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Editor - in – chief

THE INDUSTRIAL IMPACT OF OIL PRICE SHOCKS IN NIGERIA: (1970 – 2010)

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Abstract

This paper examines the industrial impact of oil price shocks in Nigeria from 1970-2009, the econometric approaches adopted in the paper is the VAR impulse response. This study came out with empirical evidence that will help in understanding the impact of oil price shocks onaggregate industrial output in Nigeria while also considering other variables like Exchange rate, Inflation, unemployment and Money Supply. The study came to the conclusion that oil price, inflation and exchange rate has the potentials of causing significant changes in industrial output in Nigeria, while it was also revealed that industrial output was not significantly determined by money supply. This study therefore suggests that more policy attention should be given toproper management of the exchange rate and inflation.

Keywords: Oil price, price shocks, Nigeria

1. Introduction and Problem Statement

Generally, oil is referred to as the engine of modern economy. This is because of its immense usefulness in every modern economy today. Oil is the basic material for a wide range of products, such as lubricants, asphalt, tars, tires, solvents, plastic, foams, bubble gums, deodorants, crayons, etc. Bacon and Kojima (2008) asserts that the amount of oil and derived products an economy consumes depends on numerous factors, such as the level of Gross Domestic Product (GDP), the structure of the economy's industrial sector, the availability of choices among fuels that permit substitution, and the level of technological progress. These also jointly depict the stage of economic development on which a country operates.

It is important to note that the use of crude oil after it is extracted from the ground is limited; the situation is absolutely turned around, once it is refined and made available. This is because oil products, especially fuels are very important for use in different sectors of an economy, such as the transportation, construction, industrial and power-producing sectors, etc. The household use of oil is also overwhelmingly significant for low-income countries, where the power-producing sector is still in an immature phase .

Despite the vast usefulness of oil products, statistics show that oil prices have risen significantly over the years. Crude oil prices have increased on average from US $25 per barrel in 2002 to US $55 in 2005. In the middle of 2008, the increase in oil prices hit a high nominal record of US $147 per barrel; but dropped sharply to US $46 per barrel towards the end of the same year (2008). This situation ignited great concern among economists and analysts about the implication of the oil price shock on industrial output.several analysts have argue that one of the most severe shocks hitting world economies since World War II was sharp increases in the price of oil and other energy products. This oil shocks in oil price have very strong consequences on economic activity as oil price shock is often considered a bad news to a nation (Hamilton, James D., and Ana Maria Herrera.2004).The prices of oil matter for an economy in several ways. This is because shocks in oil price directly affect transportation costs, heating bills, and the prices of goods made with petroleum products. Oil-price shocks induce greater uncertainty about the future, which may lead to firms' and households' delaying purchases and investments. Shocks in prices of oil also lead to reallocations of labour and capital between energy intensive sectors of the economy and those that are not energy-intensive. For these reasons and others, oil-price shocks may significantly slowdown industrial output (Hamilton, James D., and Ana Maria Herrera, 2004).

KomainJiranyakul (2006), assert that oil-price rise affect both supply and demand. Rise in oil prices affect supply because they make it more costly for firms to produce goods since energy and capital are complement which implies that to run machines you need energy, and to run machines more intensively takes more energy. If energy becomes more expensive, firms may have to purchase new energy-efficient machines if they want to maintain profit. The profit of Firms stuck with less fuel-efficient machines suffers, and so they may invest less in capital and labour. These various investment factors slow the economy's rate of industrial output. However, oil-price decreases do not boost industrial output growth as well. This is because although firms find it cheaper to produce goods when the price of oil falls, which will encourage increased production. But the reallocation effect still slows growth as resources

move across sectors in response to lower oil prices. On net, all of these factors may wash out, so that the effect of a decrease in the price of oil is just about zero. This study contributes to the literature by examining the relationship between oil price shocks and industrial output growth in Nigeria. The study is however different from previous studies in scope as it entails recent oil price shocks and industrial output growth in Nigeria.

The Nigerian economy has experience four oil price shock since 1970 till date, the first and second oil shocks occurred in 1973 and 1979, following by the third oil shock in 1990. The third oil crisis caused the rate of oil prices to increase sharply. The oil price hike is a well-known cause of stagflation as mentioned in the macroeconomic literature, i.e. spikes in oil prices cause not only the higher price level, but also lead to drop in aggregate industrial output. This causes a concern that the impact of oil shocks to developing economies facing external financial constraints will be stronger than the impact on the global economy. High oil prices can trigger a rapid decline in consumption and investment confidence with a negative strong impact on real economic activity, specifically industrial production.

The main objective of this paper is to examine the industrial impact of oil price shocks in Nigeria. Other objectives are;

1. To investigate the pattern of industrial (manufacturing) output responses to oil price shocks in Nigeria.
2. To discuss the various industrial policy in Nigeria during the period under study.

The paper is divided into six sections, following this introduction, is section two which focus on brief literature review, and empirical evidences of the relationship between oil price and industrial performance. Section three presents the trend of oil price and industrial output in Nigeria. Section four treats the data and methodology of the study, while the analysis of the result is done in section five and section six treats the recommendation and conclusion.

2 Empirical Literature Review

There exists large academic literature focusing on the economic impact of oil, its impact on the aggregate world economy and specifically on economies of net exporters or net importers of oil, emerging or developed countries etc. The price shocks of 1973 gave rise to several studies analyzing the effects of oil price spikes on industrial output. Increase in oil price can be an indication of a classic supply – side shock that reduces potential industrial output of an oil importing nation (Rasche and Tatom 1977 and 1981;Barro 1984; Brown and

Yucel, 1999). Spikes in oil price signal high cost of production as oil is a major input in production. Thus, growth of output and productivity are reduced when oil price increase.

Valadkhaniet al. (2001) assessthe impact of oil price changes on consumer goods and services during the year 1996-97 in Australia. The major impact of oil price rise was borne by transport sector and agricultural sub-sector. Further, study shows that the impact of rise in oil prices on Australian economy in the year 1996-97 was more than what was observed in 1970s.Valadkhaniet al. (2001) also show that the poor spend a higher proportion of their total consumption expenditure on basic necessities than that of rich and vice versa. In this way they rank the items of consumption expenditures according to their priorities of expenses in terms of weights. The poor household spends more on diesel fuel, kerosene, heating oil, lubricants, other oils, meat, dairy products, food products, LPG and other gas fuels. The increase in oil prices increase cost of production of these items. This increase is relatively more than other items which are less demanded. It can be easily concluded that increase in price of petroleum affects both the consumers and producers. Technically speaking, it can be tentatively concluded that impact of price rises are regressive in nature.

Jiménez-Rodríguez and Sánchez (2005) study the effects of oil price shocks on the real economic activity of Japan (among other OECD countries) employing quarterly data from 1972:I to 2001:IV. They find a negative association between oil prices and Japanese real GDP growth using a second-order vector auto-regression model. Cuñado and Pérez de Gracia (2005) use quarterly data from 1975:I to 2002:II to show that there are no co-integrating long-run relationships between oil prices and industrial production and between oil prices and CPI, with the impact of oil shocks on these variables thus being limited to the short run. Moreover, they find that oil price shocks Granger-cause both output growth rates and inflation rates.

Zhang (2008) applies Hamilton's (2001) approach to investigate the relationship between oil price shock and Japanese industrial production growth using quarterly data from 1957:I to 2006:IV and finds that the oil price changes and macroeconomic activity in Japan appear to be affected by a non-linear relationship.

Rodríguez (2007), analysisthe response of manufacturing industrial output to an oil price shock in the four EMU countries namely, France, Germany, Italy and Spain, the US, and the UK the latter is the only net oil exporting country. Andshow that oil price increase lowers the level of aggregate manufacturing output in all countries under study, although the pattern of response differs somewhat across countries.

3 Trend of oil price and industrial output

The adverse economic impacts from oil crisis are more severe for oil-importing developing economies where Nigeria happens to belong than industrialized countries because of the high dependency on imported oil. Like other developing countries, Nigeria substantially relied on imports of oil. Recently, the Nigerian economy has experienced an upward trend of oil prices which causes a concern that the overall cost of production will substantially increase. Despite all the industrial policy put in place by the Nigerian Government, industrial output has shown a decline if not constant trend. One might conclude that the reason why industrial outputs have been declining over the years is the continuous shocks in international oil price.

According to Hamilton, (1983); and Wakeford, (2006), Oil price shocks are usually defined assudden price fluctuations resulting from changes in either the demand or supply side of the international oil market which arises as a result of the following factors;(i) OPEC supply quotas;(ii) political upheavals in the oil-rich Middle East; (iii) Asian growing oil demand; (iv)militant group's activities in the Niger Delta region of Nigeria. Akpan(2007) assert that thisshock in oil price could be a rise (positive) or a fall (Negative). Two issues are usually deduce from oil price shocks; one is the magnitude of the price increase which can be quantified in absolute terms or as percentage changes, andtwo the timing of the shock, that is, the speed and persistence of the price increase. (Akpan, 2007).

From the above, four oil price shocks can be notice in Nigeria i.e. 1972-1974, 1979 – 1980, 1990, and 2003 - 2006. Each of the oil price shocks had connections with inflation rate and the level of industrial output in Nigeria. The 1972-1974, 1990, and 2003-2006 periods were associated with price increases while the world oil market crash in 1980 was an episode of oil price decrease (see table below). I.e.during the first oil price shocks in Nigeria, oil price increase 3 dollar in 1972 to 11 dollar in 1974, inflation rate rose by about 300 percent i.e. from 3 to 9.5 with capacity utilization falling from 40.9 in 1972 to 35.3 by 1974 which is an indication of a fall in industrial output. This resulted in increased unemployment. In the same vain during the oil price shocks of 1979 – 80, and 2003 – 2006, oil price increase from 30 dollars to 40 dollars, and 29 dollar to 66.7 dollars respectively.Although during this periods, Nigeria benefited from the increase in oil price, but the net effect was negative as Nigeria export unrefined oil which price is low compared to the refined oil. Thus the macroeconomic environment in Nigeria during the spikes in oil price was undesirable. For instance inflation was mostly double digit as Nigeria recorded increase in inflation rate from 8.3 in 1979 to 16.3

in 1980, and 11.6 in 2003 to 23.8 in 2006, while capacity utilization drop from 71.5 to 70.1 , and 56.5 to 53.3 in 1979-80, and 2003-2004 respectively.Reported in Table 1 is the trend of international oil price, capacity utilization and inflation rate in Nigeria. .

Table 1 oil price, industrial output and Inflation rate in Nigeria: (1970 – 2009)

Year	Oil Price	Capacity utilization	Inflation rate
1970	2		1.3
1971	2.3		2.7
1972	3	40.9	3.0
1973	12.2	36	18.5
1974	11	35.3	9.5
1975	12.4	76.6	43.5
1976	14.1	77.4	12.1
1977	14.7	78.7	31.3
1978	15.2	72.9	6.2
1979	30	71.5	8.3
1980	40	70.1	16.1
1981	37.4	73.3	17.4
1982	33.5	63.6	6.9
1983	29.9	49.7	38.8
1984	28.9	43.0	22.6
1985	27.8	38.3	1.0
1986	14.5	38.8	13.7
1987	18.5	40.4	9.7
1988	15.1	42.4	61.2
1989	18.5	43.8	44.7
1990	24.2	40.3	3.6
1991	20.6	42.0	23.0
1992	20	38.1	48.8
1993	17.6	37.2	61.3
1994	16.2	30.4	76.8

1995	17.3	29.29	51.6
1996	21.2	32.46	14.3
1997	19.4	30.4	10.2
1998	13.3	32.4	11.9
1999	18	34.6	0.2
2000	28.6	36.1	14.5
2001	24.8	42.7	16.5
2002	25.2	54.9	12.1
2003	29.0	56.5	11.6
2004	38.7	55.7	10.0
2005	55	54.80	11.6
2006	66.7	53.30	23.8
2007	75	53.38	6.6
2008	101	53.84	15.1
2009	63.9	54.2	12.1
2010	88.4	56.3	14.6

Source; CBN and OPEC Bulletin (2010)

4. Data and Methodology

Data Source

The data set for this paper consists of annual time series from 1970 - 2010. The variables under consideration are oil price (oilp), capacity utilization (CU) a measure of economic performance, inflation rate (INF), money supply (MS_2), unemployment (UN), exchange rate (EXRT)and the data are obtain from central bank of Nigeria and Organisation of Petroleum Exporting Countries Bulletin respectively.

Methodology

The principal method employed to analyze the time series behaviour of the data involves unit root test, co-integration test and the estimation of vector autoregressive model (VAR). Specifically, we employ unit root test to detect the order of integration of the variables using the Augmented Dickey Fuller (ADF) Test by dickey and fuller (1979). The unit root test is necessary because research has shown that non-stationary data leads to spurious regression. The study tested for co-integration using the johansen approach which is

suitable for VAR model. We employ the vector autoregressive model (VAR), which better explains a revolving door model. This choice of the estimation technique is as a result of the fact that Vector Auto Regression model best captures the two-way relationship between oil price, industrial output and other variable using their related lags. A unique feature of the VAR model is that an endogenous variable in one equation of the system appears in another equation as an explanatory variable thereby becoming stochastic and correlated with the disturbance term (Shock or impulse term) of the equation. Also, in a VAR model, variables are treated equally and no distinctions are made between endogenous and exogenous variables. Hence, the Ordinary Least Square (OLS) technique will appear to produce results that are inconsistent and bias.We commence by testing for unit root in the data. The first step is to determine the order of integration of the variables before testing for co – integration.

Following the theoretical background of this study, and using the autoregressive framework developed by Sims (1980) we specify a VAL model of order p. The general form of a VAR model is given by the following unrestricted (reduced form) system.

$$Z_t = \alpha + \sum_{i=1}^{p} \beta Z_{t-1} + u_t \quad \text{----------} \quad (1)$$

Equation (1) above specifies a VAR (P) process, Where Z_t is a vector of stationary endogenous Variables, α is an $n \times 1$ vector of constants, β is an (n*n) matrix of coefficients, p is the number of lag, U_t is an (n*n) vector of error term. In addition, u is an independently and identically distributed with zero mean, i.eE $(u_t) = 0$ and $E(u_{tk}, u_{sk}) = 0$ *for* $t \neq s$). The disturbance term, ut also has a covariance

More specifically, the model which also incorporates the above Direct and Indirect linkages is presented as follows:

$$OILP_t = \alpha_t + \sum_{j=1}^{n} \beta_j OILP_{t-j} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \sum_{j=1}^{n} Y_{ij} EXRT_{t-j} + \sum_{j=1}^{n} \phi_j CU_{t-j} + \sum_{j=1}^{n} \Omega_j INFL_{t-j} + \sum_{j=1}^{n} \theta_j UN_{t-j} + U_1$$

$$MS_t = \alpha_t + \sum_{j=1}^{n} \beta_j OILP_{t-j} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \sum_{j=1}^{n} Y_{ij} EXRT_{t-j} + \sum_{j=1}^{n} \phi_j CU_{t-j} + \sum_{j=1}^{n} \Omega_j INFL_{t-j} + \sum_{j=1}^{n} \theta_j UN_{t-j} + U_2$$

$$EXRT_t = \alpha_t + \sum_{j=1}^{n} \beta_j OILP_{t-j} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \sum_{j=1}^{n} Y_{ij} EXRT_{t-j} + \sum_{j=1}^{n} \phi_j CU_{t-j} + \sum_{j=1}^{n} \Omega_j INFL_{t-j} + \sum_{j=1}^{n} \theta_j UN_{t-j} + U_3$$

$$CU_t = \alpha_t + \sum_{j=1}^{n} \beta_j OILP_{t-j} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \sum_{j=1}^{n} Y_{ij} EXRT_{t-j} + \sum_{j=1}^{n} \phi_j CU_{t-j} + \sum_{j=1}^{n} \Omega_j INFL_{t-j} + \sum_{j=1}^{n} \theta_j UN_{t-j} + U_4$$

$$INF_t = \alpha_t + \sum_{j=1}^{n} \beta_j OILP_{t-j} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \sum_{j=1}^{n} Y_j EXRT_{t-j} + \sum_{j=1}^{n} \phi_j CU_{t-j} + \sum_{j=1}^{n} \Omega_j INFL_{t-j} + \sum_{j=1}^{n} \theta_j UN_{t-j} + U_{it}$$

$$UN_t = \alpha_t + \sum_{j=1}^{n} \beta_j OILP_{t-j} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \sum_{j=1}^{n} Y_j EXRT_{t-j} + \sum_{j=1}^{n} \phi_j CU_{t-j} + \sum_{j=1}^{n} \Omega_j INFL_{t-j} + \sum_{j=1}^{n} \theta_j UN_{t-j} + U_{it}$$

Where $\Omega, \phi, Y, \delta, \beta, \theta$ and α are the unknown parameters, α is the constant or interceptu"s is the stochastic error terms, n is no of lags and UN, CU, MS_2, INF, OILP, EXRT are as define above.

5. Empirical results and discussions

The vector autoregressive method of estimation of the 2nd order was used. This is because in choosing the appropriate order of VAR, one must take into account the possibility of running into the problem of lost degree of freedom or the problem of multi-collinearity. It is to this end that in choosing the best order to give us a result that is manageable, we adopt a 2 lag VAR model. We however started by first conducting stationarity test for the variables this are presented below.

5.1 Unit root test

Econometric studies have shown that most macroeconomic time series variable are non-stationary and using non-stationary variables in the model might lead to spurious regressions Granger (1969). The first or second differenced terms of most variables will usually be stationary Ramanathan (1992). All variables are tested at levels and first difference using ADF unit root test. The justification for the use of ADF unit root is based on large sample (n > 30).

Table 2: Unit Root Test using ADF Statistic

Stationarity test for variables					
variables		ADF test stat	Critical values		Order of integration
			1%	5%	
exrt	level	-1.363072	-4.211868	-3.529758	I(1)
	1st diff	-5.556079	-4.219126**	-3.533083	

Cu	level	-1.553282	-4.262735	-3.552973	I(1)
	1st diff	-4.011852	-4.262735**	-3.552973	
Ms_2	level	-2.671019	-4.219126	-3.533083	I(1)
	1st diff	-4.237124	-4.219126**	-3.533083	
Inf	level	-3.667167	-4.211868	-3.529758	I(1)
	1st diff	-7.539076	-4.219126**	3.533083	
Oilp	level	-1.792095	-4.211868	-3.529758	I(1)
	1st diff	-5.183305	-4.219126**	-3.533083	
Un	level	-1.231889	-4.211868	-3.529758	I(1)
	1st diff	-6.216775	-4.219126**	-3.533083	

Source; Own Estimates Note ** represent 1% levels significance respectively.

Table 1 above reveals that at levels, none of the variables was stationary at 1 percent, while after taking the first difference, they all became stationary. This imply that INF, broad Money Supply, Exchange Rate, OILP, CU and UN are stationary and integrated of order one i.e. I(1). The stationarity of the variables also satisfied the condition for conducting further test.

5.2 Analysis of result

5.2.1 Impulse Response Functions (IRF)

Impulse response factions are devices to display the dynamics of the variables tracing out the reaction of each variable to a particular shock at time't'. Figure 1.0 shows the impulse response functions of one of the variables (money supply, oil price, capacity utilization,

Exchange Rate, Inflation and unemployment) as against their own shocks and shocks in one other variable over a 10 year horizon. It can be deduced from figure 1.0 that past oil price shocks had positive impact with current oil price from year 1 to year 7. However,from year 8 to 10, the impact was very minute but positive. In the case of the response of capacity utilization to oil price shocks, there was positive response from year 1 and 2, from year 3, capacity utilization respond negatively to oil price shocks thus it can be concluded that oil price shocks reduces capacity utilization, this will lead to a fall in aggregate industrial output. Response of unemployment to oil price shocks was unnoticed over the years but from year 7 to year 10 unemployment respond negatively to oil price shocks.Response of inflation to oil price shocks is invariably unnoticed over a 10 year horizon. The response of exchange rate to oil price shocks was negative from year 1 to year 10. The response of money supply to oil price shocks was positive from year 1 to year 5, however from year 6 to year 10, money supply responded negatively to oil price shocks. The response of capacity utilization to inflation shock was zero until after the second year, there after, shocks in inflation impact negatively to capacity utilization up to year 10. However, exchange rate shocks had a positive impact on capacity utilization from year 1 to year 8, from year 10 the impact was positive but minute. Thus appreciation of the exchange rate will bring about increase aggregate industrial output. Finally, inflation responded to shocks in money supply from year 1 to 3, however from year 4 the impact was positive but minute.

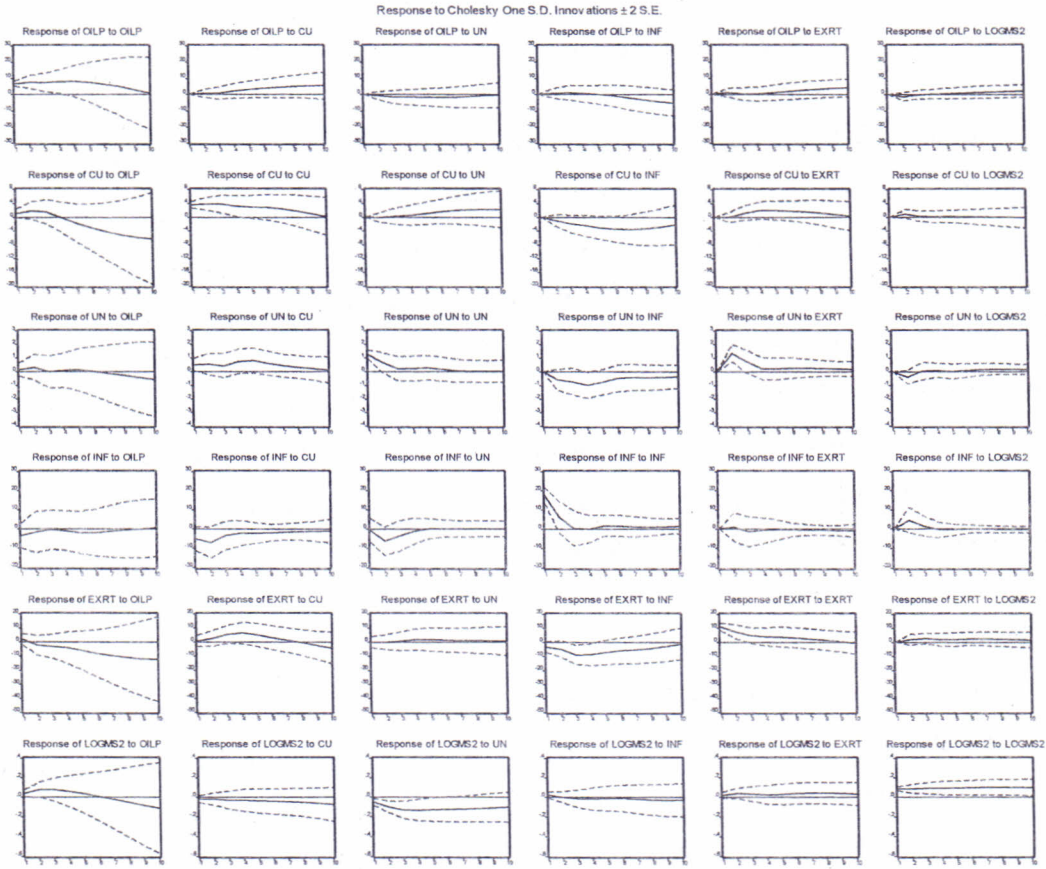

Fig 1.0

5.3 Pplicy implication of the VAR model

The result of our analysis is relevant to the Nigerian policy makers who desire to understand how a shock in oil price hinders aggregate industrial output. Our analysis has revealed that oil price shocks tend to affect industrial output. This further confirms the work ofRasche and Tatom (1977 and 1981), Barro (1984) and Brown and Yucel (1999)as well asValadkhani*et al.* (2001)who found a strong relationship between oil price and industrial output in the short run and long run in the Australia.

Sudden changes or shocks in inflation and exchange rate tend to have very minute impact on capacity utilization in Nigeria. However, money supply shocks had minute implication on capacity utilization from the 1st to 10th year. Also, from our analysis, it was discovered that past oil price has very significant impact on current oil priceuntil the 10th year in our 10 year horizon. This discovery, further gives credit to the random walk hypothesis. The presence of high money supply shocks has adverse effects on inflation rate. Thus, the regulatory body

(CBN) should do all it can to stabilize fluctuations in the supply of money in Nigeria in order to reduce inflation and boost confidence and attract investors into the economy.

6. Pplicy recommendation and conclusion

6.1 Policy Recommendations

From our study, it has been established that Exchange Rate, Inflation, oil price, money supplyact as determinants of industrial output in Nigeria. The resurgent rising and falling of oil price in the past few years is a pointer of low industrial output in Nigeria.

Policy measures that are capable of reducing degree of fluctuations in our current level of inflation, exchange rateand promoting the rehabilitation of refinery in Nigeria should be welcomed by the Regulatory bodies. Furthermore, to increase industrial output in Nigeria, there is need to reduce the multiple taxation by local, state, federal and federal government on industry in the country, there is also the need to promote alternative source of energy to reduce the over reliance of power holdings,

6.2 Cconclusion

This study examines oil price shocks on industrial output in Nigeria. It pointed out that existing literatures and empirical studies have given less attention to oil price shocks affect aggregate industrial output in Nigeria. This study came out with empirical evidence that will help in understanding the relationships among variables used in the model drawing from the Nigerian experience. The study came to the conclusion industrial output is not significantly affected by money supply. It was revealed that oil price, inflation and Exchange rate have the potentials of causing significant changes in industrial output in Nigeria. Thus, more policy attention should be given to regulation of Exchange rate and a steady inflation rate in Nigeria.

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