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Comparative Analysis of the Impact of Oil Price Shocks on Selected Macroeconomic Variables in Angola and Libya

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Abstract

Purpose: This study comparatively examines the impact of oil price shocks on five selected macroeconomic variables in two African oil-producing countries, Angola and Libya, using secondary data from 1983 to 2021.

Materials and Methods: We adopted a causal-comparative/Quasi-Experimental research design to infer cause-and-effect relationships. The structural vector error correction model (SVECM) was employed due to the advantage of cointegrated variables in both countries.

Findings: The empirical analysis reveals that the response to and significance of oil price shocks are somewhat similar in the two countries, with a significant positive and persistent effect on oil prices and real economic output. However, other macro variables responded insignificantly to oil price shocks, albeit with varying signs. Based on the empirical analysis, we conclude that while oil price shocks have a significant and lasting positive impact on oil prices and real economic output in both countries studied, their influence on other macroeconomic variables is relatively insignificant, though these variables exhibit varying responses. Hence, to mitigate the risks associated with oil price shocks and reduce dependency on oil revenues, we recommend that Angola and Libya diversify their economies by investing in non-oil sectors such as agriculture, manufacturing, tourism, and renewable energy.

Implications to Theory, Practice and Policy: Furthermore, we recommend the implementation of macroeconomic stabilization policies to reduce vulnerability to oil price shocks. Fiscal measures, such as establishing sovereign wealth funds to save excess oil revenues during high oil price periods, can stabilize the economy during low oil price periods. Monetary policies, including interest rate adjustments, can counteract inflationary or deflationary pressures resulting from oil price shocks.

Keywords: *Oil Price Shocks, Gross Domestic Product, Interest Rate, Broad Money Supply, Oil Price, Consumer Price Index, Exchange Rate, SVECM*

JEL Classification: E31, E30, C32.

1.0 INTRODUCTION

The significance of oil price shocks on macroeconomic variables in oil-exporting and importing countries has continued to be a critical area of interest for scholars and experts (Hamilton, 1983; Śmiech, Papież, Rubaszek & Snarska, 2021; Caldara, Cavallo & Iacoviello, 2019; Taghizadeh-Hesary, Yoshino & Assari-Arani, 2016). Hamilton (1983) initiated this inquiry by analyzing the influence of crude oil price hikes on the United States recession. Subsequent studies have emphasized the importance of crude oil as a vital input for industrial activities, and its role in driving price fluctuations in other commodities, ultimately affecting macroeconomic variables (Vo, Vu, Vo & McAleer, 2019; Omojolaibi, 2014; Adediji, Adeniji & Olasehinde, 2018; Hameed, Shafi & Nadeem, 2021). Hameed, Shafi & Nadeem (2021) recently suggested that the impact of oil price shocks varies across countries, depending on their status as oil exporters or importers, with oil-exporting countries experiencing more significant volatility spillover effects on macroeconomic variables.

Africa boasts more than ten major oil-producing countries, including Angola and Libya, which are among the sixteen oil exporters on the continent (African Oil and Gas Review, 2017). The continent holds 7.5% of the world's oil reserves and contributes to 8.6% of the world's production and 4.2% of its consumption, making Africa one of the world's leading oil exporters. Many African oil-producing countries heavily rely on oil revenue, making their macroeconomic performance highly susceptible to crude oil price shocks (ADB, Furceri & IMF, 2016). These vulnerabilities were evident during the 2015 Iranian sanctions lift and the coronavirus pandemic, which led to drastic declines in the macroeconomic performance of various African countries.

The transmission of oil price shocks to the economy occurs through channels such as supply, demand, economic policy reaction, valuation, and asymmetric response (Jiménez-Rodríguez and Sánchez, 2005). The supply and demand channels have garnered significant attention due to the ambiguity of other channels. On the supply side, crude oil plays a critical role in production and commerce, with rising oil prices leading to increased production costs and potential output reductions (Akinleye & Ekpo, 2013). On the demand side, oil price shocks influence investment and consumption, impacting trade terms and reducing the purchasing power of governments, firms, and households (Haque & Imran, 2020). These price fluctuations also have broader implications for exchange rates, stock market stability, interest rates, inflation, and overall monetary and financial stability (Jiménez-Rodríguez and Sánchez, 2005).

Despite a substantial body of research on the consequences of oil price fluctuations on economic activity (Grigoli, Herman, & Swiston, 2017; Sadeghi, 2017; Jiménez-Rodríguez & Sánchez, 2005), most empirical studies have focused on developed oil-importing countries (Herrera & Hamilton, 2001; Brown & Yücel, 2002; El-tony & Al-Alwadi, 2001; Backus & Crucini, 2000; Elmi & Jahadi, 2011; Jin, 2008; Chen & Chen, 2007; Bangara & Dunne, 2018; Akpan, 2009). Research on oil-exporting countries, particularly African nations like Angola and Libya, remains scarce.

Despite the abundance of research in the realm of oil price shocks and their effects on macroeconomic variables, a significant void is evident when it comes to a comparative analysis involving African oil-producing nations, specifically Angola and Libya. This study endeavors to fill this conspicuous gap by thoroughly investigating the impact of oil price shocks on select macroeconomic indicators in these two countries. To date, no known research has endeavored to contrast the impact on these two nations, making this study a pioneer in its field. Our analysis leverages historical data spanning the period from 1983 to 2021, aiming to offer a comprehensive understanding of the intricate relationship between oil price shocks and macroeconomic variables within the Angolan and Libyan economies.

On a global scale, the fluctuations in oil prices significantly impact economies worldwide, particularly accentuating the divide between oil-exporting and importing countries. As oil remains a pivotal commodity in international trade, price shocks reverberate through global markets, affecting inflation, trade balances, and economic growth. Regionally, in Africa, these impacts are deeply felt, especially in major oil-producing countries like Angola and Libya. These nations, reliant on oil revenues, experience pronounced economic volatility in response to global oil price dynamics. This scenario places African economies at a strategic point in global energy discussions, highlighting their susceptibility to external market shifts. The interaction between these global trends and regional realities forms a critical backdrop against which this study examines the nuanced effects of oil price shocks on the macroeconomic variables of Angola and Libya, reflecting a broader narrative of global economic interdependence and regional vulnerability.

2.0 MATERIAL AND METHODS

Empirical Review

The repercussions of oil price shocks on macroeconomic variables have been extensively researched by numerous scholars in both oil-exporting and importing nations using diverse methodologies. Various authors, including Amiri, Sayadi & Mamipour (2021); Folasade (2022); Hameed, Shafi & Nadeem (2021); Omolade, Ngalawa & Kutu (2019); Francisco (2020) Iwayemi, & Fowowe (2011); Saliu, Adedeji & Ogunleye (2020); Nezir & Baimaganbetov (2015), and Yildirim, & Arifli (2021) have investigated the impact of oil price shocks on macroeconomic variables, producing mixed results. While the majority of studies reveal negative consequences, some have found positive effects on the economy.

Amiri, Sayadi & Mamipour (2021) employed the new Keynesian dynamic stochastic general equilibrium (NK-DSGE) model to assess the influence of oil price shocks on macroeconomic variables in oil-exporting economies. They discovered that oil price shocks and increased oil revenue income led to liquidity growth and higher inflation rates. In contrast, Hameed, Shafi & Nadeem (2021) found that the impact of oil price shocks varied from country to country, with greater volatility spillover effects on oil-exporting countries than oil-importing ones. Omolade, Ngalawa & Kutu (2019) used the Panel Structural Vector Auto-Regression model to explore the effects of crude oil price shocks on macroeconomic performance in African oil-producing countries. Their findings indicated that output reactions to oil price fluctuations differ between economies, with structural inflation accompanying sharp declines in oil prices more than monetary inflation, and both output and investment declining significantly.

In terms of exchange rates, Amiri, Sayadi & Mamipour (2021) determined that oil price shocks lead to real exchange rate depreciation and reduced economic competitiveness. However, Alenoghena (2021) reported a positive but insignificant impact on the exchange rate. Ajala, Sakanko & Adeniji (2021) discovered a unidirectional non-linear causality from the exchange rate to stock prices and from oil prices to the exchange rate. Hameed, Shafi & Nadeem (2021) revealed that oil prices had a more significant volatility spillover effect on oil-exporting countries than oil-importing ones.

Regarding inflation, Yildirim & Arifli (2021) used the Vector Autoregressive Model (VAR) to investigate the macroeconomic effects of negative oil price shocks on Azerbaijan's economy. Their findings revealed increased inflation, currency depreciation, and declines in economic activity. In contrast, Iwayemi & Fowowe (2011) concluded that oil price shocks do not significantly affect most macroeconomic variables in Nigeria. However, Francisco (2020) determined that oil price shocks do Granger-cause macroeconomic performance.

When examining the impact of oil price shocks on economic growth, Mehrara (2008) investigated the asymmetric effects of oil revenue on output growth in 13 oil-exporting economies using a dynamic panel framework. He found that adverse shocks had more significant and long-lasting negative consequences than the positive effects of oil booms. In contrast, Igberaese (2013) reported a significant and positive relationship between oil dependency and economic growth in Nigeria. Berument, Ceylan & Dogan (2010) found that positive oil shocks had a significant impact on the economic growth of oil-exporting economies in the Middle East and North African (MENA) region.

An analysis of the impact of oil price shocks on selected macroeconomic variables in Angola and Libya necessitates a review of additional literature to identify any gaps in existing research. Here, we will discuss several studies that focus on oil price shocks and macroeconomic variables in these countries or similar contexts.

Additionally, Omolade, Ngalawa & Kutu (2019) investigated the impact of oil price shocks on the macroeconomic performance of oil-exporting African countries, including Angola, using a Vector Error Correction Model (VECM). The study found that oil price shocks had a significant impact on economic growth, inflation, and the exchange rate. However, the study did not specifically focus on Libya. While EIA (2018) provided an overview of the Libyan and Angolan oil sectors, discussing the history, current state, and future prospects of the oil industry in both countries, this report offers valuable context but does not delve into the impact of oil price shocks on macroeconomic variables. Similarly, Mukhtarov (2020) analyzed the impact of oil price shocks on economic growth in oil-exporting countries, including Angola and Libya, using a dynamic panel data model. They found that oil price shocks had significant effects on economic growth, but the study did not explore other macroeconomic variables such as inflation and exchange rates. Ogede, George & Adekunle (2020) focused on the relationship between oil price shocks and stock market performance in oil-exporting African countries, including Angola and Libya. Although this study contributed to understanding the effects of oil price shocks on financial markets, it did not consider broader macroeconomic variables.

The literature review reveals that while there are studies that investigate the impact of oil price shocks on macroeconomic variables in Angola and Libya, these studies tend to focus on specific aspects of the economy, such as economic growth or stock market performance. Furthermore, there is a lack of research that directly compares the two countries and analyzes the differences in their responses to oil price shocks. Therefore, the gap in the literature lies in the need for a comprehensive analysis of the impact of oil price shocks on various macroeconomic variables (such as economic growth, inflation, exchange rates, money supply, and interest rate) in both Angola and Libya, considering their unique economic and political contexts. This would provide a more detailed understanding of the implications of oil price fluctuations on these two major oil-exporting African countries.

Theoretical Framework

The theoretical framework for this study is based on the work of Tunyo, Armah, Cantah & Suleman (2021) who traced the multifaceted effects of crude oil production on macroeconomic performance through the lenses of the Dutch disease theory and economic intuition. He outlines the various channels of influence that oil production exerts on macroeconomic health, primarily through the Dutch disease effects - the currency appreciation and spending effects. As oil is produced, some portion is allocated to local energy needs, while the rest is exported. This exportation can lead to an appreciation of the domestic currency, making domestically produced goods less competitive on the global market, which can hamper sectors like agriculture and manufacturing (Dobrynskaya & Turkisch, 2010).

The generated revenue from oil exports is divided between the energy sector and the government, initiating a spending effect. Government expenditure, funded through royalties, trade tariffs, and taxes from oil companies, can impact fiscal balance. The revenue is typically used to bolster sectors like agriculture and services (including health, education, and infrastructure), potentially improving their performance. This increase in government spending can influence inflation and exchange rates due to heightened demand for goods and services (Arezki & Ismail, 2010).

This increased demand can create inflationary pressure by raising the prices of non-tradable goods and services. Moreover, the imbalance between supply and demand can result in increased imports, thereby causing depreciation of the domestic currency. The sectors benefiting from the energy sector, such as agriculture, manufacturing, and services, influence the exchange rate through their import/export activities. They also affect inflation through their cost of production, which is reflected in the price of goods and services.

Inflation and exchange rates are intricately linked - a high cost of goods and services relative to foreign prices can stimulate demand for imports, leading to currency depreciation (Antwi, Boadi, & Koranteng, 2014). Conversely, a falling exchange rate can reduce production costs, as imported inputs become cheaper, potentially lowering the general price level (Aron, Macdonald & Muellbauer, 2014; Chaney, 2016; Monfared & Akın, 2017).

In sum, this theoretical framework illustrates the complex interplay between oil production, macroeconomic variables, and sectoral performance, spotlighting the Dutch disease effects of currency appreciation and government spending.

Data and Model Specification

This study employed yearly historical data on the variables included in the model discussed. The data covers the period of 1983-2021 for both the Angola and Libyan economies. Data on the oil price is sourced from the OPEC reference basket (ORB), while data on the other variables is sourced from the World Bank's development index electronic database.

Following Kamin and Rogers (2000) and Kutu and Ngalawa (2016), this study employs the Panel-SVAR model to capture the dynamics of world oil price shocks on the selected domestic oil-exporting economies. The model uses a seven-variable structure comprising oil prices, real exchange rate, inflation, money supply, interest rate, unemployment, and GDP. However, this model is adapted to comparatively examine the impact of oil price shocks on five selected macroeconomic variables in two African oil-producing countries, Angola and Libya. Therefore, this study considers oil prices, real exchange rate, inflation, money supply, GDP/output, interest rate, and the corruption perception index. The econometric model for this study is presented in the equation below:

$$op_t = \beta_0 + \beta_1 rexr_t + \beta_2 infr_t + \beta_3 ms_t + \beta_4 gdp_t + \beta_5 intr_t + \mu_t \quad (1)$$

Where;

op is oil $price$;

$rexr$: is real exchange rate; $infr$ is $inflation$ $rate$; ms is $money$ $supply$; gdp is $gross$ $domestic$ $product$; $intr$ is $intrest$ $rate$; μ is the $error$ $term$

Techniques of Analysis

The Structural Vector Error Correction (SVEC) method is the underlying econometrical methodology to be used in this study. Unlike the Structural Vector Auto Regression (SVAR) model, the SVEC model took cointegration between the variables into consideration. Although the SVAR identification is somewhat similar to the SVEC identification, the SVEC model's identification has three separate components, two of which are for long-run limitation and one for short-run optimization. Additionally, this model's flexibility allows it to take into account stationary endogenous variable(s) in a unique manner known as pseudo-cointegration (Pagan & Pesaran, 2008). An SVEC form may be used to depict the macroeconomic relationship between the cointegrated $I(1)$ variables as;

$$A\Delta Z_t = C + \Pi Z_{t-1} + B(L)\Delta Z_t + V_t \quad (2)$$

Where the vector Z = {log real gross domestic product, log broad money supply, log oil price, log exchange rate, log interest rate, log consumer price index}. The matrix $\boldsymbol{A}$ is the contemporaneous effects or the short-run matrix; Δ is the backward shift operator; Π is the coefficient matrix; $B(L)$ is the lag matrix, and V_t is the zero mean and orthogonal or structural shocks. The matrix Π is typically written as $\Pi = \alpha\beta'$, where α is the adjustment coefficient and β is the cointegrating space. The equation above can be represented in a moving average form as below;

$$Z_t = \Xi A^{-1} \sum_{i=1}^{t} V_i + \Xi^*(L) A^{-1} V_t + Z_0 \quad (3)$$

Where $\Xi = \beta_\perp(\alpha'_\perp(I_K - \boldsymbol{B}(\boldsymbol{L})\beta_\perp)^{-1}\alpha'_\perp$, $\Xi^* = \sum_{j=0}^{\infty} \Xi_j^* L^j$ is an infinite-order polynomial in the lag operator with coefficient matrices j that goes to zero as j tends to infinity. The term Z_0 contains all initial values. The matrix Ξ has rank K − r if the cointegrating rank of the system is r. It represents the long-run effects of forecast error impulse responses, whereas the $\Xi_j^*{}'s$ contain transitory effects.

Structural Identification

In a model of *K* endogenous variables, there are *r (r < K)* possible cointegrating vectors and this implies that there is/are *k**(*k** = *K* – *r*) permanent shock(s) and *r* temporary or transitory shock(s). The column(s) corresponding to the transitory shock(s) is/are restricted to be zero and it stands for only *k** independent restrictions. Given the transitory shocks, the corresponding zero columns imply k^*r independent restrictions only, and $k^*(k^* - 1)/2$ additional restrictions are needed to exactly identify the permanent shocks. King et al. (1991) revealed that $r\,(r - 1)/2$ additional contemporaneous restrictions are needed to identify the transitory shocks. The sum of these restrictions is identical to that of the SVAR; $k^*r + k^*(k^* - 1)/2 + r\,(r - 1)/2 = K(K - 1)/2$. We take further steps below to illustrate how the contemporaneous (B) and the permanent (ΞB) restrictions will be carried out in this study.

This study assumes two theoretical cointegrating vectors and the underlying VEC model is given in Equation (4) below;

$$\begin{bmatrix} \Delta\log(gdp_t) \\ \Delta\log(ms_t) \\ \Delta\log(oilp_t) \\ \Delta\log(cpi_t) \\ \Delta\log(exr_t) \\ \Delta\log(intr_t) \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \\ a_{41} & a_{42} \\ a_{51} & a_{52} \\ a_{61} & a_{62} \end{bmatrix} \begin{bmatrix} 1 & 0 & \beta_{13} & 0 & \beta_{15} & 0 \\ 0 & 1 & 0 & \beta_{24} & 0 & \beta_{26} \end{bmatrix} \begin{bmatrix} \log(gdp_{t-1}) \\ \log(ms_{t-1}) \\ \log(oilp_{t-1}) \\ \log(cpi_{t-1}) \\ \log(exr_{t-1}) \\ \log(intr_{t-1}) \end{bmatrix} + \sum_{i=1}^{p} \Gamma_i \Delta Z_{t-i} + V_t \qquad (4)$$

Equation (3.3) depicts the base VEC equation for the structural model discussed above. Where in the model, the alpha matrix contains the adjustment coefficients; the beta matrix contains the cointegrating vector parameters, Z is the vector of variables as discussed above, and the last variable in the equation is the vector of shocks. The first row in the beta matrix captures the goods market equilibrium equation i.e. the opened economy IS equation while the second row captures the money market equilibrium equation i.e. the LM equation. It is thus expected that $\boldsymbol{\beta_{13}}$ is positive or negative and is $\boldsymbol{\beta_{15}}$ negative. Also, a rise in price level is expected to have a positive effect on the money in circulation, $\boldsymbol{\beta_{24}}$ is thus expected to be positive, while $\boldsymbol{\beta_{26}}$ is expected to be negative.

To identify the shocks in the structural model, the contemporaneous and the long-run identification matrices are depicted equation 5;

$$\boldsymbol{B} = \begin{bmatrix} s_{11} & 0 & s_{13} & s_{14} & s_{15} & 0 \\ s_{21} & s_{22} & 0 & s_{24} & s_{25} & s_{26} \\ s_{31} & 0 & s_{33} & 0 & s_{35} & s_{36} \\ s_{41} & s_{42} & s_{43} & s_{44} & s_{45} & s_{46} \\ s_{51} & s_{52} & s_{53} & s_{54} & s_{55} & s_{56} \\ s_{61} & s_{62} & s_{63} & s_{64} & s_{65} & s_{66} \end{bmatrix}, \quad \Xi\mathrm{B} = \begin{bmatrix} l_{11} & 0 & l_{13} & 0 & 0 & 0 \\ l_{21} & l_{22} & l_{23} & l_{24} & 0 & 0 \\ l_{31} & l_{32} & l_{33} & l_{34} & 0 & 0 \\ l_{41} & l_{42} & l_{43} & l_{44} & 0 & 0 \\ l_{51} & l_{52} & l_{53} & l_{54} & 0 & 0 \\ l_{61} & l_{62} & l_{63} & l_{64} & 0 & 0 \end{bmatrix} \qquad (5)$$

The ΞB matrix contains the long-run structural shocks matrix while the $\boldsymbol{B}$ matrix contains short-run (or contemporaneous) structural shocks. The two zero columns in the long-run matrix ΞB corresponds to the two cointegrating vectors and mean that there are no long-run effects of the shocks from policy variables (exchange and interest rates) on any variables in the system; this is in line with the study of Dungey & Fry (2012), Krusec (2003). Since the two zero columns correspond to eight linear independent restrictions, seven additional long-run restrictions are required. We follow Bernanke, Ben & Blinder (1992) and use the restriction that monetary policy shocks have no contemporaneous effect on output. also, following Blanchard and Quah (1989), Gali (1992) and Gerlach and Smets (1995), we rely on a vertical long-run Philips curve to assume that demand and monetary policy shocks have no long-run impact on the level of real output.

3.0 RESULTS AND DISCUSSION

Table 1: Descriptive statistics

	Angola				Libya			
	Mean	**Std.**	**Max.**	**Min.**	**Mean**	**Std.**	**Max.**	**Min.**
gdp	404	410	1370	44.4	443	197	925	205
ms	22400	34700	127000	4.828	342	389	1330	36
$oilp$	43.706	30.792	111.820	12.110	44.608	30.743	112.890	12.903
exr	86.899	144.788	631.442	0.000	0.931	0.758	4.514	0.281
$intr$	52.508	47.577	217.875	12.534	6.552	0.541	7.263	5.792
cpi	88.708	140.232	583.678	0.000	92.929	32.749	148.449	37.477

Source: Author's Computation

The variables for Angola and Libya are statistically described in Table 1 above. For both nations, the average real gross domestic product is significantly above the minimum levels, indicating that both countries' economies have experienced growth over the past three decades. However, during the last thirty years, Angola has consistently had a higher average money supply in circulation compared to Libya. Nevertheless, due to OPEC's price control, there isn't a substantial difference in the price of oil between the two nations. In contrast to Angola, Libya's average exchange rate is relatively low, and the standard deviation indicates that Libya's exchange rate is less volatile than that of Angola. Additionally, interest rates and consumer price indices exhibit lower volatility in Libya compared to Angola.

Table 2: ADF Test Result

Variable	D.T	Angola			Libya		
		Level	**Diff.**	**†**	**Level**	**Diff.**	**†**
$\log(gdp)$	c	-0.803	-4.410***	$I(1)$	-1.840	-6.884***	$I(1)$
	c + t	-1.761	-4.346***	$I(1)$	-2.683	-6.795***	$I(1)$
$\log(ms)$	c	-1.131	-4.688***	$I(1)$	0.404	-4.699***	$I(1)$
	c + t	-0.909	-4.726***	$I(1)$	-1.697	-4.740***	$I(1)$
$\log(oilp)$	c	-1.118	-5.147***	$I(1)$	-1.125	-5.056***	$I(1)$
	c + t	-2.575	-5.112***	$I(1)$	-2.445	-5.016***	$I(1)$
$\log(exr)$	c	-1.807	-3.047**	$I(1)$	0.432	-3.009**	$I(1)$
	c + t	-1.927	-3.245**	$I(1)$	-1.933	-3.971***	$I(1)$
$\log(intr)$	c	-2.001	-5.634***	$I(1)$	-0.584	-6.927***	$I(1)$
	c + t	-2.470	-5.546***	$I(1)$	-2.313	-6.890***	$I(1)$
$\log(cpi)$	c	-1.834	-3.943***	$I(1)$	-1.787	-3.198**	$I(1)$
	c + t	-1.938	-3.201**	$I(1)$	-2.751	-3.448**	$I(1)$

Source: Author's Computation

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 2 presents the results of the Augmented Dickey-Fuller unit root test for the variables in each country. The testing procedure was conducted under two different assumptions: the first assumes that only a constant, "c," is present in the variables, while the second assumes the presence of both a trend and a constant, "c + t." When a trend assumption-based variable becomes stationary, i.e., at the level, it implies that the variable is trend-stationary rather than difference-stationary. In capturing the complexity of a variable's data generation process, it is often beneficial to incorporate both time and trend. However, some detrended macroeconomic variables may still contain elements of randomness.

The findings of the two hypotheses for both economies indicate that the variables are integrated of the first order, i.e., (1). The choice of the structural Vector Error Correction (VEC) model is further justified by the integrated nature of the variables. Additionally, the integrated nature of the variables reveals that some of them have the propensity to share stochastic trend(s) in a vector space. This is taken into account following the selection of the optimal lags to use in the estimating procedure.

Table 3: Lag Selection Criteria Results

Country	Lag	AIC	SIC	HQ
Angola	0	12.200	12.464	12.292
	1	5.027	6.874	5.671
	2	3.296	6.727	4.493
	3	1.396*	6.411*	3.146*
Libya	0	-2.210	-1.946	-2.118
	1	-11.302	-9.455*	-10.658
	2	-12.111	-8.680	-10.913
	3	-12.873*	-7.859	-11.123*

Source: Author's Computation

Before proceeding with further computations, it is customary to utilize statistical information criteria to determine the ideal lag (p) for the VAR model. The general rule of thumb for these criteria is to select the lag that results in the least information loss. Studies have shown that when using data with a short frequency, the Schwarz Information Criterion (SIC) often parsimoniously selects the optimal model; however, no single test is universally superior to the others.

The results of the three selection criteria used in this study are presented in Table 3 above. For Angola, all three criteria indicate that a lag of 3 minimizes information loss, suggesting that a Vector Error Correction Model (VECM) of order 2 is appropriate. In the case of Libya, the SIC selects lag 1, while the Akaike Information Criterion (AIC) and Hannan-Quinn (HQ) criteria recommend lag 3. Given the short length and frequency of the data, a VAR(1) is chosen as a compromise for both nations. Table 3 below, along with the Johansen cointegration test, further describes the outcome.

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Table 3: Summary of The Johansen Test Result with VAR (1)

Critical Values Based on Mackinnon-Haug-Michelis (1999)

Data Trend	Test Type		Angola		Libya	
	Constant	Trend	Trace	Max-Eig	Trace	Max-Eig
None	no	no	2	2	2	1
	yes	no	2	2	3	1
Linear	yes	no	2	1	2	1
	yes	yes	1	1	3	1
Quadratic	yes	yes	1	1	3	1

Source: Author's Computation

One of the several assumptions made by the Johansen cointegration test is the inclusion of an intercept, a trend, or both in the cointegration space. Table 3 below summarizes the test's findings based on a 5% significance level and the specified assumptions. The Trace and Maximum-Eigen statistics are the two primary statistics used for drawing inferences in the Johansen technique.

When the VEC model is in a reduced-rank scenario, a VAR model is applicable based on a test result with a full rank. Conversely, when a zero rank test result is obtained, a VAR model with differenced variables should be employed for estimation. There are instances where the results of the Trace and Maximum-Eigen statistics do not align; however, research has demonstrated that the Trace statistics are generally more reliable than the Maximum-Eigen statistics. It is noteworthy that the Johansen cointegration test rejects the null hypothesis suggesting no cointegration, providing evidence for the existence of two cointegration vectors in both economies.

Table 4: Long-Run and Adjustment Coefficient Estimates

Country		$\log(gdp)$	$\log(ms)$	$\log(oilp)$	$\log(cpi)$	$\log(exr)$	$\log(intr)$
Angola	β'	1		-1.077***		0.035***	
				(0.104)		(0.012)	
			1		-1.041***		-1.816***
					(0.072)		(0.421)
	α'	0.011	0.240	0.442**	-0.441	-0.314	0.199
		(0.185)	(1.093)	(0.205)	(0.473)	(0.533)	(0.344)
		-0.012	-0.850***	-0.054*	-0.300***	-0.358***	-0.065
		(0.026)	(0.153)	(0.029)	(0.066)	(0.074)	(0.048)
Libya	β'	1		-0.649***		0.554***	
				(0.060)		(0.100)	
			1		-0.803**		7.454***
					(0.322)		(1.158)
	α'	-0.446*	0.051*	0.600**	-0.018	-0.102	-0.023
		(0.243)	(0.091)	(0.292)	(0.059)	(0.240)	(0.028)
		-0.378**	-0.273***	-0.188	-0.010	0.096	-0.033
		(0.187)	(0.070)	(0.224)	(0.150)	(0.184)	(0.021)

Source: Author's Computation

( ) contains the standard error

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 4 displays the estimated long-run vectors and the corresponding adjustment coefficient estimates for the countries. The results reveal that in Angola, oil price positively impacts real gross domestic product, while exchange rate depreciation has a negative long-term effect. This suggests that if the oil price increases by one percent, the real gross domestic product will, on average, increase by approximately 1.1% in the long run. Conversely, a one percent exchange rate depreciation (Angola Kwanza/Dollar) leads to a 0.04% reduction in real gross domestic product in the long run.

The second cointegrating vector shows that both price and interest rate positively impact the broad money supply in Angola in the long run. Specifically, a one percent increase in the price level and interest rate results in a 1.04% and 1.82% increase in money supply, respectively, in the long run. The adjustment coefficient indicates that Angola's real gross domestic product does not adjust toward goods and money market equilibrium, whereas the broad money supply adjusts only towards the money market equilibrium.

In the case of Libya, similar to Angola, it can be deduced that oil price has a positive long-term impact on real gross domestic product, while exchange rate depreciation has a negative effect. Specifically, if the oil price increases by one percent, the real gross domestic product will, on average, increase by about 0.65% in the long run. Conversely, a one percent exchange rate depreciation (Libyan Dinars/Dollar) results in a 0.55% reduction in real gross domestic product in the long run.

In contrast to the Angolan case, the second cointegrating vector for Libya indicates that price positively impacts the broad money supply, while the interest rate has a negative impact in the long run. A one percent increase in the price level leads to a 0.8% increase in money supply, while a one percent increase in the interest rate results in a 7.5% decrease in the broad money supply in the long run, respectively. Unlike Angola, Libya's real gross domestic product adjusts towards both the goods and money markets' long-run paths. Additionally, the money supply diverges from the goods market equilibrium and adjusts towards the money market equilibrium.

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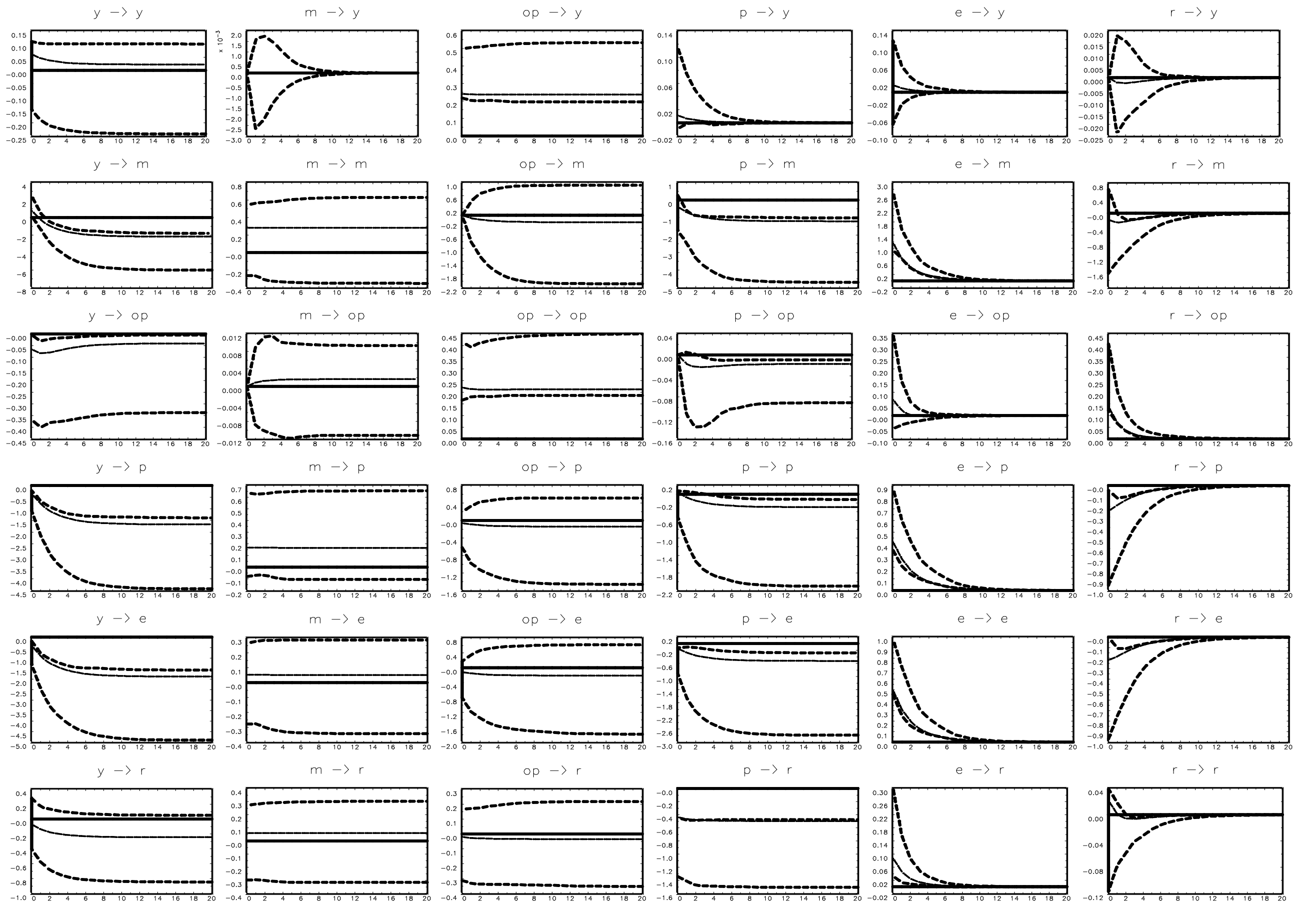

Figure 1: SVECM Impulse Response for Angola

Source: Author's Computation

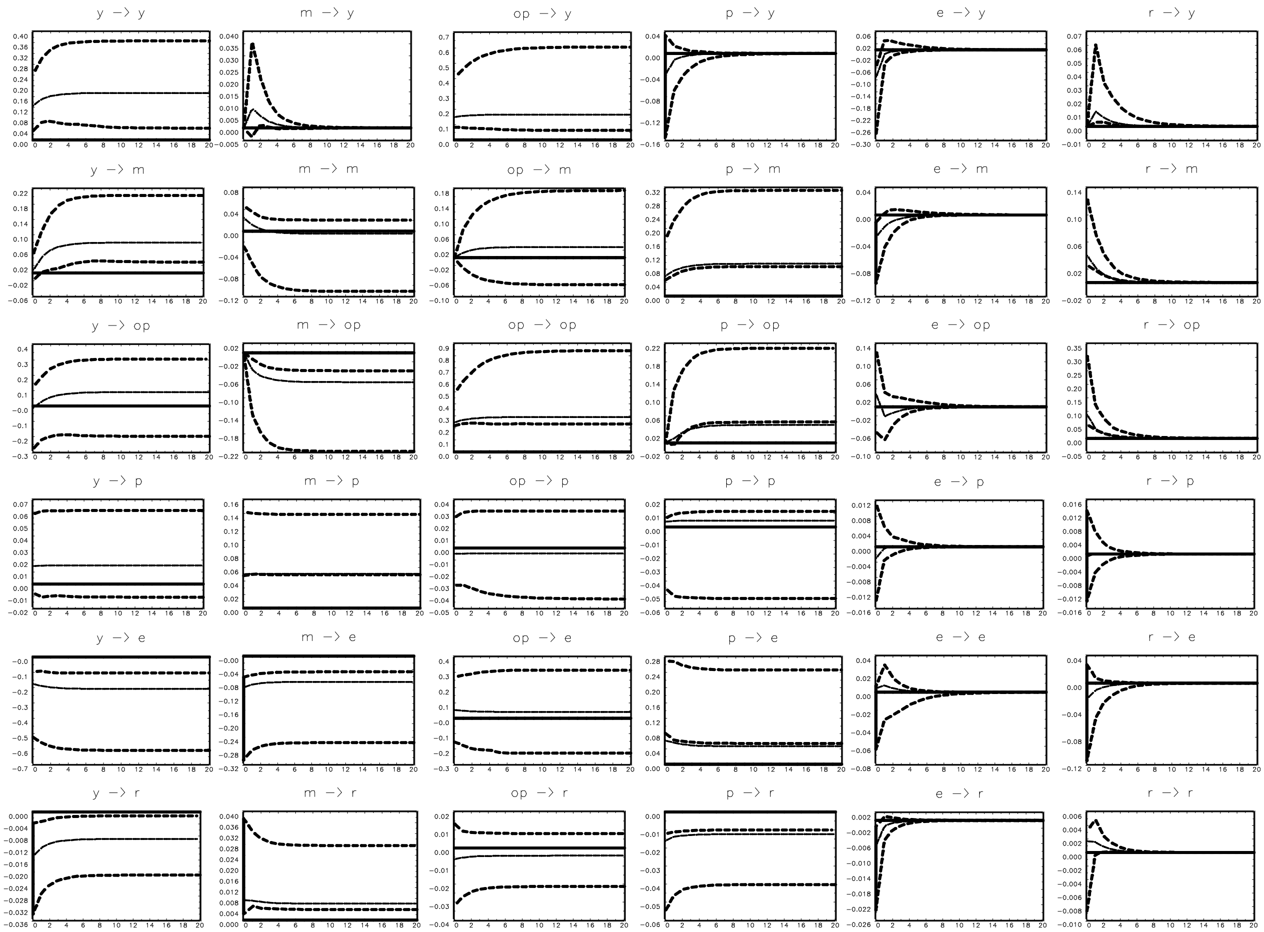

Figure 2: SVECM Impulse Response for Libya

Source: Author's Computation

Table 4 displays the estimated long-run vectors and the corresponding adjustment coefficient estimates for the countries. The results reveal that in Angola, oil price positively impacts real gross domestic product, while exchange rate depreciation has a negative long-term effect. This suggests that if the oil price increases by one percent, the real gross domestic product will, on average, increase by approximately 1.1% in the long run. Conversely, a one percent exchange rate depreciation (Angola Kwanza/Dollar) leads to a 0.04% reduction in real gross domestic product in the long run.

The second cointegrating vector shows that both price and interest rate positively impact the broad money supply in Angola in the long run. Specifically, a one percent increase in the price level and interest rate results in a 1.04% and 1.82% increase in money supply, respectively, in the long run. The adjustment coefficient indicates that Angola's real gross domestic product does not adjust toward goods and money market equilibrium, whereas the broad money supply adjusts only towards the money market equilibrium.

In the case of Libya, similar to Angola, it can be deduced that oil price has a positive long-term impact on real gross domestic product, while exchange rate depreciation has a negative effect. Specifically, if the oil price increases by one percent, the real gross domestic product will, on average, increase by about 0.65% in the long run. Conversely, a one percent exchange rate depreciation (Libyan Dinars/Dollar) results in a 0.55% reduction in real gross domestic product in the long run.

In contrast to the Angolan case, the second cointegrating vector for Libya indicates that price positively impacts the broad money supply, while the interest rate has a negative impact in the long run. A one percent increase in the price level leads to a 0.8% increase in money supply, while a one percent increase in the interest rate results in a 7.5% decrease in the broad money supply in the long run, respectively. Unlike Angola, Libya's real gross domestic product adjusts towards both the goods and money markets' long-run paths. Additionally, the money supply diverges from the goods market equilibrium and adjusts towards the money market equilibrium

4. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study conducted a comparative analysis of the impact of oil price shocks on five selected macroeconomic variables in two African oil-producing countries, Angola and Libya. Utilizing the advantage of cointegrated variables in both countries, the study employed the structural vector error correction model (SVECM). The primary conclusion drawn from the empirical analysis is that the response to and significance of oil price shocks are somewhat similar in the two countries. Specifically, oil price shocks are found to have a significant, positive, and persistent effect on both countries' oil prices and real economic output. However, the other macroeconomic variables are shown to respond insignificantly to oil price shocks in both countries, albeit with varying signs.

These findings align with previous empirical research. For instance, Omolade, Ngalawa & Kutu (2019) found that oil price shocks had a significant impact on economic growth, inflation, and exchange rates, supporting the study's conclusion regarding the positive and persistent effect of oil price shocks on real economic output in Angola and Libya. Similarly, Mukhtarov (2020) examined the impact of oil price shocks on economic growth in oil-exporting countries, including Angola and Libya, and found significant effects, corroborating the study's findings regarding the effect of oil price shocks on real economic output. Additionally, Ogede, George & Adekunle (2020) explored the relationship between oil price shocks and stock market performance in oil-exporting African countries, including Angola and Libya, indirectly supporting the study's conclusions.

Recommendations

Therefore, it is recommended that both countries diversify their economies to reduce dependency on oil revenues and mitigate the risks associated with oil price shocks. Diversification can be achieved by investing in non-oil sectors such as agriculture, manufacturing, tourism, and renewable energy, creating more stable and sustainable sources of income. This diversification would help reduce the impact of oil price fluctuations on the economy and enhance overall economic resilience. Furthermore, the implementation of macroeconomic stabilization policies is advised to reduce the vulnerability of their economies to oil price shocks. Such policies could include fiscal measures like establishing sovereign wealth funds to save excess oil revenues during periods of high oil prices, which can then be used to stabilize the economy during periods of low oil prices. Additionally, monetary policies, including interest rate adjustments, can be employed to counteract inflationary or deflationary pressures resulting from oil price shocks. By implementing these policies, Angola and Libya can better manage the impact of oil price shocks on their economies and promote long-term economic stability.

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