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Asymmetric Impacts Among Oil Price Shocks, Government Expenditures, Monetary Reserves, Exchange Rate in KSA: Evidence from A Non-Linear ARDL Approach

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Abstract

This study examines the influence of oil price shocks on government expenditures; monetary reserves; exchange rate in KSA 1970-2020. For this purpose, we employed a non-linear autoregressive distributed lag NARDL approach to disentangle the effects of positive; and negative shocks; identify the existence of structural factors and we employed the traditional unit root tests and the unit root tests with structural breaks to verify of stationary. Through the application of NARDL model we confirm the presence of co-integration between oil price shocks; government expenditures, monetary reserves, exchange rate in KSA. The results show that the asymmetry hypothesis is valid for the long run and short run which suggests that the oil price shocks is sensitive to the variation in the macroeconomic indicators. This means that these macroeconomic indicators play an important role in the oil price shocks. And in how to absorb these shocks on long run. The findings of this study suggest that in the short run, oil price is negatively influenced by the Monetary Reserves, and positively by the exchange rate; government expenditures. Results support the nonlinear proposition wherein positive shocks compared to negative shocks. Complementary macroeconomic policy guidelines; the policy of rationalization of spending and the stability of the exchange rate in KSA can help to reinstate transform their economies away from oil dependence. And this would facilitate in dealing with the shocks that may face oil prices in the future. Accordingly; policy makers must pay attention to the Economic; geopolitical and epidemiological developments in light of unexpected variables.

***Keywords**: Oil Price Shocks; Monetary reserves; Effective Exchange Rate; Non-linear the Autoregressive Distributed Lag Model (NARDL); Government Expenditures.*

JEL Classification Code: *HT27, AF6, WD19, TW81*

Introduction

Oil is a significant commodity in international trade and a major source of income for the KSA; which leads to the accumulation of large financial surpluses monetary reserves that have had and still have a major effect on economic growth; especially in the services; industry and tourism sector. Oil is commonly regarded as a comparative advantage and key strategic resource and its prices dynamics and shocks can affect the economy and financial markets; the stability of the exchange rate and in monetary reserves markets and government expenditures; because the US dollar is the major invoicing and settlement currency, the exchange rate quoted as foreign currency per US dollar is the primary channel through which an oil price shock is transmitted to the economy. The greater volatility of oil prices in the last four decades revived the interest of economists on the impact of oil price shocks on the economy.

Over the past four decades; oil prices had been branded by an upward trend where it increased from $28.1 per barrel in 2003 to the highest level of $109.45 per barrel in 2012 a trend which came to an end with a sharp drop starting from 2014 until it reached as low as $26.94 per barrel in 2016. In the last five years 2016-2020; oil prices fluctuated up and down for several reasons, the most important of which was Gulf War; the global financial crisis and the Covid-19 and the recent oil price war. Oil price shocks may push policy makers, in KSA; to make difficult choices which could have serious implications on the welfare of Saudi people. Hence, our paper derives its significance from the weight of oil revenues in the kingdom of Saudi Arabia; and its important role in financing the government needs. More specifically; we focus on the implications of oil price shocks on the foreign exchange reserve sector and the riyal exchange rates against foreign currencies given the significant role to transport on economic development and the stability of the economy. Indeed, we justify our choice of sectors by the importance of the foreign exchange reserve sector and the riyal exchange rates against foreign currencies in economic growth. The vision[2030] of KSA which aims to diversify the economy away from being heavily dependent on oil.

The objective of this paper is to measurement asymmetric effects among oil price shocks; government expenditures; monetary reserves; exchange Rate in KSA: evidence from a non-linear ARDL approach. Furthermore; we want to study how these shocks may be absorbed by the accumulation of foreign exchange reserves reflecting policy interferences aimed at limiting effective exchange rate fluctuations. Thus, the main objective of the current study is to explain the interrelationship between oil prices and government expenditures; monetary reserves; effective exchange rate in the Saudi economy. In particular; we empirically estimate the relationship between oil prices and monetary reserves; effective exchange rate over the last four decades. Unlike most of the existing literature that assumes linearity; we employ a non-linear autoregressive distributed lag (NARDL) model to disentangle the effects of positive and negative shocks to oil prices on monetary reserves; effective exchange rate; a non-linear causality approach to measuring the interrelationships between study variables.

We will; in particular; address the following research questions for the KSA economy: First, what are the trends of the impact of oil price shocks on government expenditures; monetary reserves; effective exchange Rate in KSA? Second, Is there a long-run relationship between oil price shocks; monetary reserves and effective exchange rate in KSA? Third, How long does it take to converge from the short-run deviation to the long-run equilibrium between effect of oil price shocks on monetary reserves, effective exchange rate in KSA? The remainder of this paper is organized as follows. Section 2 presents a brief overview of the literature for shocks to oil prices, government expenditures; monetary reserves and effective exchange rate. Section 3 provides a background on oil price changes or (shocks to oil prices) and the evolution of monetary reserves; effective exchange rate in Saudi Arabia. Section 4 presents the dataset and the econometric model. Section 5 summarizes the empirical results. Finally; section 6 concludes by discussing the results and giving some recommendations that contribute to rationalizing spending, maintaining the stability of the exchange rate and consolidation the cash reserves KSA.

Theoretical and Empirical Literature Review

Oil price spikes have a major effect on government spending, Monetary Reserves, Effective Exchange Rate with oil revenues being a major source for financing different expenditure categories such as social security; education; culture; and health care. There is now a large body of literature explains the relationship between oil prices shocks and macroeconomic variables in Saudi Arabia. Kireyev 1998 [1]; for example, contends that economic activities in the non-oil sector are correlated with oil prices through government spending. The findings in Al-Hakami 2002 [2] support a causal relationship between GDP and government expenditure in Saudi Arabia. A more recent study by Al-Nakib (2015) [3] shows that the recent oil price slump is likely to slow growth and widen fiscal deficit in the Saudi economy [4] show a bidirectional causality between oil consumption and economic growth. Finally [5] argue that the volatility of oil prices results in large variations which increases the economy's reliance upon the petroleum sector.

The motivation to employ non-linear ARDL model on the shock's equation is double. On the one hand; non-linear ARDL approach is able to describe the entire conditional distribution of monetary reserves; effective exchange rate and thus help us obtain a more complete picture of the factors affecting oil price shocks. Specifically; the non-linear ARDL approach estimator gives one solution to each quintile. However; we may assess how oil shocks affect government expenditures, monetary reserves; effective exchange rate according to their position on the stationary of the study variables. Using this methodology; we are able to assess the determinants of shocks. in essence, it is the optimistic views espoused by the latter group of scholars and researchers that have spawned the dedication of countless theoretical and empirical literature on the subject, specifically the oil price shocks and its impact on the economy. The contribution and additions of this paper is of numerous kinds. Present paper is the first one analyzed the relationships between oil price shocks, government expenditures; monetary reserves; exchange rate in KSA by using the non-linear ARDL.

Overview: Oil prices and Government Expenditures

In terms of the relationship between oil price, Government Expenditures; such theories as those put forward by Adedokun (2018) [6]. The results of SVAR show that oil price shocks could not predict the variation in government expenditure in the short run, prognostic The VAR; and VECM; also substantiate the results of SVAR; and provide further insight which shows that short-run fiscal harmonization hypothesis is evidenced between the oil revenues and total government expenditures; while spend-tax hypothesis exists in the long-run between total expenditures and total revenues. And Abdel-Latif; (2018) [7] he searched for the effect of oil price shocks on government expenditures on the health and education sectors in Saudi Arabia. Using a quarterly dataset 1990Q1–2017Q2 and employing a non-linear autoregressive distributed lag (NARDL) model. mainstream between oil prices shocks and macroeconomic variables. And to the best of our knowledge, more specifically, unlike the majority of the existing literature; we investigate the impacts of both negative and positive shocks to oil prices on government expenditures, Monetary Reserves, Effective Exchange Rate in KSA 1970-2019. In the study of [8] the results show that Iranian government social spending does not appear to be significantly affected by oil price shocks [9]. The main purpose of this study is to investigate the dynamic relationship between government revenues and government expenditures in Iran as a developing oil export-based economy. The results of the impulse response functions and variance decomposition analysis indicate that the contribution of oil revenue shocks in explaining the government expenditures is stronger than the contribution of oil price shocks. Furthermore, the results of the vector auto-regression; (VAR) and vector error correction; (VEC) models show that the strong causality is running from government revenues to government expenditures (both current and capital) in Iranian economy while the evidence for the reverse causality is very weak. General the results support the revenue–spending hypothesis for Iran [8]; The Iranian economy is closely associated with the oil industry as a key player in the global oil market. Accordingly; oil price spikes have a major influence on government spending with oil revenues being a major source for financing different expenditure categories such as social security; education; arts and culture; and health care. The results show that Iranian government social spending does not appear to be significantly affected by oil price shocks.

Overview: Oil prices and exchange rates

General, positive oil price shocks should lead to a real appreciation or (depreciation) of the exchange rates of oil exporting; (importing) economies; even though for oil importing economies the impact on the effective exchange rate may differ due to compensatory effects through trade and asset channels vis-a-vis other main trading partners. In practice; there are a number of potential second-round effects and offsetting factors that may dampen the impact of oil price shocks on exchange rates. From a theoretical point of view an oil price shock may be transmitted to the exchange rate through different factors: the associated trade balance, the terms of trade; wealth effects and portfolio reallocation. There are studies on the relationship between the shocks of oil prices and exchange rate including; for example, Michal; et al, (2016) [10]. This paper identified 3 structural shocks that influence on the oil market and analyzes their consequence on exchange rates in 43 advanced and emerging countries. It finds that oil-exporting countries tend to experience appreciation pressures after oil shocks; especially oil demand shocks, which are largely offset by foreign exchange reserves accumulations. Also; Cashin; et al. (2004) [11] find that only in one third of commodity exporting economies it is possible to identify such a relationship. Similarly, Habib and Kalamova (2007) [12], when investigating the exchange rate of three major oil exporters (Norway, Saudi Arabia and Russia), find a vigorous relationship with oil prices only for Russia. A study Zadmehr; et al (2017) [13] also found that it is shown that oil prices have been the dominant source of exchange rate movements. As foretold by the theory, the rise of the government expenditure and interest rate level in OPEC countries lead to the appreciation of domestic currency. On the other hand, a rise in trade openness causes OPEC currencies to depreciate. Ji, et al (2020) [14], this study findings show that oil supply shocks have a larger depreciating influence on exchange rates in oil exporters than in importers. All countries are normally more sensitive to oil-specific demand shocks, and this sensitivity can lead to a significant appreciation in exchange rates, except in Japan and the United Kingdom. Additionally, the spill over effect between oil shocks and exchange rates has strengthened after the global financial crisis of 2007–2008. Suliman; et al; (2020) [15], In the short term, the results confirm the existence of a unidirectional causal relationship ranging from the oil price to the exchange rate. In the long term, however, the causal relationship is bidirectional between these 2 variables. An appreciation of the Saudi exchange rate generates an increase in the relative demand for oil, which in turn creates upward pressure on its price. For policy purposes; such evidence suggests that Saudi Arabia should be careful not to put too much weight on the benefits of higher revenue; due to higher oil price.

Overview: Oil prices and monetary reserves

Theory suggests that oil exporters' currencies should depreciate in the awaken of negative oil price shocks (and vice versa for positive shocks), in practice there may be counter-balancing forces:

1. Monetary establishments may dislike large swings in the nominal exchange rate, countering exchange rate pressures through the accumulation or reduction of foreign exchange reserves.
2. The international risk-sharing channel may deliver an automatic stabilizer through currency exposure. Given that oil exporters have accumulated a large pool of foreign exchange reserves and tend to be {net long} in foreign currency; a decline in the oil price accompanied by a depreciation produces a positive valuation effect a net gain for them relative to domestic GDP therefore; playing a stabilizing role. In other words; the exchange rate does not need to denigrate quite as much to ensure external sustainability.

Izekor, Aigbovo (2018) [16]; The study assessed the causality effect between crude oil price shocks and the Nigerian foreign reserves as a measure for economic activities. The former post factor research design was employed using the simple time series econometric techniques to carry out the diagnostic tests and inferential analyses of the data. The study ascertained that the depletion in the foreign reserves as a measure for the current economic degradation in Nigeria; were not caused by the shocks in crude oil prices but was persuaded by other factors such as wrong policies application.

Data, model and methods

Data and empirical modeling:

Data were collected the annual data for oil price shocks, government expenditures, effective exchange rate and monetary reserves in KSA from the international monetary fund (IMF). And from certain websites such as the site the central department of statistics and information in KSA ((http://www.cdsi.gov.sa)). also, quandl website ((https://www.quandl.com/data-sources)). This study covers the annual sample period from 1970 to 2020. The variables were transformed into their logarithms form to achieve exact empirical results according to study objectives (Shahbaz et al. 2017a) [17]. The transformation of variables into its natural log form will interpret the coefficients into elasticity's (Ahmad and Du 2017) [18]. This study; therefore; contributes to the existing literature by applying the frequency domain nonlinear ARDL on oil price shocks and macroeconomic variables. The variables calculated in the study are necessary and crucial for macroeconomic policies.

Methodology

Economic theories in many examples are inadequate to determine the relationship between sure variables; in such cases it usually appears more logical to allow data to define the relationships. The links between oil price shocks;

monetary reserves and effective exchange rate are multilayered. In the econometric analysis; we do not only use Monetary Reserves or Effective Exchange Rate as a determinants of oil price shocks. A nonlinear model will be used to test the hypothesis of causality and study the long-run relationship for KSA. We explore the effects of the following variables on oil price shocks inequality. The nonlinear version of the ARDL (NARDL) approach can be defined as for this implicit form:

$OP_t = f(GE_t; MR_t; REER_t)$

$OP_t = B_0 + B_1 GE_t + B_2 MR_t + B_3 REER_t + U_i$……………………………(1)

GE_t = *Government Expenditures*

OP_t= *Oil Price shocks*

MR_t= *Monetary Reserves in KSA*

$REER_t$= *Effective Exchange Rate in KSA*

The Nonlinear Autoregressive Distributed Lag Model (NARDL)

The researcher employed multivariate nonlinear autoregressive distributed lad NARDL techniques suggested by Shin; et al. (2014a) [19] to achieve asymmetric relationships among the variables. NARDL approach comprises a dynamic error correction model that allows distinguishing between long run and short run effects of the exogenous variables on the endogenous variable; i.e.; to capture short run and long run asymmetries. The old-style or traditional co-integration approaches only support the integration order of 1; i.e.; I (1) for all variables (Baz et al. 2019) [20]; while the NARDL is more full-bodied; robust and general approach due to its flexibility that it can be used irrespective of nature of variables; i.e., I (0), I (1), or a mixture of both [18, 21, 22]. We select this technique for two main reasons: First, it is effective in executing the short- and long-term relationships between the different variables that do not have the same order of integration - provided that such variables are stationary in level; I (0); and/or they are stationary in the first difference; I (1). Second, the ARDL approach can remove the problems associated with omitted variables and auto correlation. The model used for the application of the ARDL approach:

$$\Delta OP_t = \alpha_0 + \Sigma\, \beta_i \Delta OP_{t-1} + \Sigma £ \Delta GE_{t-1} + \Sigma\, \lambda_i \Delta MR_{t-i} + \varphi OP_{t-1} + \delta REER_{t-1} + \eta \text{....(2)}$$

GE = *Government Expenditures*

OP_t= *Oil Price shocks*

MR_t= *Monetary Reserves in KSA*

$REER_t$= *Effective Exchange Rate in KSA*

$(\alpha, \beta, \lambda, \varphi, \delta)$= *Coefficients of variables*

Δ= *The first difference for the variables*

η= *Random error*

Overall, we can say the asymmetric ARDL model is essentially an asymmetric extension of the linear ARDL approach to modelling long-run levels. Shin; et.al (2012) [23] made two important contributions [24]. First; they derived the dynamic error correction representation associated with the asymmetric long-run co-integrating regression; resulting in the nonlinear autoregressive distributed lag NARDL model. Second, they developed asymmetric cumulative dynamic multipliers that allow them to trace the asymmetric adjustment patterns following positive; and negative shocks to the explanatory variables [25].

Model Construction

One main structures of these models are that they estimate long term relationship between model variables and also short-term dynamism of model. In addition; measuring long term equilibrium relationship with a non-linear method it enables researcher to identify how much time is needed for an effect of one shock on model to be adjusted. The asymmetric nonlinear ARDL model NARDL applied in this paper is a comparatively new technique for detecting both long- and short-run asymmetries between economic variables. The model was advanced by Shin, Yu and Greenwood-Nimmo (2009) [26] and is an asymmetric expansion of the above mentioned linear ARDL model. Following Pesaran; and Shin (1998); Pesaran; Shin and Smith (2001), Schorderet (2004) and Shin, Yu and Greenwood-Nimmo (2009) [26, 27-29]. Furthermore; if x and y have nonlinear relationships; the use of the ARDL approach is inappropriate. Authors in (Yu, B.; Greenwood-Nimmo; 2014) [19] proposed an extension of (Shin, Y.; Smith, 2001) [30] to characterize the asymmetric property of two series. In line with (Yu; B; Greenwood-Nimmo, 2014) [19]; the nonlinear version of the ARDL NARDL approach; can be defined as:

$OP_t = f((REER_t\_POS; REER_t\_NEG; MR_t\_POS; MR_t\_NEG; GE_t\_POS; GE_t\_NEG))$

The above affords modeling asymmetric co-integration; with partial sum decays; according the use of this approach. And defines a stationary linear combination of the partial sum components (Schorderet 2003) [31]. The model also performs better as it provides valid results regardless of the integration order of the variables, whether; I (0); I (1) or a combination of both (Nusair, 2016) [22].

Empirical Results and Discussion

Table 1 shows the descriptive statistics of variables. Oil Price shocks minimum, maximum and standard deviation values are 29.13; 109.45 and 1.210 respectively. The value of Skewness and Kurtosis of the Government Expenditures variable for KSA during the period (-0.29 and 2.53); respectively. While, figure 1,2,3 and figure 4. shows upward and downward movement trend in time series data. Figure 1 indicates the Oil Price shocks line graph which show constantly upward trend from the beginning to 2000 where oil prices increased until 2010; then decreased and then increased to the end of the time series. Figure 2. indicates government expenditures low at the beginning of the time series and then rise in mid-1985 record high in the period between 1988-1992 and then fluctuated at the end of the time series. Figure 3. show Stability in monetary reserves levels at the beginning of the study period; and a rise to the highest levels at the end of the period. While, figure.4 shows the stability of the Saudi riyal exchange rate against the US dollar during the period from 1986 until now. In this experiential study; we use the selected exchange rate is the real effective exchange rate $REER_t$ of the Saudi Riyal. all variables deviate from the normal distribution as designated by the (Jarque-Bera) - test. This test confirms there is a source of nonlinearity in study variables.

Table1: Descriptive Statistics.

Statistics	OP_t	$REER_t$	MR_t	GE_t
Mean	35.42000	3.718934	168607877183.15	60.52420
Median	27.01000	3.750000	24909304907.72	62.53308
Maximum	109.4500	4.500000	744440513643.46	89.62390
Minimum	1.210000	3.326742	669558000	19.33592
Std. Deviation	29.13506	0.212393	241607016745.35	16.14816
Skewness	1.194338	1.585923	1.1703129	-0.297943
Kurtosis	3.486759	8.368721	2.735017	2.533302
Jarque Bera	12.62825	82.62799	11.79108	1.217384

Figures 1;2;3 and 4

Figure 1:

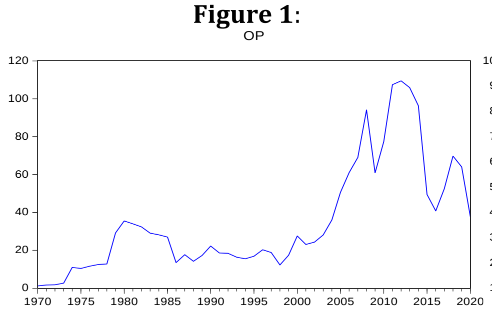


Figure 2:

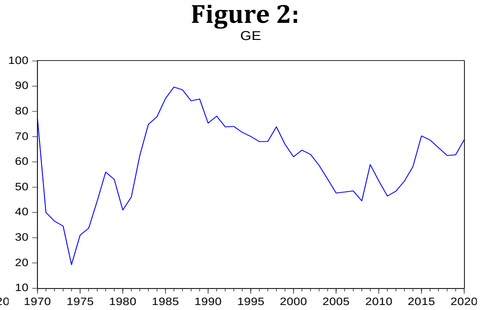


Figure 3:

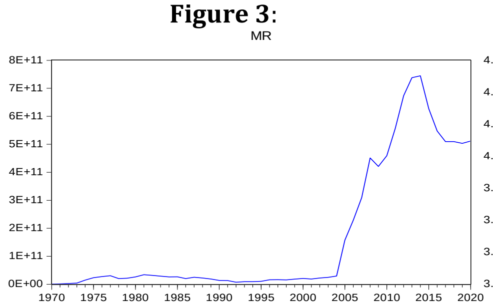
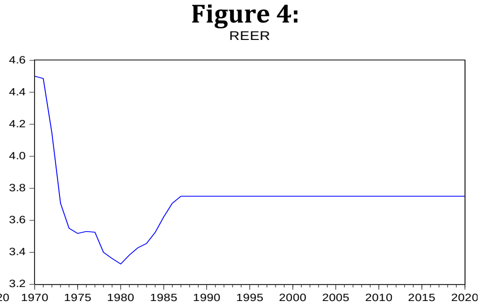


Figure 4:



Unit Root and Co-integration Tests

The basic assumptions of the (NARDL) model are that the variables it shouldn't be integrated of second order I (2); or stationary in the second difference. Accordingly; First; before starting an econometric analysis; the nature of the data must be examined. where the use of non-stationary data can yield spurious outcomes. An augmented Dicky–Fuller test (ADF) is performed and Phillip Perron (PP) to examine the nature and stability of the relevant variables (Kaushik et al); (2014) [32]. without the structural break to test the tendency of a unit root test over a time series (Phillips and Perron) (1988) [33]. The Augmented Dickey and Fuller (Dickey and Fuller 1979) [34] and Phillips and Perron (Phillips and Perron 1988) [35] stationary tests were performed. The variables must be integrated of order 0; i.e, I (0) or integrated of order one; i.e, I (1) or both for NARDL model (Shin et al. 2014a) [19]. Table 2; show revealed that all the variables are non-stationary and have unit root at level associated with trend and intercept except for $REER_t$; whereas all the selected variables become stationary at first difference for both PP and ADF unit root tests.

We conclude that the Oil Price Shocks; GE_t, MS_t and $REER_t$ variables are integrated in a mixed order. See Table2. And Appendix No.1.

Table 2: Unit root test results.

Unit Root Tests				
All Variables	**Augmented Dickey Fuller "ADF"**		**Phillip Perron "PP"**	
	Levels	**First Different; (1^st^ D)**	**Levels**	**First Different; (1^st^ D)**
OP_t	-1.762127	-5.829942***	-1.777358	-5.666304***
GE_t	-2.008572	-7.670686***	-2.348617	-7.885214***
$REER_t$	-14.02339***	-7.871991***	-4.018361***	-2.934046**
MR_t	-0.865360	-3.766502***	-0.547967	-3.794638***
Source: Author calculations using E-views[10]. Note: All variables; are transformed or distorted in the natural logarithm. Note: (*; **; and ***) are sensible standards of 10%; 5% and 1%; respectively.				

ARDL Bound Test Critical Values

Regression of equation related to (Asymmetric impacts) is based on an ARDL (2; 1; 0; 1; 2; 1; 0) model automatically chosen from a baseline framework of two lags chosen based on Hannan–Quinn and Schwarz information criterion. Table 3. shows that our two tests are consistent; t_{BDM} is significant if and only if F_{PSS} exceeds the relevant critical upper bound (Banerjee et al.; 1998, Pesaran et al., 2001) [27,36]. The results of the symmetric bound testing done are presented in this table No. 3 and have the F-statistics (F- test = 7.12) significant at all significant level (1%; 2.5%; 5% and10%). which is above the upper critical bounds. Implying there exists asymmetric long-run co-integrating relationship. And also; by significant co-integration, the variables pooled in the regression (Oil Price shocks; government expenditures; monetary reserves, exchange rate) are stationary; these results partly and generally supporting in unit root test results in Table 2. related to time series is stationary.

Table 3: The NARDL model's bound test results.

Model	**F-Statistics**	**Sign-in**	**I (0)**	**I (1)**	**Remark**
OP_t; GE_t; MR_t; $REER_t$	**7.127**	**10%**	2.12	**3.23**	Co-integration exists in this model **NARDL**
		5%	2.45	**3.61**	
		2.5%	2.75	**3.99**	
		1%	3.15	**4.43**	

CUSUM - CUSUMSQ:

Figure 5. CUSUM:

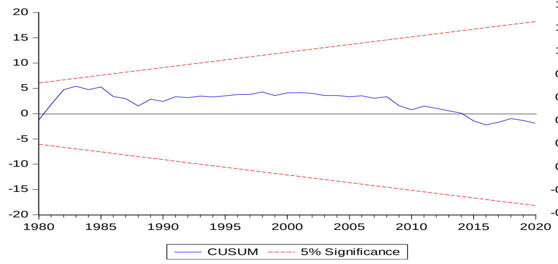
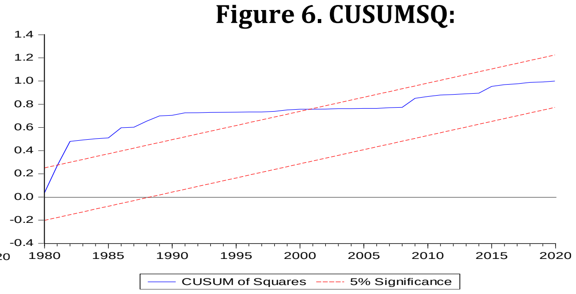


Figure 6. CUSUMSQ:



This is the CUSUM; and CUSUMSQ statistics stability test [37] plotted to ascertain the significance of trajectory at the 95% confidence bounds. In this Figure 5. CUSUM; and Figure 6. CUSUMSQ; show variables lines for the period 1970 - 2020. Line cumulative sum and line for cumulative squares are steady because the both lines are traveling between 5% confidence interval levels. Conclude that parameters in this regression are all stable. Findings of cumulative sum of Oil Price shocks CUSUM; and its square CUSUMSQ; tests. As the cumulative sum of oil price shocks; associated variables and cumulative sum of the square of this model, both were within the critical bounds at a 5% significance level. Consequently; this model is stable and trust worthy to estimate short-run and long-run coefficients.

NARDL estimation with only the long-run asymmetries

The results show in Table 4. that both positive and negative shocks in Oil Price shocks have a significant impact on Government Expenditures, Monetary Reserves; Exchange Rate in KSA in long-run with all coefficients (– 0.3; – 60.9; and - 41.6) respectively; all levels of significance (1%; 5% and 10). which indicate that a 1% increase in Oil Price shocks will degrade the government expenditure's; and exchange rate in KSA by 22%, meanwhile a 1% decrease in Oil Price shocks may help to improve the government expenditures; monetary reserves; exchange rate in KSA by 61% in long-run. Then and in general; interesting and good results have been put forward regarding the Asymmetric impacts of macroeconomic variables in KSA government expenditures; monetary reserves; exchange rate on oil price shocks. exchange rate stability; increased monetary reserves; and reduced government expenditure responsibly will cause long-run absorbing oil price shocks.

The results indicate that government expenditures (NEG), monetary reserves (POS, NEG), exchange rate (POS, NEG) have a long run asymmetric impact on oil price shocks; whereas the impact of government expenditures (POS) is symmetric in the long-run. Positive oil price shocks in the long term reflect a significant positive effect on the Exchange Rate in KSA. And a negative impact on both government expenditures; monetary reserves at all levels of statistical significance. With weakness in the value of monetary reserves (positive; negative) = (0.000125; 0.000433) respectively. The weakness of the monetary reserve's coefficient can be explained by the fact that oil price shocks have no significant impact on the size of Saudi Monetary Reserves. According to the assessed NARDL model, all diagnostic tests confirm that the null hypothesis for heteroscedasticity; functional form and serial correlation can be rejected; and the null hypothesis is accepted; indicating that there is no issue of serial correlation and heteroscedasticity; in NARDL model. Consequently; can be said the NARDL model estimates, used in this study; can detect evidence in support of co-integration tests in circumstances in which the simple all approaches might fail to do so; such like Engle and Granger test; Johansen test or other approaches.

Table 4: The NARDL model's long run.

Variables	Coefficients	Std. Error	T- Statistics	Decision
GE_POS	0.220287	0.195574	(3.304249)	Symmetry
GE_NEG	-0.300224	0.098736	**-1.640653****	**Asymmetry**
MR_POS	0.000125	0.000000	**-2.813613*****	**Asymmetry**
MR_NEG	0.000433	0.000000	**5.588476*****	**Asymmetry**
REER_POS	-60.986173	22.839639	**7.358922***	**Asymmetry**
REER_NEG	-41.690954	23.236508	**-1.541685****	**Asymmetry**
C	-47.564112	22.652548	**0.504353****	
R^2	**0.97**	**R^{-2}**	**0.96**	
D.W	**2.27**	**Serial correlation**	**4.73**	
Heteroskedasticity	**4.55**	**Functional form**	**5.02**	

Source: Author calculations using E-views[10].
Note: All variables are transformed; or distorted in the natural logarithm.
Note: (*; **; and ***) are sensible standards of 10%, 5% and 1%, respectively

Estimated coefficients of the NARDL short-run asymmetries

In the short run, positive and negative of Oil Price shocks have positive and negative impacts on the Government Expenditures, Monetary Reserves; Exchange Rate in KSA (lag 1 with coefficient -0.43; -0.32 and -0.45). Table 5. show report the short-run effects of asymmetric impacts among oil price shocks, government expenditures; monetary reserves; exchange rate in KSA; as captured by the coefficients. Table 5. reveals that positive D (GE_NEG) shocks cause negative contemporaneous D (GE_POS) adjustments (−0.43 and −0.32) to the KSA. Exchange Rate stability undergo both negative contemporaneous adjustments (28.66; −45.17) to positive shocks and offsetting negative for Monetary Reserves contemporaneous adjustments (−0.0001; and 0.0082) to negative shocks was very weak. Positive shocks cause Saudi macroeconomic indicators both with negative contemporaneous impacts (−0.36) and counterbalancing positive lag6. impacts; (0.18).

It is explained that the short run relationship of all variables with Oil Price shocks it is statistically significant. With the exception of the exchange rate variable and its positive shock; it is not statistically significant p-value is (0.617). A positive shock in oil price has positive and non-significant impact on exchange rate in KSA. The REER coefficient value in short run is 28.66 and while the probability value is 0.61. The negative shocks in short run of REER have negative significant influence on oil Price. However, the coefficient and probability values are (-45.17 and 0.08) respectively. While the negative shock in Oil Price at (lag 1) has positive and significant at 5%; and 1% influence on government expenditures with coefficient value; is 0.36.

In this Table 5. With regard to diagnostic tests at the end of the table We find that the null hypothesis of short run symmetry is accepted at the 5% level; but the null hypothesis of long run symmetry is rejected only at the 10% level. Serial correlation, heteroscedasticity; indicate that the residuals of NARDL specification are not affected by severe problems of heteroscedasticity; serial correlation for residuals.

Table 5: The NARDL model's short run.

Variables	Coefficients	Std. Error	T- Statistics	Decision
D(OP(-1))	0.368544	0.111536	**3.304249****	**Asymmetry**
D(GE_POS)	-0.434215	0.264660	**-1.640653***	**Asymmetry**
D(GE_NEG)	-0.325301	0.115617	**-2.813613****	**Asymmetry**
D(MR_POS)	0.000000	0.000000	**5.588476*****	**Asymmetry**
D(MR_NEG)	0.000825	0.000000	**7.358922*****	**Asymmetry**
D(MR_NEG(-1))	-0.000197	0.000000	**-1.541685***	**Asymmetry**
D(REER_POS)	28.667083	56.839305	(0.504353)	Symmetry
D(REER_NEG)	-45.173266	25.727136	**-1.755861****	**Asymmetry**
CointEq(-1)	-1.083527	0.188559	**-5.746356*****	
Breusch–Godfrey Serial Correlation LM Test:				
F-statistic	**4.558**	Prob. F-statistic	**0.002**	
(Breusch – Pagan – Godfrey) Heteroskedasticity Test:				
F-statistic	**3.812**	Prob. F-statistic	**0.093**	

Source: Author calculations using E-views[10].
Note: All variables are transformed or distorted in the natural logarithm.
Note: (*; **; and ***) are sensible standards of 10%; 5% and 1%; respectively.
(ECT): Error correction term

Wald test results

Table6. shows that the Wald Test rejects the null hypothesis of a symmetric relationship between Oil Price shocks, Government Expenditures, Monetary Reserves, Exchange Rate in KSA. long-run asymmetric effect is more frequent than short-run. These results indicate that Oil Price shocks cause differing macroeconomic variables reactions in KSA. That is means, according to this approach exhibits that the study variables have asymmetric long term and short term; impacts on the KSA economy. Hence; So, it can be said; according to the Wald test result that the differences between the long- and short-term adjustments; are significant NARDL was a suitable.

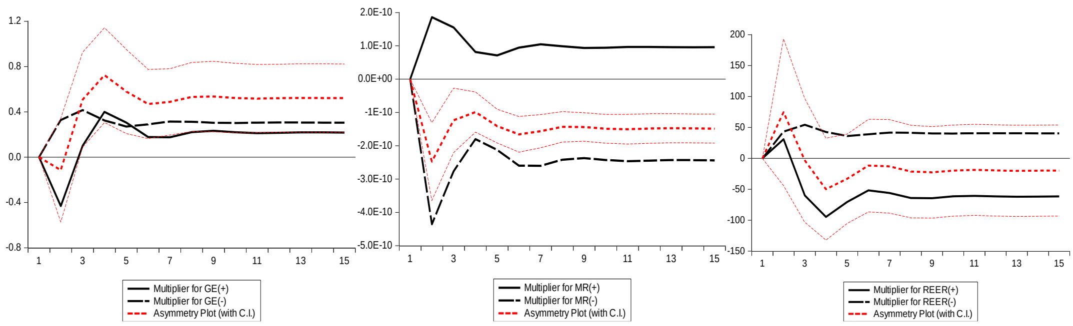
Table 6: Wald test results.

Hypothesis	F-Statistics	P-Value	Decision
H1: for **long run** asymmetry	**6.039**	**0.0021**	Asymmetry
H2: for **short run** asymmetry	18.118	**0.0004**	Asymmetry
Source: Author calculations using E-views10.			

Dynamic multiplier

Figure 7. The dynamic multiplier of Oil Price shocks reveals that Oil Price shocks, Government Expenditures in KSA are positively related to each other. The positive shocks to Oil Price shocks are more dominant than the negative shocks. Initially, the negative shock to Oil Price is less dominant than the lateral case. Also, in this Figure illustrates that Monetary Reserves and Government Expenditures are positively associated with Exchange Rate in KSA; where the positive shock to Monetary Reserves is more dominant than negative shocks. However; the negative shocks in Monetary Reserves have a unique illustration and are less dominant than positive shocks initially, while becoming more dominant than the positive shocks in lateral case. This is due to the exchange rate settled in a part of the study in KSA. Therefore, in the case of Exchange Rate; the negative shock also dominates its positive shock. Figure 7. Multiplier dynamic adjustments and by observing shapes illustrate the power of the NARDL model and which can capture even subtle differences between the Oil Price shocks impacts of positive and negative on Government Expenditures; Monetary Reserves; Exchange Rate in KSA.

Figure 7: Multiplier dynamic adjustments of oil price shocks; government expenditures; monetary reserves; exchange rate in KSA.



Conclusion and policy implications

Fascinating oil price shocks are an important factor in maintain the stability of macroeconomic indicators exchange rate configurations stability and the rationalization of government spending, because the economy variables affect and are affected by each other. This shock has to be offset by the accumulation of monetary reserves. Especially; in economies that enjoy stability and strong economic indicators; such as the economy of the KSA. Using the unit root test Augmented Dicky and Fuller test (ADF) and Phillip Perron (PP); all macroeconomic variables exhibit significant structural breaks, which coincide with the nature of Saudi macroeconomic indicators and global economic variables. Furthermore; we find a significant nonlinear relationship between Oil Price shocks; Government Expenditures, Monetary reserves, exchange rate in KSA; Which confirms that the relationship between these variables may different in the short and long run. To provide or deliver a more robust analysis; we applied the NARDL model because provides more clear-cut findings than ARDL linear approach. The results indicate the presence of asymmetric co-integration among oil price shocks; government expenditures, monetary reserves, exchange rate in KSA. Overall; results support the nonlinear proposition wherein positive shocks to oil prices would have statistical different impacts on government expenditures, monetary reserves, exchange rate in KSA compared to negative shocks. The results show that the asymmetry hypothesis is valid for the long run and short run which suggests that the oil price shocks is sensitive to the variation in the macroeconomic indicators. This means that these macroeconomic indicators play an important role in the oil price shocks. And in how to absorb these shocks on long run. The results of this study suggest that in the short run, oil price is negatively influenced by the monetary reserves; and positively by the exchange rate, government expenditures. Results support the non-linear proposal wherein positive shocks compared to negative shocks. Complementary macroeconomic policy guidelines, the policy of rationalization of spending and the stability of the exchange rate in KSA can help to reinstate transform their economies away from oil dependence. And this would facilitate in dealing with the shocks that may face oil prices in the future. Based on the finding of this study; we suggest; KSA should focus more on diversifying its energy mix; can provide an additional source of revenue. Saudi Arabia should be interest in diversifying its exports by implementing reforms that affect to encourage local production; and work to enacting export promotion laws and rationalizing government spending. The Saudi Vision[2030] economic transformation program aims to create and increase cash reserves; and encourage tourism and entrepreneurship to support of the national economy; diversify its sources of income, and stimulate savings, opening up to the outside world and encouraging tourism.

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