The Curious Case of Petro-Monetary Transmission Mechanism in Oil-Producing Countries: An Analysis of the Effect of Oil Price on Inflation in Nigeria

Evans, Olaniyi

2021

The Curious Case of Petro-Monetary Transmission Mechanism in Oil-Producing Countries: An Analysis of the Effect of Oil Price on Inflation in Nigeria

Olaniyi Evans

School of Management & Social Sciences, Pan-Atlantic University, Lagos, Nigeria

Email: olaniyievans@gmail.com

Abstract

Using Nigeria as a case study, this study shows that changes in oil price is central to the monetary transmission mechanism in oil-producing countries; a phenomenon which can be described as *petro-monetary transmission mechanism*. Using a Markov state-switching model, this study shows that there are high and low inflation regimes in the Nigerian economy. Oil price has significant impacts on inflation in the two regimes. Among the common coefficients, exchange rate and credit have significant effects. The empirical evidence from the impulse response functions of the VAR model shows that a one standard deviation shock to credit, interest rate, exchange rate, and oil price generates sharp increases in CPI, thus establishing a petro-monetary transmission mechanism in Nigeria. This study therefore establishes the presence of petro-monetary transmission mechanism in oil-producing countries. The central banks in these countries should therefore consider the oil price channel in the conduct of monetary policy.

Keywords: Petro-monetary transmission mechanism, oil price channel, Markov state-switching model.

JEL Classification: E32, E37, E52, E58.

1. Introduction

The traditional monetary transmission mechanism describes how policy-induced changes in monetary policy impact on domestic prices and general economic conditions (Ireland, 2008; Endut, Morley and Tien, 2015). Specific channels of monetary transmission in the literature are exchange rates, interest rates, and bank credit (Evans, 2017; Evans, 2019a; Evans and Saibu, 2017). However, this study argues that, in oil-producing countries, changes in oil price is central to the monetary transmission mechanism; a phenomenon which can be described as *petro-monetary*

Evans, O. (2021). The curious case of petro-monetary transmission mechanism in oil-producing countries: An analysis of the effect of oil price on inflation in Nigeria. *Iranian Economic Review*, *25*(1), 107-120.

transmission mechanism. In other words, there is another channel of transmission: the oil price channel.

From September 2014, most oil-exporting countries have experienced more than 55 percent decline in oil prices, caused by both supply and demand factors: "higher-than-expected supply, particularly from the United States, was not offset by production cuts by the Organization of the Petroleum Exporting Countries (OPEC) members, just as global oil demand (especially from China, Japan, and the euro area) was weakening" (IMF, 2015, p. 1). The resultant plummeting oil prices led to significant declines in the fiscal balances of many oil exporters (e.g., Nigeria, Venezuela, Canada and Ecuador). As a result, government policies, both fiscal and monetary, have become constrained. Particularly, the transmission mechanism of monetary policy has become constrained in many oil-producing economies as a result of the oil price channel. For example, in oil-producing countries such as Nigeria and Venezuela, the decline in oil prices has led to exchange rate depreciation and galloping inflation, which have remained non-amenable to all policy efforts of the governments (Ahmed, Kashif and Irfan, 2017; Grigoli, Herman and Swiston, 2017; Evans, 2019b; Evans, Nwaogwugwu and Odior, 2019).

The objective of this study is therefore to document the changes that have occurred in the monetary transmission mechanism in an oil-producing country and to show that oil price is behind these changes. Understanding the evolution of the curious case of petro-monetary transmission mechanism and identifying the factors behind are important for the evaluation of the policy stance and for appropriately measuring the macroeconomic impacts of policy decisions in oil-producing countries. To achieve the objectives of the study, Markov state-switching model and impulse response functions from a VAR model are applied to Nigerian data. The estimation allows the identification of the various channels at work, and especially to understand if there has been a change in the monetary transmission mechanism in Nigeria.

It is noteworthy that a lot of research in the literature has concentrated on either monetary policy transmission mechanism (e.g., Cecioni and Neri, 2011; Mishra, and Montiel, 2013; Abdullahi, 2016; Omolade and Ngalawa, 2016) or oil price and inflation (Filis and Chatziantoniou, 2014; Basnet and Upadhyaya, 2015; Castro and Jiménez-Rodríguez, 2017). Although some studies have been done on monetary policy transmission mechanism in oil-producing countries, none of these studies has considered the role of oil in monetary policy transmission mechanism. Hence, this study seeks to fill the gap.

The remainder of this study is organized as follows. Section 2 describes the conceptual framework of petro-monetary transmission mechanism. Section 3 deals with the Markov state-switching and the VAR approach. Section 4 presents the results of the empirical analysis. Section 5 offers some concluding remarks.

2. Conceptual Framework

Changes in oil price is central to the monetary transmission mechanism in an oil-producing economy; a phenomenon which can be described as *petro-monetary transmission mechanism* (Figure 1). In such economy, causality runs from oil prices to inflation (Cunado and De Gracia, 2005; Lescaroux and Mignon, 2008). Since these economies have considerable degrees of openness to international trade, the domestic price level is not immune to external price shocks (i.e. exchange rate depreciation/appreciation and changes in oil prices). The government's monetary policy is imported via oil price and exchange rate (Gagnon and Ihrig, 2004; Adeniji, Obi and Evans, 2018).). In other words, the global demand for oil indirectly determines the country's monetary conditions.

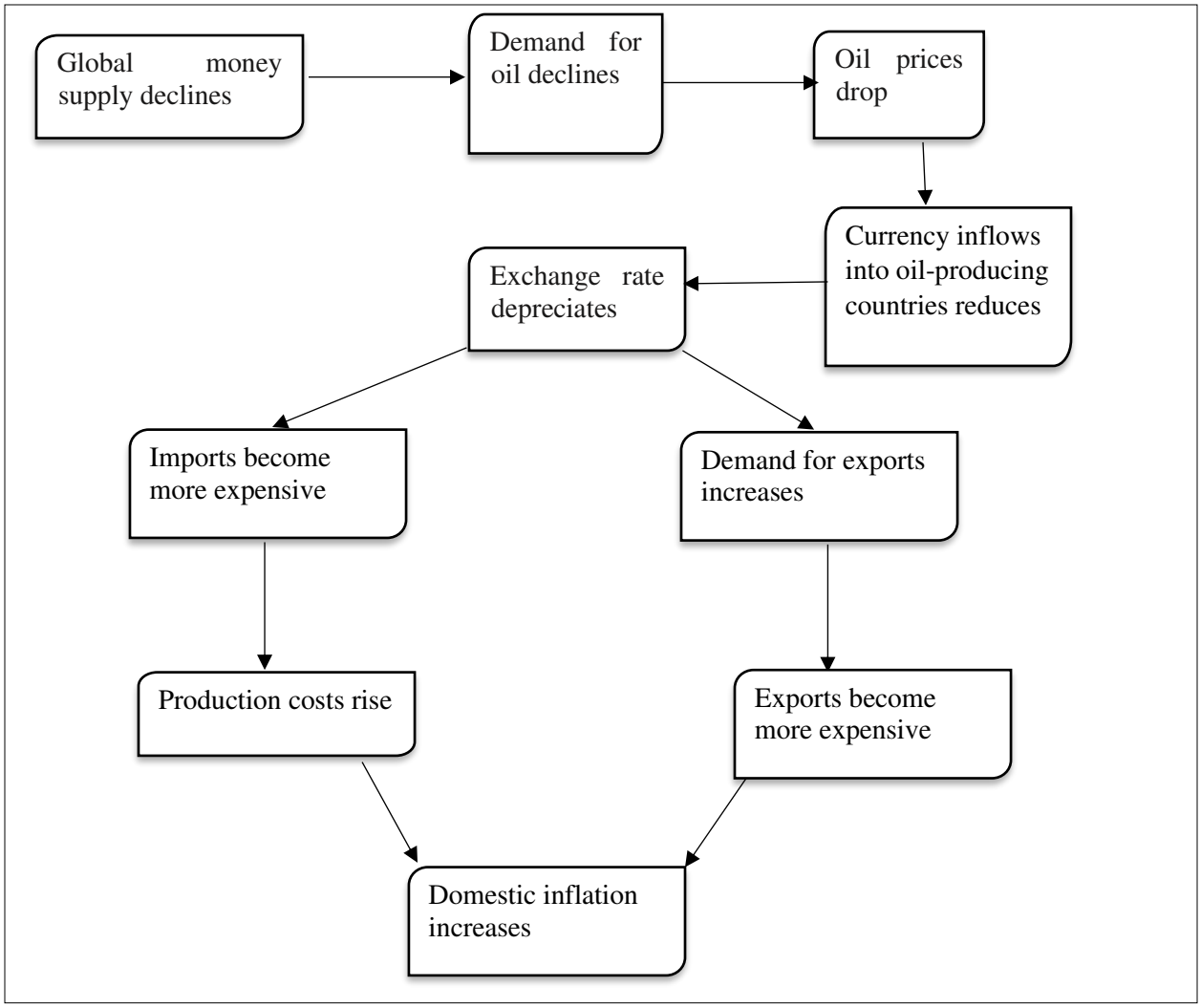

Figure 1 Petro-monetary Transmission Mechanism in Oil-Producing Countries
Source: Author's own.

As shown in Figure 1, a decline in global money supply leads to decreased demand for oil and results in a drop in oil prices (Barsky and Kilian, 2001). The resultant reduction in currency inflows into oil producing countries leads to exchange rate depreciation. Exchange rate depreciation, on one hand, can lead to increase in the price of imported finished goods and imported inputs. The potentially higher costs of imported raw materials can increase marginal costs and lead to higher domestic inflation. Exchange rate depreciation can also affect net exports, influence domestic prices and put upward pressure on domestic prices (Cole and Nightingale, 2016). Changes in oil price is thus central to the monetary transmission mechanism in an oil-producing economy; a curious case which can be described as *petro-monetary transmission mechanism.*

Evans, O. (2021). The curious case of petro-monetary transmission mechanism in oil-producing countries: An analysis of the effect of oil price on inflation in Nigeria. *Iranian Economic Review*, *25*(1), 107-120.

2. Literature Review

The monetary transmission mechanism is one of the most studied themes in monetary economics. Several studies have investigated monetary transmission mechanism in many countries, both developed and developing (e.g., Cecioni and Neri, 2011; Mishra, and Montiel, 2013; Endut et al, 2015), but none has focused on the role of oil price in the monetary transmission in oil-producing countries. Empirical evidence on the effectiveness and the exact channel through which monetary policy influence the economy is mostly mixed.

Among the recent studies, Cecioni and Neri (2011), based on a structural VAR and a DSGE model, provided evidence of changes in monetary transmission mechanism in the European Monetary Union after the implementation of the common currency in 1999. The Bayesian VAR analysis over the periods before and after 1999 showed that the effects of a monetary policy shock on output and prices have not changed significantly. They claimed that "this cannot be the final word on the evolution of the monetary transmission mechanism as changes in the conduct of monetary policy and the structure of the economy may have offset each other giving rise to similar responses of output and inflation to monetary policy shocks between the two periods" (p. 5). Further, the DSGE analysis (with real and nominal frictions for the two subsamples) showed that monetary policy has become more effective as a result of a decline in the degree of nominal rigidities and a change in monetary policy towards price stability.

Endut et al (2015) examined the relative importance of the exchange rate, interest rate, and bank lending channels for the monetary transmission mechanism in the United States over 5 decades. Based on a structural vector autoregressive model that includes bank loans and uses sign restrictions to identify monetary policy shocks, they quantified the relative importance of the various transmission channels. Their results showed evidence of a nontrivial role (but greatly diminished since the early 1980s) for the bank-lending channel at the aggregate level. They found "no support for a link between this change in the transmission mechanism and the concurrent reduction in output volatility associated with the Great Moderation. There is, however, some evidence of a link to the reduction in inflation volatility occurring at the same time" (p. 1).

While there have been several studies that investigated monetary transmission mechanism in Nigeria (e.g., Ifeakachukwu and Olufemi, 2012; Obafemi and Ifere, 2015; Abdullahi, 2016;

Omolade and Ngalawa, 2016), none has identified the changes in the monetary transmission mechanism of the Nigerian economy. Empirical evidence on the effectiveness and the exact channel through which monetary policy influence the Nigerian economy is also mixed. Among the recent studies, Obafemi and Ifere (2015) used a FAVAR model with 53 variables spanning the period 1970Q1 to 2013Q4 to show that interest rates and credit channels are the dominant and strongest transmission channels of monetary shocks in Nigeria, followed by exchange rate and money channel. Stock channel does not have a significant effect in the transmission process.

Omolade and Ngalawa (2016) examined the role of exchange rate regimes in determining the nexus between monetary policy transmission mechanism and manufacturing output growth in oil-producing economies in Africa: Libya and Nigeria. Nigeria practices flexible exchange rate while Libya practices fixed exchange rate system. Using structural variance decomposition approach, the authors showed that "exchange rate regime has some influences on the monetary policy transmission mechanism and its effectiveness on the manufacturing output growth in the two oil exporting countries. Oil price shocks affect the monetary policy instrument of both countries greatly. While monetary policy instrument appears to be ineffective in promoting output growth of the manufacturing sector in Libya that practices fixed exchange rate, the reverse is the case in Nigeria. Flexible exchange rate appears to create enabling environment for monetary policy instrument to influence manufacturing output growth positively in the face of oil price shock" (p. 67).

Abdullahi (2016) examined the impact of monetary policy on foreign-exchange reserves, real-GDP and inflation dynamics in Nigeria for the period 1970Q1-2014Q2 using a time-varying parameter-VAR with stochastic volatility model. The author found that monetary policy plays a significant role in inflation dynamics (as the impulse responses for inflation due to a monetary policy shock changes significantly over time). However, he observed that monetary policy shocks have little influence on other exogenous non-policy shocks (i.e., the dynamics of real-GDP and forex reserves). He also showed that the transmission mechanism and the exogenous shocks for the economy are time varying.

Also, many studies have dwelt on oil price and inflation (Filis and Chatziantoniou, 2014; Basnet and Upadhyaya, 2015; Castro and Jiménez-Rodríguez, 2017). Research on oil markets in the last

decade has challenged many long-held beliefs about the consequences of oil price shocks. As the theoretical and empirical models used by economists have evolved, so has understanding of the interaction between oil markets and the global economy. Many of such studies are from oil-importing countries. For example, Abounoori, Nazarian and Amiri (2014), using a time-varying pass-through coefficient and data from 19 industrialized countries to investigate oil price pass-through to inflation and the determinants of the declining effects of oil shocks on inflation, found that a higher degree of trade openness, a more active monetary policy in response to inflation, and appreciation of the domestic currency explain the decline in oil price pass-through. Zhao, Zhang, Wang and Xu (2016) found that oil supply shocks driven by political events mainly produce short-term effects on China's output and inflation, while the other oil supply shocks, demand shocks specific to the crude oil market, and aggregate shocks to the demand for industrial commodities produce relatively long-run effects; in addition, demand shocks specific to the crude oil market contribute the most to fluctuations in output and inflation.

Castro and Jiménez-Rodríguez (2017) investigated how oil price shocks are transmitted to producer and consumer prices in the euro area. They generated a database of each industrial production sector with its corresponding price of consumer goods. Using a constrained VAR model, they found "a statistically significant increase in producer prices after an oil price shock for branches with high oil consumption, although this statistical pass-through is only partial. However, there is no evidence of a significant oil price pass-through to consumer prices for most branches, which suggests the adaptability of European producers from the most branches to higher oil price pressures without transmitting them to consumers" (p. 24). Basnet and Upadhyaya (2015) examined the impact of oil price shocks on inflation, real output, and the real exchange rate in Malaysia, Singapore, Thailand, the Philippines and Indonesia using an SVAR model. They found that oil price fluctuations do not impact these economies in the long run and much of its effect is absorbed within five/six quarters. They also identify a high degree of similarity in the response to oil price fluctuations between Malaysia and Singapore and between the Philippines and Thailand.

A strand of the studies in the literature consider both oil-exporting and oil-importing countries. For example, Filis and Chatziantoniou (2014) investigate the financial and monetary policy responses to oil price shocks using an SVAR and distinguishing between net oil-importing and net oil-exporting countries. Overall, their results indicate that inflation in net oil-exporting and net oil-

importing countries is significantly influenced by oil price shocks. Furthermore, they found that the response of interest rates to an oil price innovation depends on the monetary policy regime of the country. Further, stock markets in oil-importing countries show a negative response to increased oil prices. The reverse is true for net oil-exporting countries. They also found that the stock market responses to oil price innovations is higher for newly established and less liquid stock markets. Salisu, Isah, Oyewole and Akanni (2017) examined the role of asymmetries in oil price-inflation nexus for selected net oil-exporting and net oil-importing countries using quarterly data from 2000 to 2014. They found a significant long-run positive relationship between oil price and inflation for both oil-exporting and oil-importing countries with mixed evidence in the short run. In the long run, oil price exerts a higher impact on inflation in oil-importing countries than oil-exporting countries.

From the foregoing review of literature, it is evident that a lot of research on monetary policy transmission mechanism has concentrated on a broader global perspective, with little or no attention to oil-producing countries contexts. Also, although some studies have been done on monetary policy transmission mechanism in oil-producing countries, none of these studies has considered the role of oil in monetary policy transmission mechanism. Hence, this study seeks to fill the gap.

3. Data and methodology

3.1. Data

In order to estimate the model, annual data for the period 1970-2016 is used for the following five variables: oil price, lending interest rate, official exchange rate, domestic credit to private sector (% of GDP), and consumer price index. The data on lending interest rate, official exchange rate, domestic credit to private sector (% of GDP) and consumer price index are collected from World Development Indicators. Oil price is collected from International Energy Agency. All the variables are logged. For a description of the data, see Table 1.

Table 1 Description of Variables

	Indicator Name	Definition

INTR	Lending interest rate	It is the bank rate that meets the short- and medium-term financing needs of the private sector. It is often differentiated according to the creditworthiness of the borrowers and the objectives of financing.
EXCR	Official exchange rate	It is the rate determined in the legally sanctioned exchange market. It is computed as an annual average based on monthly averages (naira relative to the U.S. dollar).
CREDIT	Domestic credit to private sector (% of GDP)	It is the financial resources provision to the private sector by financial corporations, through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. The financial corporations include monetary authorities, deposit money banks and other financial corporations (e.g., finance and leasing companies, insurance corporations, money lenders, and pension funds).
CPI	Consumer price index	It shows changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.
OILP	Oil price	It measures the spot price of various barrels of oil. It is the average of the West Texas Intermediate and the Brent Blend.

3.2 Model

Consistent with the literature (e.g. Filis and Chatziantoniou, 2014; Basnet and Upadhyaya, 2015; Omolade and Ngalawa, 2016; Castro and Jiménez-Rodríguez, 2017; Adeniji et al, 2018), the following empirical framework is used to investigate the role of oil in monetary policy transmission mechanism in Nigeria. In general form, the model can be characterized as:

$$cpi_t = \rho_0 + \rho_1 Oilp_t + \rho_2 Cred_t + \rho_3 Excr_t + \rho_4 Intr_t + \varepsilon_t \quad (1)$$

Where *cpi* is inflation measured by consumer price index; *Oilp* is the international oil price; *Cred* is domestic credit to private sector (% of GDP); *Excr* is official exchange rate; *Intr* is lending interest rate and t is the year. The proxy for the variables are in line with the economic literature (e.g.

Nwaogwugwu and Evans, 2016, Adeola and Evans, 2017a, Adeola and Evans, 2017b; Evans, 2018; Evans, 2019b, Adeola and Evans, 2019).

3.3 The Markov state-switching regression

The Markov state-switching regression model as developed by Hamilton's (1989) is used in this study because it can address structural changes in the economy. The first-order Markov process requires that the probability of being in a regime depends on the previous state, so that,

$$P(s_t = j \mid s_{t-1} = i) = p_{ij}(t) \tag{2}$$

Since the probabilities are time-invariant, $p_{ij}(t) = p_{ij}$ for all t.

(1) may be rewritten in a transition matrix

$$p(t) = \begin{bmatrix} p_{11}(t) & \dots & p_{1M}(t) \\ . & \dots & . \\ p_{M1}(t) & \dots & p_{MM}(t) \end{bmatrix} \tag{3}$$

Where the ij-th element is the probability of transitioning from regime *i* in period *t-1* to regime *j* in period *t*.

The probabilities can then be re-parameterized in terms of a multinomial logit:

$$p_{ij}(G_{t-1}, \delta_i) = \frac{\exp(G_{t-1}, '\delta_{ij})}{\sum_{s=1}^{M} \exp(G_{t-1}, '\delta_{is})} \tag{4}$$

Since Markov state-switching models are specified with constant probabilities, G_{t-1} contains only a constant.

3.4 Impulse Response Function from a VAR Model

For a set of n time series variables $y_t = (y_{1t}, y_{2t,}..., y_{nt})'$, a VAR model of order p(VAR(p)) can be written as:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + u_t \quad (5)$$

Where the A_i's are (nxn) coefficient matrices and $u_t = (u_{1t}, u_{2t}, ..., u_{nt})'$ is an unobservable i.i.d. zero mean error term.

Consider a two-variable VAR(1) with k=2.

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix} \quad (6)$$

with $\varepsilon_{it} \sim i.i.d(0, \sigma_{\varepsilon i}^2)$ and $\text{cov}(\varepsilon_y, \varepsilon_z) = 0$

A shock to the i-th variable affects the i-th variable and is also transmitted to the other endogenous variables via the dynamic (lag) structure of the VAR. Impulse response functions are the plots of the effect of $\varepsilon_{z,t}$ on current and all future y and z. They show how $\{y_t\}$ or $\{z_t\}$ react to different shocks, and traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables.

4. Empirical Analysis

The result of the Markov state-switching estimation is presented in Table 2. The equation specification consists of a two-state Markov state-switching model with a single switching mean regressor C and the four non-switching variables (*Credit*, *Excr* and *Intr*). The error variance is assumed to be common across the regimes. The only probability regressor is the constant C since there are time-invariant regime transition probabilities. The middle section displays the coefficients for the regime specific means. The differences in the regime specific means reflects what can be termed high and low inflation states of the Nigerian economy. The first regime is highly persistent, and characterized by high inflation, with an average duration of 11.6 years. The second regime is not persistent but characterized by low inflation with an average duration of 6 years.

Table 2 The Results of the Markov State-switching Estimation

Dependent Variable: CPI

Variable	Coefficient	Std. Error
Regime 1		
C	-4.18*	0.51
OILP	0.60*	0.12
LOG(SIGMA)	-1.72*	0.15
Regime 2		
C	-0.20	0.41
OILP	-0.22*	0.07
LOG(SIGMA)	-2.25*	0.22
Common		
CREDIT	0.35*	0.08
EXCR	0.99*	0.02
INTR	0.016	0.12
Transition Matrix Parameters		
P11-C	2.36*	0.71
P21-C	-1.67**	0.79

Notes: Number of states: 2, Initial probabilities obtained from ergodic solution, Standard errors & covariance computed using observed Hessian, Random search: 25 starting values with 10 iterations using 1 standard, deviation (rng=kn, seed=314765321), Convergence achieved after 39 iterations

Oil price has significant impacts on inflation in the two regimes. Consistent with the literature, oil price and inflation are significantly related. As oil prices move up or down, inflation follows in the same direction (Barsky and Kilian, 2001; Gagnon and Ihrig, 2004). The reason why this happens is that oil is a major input in any economy - it is used in critical activities such as heating homes and fueling transportation - and if input costs rise, so should the cost of end products (Cunado and De Gracia, 2005; Lescaroux and Mignon, 2008).

Among the common coefficients, exchange rate and credit have significant effects on inflation while the remaining results show the parameters of the transition matrix. It is not surprising that exchange rate has significant effects on inflation: since the Nigerian economy has high degree of openness to international trade, the domestic price level is not immune to external price shocks

(i.e. exchange rate depreciation/appreciation and changes in oil prices). The government's monetary policy is imported via oil price and exchange rate (Gagnon and Ihrig, 2004).

Instead of focusing on the transition matrix parameters in Table 2, it is better to examine the transition matrix probabilities in Table 3. It is observed that there is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime (0.91 for the high inflation state, 0.84 for the low inflation state). The corresponding expected durations in a regime are approximately 11.6 years and 6.4 years, respectively.

Table 3 Transition summary

Constant transition probabilities:		
	1	2
1	0.91	0.09
2	0.16	0.84
Constant expected durations:		
1	2	
11.60	6.35	

Constant transition probabilities: P(i, k) = P(s(t) = k | s(t-1) = i)(row = i / column = j)

The smoothed probability of inflation is presented in Figure 2. The low inflation regime fell within the period 1970-1985. During this period, direct approaches to monetary management were the main technique of monetary policy implementation, with emphasis on direct monetary control. The CBN executed monetary policy by relying on credit ceilings and sectoral credit allocation, as directed by the Ministry of Finance and short-term political factors (Obafemi and Ifere, 2015).

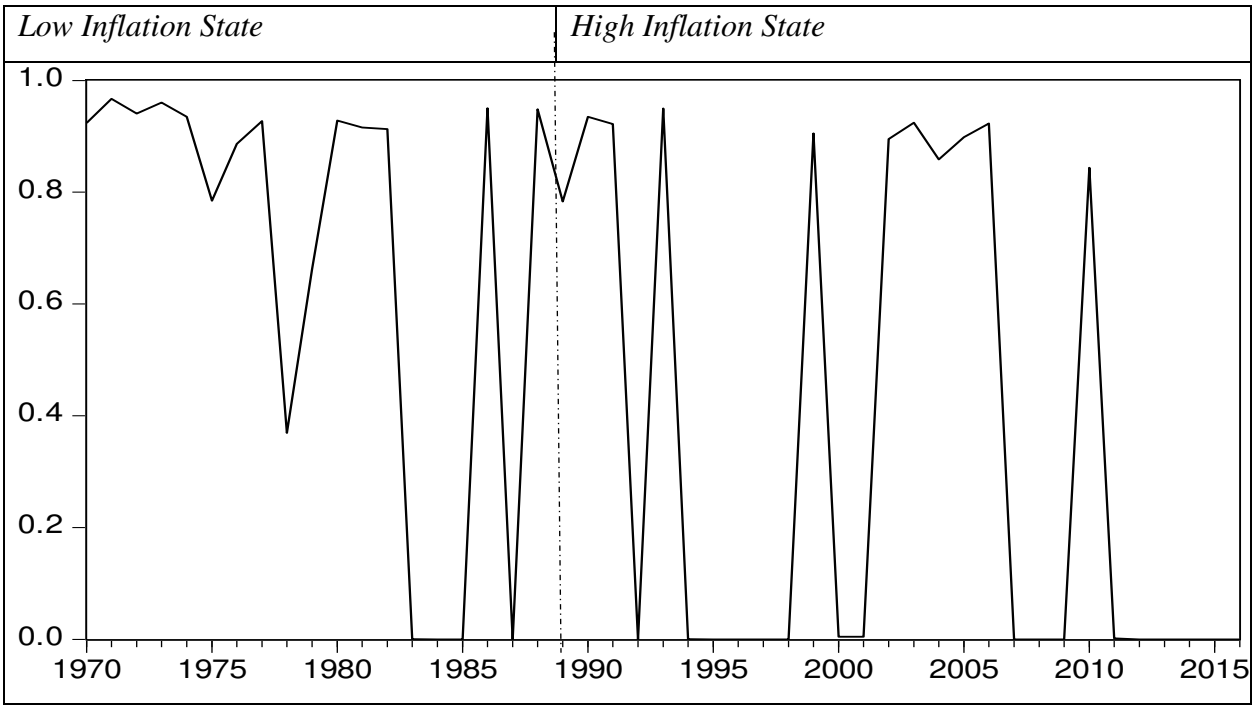

Figure 2 Smoothed probability of Inflation
Source: Research Findings

The high inflation regime coincided with the period of the indirect (market-based) approach which started in 1993. This approach was adopted with the intent of removing all the inefficiencies in the financial system, caused by administrative controls (Ibeabuchi, 2007). The major monetary instrument is the Open Market Operation, later complimented by CBN securities, the reserve requirement, and moral suasion. However, in spite of the various monetary policy measures and frameworks implemented by CBN, the economy has not responded favorably. This is due to the fact that there is another channel of monetary policy transmission in oil-producing countries: the oil price channel.

To determine how long these effects will persist, it is appropriate to use the impulse response analyses (Bloch, Shuddhasattwa, and Salim, 2011). Figure 3 plots the impulse responses to a monetary policy shock that raises the CPI by one standard deviation. Each panel contains the impulse responses for the four possible combinations of monetary policy channels and CPI. The empirical evidence from the impulse response functions from the VAR analysis shows that the transmission mechanism of monetary policy in Nigeria has changed significantly in the last ten years.

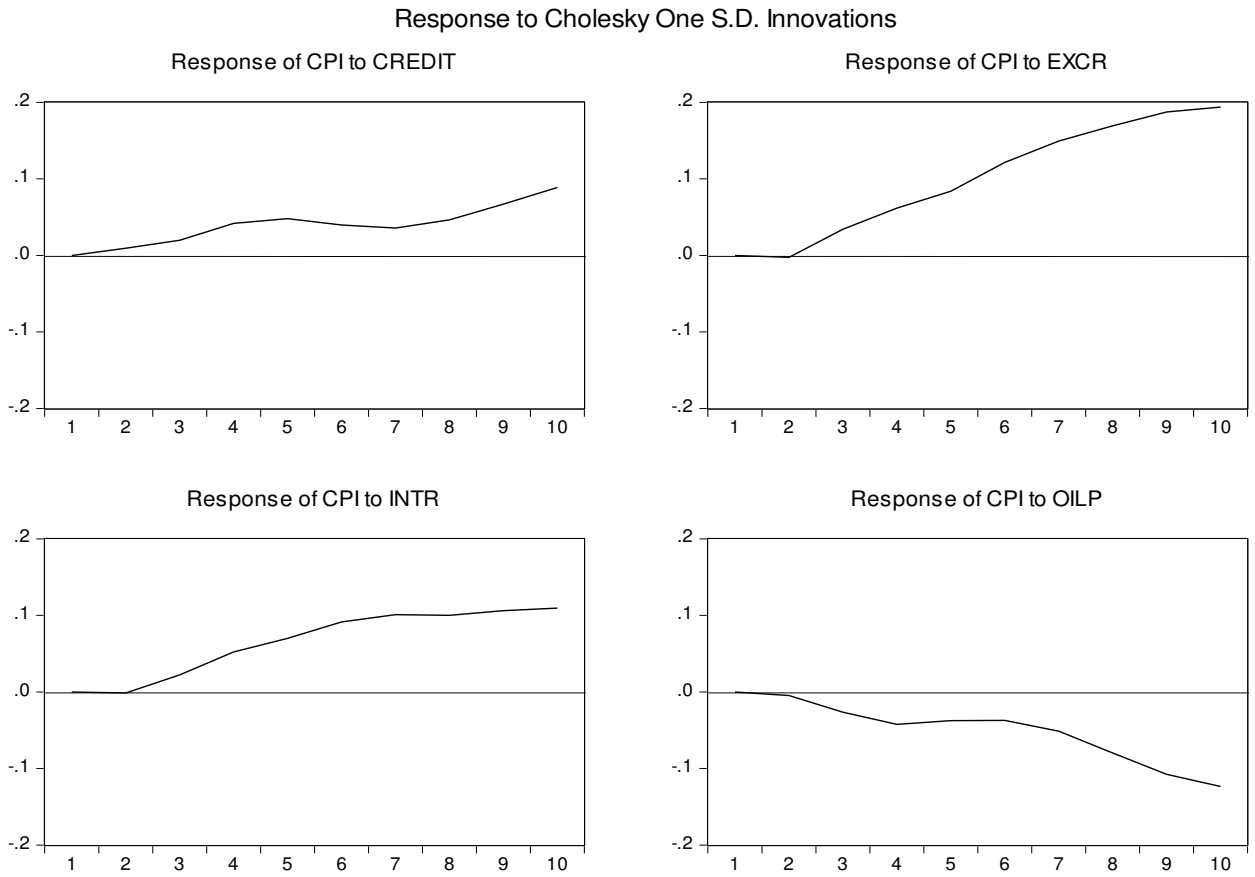

Figure 3 Impulse Response Functions

A monetary policy expansion implemented through monetary aggregates such as credit, interest rate and exchange rate, results in a high rise of CPI. The effects of exchange rate shock on inflation is swift and sharp, as a one standard deviation shock to exchange rate generates sharp increase in CPI. Largely, exchange rate issues are important with regards to local market oil prices. Oil trades largely in US Dollars, so any country, whose currency loses relative value to the dollar will see costs per barrel go up.

Most importantly, a one standard deviation shock to oil price result in at first a slow and then an increased negative shock to inflation, thus establishing a petro-monetary transmission mechanism in Nigeria. As a commodity and basic need for most economies, oil price changes are more likely to drive inflation. The ability of people to increase or decrease consumption will impact the broader inflation impacts. Indeed, it makes sense that oil prices explain much of the variation in inflation because many industries in Nigeria consume oil, often for transportation and electricity generation.

Indeed, the finding that there are changes in the transmission mechanism in Nigeria contrasts with studies such as Cecioni and Neri (2011), who based on a Bayesian VAR analysis, provided evidence that, over the periods before and after 1999, the effects of a monetary policy shock on output and prices have not changed significantly in the European Monetary Union. In fact, Cecioni and Neri's (2011) DSGE analysis (with real and nominal frictions for the two subsamples) showed that monetary policy has become more effective as a result of a decline in the degree of nominal rigidities and a change in monetary policy towards price stability.

The evidence that a one standard deviation shock to credit, interest rate, and exchange rate generates sharp increases in CPI is in line with studies such as Obafemi and Ifere (2015) who used a FAVAR model with 53 variables spanning the period 1970Q1 to 2013Q4 to show that interest rates and credit channels are the dominant and strongest transmission channels of monetary shocks in Nigeria, followed by exchange rate and money channel. The evidence of petro-monetary transmission mechanism is in line with Omolade and Ngalawa (2016) who found that oil price shocks affect the monetary policy instrument in Libya and Nigeria.

5. Conclusion

Using Nigeria as a case study, this study shows that changes in oil price is central to the monetary transmission mechanism in oil-producing countries; a phenomenon which can be described as *petro-monetary transmission mechanism*.

The results of the estimation of the Markov state-switching model shows that there are high and low inflation regimes in the Nigerian economy. The first regime is highly persistent, and characterized by high inflation, with an average duration of 11.6 years. The second regime is not persistent but characterized by low inflation, with an average duration of 6 years. Oil price has significant impacts on inflation in the two regimes. Among the common coefficients, exchange rate and credit have significant effects. There is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime (0.91 for the high inflation state, 0.84 for the low inflation state).

Further, the empirical evidence from the impulse response functions from the VAR analysis shows that the transmission mechanism of monetary policy in Nigeria has changed significantly in the last ten years. Most importantly, a one standard deviation shock to credit, interest rate, exchange

rate, and oil price generates sharp increases in CPI, thus establishing a petro-monetary transmission mechanism in Nigeria.

Hence, the findings of this study have established the presence of a petro-monetary transmission mechanism in oil-producing countries. Policy recommendations and quick tips are important (Evans, 2019d; Adeola, Ngoasong and Evans, 2017). Firstly, the central banks in oil-producing countries should consider the oil price channel in the conduct of monetary policy. As oil prices move, inflation follows. Oil is a major input in the economy – it is indispensable in critical activities such as transportation and homes – and therefore if oil price rises, the cost of consumer products also rises. The government should therefore consider the oil price channel in the conduct of its monetary policy.

References

Abdullahi, B. (2016). Time-Varying VAR with Stochastic Volatility and Monetary Policy Dynamics in Nigeria. *Economics Bulletin*, *36*(4), 2237-2249.

Abounoori, A. A., Nazarian, R., & Amiri, A. (2014). Oil price pass-through into domestic inflation: the case of Iran. *International Journal of Energy Economics and Policy*, *4*(4), 662.

Adeniji, S. O., Obi, B., & Evans, O. (2018). The Impact of Oil Price Shocks on Stock Market Prices Volatility in Nigeria. *Journal of Global Economy*, *14*(3), 173-190.

Adeola, O., & Evans, O. (2017a). Financial inclusion, financial development, and economic diversification in Nigeria. *The Journal of Developing Areas*, 51(3), 1-15.

Adeola, O., & Evans, O. (2017b). The impact of microfinance on financial inclusion in Nigeria. *The Journal of Developing Areas*, 51(4), 193-206.

Adeola, O., & Evans, O., (2019). Digital tourism: mobile phones, internet and tourism in Africa, *Tourism Recreation Research*, DOI: 10.1080/02508281.2018.1562662.

Adeola, O., Ngoasong, M. Z., & Evans, O. (2017). The Gender Question and Family Entrepreneurship Research. In *Knowledge, Learning and Innovation* (pp. 159-176). Springer, Cham.

Ahmed, F., Kashif, M., & Irfan, M. Z. (2017). Long-Run Relationship between Oil Price and Macroeconomic Indicators using Johansen Co-integration Test: A Case of Pakistan. RADS *Journal of Social Sciencess & Business Management*, 4(1), 79-95.

Barsky, R. B., & Kilian, L. (2001). Do we really know that oil caused the great stagflation? A monetary alternative. *NBER Macroeconomics annual*, *16*, 137-183.

Basnet, H. C., & Upadhyaya, K. P. (2015). Impact of oil price shocks on output, inflation and the real exchange rate: evidence from selected ASEAN countries. *Applied Economics*, *47*(29), 3078-3091.

Bloch, H., Rafiq, S., & Salim, R. (2012). Coal consumption, CO 2 emission and economic growth in China: empirical evidence and policy responses. *Energy Economics*, *34*(2), 518-528.

Castro, C., & Jiménez-Rodríguez, R. (2017). Oil price pass-through along the price chain in the euro area. *Energy Economics*, *64*, 24-30.

Cecioni, M., & Neri, S. (2011). The monetary transmission mechanism in the euro area: has it changed and why? Temi di discussione (Economic working papers) 808, Bank of Italy. *Economic Research Department*.

Cole, D., & Nightingale, S. (2016). Sensitivity of Australian trade to the exchange rate. *Reserve Bank of Australia Bulletin*, 13-20.

Cunado, J., & De Gracia, F. P. (2005). Oil prices, economic activity and inflation: evidence for some Asian countries. *The Quarterly Review of Economics and Finance*, *45*(1), 65-83.

Endut, N., Morley, J., & Tien, P. L. (2015). *The Changing Transmission Mechanism of US Monetary Policy* (No. 2015-03). School of Economics, The University of New South Wales.

Evans, O. & Saibu, O. (2017) Quantifying the Impact of Monetary and Exchange Rate Policies on Economic Diversification in Nigeria, *Nigerian Journal of Economic and Social Studies*, 59(1), 131-152.

Evans, O. (2017) Threshold Effects in the Relationship between Interest Rate and Financial Inclusion in Nigeria. *Journal of Economics and Business Research,* 23(1), 7-22.

Evans, O. (2018). Connecting the poor: the internet, mobile phones and financial inclusion in Africa, *Digital Policy, Regulation and Governance*, 20(6), 568-581.

Evans, O. (2019). Money, Inflation and Output in Nigeria and South Africa: Could Friedman and Schwartz Be Right. *Journal of African Business*. https://doi.org/10.1080/15228916.2019.1581012

Evans, O. (2019b). The effects of US-China trade war and Trumponomics, *Forum Scientiae Oeconomia*, 7(1), 47-58.

Evans, O. (2019c). Blockchain Technology and the Financial Market: An Empirical Analysis, *Actual Problems of Economics*.

Evans, O. (2019d). The Firstclass You, Rysearch, Lagos.

Filis, G., & Chatziantoniou, I. (2014). Financial and monetary policy responses to oil price shocks: evidence from oil-importing and oil-exporting countries. *Review of Quantitative Finance and Accounting*, *42*(4), 709-729.

Gagnon, J. E., & Ihrig, J. (2004). Monetary policy and exchange rate pass-through. *International Journal of Finance & Economics*, *9*(4), 315-338.

Grigoli, F., Herman, A., & Swiston, A. J. (2017). A Crude Shock; Explaining the Impact of the 2014-16 Oil Price Decline Across Exporters (No. 17/160). International Monetary Fund.

Hamilton, J. D., (1989). A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica* 57, 357-384.

Ibeabuchi, O. (2007). Overview of monetary policy in Nigeria. Central Bank of Nigeria Economic and Financial Review.

Ifeakachukwu, N. P., & Olufemi, S. M. (2012). The monetary transmission mechanism in Nigeria: A sectoral output analysis. *International Journal of Economics and Finance*, *4*(1), 204.

IMF (2015) Falling Oil Prices Hurt Exporters across Mideast, Central Asia, Regional Economic Outlook, https://www.imf.org/external/pubs/ft/survey/so/2015/CAR012115A.htm

Ireland P. (2008) The New Palgrave Dictionary of Economics, Second Edition, Edited by Steven N. Durlauf and Lawrence E. Blume.

Lescaroux, F., & Mignon, V. (2008). On the influence of oil prices on economic activity and other macroeconomic and financial variables. *OPEC Energy Review*, *32*(4), 343-380.

Mishra, P., & Montiel, P. (2013). How effective is monetary transmission in low-income countries? A survey of the empirical evidence. *Economic Systems*, *37*(2), 187-216.

Nwaogwugwu, I., & Evans, O. (2016). A sectoral analysis of fiscal and monetary actions in Nigeria. *The Journal of Developing Areas*, 50(4), 211-230.

Obafemi, F. N., & Ifere, E. O. (2015). Monetary policy transmission mechanism in Nigeria: A FAVAR approach. *International Journal of Economics and Finance*, *7*(8), 229.

Omolade, A., & Ngalawa, H. (2016). Monetary policy transmission mechanism and growth of the manufacturing sectors in Libya and Nigeria. *Journal of Entrepreneurship, Business and Economics*, *5*(1), 67-107.

Salisu, A. A., Isah, K. O., Oyewole, O. J., & Akanni, L. O. (2017). Modelling oil price-inflation nexus: The role of asymmetries. *Energy*, *125*, 97-106.

Zhao, L., Zhang, X., Wang, S., & Xu, S. (2016). The effects of oil price shocks on output and inflation in China. *Energy Economics*, *53*, 101-110.