances.

Table 11 Paired t- test for Import

Hypothesis Testing for DIFF		
Date: 06/21/14 Time: 22:37		
Sample: 1 263		
Included observations: 263		
Test of Hypothesis: Mean = 0.000000		
Sample Mean = -23660969		
Sample Std. Dev. = 2.52e+08		
Method	Value	Probability
t-statistic	-1.524078	0.1287

Table 12 Paired t- test for Export

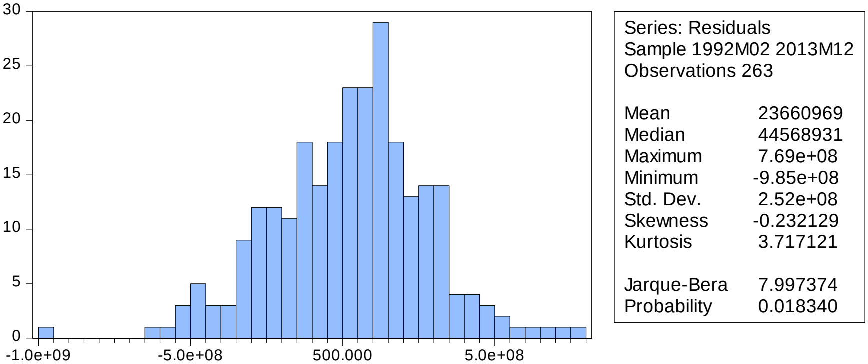
Hypothesis Testing for DIFF		
Date: 06/25/14 Time: 10:16		
Sample: 1998M04 2013M12		
Included observations: 189		
Test of Hypothesis: Mean = 0.000000		
Sample Mean = 2419508.		
Sample Std. Dev. = 2.42e+08		
Method	Value	Probability
t-statistic	0.137733	0.8906

To test whether there is no significant difference between two compared samples, Paired t- test was utilized.
The Hypothesis is:

H_o: *There is no significant difference* .
H_a: *There is a significant difference.*

Since the p- value of 0.1287 and 0.8906 is greater than the critical value of 0.01, fail to reject the null hypothesis therefore, it can be concluded that there is no significant difference between the actual value and forecasted value of import and export.

Figure 16 Normality Test for Import

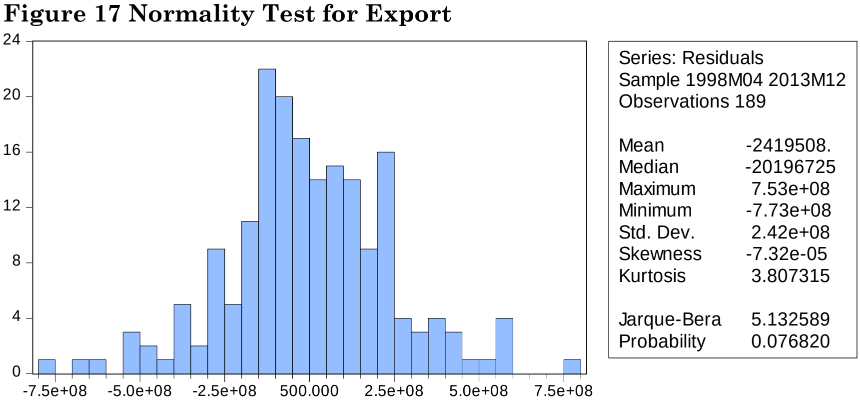


To test the normality of the best fitted model for Import, Normality Test was utilized.
The Hypothesis is:

H_o: *The residuals follow a normal distribution.*
H_a: *The residuals do not follow a normal distribution.*

The result of the test showed a p- value of 0.018340 indicating that the model is normal.

Figure 17 Normality Test for Export



To test the normality of the best fitted model for export, Normality Test was utilized.

The Hypothesis is:

H_o: *The best fitted model.*
H_a: *The best fitted model.*

The result of the test showed a p- value of 0.076820 indicating that the model is normal.

Figure 18 Graph of Actual and Forecasted Import

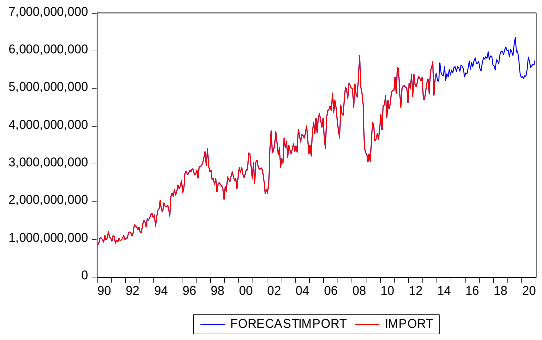


Figure 19 Graph of Actual and Forecasted Export

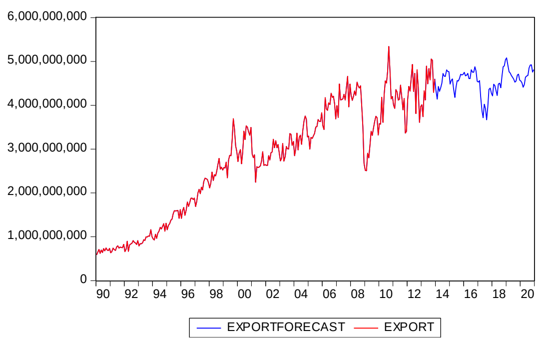


Table 13 Forecasted Data of Import

Forecasting Period	Import	Forecasting Period	Import	Forecasting Period	Import
2014M01	5,224,452,695.42	2016M05	5,508,697,305.23	2018M09	5,904,632,447.04
2014M02	5,194,723,731.65	2016M06	5,696,503,449.16	2018M10	6,031,399,498.08
2014M03	5,689,435,012.88	2016M07	5,588,115,198.23	2018M11	6,104,608,375.71
2014M04	5,428,723,418.90	2016M08	5,742,195,368.07	2018M12	6,009,112,524.40
2014M05	5,355,178,401.67	2016M09	5,815,945,820.31	2019M01	6,026,693,625.89
2014M06	5,336,504,334.77	2016M10	5,662,171,512.89	2019M02	5,843,360,333.38
2014M07	5,580,259,389.64	2016M11	5,676,996,091.66	2019M03	6,040,218,872.41
2014M08	5,212,127,494.61	2016M12	5,719,438,138.00	2019M04	5,977,859,192.87
2014M09	5,393,866,939.32	2017M01	5,531,990,303.26	2019M05	5,879,427,585.29
2014M10	5,319,742,761.22	2017M02	5,475,683,508.03	2019M06	6,171,249,324.15
2014M11	5,511,615,963.76	2017M03	5,674,778,588.44	2019M07	6,356,619,298.93
2014M12	5,361,910,952.16	2017M04	5,824,803,471.09	2019M08	5,970,132,977.96
2015M01	5,496,158,142.47	2017M05	5,783,152,150.73	2019M09	5,999,708,075.49
2015M02	5,418,432,674.34	2017M06	5,848,362,071.07	2019M10	5,729,775,927.87
2015M03	5,558,727,157.45	2017M07	5,805,343,554.23	2019M11	5,402,030,134.39
2015M04	5,585,136,412.42	2017M08	5,980,313,126.38	2019M12	5,296,730,482.41
2015M05	5,456,623,655.19	2017M09	5,770,253,590.27	2020M01	5,321,617,267.36
2015M06	5,580,243,327.47	2017M10	5,866,819,703.84	2020M02	5,265,604,923.73
2015M07	5,557,692,253.11	2017M11	5,858,126,602.43	2020M03	5,345,135,489.95
2015M08	5,461,132,228.57	2017M12	5,622,401,185.60	2020M04	5,325,416,242.57
2015M09	5,628,301,363.64	2018M01	5,601,099,817.28	2020M05	5,490,751,628.49
2015M10	5,591,873,141.07	2018M02	5,493,438,377.89	2020M06	5,840,472,762.37
2015M11	5,528,668,915.16	2018M03	5,765,638,307.87	2020M07	5,725,171,456.14
2015M12	5,310,185,618.00	2018M04	5,727,923,820.69	2020M08	5,561,151,483.26
2016M01	5,418,475,202.76	2018M05	5,657,849,850.01	2020M09	5,607,044,430.33
2016M02	5,392,806,546.60	2018M06	5,897,272,685.57	2020M10	5,647,838,545.43
2016M03	5,554,774,409.27	2018M07	5,998,641,913.42	2020M11	5,642,691,010.71
2016M04	5,734,543,253.23	2018M08	5,985,888,617.49	2020M12	5,779,853,099.18

Table 14 Forecasted Values of Export

Forecasting Period	Export	Forecasting Period	Export	Forecasting Period	Export
2014M01	4,343,647,866.06	2016M05	4,609,311,858.00	2018M09	4,669,947,604.91
2014M02	4,140,374,540.24	2016M06	4,609,980,120.87	2018M10	4,877,582,977.65
2014M03	4,427,336,678.09	2016M07	4,809,266,538.18	2018M11	4,897,752,803.81
2014M04	4,317,650,982.93	2016M08	4,754,755,433.18	2018M12	5,036,782,530.26
2014M05	4,396,782,858.85	2016M09	4,753,222,851.12	2019M01	5,081,900,562.54
2014M06	4,505,027,034.78	2016M10	4,878,988,729.20	2019M02	4,922,986,535.63
2014M07	4,725,353,504.16	2016M11	4,779,832,441.31	2019M03	4,764,870,782.23
2014M08	4,665,413,560.22	2016M12	4,548,305,028.67	2019M04	4,734,093,283.35
2014M09	4,656,631,977.39	2017M01	4,530,566,333.36	2019M05	4,677,646,116.86
2014M10	4,806,586,174.13	2017M02	4,564,020,390.38	2019M06	4,639,992,598.04
2014M11	4,773,314,056.49	2017M03	4,192,289,443.63	2019M07	4,596,136,565.38
2014M12	4,766,284,081.72	2017M04	3,869,945,370.90	2019M08	4,526,233,665.27
2015M01	4,483,337,165.25	2017M05	3,715,382,781.86	2019M09	4,554,103,032.77
2015M02	4,568,200,380.32	2017M06	4,021,729,826.60	2019M10	4,688,192,277.31
2015M03	4,600,546,169.48	2017M07	3,928,949,050.63	2019M11	4,711,344,036.37
2015M04	4,377,318,097.44	2017M08	3,669,110,393.01	2019M12	4,572,972,878.15
2015M05	4,180,058,695.42	2017M09	3,964,889,472.20	2020M01	4,554,820,310.28
2015M06	4,415,286,608.92	2017M10	4,362,189,149.24	2020M02	4,513,435,173.11
2015M07	4,563,482,018.35	2017M11	4,390,382,769.29	2020M03	4,412,040,148.27
2015M08	4,554,073,529.56	2017M12	4,272,753,666.38	2020M04	4,472,754,759.15
2015M09	4,615,796,277.58	2018M01	4,213,624,552.20	2020M05	4,639,993,081.14
2015M10	4,706,005,202.10	2018M02	4,479,391,300.81	2020M06	4,670,205,756.62
2015M11	4,693,368,890.76	2018M03	4,448,372,920.00	2020M07	4,681,256,207.32

2015M12	4,703,162,570.09	2018M04	4,329,134,055.81	2020M08	4,853,046,037.13
2016M01	4,750,343,971.19	2018M05	4,224,018,890.03	2020M09	4,916,758,803.86
2016M02	4,671,132,479.10	2018M06	4,481,873,366.50	2020M10	4,923,241,932.91
2016M03	4,686,732,937.35	2018M07	4,502,961,722.59	2020M11	4,756,310,434.50
2016M04	4,728,589,474.45	2018M08	4,400,978,301.99	2020M12	4,813,299,167.26

Table 15 Actual Data for Import and Export

DATE	IMPORT	EXPORT	DATE	IMPORT	EXPORT
1990MO1	853,607,970	587,144,994	2002MO1	2,225,785,816	2,631,435,355
1990MO2	921,942,859	652,042,147	2002MO2	2,543,971,218	2,627,871,195
1990MO3	1,047,796,485	710,812,321	2002MO3	3,435,733,641	2,849,061,701
1990MO4	1,033,614,133	623,822,590	2002MO4	3,881,243,822	2,748,802,011
1990MO5	997,499,489	697,095,924	2002MO5	3,302,515,506	2,918,058,836
1990MO6	923,573,821	642,140,316	2002MO6	3,353,373,336	2,936,411,423
1990MO7	1,113,856,619	730,731,983	2002MO7	3,520,285,337	3,222,741,781
1990MO8	990,305,996	680,138,790	2002MO8	3,857,012,732	3,032,171,349
1990MO9	1,040,442,726	744,945,298	2002MO9	3,536,524,609	3,191,393,763
1990MO10	1,202,030,349	696,702,896	2002MO10	3,247,166,736	3,033,181,410
1990MO11	1,047,489,415	686,330,427	2002MO11	3,436,504,924	3,103,283,089
1990MO12	1,034,000,670	734,119,706	2002MO12	2,896,396,477	2,913,746,779
1991MO1	950,413,910	635,568,518	2003MO1	3,142,485,095	2,732,849,831
1991MO2	1,094,809,986	662,653,306	2003MO2	3,021,435,800	2,787,824,284
1991MO3	1,076,870,602	742,131,287	2003MO3	3,694,218,185	3,128,981,051
1991MO4	896,518,315	709,699,025	2003MO4	3,432,718,138	2,726,211,859
1991MO5	983,148,884	688,512,212	2003MO5	3,609,650,172	2,827,660,315
1991MO6	937,909,890	767,697,709	2003MO6	3,175,460,334	3,060,470,078
1991MO7	1,025,694,725	793,503,022	2003MO7	3,491,615,410	3,009,494,255
1991MO8	967,429,389	741,203,157	2003MO8	3,360,194,190	3,003,210,820
1991MO9	988,482,404	764,460,901	2003MO9	3,265,383,065	3,353,950,818
1991MO10	1,023,146,103	756,876,809	2003MO10	3,401,221,235	3,339,920,475
1991MO11	1,110,038,158	751,075,238	2003MO11	3,545,748,924	3,085,491,785
1991MO12	996,900,794	826,132,668	2003MO12	3,330,381,135	3,175,139,873
1992MO1	1,037,692,861	662,366,553	2004MO1	3,481,404,008	2,849,366,652
1992MO2	1,032,513,181	714,898,830	2004MO2	3,313,652,857	3,004,810,087
1992MO3	1,164,811,895	898,456,547	2004MO3	3,921,992,789	3,361,747,792
1992MO4	1,196,813,604	666,450,742	2004MO4	3,764,804,339	2,982,491,297
1992MO5	1,186,290,856	811,705,523	2004MO5	3,583,997,105	3,267,549,867
1992MO6	1,088,949,451	835,569,902	2004MO6	3,778,070,418	3,317,928,115
1992MO7	1,166,412,609	851,128,658	2004MO7	3,760,773,676	3,108,881,144
1992MO8	1,399,194,917	913,091,061	2004MO8	3,687,633,143	3,430,059,627
1992MO9	1,335,702,448	873,343,155	2004MO9	3,816,873,705	3,641,425,821
1992MO10	1,330,786,480	860,359,168	2004MO10	4,007,923,809	3,753,434,618
1992MO11	1,255,044,582	824,140,485	2004MO11	3,657,579,571	3,685,405,864
1992MO12	1,324,715,028	912,803,677	2004MO12	3,264,507,024	3,277,419,596
1993MO1	1,183,584,123	790,437,274	2005MO1	3,501,396,118	3,294,323,624
1993MO2	1,181,677,413	842,705,095	2005MO2	3,211,228,572	3,000,164,622
1993MO3	1,390,574,091	842,460,915	2005MO3	3,832,010,849	3,267,571,826
1993MO4	1,504,004,787	861,726,377	2005MO4	4,112,555,946	3,245,696,520
1993MO5	1,460,290,991	932,139,386	2005MO5	3,797,998,517	3,304,994,276
1993MO6	1,335,128,874	914,435,963	2005MO6	4,210,263,190	3,358,573,683
1993MO7	1,553,484,846	998,166,493	2005MO7	3,832,986,991	3,503,070,371
1993MO8	1,512,665,113	994,502,712	2005MO8	4,238,873,900	3,512,640,841
1993MO9	1,565,589,576	1,018,302,145	2005MO9	4,337,202,046	3,674,931,488
1993MO10	1,654,686,216	1,012,522,775	2005MO10	4,159,123,833	3,634,525,359
1993MO11	1,682,738,585	1,163,360,210	2005MO11	3,975,165,387	3,631,007,906
1993MO12	1,572,976,601	1,004,045,941	2005MO12	4,209,377,205	3,827,182,953
1994MO1	1,650,563,166	951,621,856	2006MO1	3,707,182,989	3,532,749,442
1994MO2	1,349,042,458	927,008,502	2006MO2	3,415,251,347	3,448,303,896

1994MO3	1,599,521,823	1,057,666,674	2006MO3	4,226,604,784	4,173,597,607
1994MO4	1,775,994,622	965,793,270	2006MO4	4,416,675,003	3,917,884,768
1994MO5	1,810,364,008	1,083,859,879	2006MO5	4,447,840,897	3,885,116,437
1994MO6	2,041,894,551	1,125,272,636	2006MO6	4,533,998,702	4,055,141,466
1994MO7	1,768,459,641	1,217,561,845	2006MO7	4,412,450,654	4,016,282,591
1994MO8	1,728,144,611	1,178,012,739	2006MO8	4,883,658,015	4,273,802,974
1994MO9	1,967,953,714	1,239,739,740	2006MO9	4,355,481,743	4,178,404,907
1994MO10	1,886,759,851	1,299,342,735	2006MO10	4,686,409,641	4,207,335,417
1994MO11	1,860,742,129	1,128,464,006	2006MO11	4,509,656,431	4,031,033,192
1994MO12	1,893,127,213	1,308,551,660	2006MO12	4,178,473,968	3,690,464,643
1995MO1	1,855,579,497	1,160,748,394	2007MO1	3,904,161,111	3,991,848,889
1995MO2	1,615,887,292	1,263,768,380	2007MO2	3,690,137,256	3,721,345,093
1995MO3	2,142,537,620	1,298,577,283	2007MO3	4,566,515,375	4,487,333,472
1995MO4	2,229,563,126	1,377,417,699	2007MO4	4,342,796,679	4,124,048,820
1995MO5	2,143,626,871	1,400,580,633	2007MO5	4,296,137,369	4,127,864,486
1995MO6	2,328,664,433	1,521,691,870	2007MO6	4,706,535,408	4,147,420,772
1995MO7	2,175,487,584	1,592,693,716	2007MO7	5,041,563,307	4,248,793,462
1995MO8	2,273,585,811	1,591,446,955	2007MO8	4,986,612,367	4,121,450,834
1995MO9	2,444,224,628	1,594,970,078	2007MO9	4,743,796,494	4,389,378,756
1995MO10	2,342,361,497	1,601,650,105	2007MO10	5,150,645,086	4,659,530,169
1995MO11	2,414,722,228	1,422,627,417	2007MO11	5,084,213,106	3,964,806,575
1995MO12	2,571,385,721	1,621,013,605	2007MO12	5,000,629,663	4,481,902,591
1996MO1	2,236,094,895	1,420,447,244	2008MO1	4,995,763,280	4,230,559,185
1996MO2	2,359,578,155	1,594,005,715	2008MO2	4,491,460,270	4,112,011,705
1996MO3	2,760,472,686	1,670,603,477	2008MO3	5,123,010,793	4,200,129,457
1996MO4	2,811,146,347	1,491,866,914	2008MO4	4,856,957,640	4,327,475,585
1996MO5	2,712,349,002	1,612,182,193	2008MO5	4,775,682,154	4,225,382,102
1996MO6	2,750,550,811	1,793,390,815	2008MO6	5,322,249,868	4,527,022,129
1996MO7	2,838,704,800	1,693,694,307	2008MO7	5,882,357,556	4,437,234,124
1996MO8	2,799,675,243	1,773,892,603	2008MO8	5,044,108,186	4,394,497,148
1996MO9	2,870,062,593	1,875,570,991	2008MO9	4,891,088,820	4,445,618,966
1996MO10	2,858,505,702	1,883,709,477	2008MO10	4,577,741,128	3,990,058,305
1996MO11	2,711,554,979	1,849,914,761	2008MO11	3,484,679,377	3,512,973,480
1996MO12	2,718,238,732	1,883,267,902	2008MO12	3,300,961,298	2,674,578,323
1997MO1	2,837,888,446	1,692,263,113	2009MO1	3,269,937,726	2,512,962,951
1997MO2	2,626,538,787	1,812,415,070	2009MO2	3,058,781,168	2,506,323,003
1997MO3	2,935,163,641	2,001,018,452	2009MO3	3,269,832,510	2,906,745,064
1997MO4	2,942,077,383	2,082,429,845	2009MO4	3,057,230,958	2,803,772,063
1997MO5	2,954,365,646	1,982,879,342	2009MO5	3,616,585,310	3,088,029,755
1997MO6	3,032,341,153	2,129,077,284	2009MO6	4,106,944,174	3,406,912,732
1997MO7	3,169,204,752	2,067,142,448	2009MO7	4,025,962,245	3,313,362,062
1997MO8	3,327,943,486	2,257,973,088	2009MO8	3,617,293,198	3,472,893,225
1997MO9	2,956,476,409	2,337,468,892	2009MO9	3,669,908,170	3,637,638,407
1997MO10	3,413,800,271	2,326,046,764	2009MO10	3,808,286,396	3,748,094,991
1997MO11	2,945,288,406	2,308,430,580	2009MO11	3,654,514,062	3,717,828,961
1997MO12	2,792,733,044	2,230,557,752	2009MO12	3,936,259,964	3,321,242,946
1998MO1	2,837,901,972	2,114,812,034	2010MO1	4,310,255,692	3,579,440,238
1998MO2	2,585,234,573	2,227,202,908	2010MO2	3,906,250,414	3,570,228,465
1998MO3	2,613,595,753	2,474,181,862	2010MO3	4,555,823,918	4,181,803,677
1998MO4	2,457,455,132	2,284,501,468	2010MO4	4,568,356,276	3,611,608,900
1998MO5	2,624,021,365	2,414,739,055	2010MO5	4,811,756,231	4,241,422,444
1998MO6	2,260,740,554	2,389,568,281	2010MO6	4,224,948,879	4,556,729,367
1998MO7	2,465,592,507	2,501,374,868	2010MO7	4,687,766,029	4,505,187,660
1998MO8	2,508,465,350	2,652,454,948	2010MO8	4,461,161,269	4,774,445,446
1998MO9	2,454,452,775	2,786,324,139	2010MO9	4,597,217,542	5,340,846,922
1998MO10	2,417,414,425	2,542,295,807	2010MO10	4,904,460,728	4,788,452,359
1998MO11	2,373,400,659	2,585,815,298	2010MO11	4,955,778,246	4,146,073,638
1998MO12	2,061,612,032	2,523,082,200	2010MO12	4,949,141,763	4,201,275,491
1999MO1	2,399,845,062	2,580,780,826	2011MO1	5,302,439,096	4,001,933,656

1999MO2	2,256,560,130	2,569,328,986	2011MO2	4,876,579,960	3,927,751,788
1999MO3	2,656,303,584	2,702,330,690	2011MO3	5,552,507,651	4,356,350,530
1999MO4	2,599,207,956	2,345,945,316	2011MO4	5,525,435,059	4,306,444,209
1999MO5	2,533,475,252	2,746,896,905	2011MO5	4,892,571,282	4,118,691,412
1999MO6	2,670,938,322	2,857,196,085	2011MO6	4,503,899,301	4,134,781,698
1999MO7	2,791,640,360	2,851,061,303	2011MO7	5,001,324,831	4,460,269,870
1999MO8	2,661,455,290	3,211,535,584	2011MO8	5,076,381,479	4,172,903,202
1999MO9	2,555,295,681	3,693,275,081	2011MO9	5,082,890,815	3,896,952,089
1999MO10	2,612,624,199	3,459,665,969	2011MO10	5,024,485,134	4,155,662,784
1999MO11	2,351,642,775	3,075,370,095	2011MO11	5,024,010,143	3,366,029,692
1999MO12	2,653,469,947	2,943,505,820	2011MO12	4,633,315,515	3,407,157,204
2000MO1	2,900,849,185	2,716,571,560	2012MO1	5,139,403,837	4,123,420,986
2000MO2	2,775,144,920	2,902,308,122	2012MO2	4,998,181,721	4,430,449,373
2000MO3	2,908,071,277	2,988,516,721	2012MO3	5,371,483,010	4,324,619,800
2000MO4	2,728,169,303	2,667,587,635	2012MO4	4,788,116,423	4,635,171,810
2000MO5	2,641,931,449	2,930,834,998	2012MO5	5,385,843,569	4,931,595,660
2000MO6	2,730,329,347	3,410,273,546	2012MO6	5,103,026,146	4,314,231,994
2000MO7	2,855,651,733	3,219,402,685	2012MO7	5,047,279,934	4,727,394,926
2000MO8	2,842,449,582	3,529,461,791	2012MO8	5,183,825,724	3,809,977,241
2000MO9	3,294,233,553	3,502,006,958	2012MO9	5,326,588,737	4,810,795,438
2000MO10	3,276,141,087	3,398,137,887	2012MO10	5,276,855,131	4,410,108,337
2000MO11	2,919,802,695	3,316,782,069	2012MO11	5,207,737,397	3,611,009,789
2000MO12	2,618,099,089	3,496,365,822	2012MO12	5,300,315,989	3,970,745,308
2001MO1	3,031,155,224	2,888,995,982	2013MO1	4,727,031,391	4,010,779,236
2001MO2	2,482,110,685	2,805,471,748	2013MO2	4,707,488,493	3,740,782,025
2001MO3	3,037,402,171	2,869,640,382	2013MO3	4,921,836,577	4,328,976,422
2001MO4	3,105,061,460	2,245,694,300	2013MO4	5,141,343,971	4,121,281,122
2001MO5	2,939,857,616	2,599,971,007	2013MO5	5,257,805,111	4,893,276,517
2001MO6	2,856,881,764	2,578,163,835	2013MO6	4,859,799,497	4,490,201,185
2001MO7	2,873,159,620	2,594,446,005	2013MO7	5,486,958,178	4,836,426,783
2001MO8	2,893,639,222	2,620,764,527	2013MO8	5,545,608,441	4,581,223,371
2001MO9	2,752,002,754	2,731,019,845	2013MO9	5,710,698,434	5,056,209,122
2001MO10	2,540,952,151	2,940,767,411	2013MO10	4,824,061,431	5,025,629,257
2001MO11	2,216,795,607	2,629,794,168	2013MO11	5,235,565,664	4,294,041,015
2001MO12	2,328,142,161	2,645,473,482	2013MO12	5,412,933,747	4,599,441,853

Table 16 Granger Causality Test

Pairwise Granger Causality Tests
Date: 07/03/14 Time: 11:28
Sample: 1990M01 2013M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DY2 does not Granger Cause DY1	285	1.56965	0.2099
DY1 does not Granger Cause DY2		3.70212	0.0259
DX1 does not Granger Cause DY1	285	1.07843	0.3415
DY1 does not Granger Cause DX1		0.21867	0.8037
DX2 does not Granger Cause DY1	285	14.2873	1.E-06
DY1 does not Granger Cause DX2		0.57434	0.5637
DX3 does not Granger Cause DY1	271	0.02960	0.9708
DY1 does not Granger Cause DX3		0.62981	0.5335
DX4 does not Granger Cause DY1	268	0.40957	0.6644
DY1 does not Granger Cause DX4		0.04782	0.9533
DX1 does not Granger Cause DY2	285	0.24576	0.7823
DY2 does not Granger Cause DX1		0.10563	0.8998
DX2 does not Granger Cause DY2	285	13.8795	2.E-06
DY2 does not Granger Cause DX2		0.31314	0.7314
DX3 does not Granger Cause DY2	271	1.27239	0.2819
DY2 does not Granger Cause DX3		0.45987	0.6319
DX4 does not Granger Cause DY2	268	0.15868	0.8534
DY2 does not Granger Cause DX4		0.11087	0.8951

To test Granger Causality between the dependent and independent variables, Pairwise Granger Causality was utilized.
The Hypothesis is:
Ho: Does not Granger Cause
Ha: Granger Causes

Figure 20 Scatter Diagram

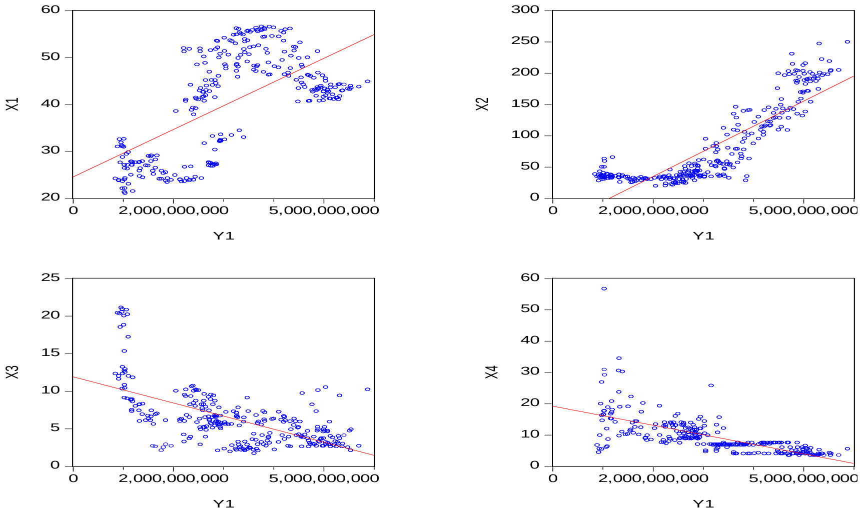


Figure 21 Scatter Diagram

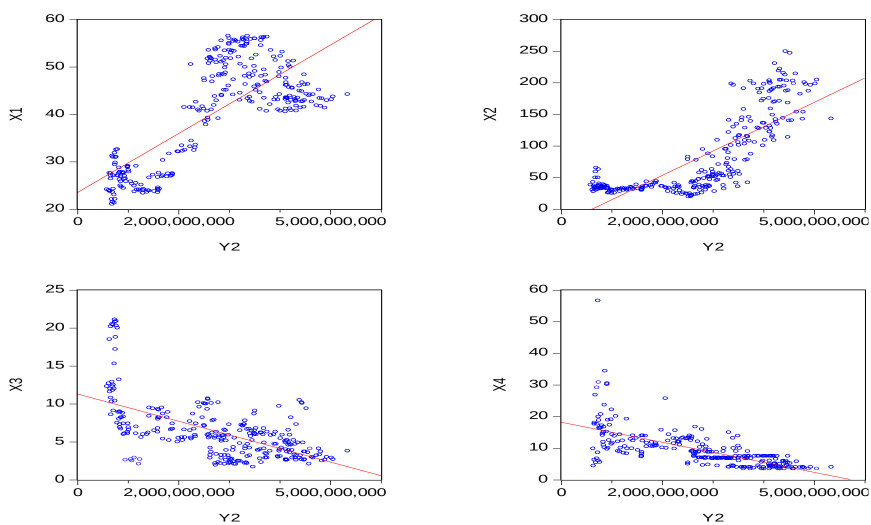


Table 17

	Exchange Rate (X_1)	Domestic Crude Oil Price (X_2)	Inflation Rate (X_3)	Interest Rate (X_4)
Import (y_1)	0.600870	0.862964	-0.580180	-0.662250
p-value	0.000000	0.000000	0.000000	0.000000
Export (y2)	0.726617	0.786668	-0.568310	-0.659330
p-value	0.000000	0.000000	0.000000	0.000000

Table 18 Values of the Coefficients

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	1.43E+09	1.90E+08	7.534009	0.0000
Exchange Rate (X_1)	29985588	3144207.	9.536771	0.0000
Domestic Crude Oil Price (X_2)	14054505	506875.	27.72773	0.0000
Inflation Rate (X_3)	-73456612	8099581.	-9.069187	0.0000
Interest Rate (X_4)	-15373534	5913211.	-2.599862	0.0098

Table 19 Values of the Coefficients

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	83647546	1.91E+08	0.437635	0.6620
Exchange Rate (X_1)	52973005	3163725	16.74387	0.0000
Domestic Crude Oil Price (X_2)	11182796	510021.9	21.92611	0.0000
Inflation Rate (X_3)	-51723738	8149859	-6.346581	0.0000
Interest Rate (X_4)	-8125377	5949918	-1.365628	0.1732