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Oil Price Fluctuation and their Impact on the Macroeconomic Variables: The Case of Kuwait

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ABSTRACT

The fluctuations in the international prices of crude oil have been a major concern for many economies who depend mainly on oil exports. Oil price shocks are a major disturbance for the economies of oil producing countries. This study investigates the impact of oil price shocks on selected macroeconomic variables in Kuwait using secondary data covering the period of 2001-2022. The study adopted the Vector autoregression (VAR) method to analyze the response of Kuwait macroeconomic variables to shocks in oil prices. Oil price in the study is considered in 2 categories: the linear oil price and the non-linear oil price (positive and negative changes in oil price). Based on the findings, it is observed that oil price shocks significantly impact macroeconomic variables in Kuwait. It is found that positive changes in oil prices have a more positive and significant impact on the macroeconomic variables compared to the negative changes in oil price. It is however concluded that there is a need for more policy developments to better harness periods of positive oil price experiences, and develop hedging risk framework for periods of negative changes in oil price in order to curb the impact of oil price shocks on Kuwait's macroeconomy.

Keywords: Macroeconomic, Oil Price Shocks, Developing Economies, Kuwait, VAR Modelling
JEL Classification Codes: C23, F3, Q43, O2.

1. INTRODUCTION

Crude oil prices play a vital role in every economy, which makes any changes in the price of oil result in a significant influence on economic conditions. Changes in crude oil price are a result of the interaction of the forces of demand and supply of oil in the global commodity markets (Arezki et al., 2017). Fluctuations in the price of crude oil over the years have been remarkable. After an extremely calm 20-year period between 1986 and 2006, Brent crude oil prices rose from $60 to $145 between 2007 and 2014 and then fell sharply to $30 in 2020 due to the impact of the covid-19 pandemic on demand and supply of crude oil globally. Existing research had focused on investigating the relationships between crude oil prices and macroeconomic variables such as real GDP, government expenditure, inflation, real exchange rate, and net exports. They provide evidences that fluctuating crude oil prices significantly impact the global economy, some have identified the changes in crude oil price as an essential source of economic instability and a paradigm of a global shock, likely to affect many economies simultaneously (Balcilar et al., 2019; Balcilar and Ozdemir, 2013; Bouri, 2015; Kilian, 2008; Kilian and Zhou, 2019; Naifar and Al Dohaiman, 2013). Some studies has also focused on crude oil prices impact on the stock market prices across countries and they found the significant link between the variables (Balcilar et al., 2019; Bastianin and Manera, 2018; Cologni and Manera, 2008; Gronwald, 2008).

According to Zulfigarov and Neuenkirch (2020) developing oil exporting countries are more vulnerable to the shocks in oil price compared to developed countries. Kuwait is known as a heavily oil dependent country through its export and revenue generation, while its governmental efforts are devoted towards diversification

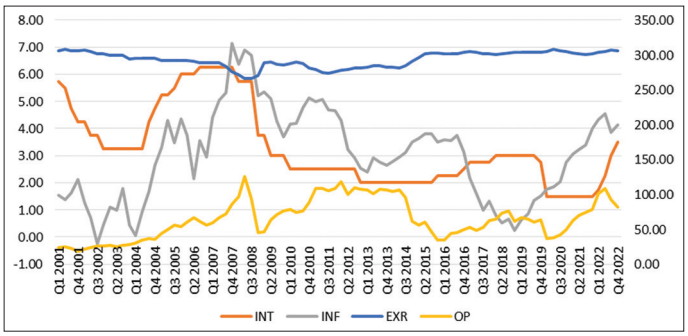
of the economy to hedge the risk of oil price shocks (Eltony & Al-Awadi, 2001). Hence, Kuwait's GDP and other macroeconomic variables such as exchange rate, interest rate and inflation rate are tightly connected to movement of oil price. Observing the data sourced from the Central Bank of Kuwait, oil price and inflation rate are highly correlated following the close trend noted in Figure 1. In the early 2000s, oil price trades below $50 per barrel. From 2001 to 2008, the oil price maintained a continuous increase from $25 per barrel to an average of $105 per barrel in 4th quarter 2008. During this period, the inflation rate also maintained progressive record in its figures from 1.37% in 1st quarter 2001 to 5.2% in 4th quarter 2008. The interest rate was at 5.75% in 1st quarter 2001 and dropped at 3.25% in 2nd quarter 2004 then peaked again to 5.75% in 2nd quarter 2008. The changes in 2008 were influenced by the impact of the 2006 global financial crisis. Between 2009 and 2019, the variables of oil price, interest rate and inflation rate followed similar trends of uncertainty. In 2020, while oil price was declining, it was observed that inflation rate maintained a continuous increase since the 1st quarter 20202 to the 2nd quarter 2022, but maintained single digit. Interest rate was maintained at 1% throughout the pandemic then peaked to 3.5% in 4th quarter 2022.

Following the strong association observed between oil price and some selected Kuwait macroeconomic variables, this paper aims to investigate the relationship between shocks in crude oil price and their impact on the macroeconomic variable of Kuwait. The study is significant as it adds on to the body of knowledge in literature on the performances of Kuwait economy following the event of oil price shocks and the outbreak of covid-19 pandemic. The remainder of the paper is divided as follows: Section 2 presents contemporary literature review. Section 3 presents the methodology and data. Section 4 presents the empirical results and findings, and Section 4 provides concluding remarks and policy implications.

2. REVIEW OF THE LITERATURE

To effectively situate this study, this literature review takes the form of evaluation the existing studies which have been conducted relating to oil price shocks and aspects of the economy. This is reinforced by Gisser and Goodwin (1986) who explain that oil price fluctuation is believed to have different relationships with economic growth and macroeconomic variables. The review begins with a review of the empirical studies which were conducted in designated developed countries and then moves on how the impact of oil price shocks have been handled in developing countries to previous studies that have been conducted in Kuwait.

Figure 1: Comparing oil price with inflation rate, interest rate and exchange rate



Taghizadeh-Hesary (2016) examined the impact of oil price shocks on the macroeconomic variables of developed economies (Japan and USA) and the emerging economy of China. The study was aimed at discovering how oil price volatility impacts these varied economies and how those economies respond to oil price shocks. The study adopted an N-variable structural vector autoregression (SVAR) model to analyze the collected panel data between 2000 and 2013. The analysis revealed that oil price shocks have varied impacts on each of the examined economies. For example, oil price shocks had a milder impact on the GDP of developed countries such as Japan and USA but has a more significant impact on of China, which the study observed to be an emerging economy at the time the study was conducted. On the other hand, the analysis revealed that the impact of oil price shocks on the inflation rate of China was milder compared to the inflation rate of Japan and the USA. The findings of this study are apt in the sense that it indicated that oil price shocks do not have a uniform impact on different economies. However, the key limitation of this study is that it assumes that two different economies respond similarly to oil price shocks (as seen in the case of Japan and USA). This limitation is reinforced by the fact that the socio-economic and socio-political forces which shape each economy are different. As such, it becomes curious to conceive how oil price shock have a similar impact on the macroeconomic variables on two separate countries. Thus, therefore reinforcing the need for a country-specific study of the impact of oil price fluctuations on macroeconomic variables of a country.

In another study, Lorusso and Pieroni (2018) investigated the impact and consequences of oil price volatility on the macroeconomic aggregates of the United Kingdom (U.K.), which is an example of a developed country. The study adopted an empirical approach to gain insight into the core basis of the continuous oil price shocks. One of the key findings of the study is that the nature of the impact that oil price fluctuation has on macroeconomic variables of the U.K. is dependent on the type of oil price shocks. For example, the study noted that an increase in the total market-based demand not negatively impact on the economy of the U.K. in the short run. In addition, it also discovered that a shortfall in the supply of oil results in an immediate fall in the country's GDP growth. The study also discovered that the inflation rate in the U.K. increased as a response to an increase in oil prices. It is on this note that the study argued that there is a significant relationship between oil price changes and changes in the country's GDP growth, nominal interest rate, inflation, and unemployment rate. Having observed this, the study further highlighted that Bank of England deployed policy measures by adjusting the interest rate to align with prevailing economic conditions created by oil price changes. Specifically, the study noted that there is an increase in interest rate when there is an oil boom caused by an increase in demand. In the case of oil supply disruptions, the result is reversed. This study offered a comprehensive impact of oil price shocks on macroeconomic variables of the U.K. economy as it

offered the linear and non-linear impact of oil prices changes on key macroeconomic variables.

Similar studies have also been examined in a developing countries using a country-specific study. One of such studies is Zulfigarov and Neuenkich (2020) which assessed the nexus between oil price changes on key macroeconomic indicators of Azerbaijan. The study adopted vector autoregressive models to analyze data set covering the period from Q1 2022 and Q4 2018. The analysis indicated that the GDP of Azerbaijan decrease following increases in oil prices and this impacts on all aspects of the economy especially the oil and gas sector. In addition to that, it also discovered the positive correlation between the downturns in the oil and gas sector and the downturns in the non-oil sector, this negatively impacting on aggregate revenue. Further, increases in oil prices also result in an increase in the country's inflation rate. In line with this also, exchange rate and interest rates also increase when there is a decrease in oil prices. Overall, it is evident that oil prices change significantly shapes and upward or downward movement of macroeconomic indicators.

In addition to the studies on the impact of oil price changes on regional economies, Negi (2015) and Al Rasasi and Yilmaz (2016) studied the impacts of oil price shocks on the GDP of BRIC nations. Following the adoption of Ordinary Least Square (OLS), Random Effect Model (REM), and Fixed Effect Model (FEM) to determine the impact of oil price changes on GDP. the study discovered that there is a generally positive and significant relationship between oil prices and GDP. In terms of oil price changes, however in terms of oil price changes, the study noted that oil price fluctuations have a negative impact on the GDP of the nations.

To review an empirical study from Africa, Abubakar and Akadiri (2022) examined the effects of oil rents and revenues on economic growth using the dynamic autoregressive distributive lag (DYNARDL) model as well as the kernel-based regularized least squares (KRLS) approach to analyze a data set spanning 1973-2020. They found that oil rents are inconsequential and have decreasing marginal effects on economic growth in Nigeria. But oil revenue has a significant and sustainable effect on economic growth in Nigeria. It must be noted however that this did not highlight the impact of oil prices changes on macroeconomic indicators Nigeria.

While the above study examined a country specific study, Berument et al. (2010) and Bala and Chin (2018) and Van Eyden et al. (2019) investigated the effect of oil prices on output growth especially in the MENA region. The choice of the MENA region as the focus of the study was chosen by the fact that the countries that make up the MENA are regarded as net importers or net exporters of oil as such their demand and supply activities may not significantly impact the global oil prices. From the vector autoregressive model that was deployed for the analysis, the study shows that there is no uniform impact of oil price shocks on the economies in the MENA region. For example, the analysis revealed that there is statistically significant positive effect of oil prices increase on the outputs of Algeria, Iraq, Libya, Kuwait, Oman, Qatar, and the United Arab Emirates. On the other hand, the study discovered that oil price shocks do not appear to have a statistically significant impact on the economic outputs of countries such as Morocco, Tunisia, Jordan, Egypt, and Israel. The finding of this study resonate with that of Taghizadeh-Hesary (2016) who also discovered that oil price shocks produce dissimilar impacts on countries. It should be highlighted that also that despite the fact that oil price shocks lead to lower output, the impact of increased oil demand on economic output remains positive. Thus, it was found in this study that increases in oil price cause a statistically significant and positive effects on economic growth. One of the key limitations of Berument et al. (2010)'s study is that it paid little attention to macroeconomic variables. As such, it becomes challenging to gain deeper insights into the specific impacts that oil price changes generate.

While Berument et al. (2010) above examined the impact of oil price shocks on the GCC region, Nusair (2016), Alhassan et al. (2019) and Alhamran et al. (2022) investigated the impact of oil prices on the economies of the GCC countries. Two key findings were made by these studies. Berument et al. (2010) discovered that positive oil price changes have a considerably larger effect on real GDP while Alhassan et al. (2019) revealed that a decrease in oil price has a significant positive effect on unemployment rate. These two studies therefore indicate that there is a clear nexus between changes in oil prices, GDP, and unemployment rates in the GCC region. This resonates with the argument that as a result of the oil dependent nature of GCC states, their economies become very sensitive to oil price fluctuations (Maghyereh et al., 2020; Jawadi and Ftiti, 2019; Gray 2011). To clearly highlight similar studies on the GCC region, other studies have also studied the relationship of oil price fluctuations on GDP growth and on income sustainability as well as other impacts of oil price on microeconomic variables of a country (Murshed et al., 2020; Chang et al., 2020; Demirer et al., 2020; Tala and Hlongwane, 2023; Balcilar et al., 2019; Badeeb and Lean, 2018; Basher et al., 2018; Neifar and Kammoun, 2022; Sharma and Dahiya, 2023; Salisu and Oloko, 2015; Musa 2010). In another related study Nasir et al., (2019) revealed the impact of oil price on macroeconomic variables in GCC member countries between 1980-2016. the studies mentioned above observed a heterogenous response of GCC member countries on oil price shocks. Thus, it would be adequate to examine each country separately.

In some of the few studies that were conducted in Kuwait, Al-Mutairi (1993) and Eltony and Al-Awadi (2001) found evidence that oil price shocks are important in explaining fluctuations in macroeconomic variables in Kuwait. Likewise, Alhayky and Naim, (2017) examined the dynamic relationship between crude oil prices and Kuwait's Stock Market. The study discovered that Kuwait Stock Market Index reacts differently to changes in crude oil price in different periods. During high volatility periods, there is a positive and significant relationship between crude oil price and Stock Market Index. Most recent study by Alshihab and AlShammari (2020) examined the impact of fluctuations in the price of oil on Kuwaiti stock market returns. The findings confirmed that changes in Kuwaiti stock market returns are only affected by crude oil price fluctuations in the short run.

Based on the above literature, it is evident that the study has identified oil price as a dominant commodity and determinant of macroeconomic activities and by extension economic growth (Badeeb and Lean, 2018; Basher et al., 2018; Chang, 2020; Chang et al., 2020; Demirer et al., 2020; Joo and Park, 2021; Ready, 2018). However, there has not been enough focus given to oil price volatility in the modelling of macroeconomic volatility in Kuwait, especially in correlation to the impact of covid-19 pandemic. This paper therefore fills the research gap by modelling the impact of oil price volatility on macroeconomic variables (GDP, Inflation, Interest Rate, Consumer Price Index, and Exchange Rate).

3. METHODOLOGY AND DATA

The methodology presents the theoretical framework adapted to model the impact of oil price shocks on macroeconomic variables in Kuwait.

3.1. Model Specification

The paper aims at investigating the impact of oil price volatility on macroeconomic variables on the economy of Kuwait. For this purpose, the first step in developing a VAR model is to make a choice of the macroeconomic variables which are essential for this analysis. The variables consist of key macroeconomic variables such as: Real Gross Domestic Product, Real Kuwaiti Dinar exchange rate against the $US, Inflation rate in Kuwait, Interest Rate for the Kuwaiti Dinar, and Kuwaiti consumer price index. The notations of these variables are as follow:

GDP: Real Gross Domestic Product (millions of Kuwaiti Dinar).

EXR: Real Kuwaiti Dinar exchange rate against the $US.

INT: Inflation rate in Kuwait

INF: Interest Rate for the Kuwaiti Dinar

CPI: Kuwaiti consumer price index.

The scope for the study and the variables used are selected based on data availability. The argument on oil price shocks on macroeconomic variables remain unsettled in studies following the methods which they were measured in (Iwayemi and Fowowe, 2011), who further observed that the usual measures of oil price shocks/volatility determines the functional relationship with macroeconomic variables. Due to this, the model is suggested to be incorrect and has contributed to the unsettled empirical studies on oil price shocks/volatility on macroeconomic variables (Hamilton, 2003; Iwayemi and Fowowe, 2011). Whereby Mork (1989) and other authors including (Hamilton, 1996; Lee et al., 1995) argued that the relationship between oil price and macroeconomic variables are nonlinear, and have specified that in different models. Iwayemi and Fowowe (2011) extended the oil price shocks/volatility model by considering both the linear and nonlinear impact of oil price shocks on macroeconomic variables. Following (Hamilton, 1983; 1996; 2008)) and (Bachmeier, 2008), the linear benchmark is estimated as the percentage change in the nominal price of crude oil (OIL). Hamilton (1996) asserted that, to compute the net oil price (NOP), the current oil price is compared with the previous year prices if it is positive and assumed zero otherwise. The Hamilton (1996) is defined as;

$$NOP_t = max[0, (In(Oil_t) – In(max(oil_{t-j}, ..., Oil_t)))] \quad (1)$$

Mork (1989) considered the asymmetries in oil price by computing the positive and negative changes in oil price (OILP). The changes in oil price are computed as;

$$ROILP_t^+ = \max(0, (roilp_t - roilp_{t-1})) \quad (2)$$

$$ROILP_t^- = min(0, (roilp_t - roilp_{(t-1)})) \quad (3)$$

From equation 2 and 3, ROILP is the real price of oil at time t. $ROILP_t^+$ depicts positive changes in the real price of oil at time t and $ROILP_t^-$ depicts negative changes in the real price of oil at time t.

Lee et al. (1995) derived oil shock variable using GARCH model which reflects both the unexpected changes in real oil price and the time varying conditional variance of oil price change forecasts. Based on GARCH (1,1) model, Lee et al. (1995) captured oil price shocks as;

$$X_t = \delta + \sum_{i=1}^{k} A_t X_{t-i} + \sum_{i=1}^{k} B_t Z_{t-i} + + \varepsilon_t \quad (4)$$

$$\varepsilon_t = V_t \sqrt{h_t, V_t} \sim N(0,1) \quad (5)$$

$$h_t = \gamma_t + \gamma_1 \varepsilon_{t-1}^2 \gamma_t, h_{t-1} \quad (6)$$

$$OILVOL = \max(0, \frac{\varepsilon_t}{\sqrt{h_t}}) \quad (7)$$

For this study, our empirical strategy is hinged on the Linear VAR model in equation 4 which includes O_t, a vector of endogenous variables, Z_t is the vector of exogenous variables, δ is the vector of intercepts, ε_t is the vector of error terms, while A and B are parameters matrices.

To estimate the asymmetries, we followed the model of Lee et al., (1995). We measured positive changes in oil price as $OILP_t^+$ and the negative changes in oil price as $OILP_t^-$. $OILP_t^+$ comprises of all positive changes with the negative values taking as zero, while $OILP_t^-$ comprises of all negative changes in the price of oil taking the positive changes as zero.

The study considers at first the unit root test to examine the time series properties of the variables. For this purpose, the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root methods are considered to test the variables order of integration. Depending on the result, if the variables are stationary at I (1), the study will further estimate the long-run cointegrating relationship among the variables. The VAR model is adopted to test for the impact of oil price shocks on macroeconomic variables in Kuwait. According to Iwayemi and Fowowe (2011), the VAR model permits the assessment of the impact of a particular variable on other variables. In addition, since all the variables are considered endogenous, there are no a priori restrictions to the structural relationships (Farzanegan & Markwardt, 2009).

The Granger Causality Test is adopted after the VAR estimation. The Granger Causality test is considered as it ascertains the explanatory power of a lagged values of the variables (X) on the lagged values of the variable Y. The Granger Causality test model can be expressed below;

$$y_t = a(L)\,y_{t-k} + \mathrm{b}(\mathrm{L})\,x_{t-k} + \varepsilon_t \tag{8}$$

$$x_t = c(L)\,y_{t-k} + \mathrm{d}(\mathrm{L})\,y_{t-k} + v_t \tag{9}$$

From equation 8, x_t does not granger cause y_t if b(L) = 0. Variable y is considered as the dependent variable explained by variable x. In equation 9, y_t does not granger cause x_t if d(L) = 0. Variable x is considered as the dependent variable explained by variable y.

To examine the response of the selected macroeconomic variables to oil price shocks, the impulse response functions are used. To examine the variations in the macroeconomic variables as a result of shocks in oil price, the variance decomposition analytical method is adopted. For selection of the number of lags optimal for the VAR analysis, the Akaike Information Criterion (AIC) is considered. The number of lags selected by the method is 1.

The study also considered an analysis of the short-run impact of oil price shocks on macroeconomic variables in Kuwait. In analyzing this, the Non-Linear Autoregressive Distributed Lag (NARDL) model is considered (see Appendix). Following the nature of the unit root tests results which confirms the stationarity of the variables (both the dependent and independent variables) at I(0) and I(1). From equation 10 -13, the models are stated at first in their Non-Linear function detailing the performances of the macroeconomic variables (exchange rate (EXR), Inflation rate (INF), Interest Rate (INT) and GDP) as a function of the linear oil price and oil price asymmetries (positive and negative changes in oil price);

$$EXR_t = \beta_0 + \beta_1 OP + \beta_2 OP_t^{+} + \beta_3 OP_t^{-} + \varepsilon_t \tag{10}$$

$$INF_t = \beta_0 + \beta_1 OP + \beta_2 OP_t^{+} + \beta_3 OP_t^{-} + \varepsilon_t \tag{11}$$

$$INT_t = \beta_0 + \beta_1 OP + \beta_2 OP_t^{+} + \beta_3 OP_t^{-} + \varepsilon_t \tag{12}$$

$$GDP_t = \beta_0 + \beta_1 OP + \beta_2 OP_t^{+} + \beta_3 OP_t^{-} + \varepsilon_t \tag{13}$$

From equations 10-13, β_0 is the intercept. β_1–β_3 are the coefficients of the oil price variables at time t. ε_t is the error term at time t.

The NARDL model is therefore presented in equation 14-17. The models present the short-run impact of the oil prices on the macroeconomic variables. This is because of the ARDL bounds test result in Table 2 which concludes that the variables are not cointegrating in the long-run and as a result, only the short-run result should be reported.

$$\Delta EXR_t = \vartheta_t + \sum_{q=1}^{n}\rho_1 \Delta EXR_{t-k} + \sum_{q=1}^{n}\rho_2 \Delta OP_{t-k} + \sum_{q=1}^{n}\rho_3 OP_t^{+} + \sum_{q=1}^{n}\rho_4 OP_t^{-} + \delta ecm_{t-1} \tag{14}$$

$$\Delta INF_t = \vartheta_t + \sum_{q=1}^{n}\rho_1 \Delta INF_{t-k} + \sum_{q=1}^{n}\rho_2 \Delta OP_{t-k} + \sum_{q=1}^{n}\rho_3 OP_t^{+} + \sum_{q=1}^{n}\rho_4 OP_t^{-} + \delta ecm_{t-1} \tag{15}$$

$$\Delta INF_t = \vartheta_t + \sum_{q=1}^{n}\rho_1 \Delta EXR_{t-k} + \sum_{q=1}^{n}\rho_2 \Delta OP_{t-k} + \sum_{q=1}^{n}\rho_3 OP_t^{+} + \sum_{q=1}^{n}\rho_4 OP_t^{-} + \delta ecm_{t-1} \tag{16}$$

$$\Delta GDP_t = \vartheta_t + \sum_{q=1}^{n}\rho_1 \Delta GDP_{t-k} + \sum_{q=1}^{n}\rho_2 \Delta OP_{t-k} + \sum_{q=1}^{n}\rho_3 OP_t^{+} + \sum_{q=1}^{n}\rho_4 OP_t^{-} + \delta ecm_{t-1} \tag{17}$$

From equations 14-17, ϑ_0 is the short intercept of the models specified. ρ_2–ρ_4 are the short-run coefficients of the oil price variables at time t. They explain the magnitude at which the independent variables (linear oil price and oil price asymmetries) impacted the dependent variables. ε_t is the error term at time t.

3.2. Data Used

Quarterly data covering the period between 1st quarter 2001-4th quarter 2022 were utilized in this study. All economic indicators are obtained from Central Bank of Kuwait and expressed in logarithmic form. This paper uses Dubai crude oil prices (also known as Dubai Fateh), for the oil price variable, unlike the vast majority of papers that use West Texas Intermediate (WTI) or Brent oil prices. The rationale of using Dubai crude is linked to the theoretical underlying definition of these crude oils. Brent is a blend of crudes which is produced from offshore fields in the North Sea. Brent, which is waterborne, is the primary reference grade and benchmarking all the trades in the European and African markets (Fattouh, 2011). While WTI is a blend of US landlocked domestic crudes and been transported through pipelines and deliveries of its cargo take place in the US major storage centers. WTI is heavily influenced by local infrastructural issues, and its exposure to infrastructural bottlenecks had on some occasions resulted in disconnecting its prices from those of other international crudes such as Brent and Dubai (Kao and Wan, 2012).

On the other hand, Dubai crude benchmark is the primary crude oil loading from GCC region since the 1980s, and Dubai crude price is more volatile and reflective to regional geopolitical elements inside GCC region Arouri et al. (2010). For instance, during times of crisis in GCC region (i.e. Gulf war 1990), the spread between Dubai and Brent blows out as political uncertainty leads to surges in Dubai crude prices, while Brent is less reflective Roekchamnong et al. (2014). As a result, this paper argues that using Dubai crude price is more representative of the examination of microeconomics of GCC region. Dubai crude oil price is obtained from the Energy Information Administration (EIA) using quarterly frequency of Dubai crude prices is denominated in US dollars.

4. EMPIRICAL RESULTS AND FINDINGS

This section presents the empirical results of the analysis, which will involve 3 steps; Unit root test for the variables, Granger causality test, Forecast Error Variance Decomposition (FEVD), and then an impulse response function (IRF) is to traces performed the effects of price shock on current values of the endogenous variables.

4.1. Unit Root Tests

The analysis is based on time series data. This therefore requires some specific approaches to the analysis. It is generally known that the econometric estimation of a model based on time series data demands that the series be stationary, as non-stationary series usually results in misleading inferences. Engle and Granger (1987) provide a standard technique to deal with this problem. This involves testing the variables of an equation for stationarity by running the regressions for all the series at both first difference and levels and, with constant and trend in the equation employing the Augmented Dickey and Fuller (1979) (ADF) tests. For this purpose, we employed the Augmented Dickey-Fuller (ADF) with a structural break which is preferable to the simple ADF test as the simple test without considering structural break can give biased results (Perron, 1989).

The unit root results for all the variables are presented in Table 1. From the result, GDP, Exchange rate (EXR), Interest rate (INT), Inflation rate (INF) are stationary after first difference [i.e order of integration one I(1)]. This implies that the variables have unit root problem and are not mean reverting. For all the oil price shocks variables (OP, OPN, OPP), the results support stationarity at I(0). Given the nature of the unit-root result at I(0) and I(1), it is impossible to estimate the long-run relationship among the variables only if the existence of a long-run cointegrating relationship is verified. Therefore, the study adopts the unrestricted VAR in levels following (Farzanegan and Markwardt, 2009) proposition.

4.2. ARDL Bounds Test

The ARDL bounds is considered for examining the long-run cointegration relationship among the variables. The null and alternative hypothesis is tested as;

Null Hypothesis H_0: $0_1 = \beta_2 = \beta_3 = 0$

Alternative Hypothesis H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$

The ARDL Bounds test F-statistics and the Lower I(0) and upper bounds I[1] class guided the interpretation of the results. Following the standard decision criteria of the test, it is stated that a long-run cointegrating relationship exists if the F-statistics value is greater than the lower and upper bounds values. With this, the study can further report the long-run impact of the explanatory variables. If the F-statistics is lower than the lower and upper bounds values, it implies no long-run cointegrating relationship. Due to this, the study is restricted to report the long-run impact of the explanatory variables However, if the F-statistics value falls in-between the lower and upper bounds class, the long-run cointegrating relationship existence remains inconclusive. Therefore, the study may decide or decide not to estimate the long-run impact of the explanatory variable.

4.3. Granger Causality Test

The granger causality test results are presented in Table 3. The results reveal that the causal relationship between oil price and GDP, interest rate, and inflation rate supports the alternative hypothesis assertion that the linear oil price granger causes the macroeconomic variables (GDP, interest rate and inflation). The result between the linear oil price and exchange rate evidenced the null hypothesis that there is no causal relationship.

Interestingly, the results for the oil price shocks variable (positive changes in oil price) supports the alternative hypothesis that positive changes in oil price granger causes exchange rate and inflation rate. However, the null hypothesis that positive changes in oil price does not granger cause interest rate and GDP exists. For the negative changes in oil price, the results confirm that no causal relationship between negative changes in oil price and the selected macroeconomic variables.

4.4. Forecast Error Variance Decomposition (FEVD)

After IRF, we further considered Forecast Error Variance Decomposition (FEVD) test to show the proportion of the forecast error variance of a variable that can be explained by exogenous shocks to other variables. The variance decomposition results are presented in Table 3. From the results, the third column, linear oil price contributed 0% to variations in exchange rate in the 1st period, increased by 4.2% in the 5th period and declined at 2.8% in the 10th period. Linear oil price contributions to the variations in other variables (Inflation rate, interest rate and GDP) is 0% in the first

Table 1: Unit root tests results

Variables	ADF		ADF		PP		PP		Order of Integration
	Level		First difference		Level		First difference		
	Intercept	Intercept/ Trend	Intercept	Intercept/ Trend	Intercept	Intercept/ Trend	Intercept	Intercept/ Trend	
InGDP	−1.14	−1.68	−8.28*	−8.23*	−1.20	−1.84	−8.28*	−8.24*	*I (1)*
EXR	−2.21	−2.64	−5.75*	−5.85*	−1.57	−1.80	−5.35*	−5.39*	*I (1)*
INT	−1.89	−2.02	−4.25*	−4.27*	−2.10	−1.97	−7.40*	−7.64*	*I (1)*
INF	−1.87	−1.88	−5.41*	−5.38*	−2.06	−−2.05	−9.26*	−9.21*	*I (1)*
OP	−2.62***	−2.65	−7.47*	−7.43*	−2.22	−2.24	−7.09*	−7.05*	*I (0) I (1)*
$OILP_t^+$	−5.13*	−5.09*	−7.90*	−7.86*	−4.00*	−3.96*	−9.19*	−9.07*	*I (0) I (1)*
$OILP_t^-$	−3.33*	−3.31**	−8.48*	−8.43*	−3.65*	−3.64**	−8.47*	−8.42*	*I (0) I (1)*

*Significance at 1% level. **Significance at 5% level. ***Significance at 10% level

period. However, for inflation rate, the variation contributions in the 5th and 10th period 3.4% and 6.7% respectively. The variations contributions to interest rate by the linear oil price is 1.6% in the 5th period but increased significantly at 7.5% in the 10th period. The linear oil price contributed 3.7% in the 5th period and increased marginally to 3.8% in the 10th period.

In the fourth column of Table 4, the variance contributions of positive changes in oil price to the macroeconomic variables is presented. From the result, it is observed for all the macroeconomic variables in the 1st period, positive changes in oil price contribute 0% variation to the macroeconomic variables. 10% of variations in exchange rate is contributed by positive changes in oil price in the 5th period and the variations increased marginally at 11.5% in the 10th period. Positive changes in oil price contribute 0.53% variations to inflation rate in the 5th period and increased marginally at 0.69% in the 10th period. The variations contributions of positive changes in oil price to interest rate in the 5th period is 0.04%, however, it increased marginally at 0.09% in the 10th period. For GDP, the variations contributed by positive changes in oil price in the 5th period is 1.2% but contracted marginally in the 10th period to 1.1%.

Table 2: ARDL bounds test result

Exchange Rate Model				
Test Statistic	**Value**	**Signif. (%)**	**I (0)**	**I (1)**
F-statistic	3.08	5	3.38	4.23
K	3	1	4.3	5.23
Inflation Rate Model				
F-statistic	1.57	5	3.38	4.23
K	3	1	4.3	5.23
Interest Rate Model				
F-statistic	1.93	5	3.38	4.23
K	3	1	4.3	5.23
GDP Model				
F-statistic	3.18	5	3.38	4.23
K	3	1	4.3	5.23

Table 3: Granger causality tests results

Variables	OP	$OILP_t^+$	$OILP_t^-$
EXR	4.49 [0.1061]	6.14** [0.0465]	4.10 [0.1288]
INF	5.11*** [0.0775]	6.97** [0.0307]	1.23 [0.5404]
INT	5.52*** [0.0632]	4.47 [0.1072]	3.20 [0.2016]
LNGDP	7.57** [0.0227]	4.11 [0.1281]	0.50 [0.7798]

The parenthesis [] are the *P* values, the values are Chi-square. * Significance at 1% level. ** Significance at 5% level. *** Significance at 10% level

Table 4: Variance decomposition analysis

Dependent variables	Periods	OP	$OILP_t^+$	$OILP_t^-$
EXR	1	0.000000	0.000000	0.000000
	5	4.125996	10.080570	1.827516
	10	2.801194	11.531410	2.287789
INF	1	0.000000	0.000000	0.000000
	5	3.421899	0.538881	0.591603
	10	6.668167	0.690264	0.411452
INT	1	0.000000	0.000000	0.000000
	5	1.602966	0.040405	2.429137
	10	7.459717	0.090100	1.825711
LNGDP	1	0.000000	0.000000	0.000000
	5	3.748089	1.211328	3.786326
	10	3.815066	1.148312	5.504917

In the fifth column of Table 4, the variance contributions of negative changes in oil price to the macroeconomic variables is presented. From the result, negative changes in oil price contributes 0% to all the macroeconomic variables in the 1st period. For exchange rate and GDP, the variations contributed by negative changes in oil price is 1.8% and 3.79% respectively in the 5th period, and increased at 2.28% and 5.5% respectively in the 10th period. The variations contributed to inflation rate and interest rate by negative changes in oil price in the 5th period is 0.59% and 2.42% respectively, but subsequently contracted at 0.41% and 1.82% respectively in the 10th period.

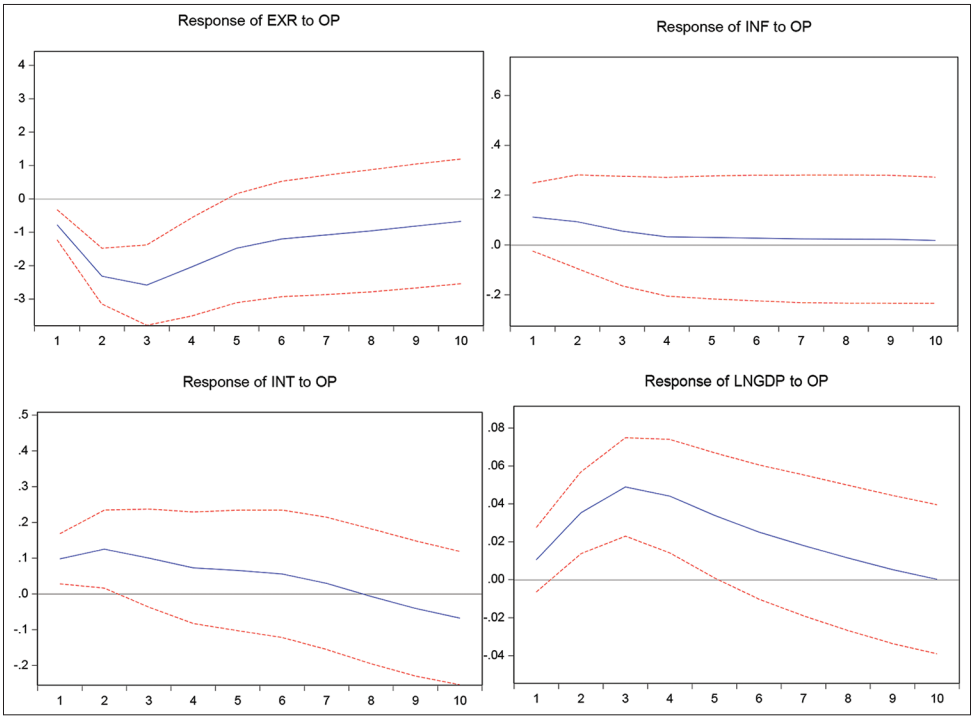
4.5. Impulse Response Functions (IRF)

After testing for stationarity, we performed the Impulse Response Function (IRF) analysis, the IRF analysis is helpful in tracking the impact of an exogenous shock on the response variables in the system. Figure 2 contains the impulse response function between the classes of oil price (linear oil price and oil price asymmetries which is measured considering positive and negative changes in oil price denoted as ($OILP_t^+$ and $OILP_t^-$) and the macroeconomic variables (exchange rate, inflation rate, interest rate and GDP). It also presents the response of the macroeconomic variables to the shocks in the linear oil price. It is observed that the responses of exchange rate (EXR) to the linear oil price is negative throughout the 10 periods aftershocks. This implies that the effect of the linear oil price on the exchange rate is negative. The response of Inflation rate (INF) and GDP is positive throughout the 10 periods. This connotes that the linear oil price has a positive effect on inflation

Table 5: NARDL short-run results

Exchange rate model	Coefficient	Standard error	t-Statistic	Prob.*
OP	−0.107	0.031	−3.491	0.001
OP(−1)	−0.015	0.040	−0.361	0.719
OP(−2)	0.073	0.033	2.218	0.030
OPN	2.476	3.306	0.749	0.456
OPN(−1)	−7.140	3.839	−1.860	0.067
OPN(−2)	6.364	2.808	2.267	0.026
OPP	2.093	1.292	1.620	0.109
Inflation Rate Model				
OP	0.018	0.008	2.200	0.031
OP(−1)	−0.011	0.007	−1.481	0.143
OPN	−1.040	0.668	−1.558	0.124
OPP	−0.161	0.487	−0.331	0.742
OPP(−1)	0.847	0.568	1.491	0.141
OPP(−2)	−−1.097	0.577	−1.903	0.061
OPP(−3)	1.463	0.551	2.655	0.010
OPP(−4)	−0.967	0.410	−2.359	0.021
Interest Rate Model				
OP	1.5E-05	0.004	0.004	0.997
OP(−1)	0.007	0.005	1.459	0.149
OP(−2)	−0.009	0.004	−2.246	0.028
OPN	1.558	0.400	3.892	0.000
OPN(−1)	−2.782	0.500	−5.560	0.000
OPN(−2)	1.513	0.400	3.787	0.000
OPP	0.039	0.151	0.255	0.799
GDP Model				
OP	0.001	0.001	1.607	0.112
OPN	0.024	0.093	0.254	0.800
OPN(−1)	0.193	0.082	2.361	0.021
OPP	0.074	0.038	1.960	0.054

Figure 2: The responses of the macroeconomic variables to linear oil price.



rate and GDP. Interest rate response to linear oil price was positive throughout the 1st and 8th period but responded negatively in the 9th and 10th period.

The responses of the macroeconomic variables to oil price asymmetries ($OILP_t^+$ and) is presented in Figure 2. For responses of the macroeconomic variables to positive changes in oil price. The response of exchange rate to positive changes in oil price deviates from its response to the linear oil price. The response from exchange rate to oil price is initially negative in the first 2 periods, turned positive from the 3rd period and remained the same for the rest of the periods. The response of inflation rate to positive changes in Kuwait oil price is positive for the first 4 periods, but subsequently remained negative throughout the period from the 5th period. Interest rate response to positive changes in oil price is positive throughout the 1st to the 7th period, but negative from the 8th period till the 10th period. The response of GDP to positive changes in oil price is positive throughout the 10 periods. This implies that the effect of positive changes in oil price is positive on Kuwait GDP.

Figure 4 presents the responses of the macroeconomic variables to negative changes in oil price. From the results, Exchange rate response to negative changes in oil price is negative throughout the 10 periods. This implies that as oil price declines, exchange rate of Kuwaiti Dinar to the US dollars drops. Inflation rate response to negative changes in oil price is negative in the first 3 periods, however, returns negative from the 4th period through the 10th period. Interest rate and GDP response to negative changes in oil price is positive throughout the 10 periods. This implies that negative changes in oil price impact on interest rate and GDP is positive.

4.6. NARDL Short-run Analysis

The short-run analysis is presented following the outcome of the NARDL bounds test which concludes that there is no long-run cointegrating relationship among the variables. Therefore, only the short-run result is table 5. From the NARDL short-run result, for the exchange rate model result, it is observed that the linear oil price has a positive and 5% significance impact on Kuwait exchange rate. This translates that, 1% change in the linear oil price results in 0.07% increase in the exchange rate power of Kuwait currency. Negative changes in oil price has a positive and 5% significance impact on exchange rate. The result implies that, negative changes in oil price strengthens Kuwait exchange rate by 6.36%. Positive changes in oil price on the other hand impacted Kuwait exchange rate negatively but insignificant.

For Inflation rate model, the results evidenced that the impact of the linear oil price on inflation rate is significantly positive at 5% level. The results connote that a 1% increase in oil price results in 0.02% increase in inflation rate in the short-run. The impact of negative changes in oil price on inflation rate is insignificantly negative. Positive changes in oil price has a negative but significant impact on inflation rate in Kuwait. The implication of this is that, for every negative changes in the price of oil, inflation rate in Kuwait declines by 0.97% (see Table 5).

For the interest rate model, the result shows that the linear oil price impact on interest rate (lending rate) in Kuwait in the short-run is negative and significant at 5% level. This implies that, 1% change in the linear oil price has a contraction impact of 0.008% on the interest rate. Negative changes in oil price impact on interest rate in the short-run is positive and at 5% significant. The result denotes that, negative changes in oil price leads to 1.51% changes in interest rate. Positive changes in oil price have

Figure 3: The responses of the macroeconomic variables to positive changes in oil price.

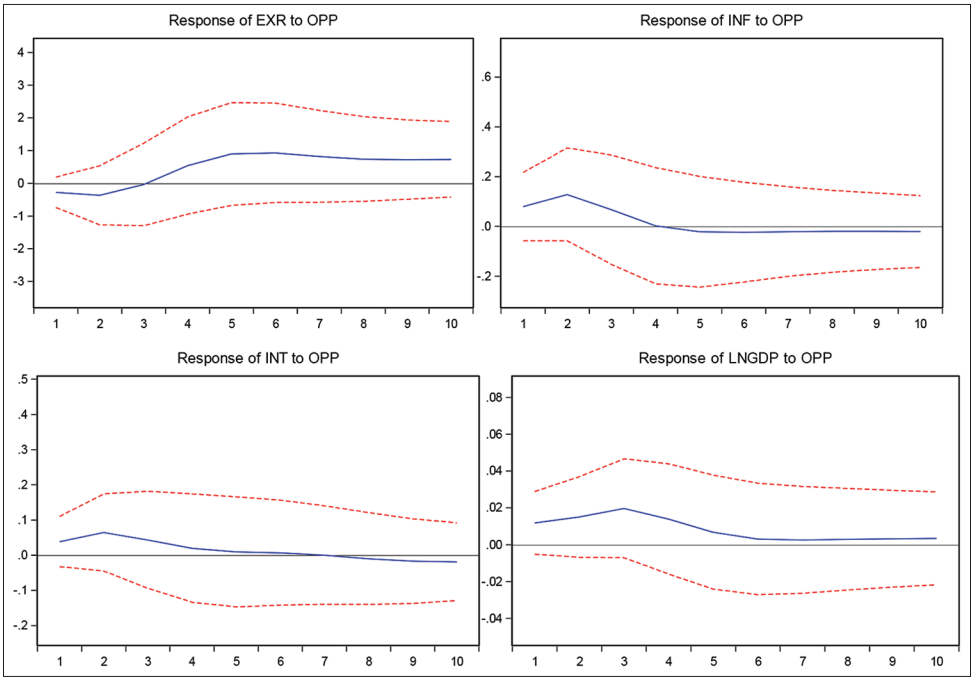
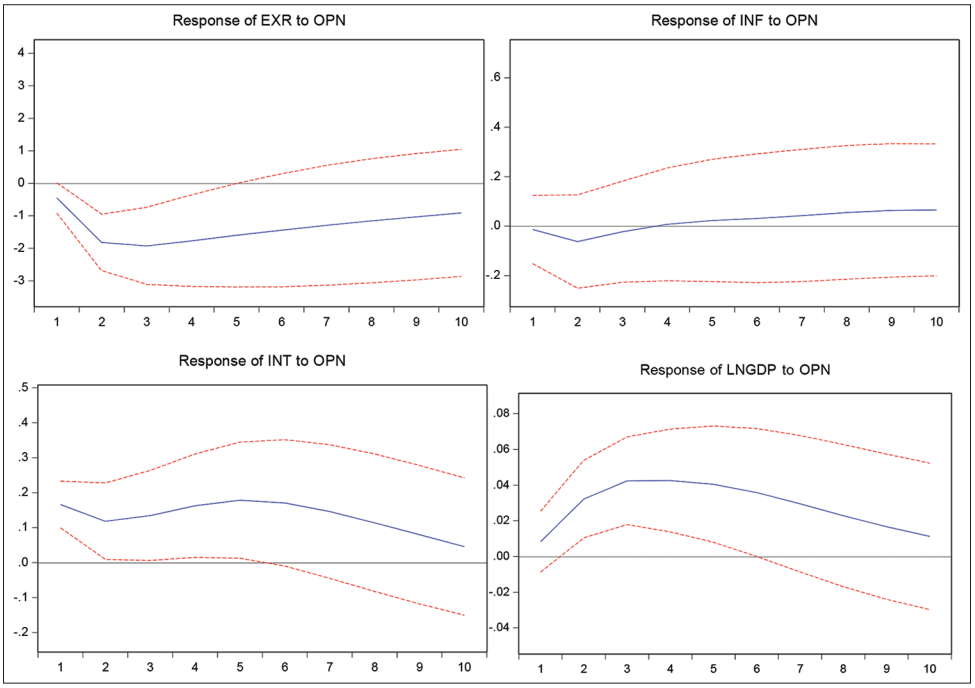


Figure 4: The responses of the macroeconomic variables to negative changes in oil price.



a positive insignificant impact on interest rate. This implies that, positive changes in oil price increases interest rate insignificantly by 0.04%. From the GDP model, it is noted that the linear oil price impact on Kuwait GDP is positive and insignificant. The implication of this is that as the linear oil price changes by 1%, GDP increases marginally by 0.001%. Negative and positive changes in oil price impact on GDP is positive and significant at 5%. The results show that the negative and positive changes are capable of increasing Kuwait GDP by 0.19% and 0.07% respectively (Table 5).

5. DISCUSSION AND POLICY IMPLICATION

This study investigates the impact of oil price shocks on Kuwaiti macroeconomic variables using the VAR and ARDL models. From the findings, it is observed that positive changes in oil prices have more a variant impact on the exchange rate, the inflation rate and the interest rate compared to the negative changes in oil price. On GDP, the negative changes in oil price have a more variant impact compared to the positive changes in oil price. The implication of this

is that, when oil prices increase, there is a potential increase in the value of Kuwait currency against the dollar through the increase in its foreign reserves. These findings negate the results of Mehara (2008) and Iwayemi and Fowowe (2011) that negative changes in oil price is more effective on macroeconomic variables. Based on this finding, it is evident that there is need for the economy of Kuwait to explore the periods of positive changes in oil price through policies such as diversification of its exports by supporting potential growing sectors with excess funds from the crude oil trade which then translates to expand its production base. This finding is also in line with the study of Zulfigarov and Neuenkirch (2020) which states that improved macroeconomic variable performances are recorded following positive changes (increase) in oil price. The impact of negative changes (decrease) in oil price on the macroeconomic variables, encourages the Central Bank of Kuwait to curb the negative shocks by reviewing its interest rate and exchange rate policies by encouraging private sector involvement in Kuwait economic activities. This is also in consonance with the findings of Alhayky and Naim (2017).

Furthermore, the results reveal that in the 10th period, linear oil price has more variant impact on the selected macroeconomic variables. This implies that as oil price impact on the variables follows a process to reflect its impact on Kuwait's economy. Against the study of Iwayemi and Fowowe (2011), we noted that oil price has a considerable impact on macroeconomic variables. It is not surprising that GDP responds positively throughout the periods. This is because, the economy of Kuwait is mainly dependent on crude oil as its major trade activity. Therefore, it is expected that the economy's GDP follow the same performance trend of the oil sector. This finding implies that, irrespective of the oil price direction, the economy of Kuwait is positively impacted.

It is also established from the results in this study that the impact of oil price shocks on macroeconomic variables in Kuwait is only a short-run phenomenon. This implies that in the long-run, the potential of oil price impact on the selected macroeconomic variables are a mirage. However, in the short-run shocks in oil prices significantly impact macroeconomic variables as implied by Alshihab and AlShammari (2020). Henc, it can be concluded that the in the context of economy in Kuwait, positive changes in oil price have more impact on macroeconomic variables compared to the negative changes.

Accordingly, this study contributes to the literature in several ways: Firstly, it is a unique study which reveals linear and nonlinear behavior of oil price with the interacting effect of macroeconomic variables in the context of Kuwait, and it also proves the asymmetric behavior of oil prices that support the theoretical channels. Secondly, the analysis of Kuwait is of interest to the Kuwaiti government officials, policymakers as well as researchers since Kuwait is highly depending on oil revenue. Finally, it provides valuable suggestions to open the path for research in future related to economic reform in Kuwait.

From an economic policy perspective, the finding of this paper suggests that any drop in oil prices may lead to a dramatic drop in the general stock market index. Hence, The Kuwaiti government needs to apply effective policies to provide stability within the Kuwaiti economy, this can be accomplished by developing more policies to manage the benefits during the periods positive oil price changes and a risk hedging framework to manage the resulting effect of negative changes in the price of crude oil. Moreover, this result is consistent with those reported by Al-Mutairi (1993) and Eltony and Al-Awadi (2001) in which the main determinant of domestic prices is followed by the value of imports, and the a minimal effect from monetary stimuli.

The results indicate the existence of high dependency of government expenditures on oil revenue. The study recommends that the Kuwaiti government and policymakers should either increase oil revenue by value added in oil exports or diversify the sources of government revenue by creating and expanding non-oil sectors, or both. For example, Kuwait should seriously seek to diversify its sources of income and its major economic activities by investing more in industrialization, education, and the expansion of private sector activities. Based on the above, the Kuwaiti government is encouraged to promptly adopt effective operational policies for stabilizing the impact of oil price volatility on the Kuwaiti economy overall.

6. CONCLUSION

This study empirically investigated the effects of oil price fluctuation on selected macroeconomic variables (GDP, real exchange rate, inflation rate, interest rate and consumer price index) of the Kuwait economy between 2001 and 2022. The study had considered econometric techniques including the Granger-causality tests, Vector Autoregressive (VAR) and NARDL techniques in analyzing the data used. Results from the Granger-causality tests and VAR permit us to conclude that the impact of oil price fluctuations on macroeconomic variables in the Kuwait economy is significant. The findings also verified the conclusion that positive changes in oil prices have a more a variant impact on exchange rate, inflation rate and interest rate compared to the negative changes in oil price. On GDP, the negative changes in oil price have a more variant impact compared to the positive changes in oil prices.

Overall, we concluded that in the context of the economy of Kuwait, positive changes in oil price have more impact on macroeconomic variables compared to the negative changes. Although a policy of diversification is usually recommended for economies which depend solely on oil revenue, the applicability of such an option will be a challenging decision for the government and policymakers in Kuwait.

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