



## Statistical Analysis of Nigeria's Price Sector: An Econometric Approach

D. M. O. Omebo<sup>1\*</sup>, T. D. Ailobhio<sup>1</sup> and G. I. Fanen<sup>1</sup>

<sup>1</sup>Department of Statistics, Federal University of Lafia, Nasarawa State, Nigeria.

### Authors' contributions

This work was carried out in collaboration among all authors. Author DMOO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author TDA carried out the two stage least square which was used to compare with ordinary least square. Author GIF managed the literature searches and also carried out the second analysis to ascertain if the analysis done by author DMOO was in order. All authors read and approved the final manuscript.

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## Abstract

This study analyzed Nigeria's price sector using a formulated model for the price sector of the Nigeria economy. A set of simultaneous equations were used to reflect the implicit gross domestic product deflators for each of the sectors of the Nigeria economy and was found to be over identified under the order condition for identification. The model was estimated by ordinary least square method and two stage least square methods. All the variables have expected signs and as indicated by the F –statistic, the overall performance of the entire regression is significant. The high measure of  $R^2$  and  $\bar{R}^2$ , in each case indicates that the explanatory variables included in the equation jointly account for the entire variation. The small RMSE also indicates that the equations have good fit. Durbin –Watson statistics shows that there is no positive first order autocorrelation. The small value of the Theil's inequality indicates that the equation has good predictive performance. The researcher therefore recommends that government should employ the model so as to be able to monitor price of each of the sectors of the economy and put proper mechanism in place to control those sectors that affect the overall price sector of the economy.

\*Corresponding author: Email: damebo2002@yahoo.co.uk;

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## 1 Introduction

The importance of price statistics to the economy world over cannot be under estimated. They constitute a very useful tool for policy making, economic planning, analysis and monitoring because price signals help to understand the degree of economic stability or otherwise in the system [1,2]. They also expose distortions and guide decisions regarding corrections. Every commodity produced or service rendered in any economy can be conceived of in terms of a price and quantity relation. Almost every economic transaction has a price tag. Prices to some producers are costs to others, and in this sense the price of a commodity is a reflection of other prices [3]. A single commodity or service usually has more than one price at a point in time. It is therefore, intuitively appealing to a basis for collecting and studying prices. As a result, prices are usually studied in the following forms:

- i. Producer's prices
- ii. Wholesale prices
- iii. Retail price

### Producers' Prices

- (a) **Agricultural commodities:** sources of price statistics for agricultural commodities are at two levels. Export commodity prices are determined either by Government of the market at the beginning of each crop season. There are also farm gate and secondary market prices determined by the interplay of market forces at each market level.
- (b) **Locally –manufactured commodities:** Ex-factory prices of locally –manufactured commodities are usually available in the census of manufacturing or in the industrial survey of economic activities. In the questionnaire administered in such surveys, producers are required to supply information in respect of each manufactured good – the quantity produced, quantity sold, price and total value of sales.
- (c) **Imported commodities:** prices of imported commodities include cost, insurance and freight (C.I.F). A substantial proportion of imported commodities pass through local manufacturers before reaching wholesalers, although many wholesalers engage directly in the import trade. In most countries, the ministry of trade/commerce or the customs and excise department are responsible for providing information on the value and volume of imported commodities.

### Wholesale Price

**Wholesale Price of manufactured Goods:** These are mostly available from major distributors. An additional source of information is the census or survey of distributive trade and services. Wholesale prices can sometimes be used to reconstruct producers' prices where the latter are available and wholesaler' margin is known [4].

### Retail Prices

In most countries, information on retail prices is usually available from retailers. Sample surveys are mounted, during which prices of selected commodities are collected at selected retail outlets. To be meaningful; such prices are weighed in indexed form. This is to ensure that the importance of each commodity to the consumer is reflected in the computed average retail price of a group of commodities.

Survey aimed at measuring changes in retail prices take different forms in different countries. In some countries, such surveys are titled 'consumer surveys'; others call them 'cost of living surveys' or 'retail price indices'. While they all strive to index retail prices, they usually differ in their commodity and geographical coverage. A consumer survey should be based on a stratified sample of all consumers (urban, rural, lower, middle and upper income groups) and of groups of commodities and services

## 1.1 Definition of terms

### 1.1.1 Implicit GDP deflators

Implicit GDP provide a broad measure of the change in the overall level of prices of the goods and services that make up GDP between the base year and any other period. An IGD is derived from the followings:

- (i) **Current Price GDP:** This is an indicator of changes in quantity and price, as it measures the value of goods and services in the prices prevailing in the current period. It is obtained for each year's prices.
- (ii) **Constant Price GDP:** This is an indicator of changes in quantity, as it measures the value of goods and services in the prices prevailing in the base year. Constant price GDP is obtained by summing the current year's quantities at the base year's prices.
- (iii) **Private consumption expenditure (PCE):** This measures the final purchase of goods and services by households. The trend of the PCE, IGD and CPI are broadly similar.
- (iv) **The production Based IGDs:** These are derived from production –based GDP estimates. It reflects the implicit price changes of the various industries.

## 1.2 Justification of the study

The presentation (usually in tabular form) of the price index, inflation figures as well as other statistical measures on the economy by the Central Bank of Nigeria (CBN) or related institutions does not provide a logical or scientifically rational frame work for an insight into the workings of the economy from the price sector standpoint. Merely looking at these figures does not afford one the opportunity of integrating in a meaningful way the relationship among the variables for the purpose of forecasting and planning. An econometric model is to be formulated and estimated for the purpose of providing a rational framework for prediction, planning and getting important economic parameters.

The model is designed to allow for testing and refining on a continuous basis for the purpose of making regular short term forecasts, policy analysis and projections.

## 1.3 Aim and objectives of the study

The aim and objectives of the study among others are:

- i. To formulate a model for the price sector
- ii. To access the predictive performance of the model
- iii. To make regular short term forecasts

## 1.4 Nature and scope of data

The data to be used for the study is a secondary data extracted from various issues of Annual Abstract of Statistics, Digest of Statistics and Statistics Bulletin and Annual Report and Statement of Accounts published by the Central Bank of Nigeria (CBN). The data cover a period of twenty-five years from 1981-2005. Central Bank of Nigeria Statistical Bulletins and Annual Report and Statement of Account for 1981,1985 and 2001 was extensively used for the analysis.

## 2 Review of Related Literature

Karpetis [4] in the work Fiscal and Monetary policy interaction in a simple accelerator model posited that long run value inflation (expected and actual) is affected by size of government expenditure and nominal money supply. Han and Mulligan [5] found a positive relationship between big government and inflation. That is, big government causes high inflation rate. Sulaiman et al. [6] in their study of money, government

expenditure, output and prices in Pakistan found that government expenditure and inflation are negatively related to economic growth in the long run while  $M_2$  positively, impact on economic growth.

Okpara [1,2] in his study on government, money supply and prices in Nigeria, found a very poor and insignificant relationship between government expenditure and prices. Nevertheless, through exerting a strong influence on money supply (via high powered money) government expenditure influences prices. He established a strong relationship between government expenditure and money supply through the stock of high-powered money. According to him, as government expenditure increases the stock of high powered money increase and leads to increase in the money supply, which strongly affects the price level. He concluded that inflation in Nigeria is a monetary phenomenon. Olubusoye and Oyaramade [7] analyzing the source of fluctuations in inflation in Nigeria using the framework of error correction mechanism found that the lagged consumer price index (CPI) among other variables propagate the dynamics of inflationary process in Nigeria. The level of output was found to be negative and significant only at the 10% level in the parsimonious error correction model. Omoke and Ugwuanyi [8] in their long run study of money, price and output in Nigeria found no cointegrating vector but however found that money supply granger causes both output and inflation suggesting that monetary stability can contribute towards price stability. They also concluded that inflation in Nigeria is a monetary phenomenon.

### 3 Methodological Framework

This section employs the macro-economic models and discusses material sources and the econometrics methods for the estimation and evaluation of the relationship of the variables.

#### 3.1 Specification of model for the analysis

An attempt is made to explain the implicit GDP deflator obtained for each of the twelve supply sectors. Beside the overall GDP deflator, twelve price equations are specified using in each case a relevant price variable. The following are the thirteen price equations.

#### THE MODEL FOR THE PRICE SECTOR

$$PAG_t = \alpha_0 + \alpha_1 P_t + (1-\lambda) PAG_{t-1} + U_{1t} \dots \dots \dots \text{equation 1}$$

$$PMAN_t = \alpha_0 + \alpha_1 IPM_t + (1-\lambda) PMAN_{t-1} + U_{2t} \dots \dots \dots \text{equation 2}$$

$$PBC_t = \alpha_0 + \alpha_1 IUPMC_t + \alpha_2 IMP_t + U_{3t} \dots \dots \dots \text{equation 3}$$

$$PFS_t = \alpha_0 + (1-\lambda) PFS_{t-1} + U_{4t} \dots \dots \dots \text{equation 4}$$

$$PPET_T = \alpha_0 + (1-\lambda) PPET_{t-1} + U_{5t} \dots \dots \dots \text{equation 5}$$

$$PU_t = \alpha_0 + (1-\lambda) PU_{t-1} + U_{6t} \dots \dots \dots \text{equation 6}$$

$$PL_t = \alpha_0 + \alpha_2 PFS_t + U_{7t} \dots \dots \dots \text{equation 7}$$

$$PD_t = \alpha_0 + \alpha_1 PTC_t + U_{8t} \dots \dots \dots \text{equation 8}$$

$$POS_t = \alpha_0 + \alpha_1 PU_t + U_{9t} \dots \dots \dots \text{equation 9}$$

$$PTC_t = \alpha_0 + (1-\lambda) PTC_{t-1} + U_{10t} \dots \dots \dots \text{equation 10}$$

$$PGS_t = \alpha_0 + (1-\lambda) PGS_{t-1} + u_{11t} \dots \dots \dots \text{equation 11}$$

$$POM_t = \alpha_0 + (1-\lambda) POM_{t-1} + U_{12t} \dots \dots \dots \text{equation 12}$$

$$P_t = \alpha_0 + \alpha_1 \text{CPI}_t + \alpha_2 \text{IMP}_t \dots \dots \dots \text{equation 13}$$

Where  $0 < \lambda < 1$ ,  $\alpha_1 > 0$ ,  $\alpha_2 > 0$ .

The endogenous variables are listed below:

- PAG<sub>t</sub> = Implicit G.D. P. deflator agric
- PMAN<sub>t</sub> = Implicit G.D.P. deflator manufacturing
- PBC<sub>t</sub> = Implicit G.D.P. deflator building and construction
- PFS<sub>t</sub> = Implicit G.D.P. deflator fishing
- PPET<sub>t</sub> = Implicit G.D.P. deflator petroleum
- PU<sub>t</sub> = Implicit G.D.P. deflator utilities
- PL<sub>t</sub> = Implicit G.D.P. deflator livestock
- PD<sub>t</sub> = Implicit G.D.P. deflator distribution
- POS<sub>t</sub> = Implicit G.D.P. deflator other services
- PTC<sub>t</sub> = Implicit G.D.P. deflator transport and communication
- PGS<sub>t</sub> = Implicit G.D.P. deflator government services
- POM<sub>t</sub> = Implicit G.D.P. deflator mining
- P<sub>t</sub> = Overall G.D.P. deflator

Similarly, below are the exogenous variables which are distinguished by (\*) at the top.

- PAG\*<sub>t-1</sub> = lagged value of G.D.P. agric
- IMP\*<sub>t</sub> = import price manufactures index
- PMAN\*<sub>t-1</sub> = Lagged value of G.D.P fishing
- PPET\*<sub>t-1</sub> = Lagged value of G.D.P petroleum
- PU\*<sub>t-1</sub> = Lagged value of G.D.P utilities
- PTC\*<sub>t-1</sub> = Lagged value of G.D.P transport and communication
- PGS\*<sub>t-1</sub> = Lagged value of G.D.P government services
- POM\*<sub>t-1</sub> = Lagged value of G.D.P mining
- CPI\*<sub>t</sub> = Consumer price index all items.

### 3.2 Materials and methods

The data are sourced from the statistical Bulletin of the Central Bank of Nigeria.

Even though ordinary least squares method is seen to give biased and inconsistent estimate when applied to relationships with current endogenous variables on the right hand side [9], the model will first be estimated by ordinary least squares. The above complete macro-economic model is seen to be over identified, under the order conditions for identification; that is  $(K-M) > (G-1)$  in each of the equations.

Where K is the number of total variable in the model (endogenous and predetermined), M is the number of variables (endogenous and exogenous) included in a particular equation while G is the total number of equations or total number of endogenous variables. In view of these, the complete macro-economic model will be evaluated by employing the two stages least squares method.

### 3.3 Theil's inequality

To assess the predictive performance of the estimated equations, use will be made of Theil's inequality. This is a systematic measure of the accuracy of the forecasts obtained from an econometric model as suggested by H. Theil. [10]. This measure is called the inequality coefficient and is defined by the expression.

$$U^2 = \frac{\sum(P_i - A_i)^2/n}{\sum A_i^2/n} \dots\dots\dots \text{equation (14)}$$

Where  $P_i$  predicted changes in dependent variables.

$A_i$  = Actual changes in dependent variable with  $0 \leq U \leq \infty$ . The smaller the value of the inequality coefficient, the better the forecasting performance of the model.

If  $P_i = A_i$ , then  $U^2 = 0$ , we say that we attain a perfect forecast with our model.

The analysis was carried using E-view 7 as given below:

**The estimation of equation (1) is given by:**

**OLS:**

$$PAG_t = -33411.44 + 0.320111P_t + 0.859308PAG_{t-1}$$

(0.057650)                      (0.017037)                      (0.047428)

$R^2 = 0.975995$      $\bar{R}^2 = 0.908342$      $RMSE = 1.056896$      $D.W = 1.907128$   
 $F\text{-statistic} = 447.2407$      $\text{Theil's inequality} = 0.034497$

**2SLS:**

$$PAG_t = -140131.0 + 0.230172P_t + 0.50756 PAG_{t-1}$$

(0.015927)                      (0.047987)                      (0.16605)

$R^2 = 0.915980$      $\bar{R}^2 = 0.908342$      $RMSE = 1.059043$      $F\text{-Statistic} = 130.9217$      $D.W = 1.834269$   
 $\text{Theil's inequality} = 0.034570$

All the variables have expected signs and as indicated by the F –statistic, the overall performance of the entire regression is significant.

The high measure of  $R^2$  and  $\bar{R}^2$ , in each case indicates that the explanatory variables included in the equation jointly account for the entire variation in  $PAG_t$ . The small RMSE also indicates that the equation has a good fit.

Durbin –Watson statistics shows that there is no positive first order autocorrelation. The small value of the Theil’s inequality indicates that the equation has good predictive performance.

**(2) The estimation of equation (2) is given by:**

**OLS:**

$$PMAN_t = 869.1161 + 131.5269IMP_t + 0.85681PMAN_{t-1}$$

$$(3.638143) \quad (2.491050) \quad (0.054566)$$

$$R^2=0.991564 \quad \bar{R}^2=0.990797 \quad RMSE=2.281545 \quad F\text{-statistic}=1292.878, D.W=0.699015$$

$$\text{Theil's inequality}=0.065881$$

**2SLS:**

$$PMAN_t=869.1161 + 131.52691IMP_t + 0.856581PMAN_{t-1}$$

$$(3.638143) \quad (2.491050) \quad (0.054566)$$

$$R^2=0.991564 \quad \bar{R}^2=0.990797 \quad RMSE=9.650337 \quad D.W=0.699015 \quad F\text{-statistic}=1292.878$$

$$\text{Theil's inequality}=0.804721$$

All the variables have expected sign under OLS and 2SLS. Durbin –wartson under OLS and 2SLS indicates that there is no positive first order autocorrelation. That value of Theil’s inequality shows that the equation has a good predictive performance.

**(3) The estimation of equation (3) is given by:**

**OLS:**

$$PBC_t = -9343.017 + 32.076391IUPMC_t + 0.6619051IMP_t$$

$$(0.5026880) \quad (0.3145255) \quad (0.2839887)$$

$$R^2 = 0.908780 \quad \bar{R}^2 = 0.900488 \quad RMSE=1.684082 \quad F\text{-Statistic}=109.5881 \quad D.W =1.839682$$

$$\text{Theil's inequality} = 0.034570$$

**2SLS:**

$$PBC_t = -9343.017 + 32.07639UPMC_t + 0.661905IMP_t$$

$$(0.5026880) \quad (0.3145255) \quad (0.2839887)$$

$$R^2=0.908780 \quad \bar{R}^2=0.900488 \quad RMSE =1.684082 \quad F\text{-Statistic}=109.5881 \quad D.W.=1.839682$$

$$\text{Theil's inequality}=0.034570$$

Similarly, all the variables have expected signs and as such all the exogenous variables are significant parameters in explaining  $PBC_t$ .

**(4) The estimation of equation (4) is given by:**

**OLS**

$$\begin{aligned} PFS_t = & 842.7261 + 0.000856PFS_{t-1} \\ & (694.7462) \quad (0.012190) \\ R^2 = & 0.996535 \quad \bar{R}^2 = 0.996384 \quad RMSE = 3.495424 \end{aligned}$$

$$D.W = 2.128123 \quad F\text{-Statistic} = 6615.081 \quad \text{Theil's inequality} = 0.078999$$

**2SLS:**

$$\begin{aligned} PFS_t = & 842.7261 + 0.000856PFS_{t-1} \\ & (694.7462) \quad (0.012190) \\ R^2 = & 0.996535 \quad \bar{R}^2 = 0.996384 \quad RMSE = 3.495424 \end{aligned}$$

$$D.W = 2.128123 \quad F\text{-Statistic} = 66.0381$$

$$\text{Theil's inequality} = 0.023439$$

All the coefficients support economic theory by retaining their signs as in the model under the two methods. They are all statistically significant at the 5% level for all the methods. Measures of  $R^2$  and  $\bar{R}^2$  shows that all the variables jointly explains the variation in  $PFS_t$ . These together with the RMSE show a good fit under the two estimation methods. The value of Durbin –Watson indicates that there is no positive first order autocorrelation. The overall regression using the F-Statistic is also statistically significant.

The small measure of Theil's inequality coefficient in each case show that the equation has good predictive performance.

**(5) The estimation of equation (5) is give by:**

**OLS:**

$$\begin{aligned} PPET_t = & -3062050 + 0.7808413PPET_{t-1} \\ & (1.925925) \quad (1.482015) \\ R^2 = & 0.546888 \quad \bar{R}^2 = 0.527187 \quad RMSE = 2.281545 \end{aligned}$$

$$D.W = 1.410710 \quad F\text{-Statistic} = 27.76006$$

$$\text{Theil's inequality} = 0.065881$$

**2SLS:**

$$\begin{aligned} PPET_t = & -3062050 + 0.7808413PPET_{t-1} \\ & (1.925915) \quad (1.482015) \\ R^2 = & 0.546888 \quad \bar{R}^2 = 0.527187 \quad RMSE = 1.684082 \quad D.W. = 1.410710 \quad F\text{-Statistic} = 27.76006 \quad \text{Theil's} \\ & \text{Inequality} = 0.1542 \end{aligned}$$

Similarly, the performance of the equations is as expected. This is seen from the valves of  $R^2$  and  $\bar{R}^2$ . Likewise, the value of Durbin – Watson is an indication that there is no first order autocorrelation.

**Estimation of equation (6) is given by:**

**OLS:**



$$Pu_t = 603.0284 + 0.1128633 Pu_{t-1}$$

(6.649913)      (0.076602)

$$R^2 = 0.904200 \quad \bar{R}^2 = 0.90035 \quad RMSE = 1.056896 \quad D.W. = 2.061712 \quad F\text{-Statistic} = 217.083$$

$$\text{Theil's inequality} = 0.0575$$

**2SLS:**

$$Pu_t = 603.0284 + 0.1128633 Pu_{t-1}$$

(6.649913)      (0.076602)

$$R^2 = 0.904200 \quad \bar{R}^2 = 0.900035^i \quad RMSE = 1.056896 \quad D.W. = 2.061712 \quad F\text{-Statistic} = 217.831 \quad \text{Theil's inequality} = 0.0575$$

**(7) The estimation of equation (7) is given by:**

**OLS:**

$$PL_t = 8167.725 + 1.873418 PFS_t$$

(3181.485)      (0.055742)

$$R^2 = 0.980044 \quad \bar{R}^2 = 0.979177 \quad RMSE = 1.056896 \quad D.W. = 0.500718 \quad F\text{-Statistic} = 1129.553 \quad \text{Theil's inequality} = 0.054029$$

**2SLS:**

$$PL_t = 8167.725 + 1.873418 PFS_t$$

(3181.405)      (0.055742)

$$R^2 = 0.980044 \quad \bar{R}^2 = 0.979177 \quad RMSE = 1.056896 \quad D.W. = 0.500718 \quad F\text{-Statistic} = 1129.553 \quad \text{Theil's inequality} = 0.054029$$

All the variables have expected signs. The Durbin – Watson statistic is low which is an indication that the predictive performance of the equation is poor.

**The estimation of equation (8) is given by:**

**OLS:**

$$PD_t = 113147.1 + 0.759613 PTC_t$$

(45269.58)      (0.380979)

$$R^2 = 0.147372 \quad \bar{R}^2 = 0.110301 \quad RMSE = 2.03143 \quad F\text{-Statistic} = 3.975430 \quad D.W = 0.714370 \quad \text{Theil's inequality} = 0.408711$$

**2SLS:**

$$PD_t = 113147.1 + 0.759613 PTC_t$$

(45269.58)      (0.380979)

$$F\text{-Statistic} = 3.975430 \quad D.W = 0.714370 \quad \text{Theil's inequality} = 0.408711$$

**The estimation of equation (9) is given by:**

**OLS:**

$$\text{POS}_t = 2269.271 + 3.724111\text{PU}_t$$

(2428.436) (0.231644)

$$R^2 = 0.918285 \quad \bar{R}^2 = 0.914732 \quad \text{RMSE} = 1.043201 \quad F\text{-Statistic} = 258.4658 \quad \text{D.W} = 0.967941 \quad \text{Theil's inequality} = 0.120918$$

**2SLS:**

$$\text{POS}_t = 2269.271 + 3.724111 \text{PU}_t$$

(2428.436) (0.231644)

$$R^2 = 0.918285 \quad \bar{R}^2 = 0.914732 \quad \text{RMSE} = 1.043201 \quad F\text{-Statistic} = 258.4658 \quad \text{D.W} = 0.967941 \quad \text{Theil's inequality} = 0.23087$$

**The estimation of equation (10) is given by:**

**OLS:**

$$\text{PTC}_t = 2294.898 + 0.010441\text{PTC}_{t-1}$$

(1890.95) (0.015948)

$$R^2 = 0.994062 \quad \bar{R}^2 = 0.993803 \quad \text{RMSE} = 5.0224 \quad \text{D.W} = 2.1436668 \quad F\text{-Statistic} = 3850.125 \quad \text{Theil's inequality} = 0.031531$$

**2SLS:**

$$\text{PTC}_t = 2294.898 + 0.010441\text{PTC}_{t-1}$$

(1890.95) (0.015948)

$$R^2 = 0.994062 \quad \bar{R}^2 = 0.993803 \quad \text{RMSE} = 5.02114$$
$$F\text{-Statistic} = 3850.125 \quad \text{D.W} = 2.143668 \quad \text{Theil's inequality} = 0.031531$$

**The estimation of equation (11) is given by:**

**OLS:**

$$\text{PGS}_t = 2105.867 + 0.998322\text{PGS}_t$$

(1935.904) (0.038720)

$$R^2 = 0.973578 \quad \bar{R}^2 = 0.972429 \quad \text{RMSE} = 7.04320$$
$$F\text{-Statistic} = 847.4761 \quad \text{D.W} = 1.655313 \quad \text{Theil's inequality} = 0.064923$$

**2SLS:**

$$\text{PGS}_t = 2105.867 + 0.998322 \text{PGS}_{t-1}$$

(1935.904) (0.038720)

$$R^2 = 0.973578 \quad \bar{R}^2 = 0.972429 \quad \text{RMSE} = 7.04320 \quad F\text{-Statistic} = 847.4761 \quad \text{D.W} = 1.655313 \quad \text{Theil's inequality} = 0.064923$$

**The estimation of equation (12) is given by:**

**OLS:**

$$POM_t = -256.6329 + 0.9750644 POM_{t-1} \quad D.W = 2.162283 \quad F\text{-Statistic} = 1470.232 \quad \text{Theil's inequality} = 0.049079$$

**2SLS:**

$$POM_{t-1} = -256.6329 + 0.9750644 POM_{t-1} \\ (142.1228) \quad (0.035220)$$

$$R^2 = 0.984597 \quad \bar{R}^2 = 0.983927 \quad RMSE = 5.202481 \quad D.W. = 2.162283 \quad F\text{-Statistic} = 1470.232 \quad \text{Theil's inequality} = 0.049079$$

**The estimation of equation (13) is given by:**

**OLS:**

$$P_t = -1790990 + 6679.016CPI_t + 139372.61MP_t \\ (3965119) \quad (47370.71) \quad (47370.71)$$

$$R^2 = 0.708081 \quad \bar{R}^2 = 0.681543 \quad RMSE = 2.056023 \quad D.W. = 0.454178 \quad F\text{-Statistic} = 26.68174 \quad \text{Theil's inequality} = 0.002345$$

**2SLS:**

$$P_t = -790990 + 6679.016CPI_t + 139372.61MP_t \\ (3965119) \quad (34261.54) \quad (47370.71)$$

$$R^2 = 0.708081 \quad \bar{R}^2 = 0.681543 \quad RMSE = 2.056023 \quad D.W. = 0.454178 \quad F\text{-Statistic} = 26.68174 \quad \text{Theil's inequality} = 0.002345$$

## 4 Conclusion

In our estimation of each of the 13 equations, it is expected that the signs of each of the exogenous variables be positive. When any of the equation goes contrary to this, then, it calls for further analysis as it will make the equation not plausible. All the variables have expected signs and as indicated by the F –statistic, the overall performance of the entire regression is significant. The high measure of  $R^2$  and  $\bar{R}^2$ , in each case indicates that the explanatory variables included in the equation jointly account for the entire variation. The small RMSE also indicates that the equation has a good fit. Durbin –Watson statistics shows that there is no positive first order autocorrelation. The small value of the Theil’s inequality indicates that the equation has good predictive performance.

## Competing Interests

Authors have declared that no competing interests exist.

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