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Asymmetric Effect of Oil Price Changes on Trade Balance in Saudi Arabia, Kuwait and United Arab Emirates

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Abstract

The fluctuations in oil price have vital importance for their presumed role in the trade balance. Our study investigates the oil price fluctuation effect on the trade balance for period 1980-2017. We employ linear and nonlinear autoregressive distributed lag models simultaneously and find the heterogeneous response of Saudi Arabia, Kuwait and United Arab Emirates to oil price fluctuations. The nonlinear ARDL results indicate oil price affects trade balance asymmetrically. We also analyze the moderating effect of real effective exchange rate on the oil-trade balance relationship that found an adverse impact in Saudi Arabia and Kuwait while the positive impact in case of United Arab Emirates trade balance. The oil price marginal effect evaluated at the minimum level of the real effective exchange rate is positive in Kuwait and negative in Saudi Arabia and United Arab Emirates. It also shows positive at the maximum level of the real effective exchange rate in Kuwait and United Arab Emirates while negative in the case of Saudi Arabia that varies at different levels of exchange rate. The findings of the study give policy recommendation related to positive and negative changes of oil price that appear to have a valuable impact on economic decisions.

Keywords: trade balance, oil price fluctuations, real exchange rate, Saudi Arabia, Kuwait, United Arab Emirates.

1. Introduction

For many decades, oil is considered as a major production input due to its significance and its share in trade globally (Nasir et al., 2019). The term of trade of the country is affected through unexpected surge and downturn of oil price (Amano and Van Norden, 1998). In trade volume, huge part products are petroleum products in almost 20 percent of world trade (UNCTAD, 2013). There are different ways through which oil price affect oil-rich economies. High oil price improves the term of trade of oil-rich countries that uplift the real income of that leads to improving term of trade. Households and firms will increase expenditures and investment plans in response to high price oil that leads to appreciate local currency of oil-rich countries and reverse case in oil-importing countries' exchange rates. Thus initial trade surplus will increase and there decrease in non-oil trade balance when real output increase. The literature reveals the oil price effect on different macroeconomic variables, but scarce studies focus on oil-trade channel (Le and Chang, 2013; Raheem, 2017).

The trade balance is a key factor for the stability of an economy at the global level and trade balance affected through fluctuations in global oil prices in countries (Nasir et al., 2018). On this issue studies argued that the cost of production of the products increases due to surge to an oil price that affects trade balance in oil-importing economies and different policies have to use for the eradication of this effect (Fratzscher et al., 2014). Moreover, the oil price increase possibly will direct to the Dutch disease phenomenon in oil-dependent economies (Lizardo and Mollick, 2010; Buetzer and Habib, 2012).

Although many studies have shown the association of oil price changes with trade balance in different economies, there is limited literature in case of these oil-exporting economies. Saudi Arabia, Kuwait and United Arab Emirates are GCC member countries as well as OPEC member countries. These countries covers major share of oil production and have been chosen on the basis of some characteristics and availability of the data. Saudi Arabia considered as richest economy and has dominancy over GCC member countries regarding oil production and exports (Javid et al., 2018). Kuwait and United Arab Emirated still depending on oil revenue in spite of struggling towards diversification (Mahmah and Kandil, 2019). Therefore, this study contributes to literature in many ways: (i) It is the first study which reveals linear and nonlinear behavior of oil price with interacting effect of exchange rate in these countries separately, (ii), the analysis of GCC member countries in of interest to government officials, policymakers as well as researchers as these are highly depending on oil extraction, (iii) it provides precious suggestions based on findings with interaction term that will open the path for research in future related to trade balance.

The remaining of the paper is composed of five parts. Part 2 will give a review of the literature. Part 3 will discuss data sources and methodology that is applied in the study. Part 4 is about results and discussion. Part 5 gives a summary and conclusion and description of variables reported in appendix A.

2. Literature Review

The theoretical transmission channels that capture the oil and trade relationship, one direct revenue effect is as follows: in oil-dependent economies, oil price increase improves the term of trade. In reaction to this, revenue will increase, which improves the trade balance (Korhonen and Ledyaeva, 2010). This is further explained by two indirect effects, which are supply and demand effects. In case of supply effect, increase in oil price leads to downturn those countries which import oil due to negative supply shock in the production process that reduce their imports that effect on oil-producing countries' balance of trade. In the demand effect, oil price increase creates inflation pressure on the global market that financially leads to high prices of imports in the case of both countries. Thus, this will increase the interest rate because monetary authorities will lead to reducing investment as well as consumption. So this will leads to a downturn the growth rate in partner economies and decrease in oil demand in oil-importing countries as response lower exports that will impact the balance of trade of oil-dependent economies. The overall exporting countries gain from oil price increase that depends on magnitudes of revenue, supply and demand effects. Oil negative shocks also prove a gift for oil-exporting countries rather than a curse (Korhonen and Ledyaeva, 2010; Le and Chang, 2013; Rafiq et al., 2016; Raheem, 2017). The other channel is the oil price decrease effect on oil-producing economies as follows: oil price decline would reduce the revenues in oil-rich economies (the revenue effect) which affect their exports (the demand effect). However, an adverse effect is reduced by trade composition and the cost-share effect and ultimately expected trade balance may be improved (Kilian, 2010). Oil price decline on oil-importing economies may have a harmful effect in the long run because huge import put pressure on trade balance (both the trade composition and the cost-share effect) and efficiency and production of the non-oil sector may increase that adjust adverse that depend on the real exchange rate of trading partners (Beckerman, 1951; Le and Chang, 2013). The other theoretical model about trade balance that is an imperfect substitute model based on several assumptions like domestic goods are not perfect substitutes to foreign goods, the consumer has no money illusion and wants to maximize his utility within his budget constraints (Bickerdike, 1920; Robinson, 1947; Metzler, 1948). The import and export demand and relative traded goods price ascertain by the level of foreign and domestic income (Goldstein and Khan, 1985).

The literature was extended by Bodenstein et al. (2011) revealed oil price affected non-oil trade balance. Several reasons through which deterioration of oil trade balance in oil-importing economies as an increase in oil price like low price elasticity of demand for oil and incomplete international financial market and due to this wealth transfer from economies that import oil to oil-dependent ones. The argument of Rebucci and Spatafora (2006) akin to Bodenstein et al. (2011) that trade surpluses of an oil-exporting economy partially offset by the real exchange rate and amplify in growth by fluctuation in oil price. The study of Kilian et al. (2009) is also in line with the study that shows the oil price effect on external balance. In response to oil price increase trade surplus experienced to increase in oil-exporting countries and showed that overall trade balance improves.

Furthermore, the study of Ahad and Anwer (2020) explored the association of oil price with trade balance in BRICS by employing nonlinear ARDL model over quarterly data from 1992 to 2015. The study found the asymmetric behavior of oil price on trade balance. Baek and Choi (2020) analyzed the effect of oil price on trade balance in bilateral trade framework between Korea and AEAN member countries and found asymmetric effect of oil price on trade balance. The study of Jibril et al. (2020) also found the nonlinear effect of oil shocks on trade balance on large sample of oil importing and exporting economies. Baek and Kwon (2019) found the effect of oil price on trade balances in major African economies asymmetrically. Similarly, Nasir et al. (2019) revealed the impact of oil price on macroeconomic variables in GCC member countries over 1980-2016. The results found the heterogenous response GCC member countries in response of oil price shocks. The study of Le and Chang (2013) used the VAR estimation for the data 1980-2011 to show oil price and trade balance affiliation for three different economies such as Malaysia, Japan and Singapore. The findings of the study showed that oil-exporting country (Malaysia) oil, non-oil and trade balance (overall) improves due to an unexpected oil price surge. At the same time, this impact was inverse for Japan and Singapore. Similarly, Chuku et al. (2010) reveal nonlinear and linear effects of oil price in Nigeria. Ahad and Anwer (2020) also find oil- trade deficit associated the asymmetrically in Pakistan. Aliyu and Tijjani (2015) showed the evidence of asymmetric co-integration in adjustment relation of variables with new guidance for slow transmission of exchange rate deprecation into trade balance of Nigeria. Similarly, Rafiq et al. (2016) and Nasir et al. (2018) revealed the positive association of oil and trade balance oil-producing economies.

Studies conclude that the real exchange rate is assumed by change nominal appreciation or depreciation that leads to affect the trade balance directly (Bahmani-Oskooee, 2001). Moreover, Javid et al. (2018) revealed the role of oil price and exchange rate on bilateral trade. They used gravity model over 1980-2014, and findings reveal that oil price fluctuation affects GCC and Northeast Asia exports negatively whereas oil price impact GCC exports positively and reverse in Northeast Asian exports. Moreover, to gain international competitiveness, a country may devaluate her currency to improve trade balance (Bahmani-oskooee, 2001; Bahmani-oskooee, 2015). The exchange rate appreciates in when oil price increase and reverses when oil price decrease is stated theoretically in oil-rich economies (Krugman, 1983; Golub, 1983; Corden, 1984; Aliyu, 2009; 2015).

3. Methodology

The trade balance as:

$TB = XQ \times Px - MQ \times Pm,$ (1)

Where TB denotes the trade balance; Px (Pm) shows the exports(imports) domestic price, and XQ (MQ) exports (imports) volume.

This study is based on the Lindert's (1986) model of two-country trade (home vs. foreign) theoretical model to examine the trade balance. The formula of calculating trade balance and variables selection are according to theory that provides comprehensive detail to attain study objective.

The following equation shows the simple form of the model:

$TB = X(YW, E) - M(Y, E)$ (2)

Where *X* denotes the export function; *M* shows an import function; *Y*W denotes the real income (foreign country); *Y* is the real income (home country), and *E* is the real exchange rate that will be replaced by REER in equation (3). Real income is affected by oil price in both countries, so study hypothesized oil prices (OILP) is also the reason that affects the trade balance because oil extraction is the major source of income in these countries.

So,

TB = TB (OILP, Y, YW, REER)   (3)

$$TB_t = \beta_1 + \beta_2 LOILP_t + \beta_3 x_t + \mu_i \qquad (4)$$

Where,

TB = Trade balance

OILP = Oil price

x_i = Control variables that mentioned above.

μ_t = Error Term

t = 1, 2,3…

Following is the model specification based on the previous studies,

$$LTB_t = \beta_1 + \beta_2 LOILP_t + \beta_3 LY_t + \beta_4 LYW_t + \beta_5 LREER_t + \mu_t \qquad (5)$$

The ARDL formulation as follows:

$$\Delta LTB_t = \alpha_0 + \sum_{i=1}^{l} a_{1i}\Delta LTB_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\Delta LOILP_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\Delta LY_{t-i} + \sum_{i=0}^{r} \alpha_{4i}\Delta LYW_{t-i} + \sum_{i=0}^{s} \alpha_{5i}\Delta LREER_{t-i} + \\ + \beta_1 LTB_{t-1} + \beta_2 LOILP_{t-1} + \beta_3 LY_{t-1} + \beta_4 LYW_{t-1} + \beta_5 LREER_{t-1} + \mu_t \qquad (6)$$

So, ECM model estimation as :

$$\Delta LTB_t = \alpha_0 + \sum_{i=1}^{l} a_1\Delta LTB_{t-i} + \sum_{i=0}^{p} \alpha_2\Delta LOILP_{t-i} + \sum_{i=0}^{q} \alpha_3\Delta LY_{t-i} + \sum_{i=0}^{r} \alpha_4\Delta LYW_{t-i} + \sum_{i=0}^{s} \alpha_5\Delta LREER_{t-i} \\ + \lambda ECT - 1 + vt_t \qquad (7)$$

λ expresses the speed of adjustment parameter in equation (7) and the residuals are denoted by ECT.
The model can be written as NARDL (Shin, Yu, and Greenwood-Nimmo (2014)) formulation as follows:

$$\Delta LTB_t = \alpha_0 + \sum_{i=1}^{l} a_{1i}\Delta LTB_{t-1} + \sum_{i=0}^{p1} \alpha^{+}{}_{2i}\Delta LOILP^{+}{}_{t-i} + \sum_{i=0}^{p2} \alpha^{-}{}_{2i}\Delta LOILP^{-}{}_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\Delta LY_{t-i} + \sum_{i=0}^{r} \alpha_{4i}\Delta LYW_{t-i} + \sum_{i=0}^{s} \alpha_{5i}\Delta LREER_{t-i} + \qquad (8) \\ + \beta_1 LTB_{t-1} + \beta_2^{+} LOILP_{t-1}^{+} + \beta^{-}{}_2 LOILP^{-}{}_{t-1} + \beta_3 LY_{t-1} + \beta_4 LYW_{t-1} + \beta_5 LREER_{t-1} + \mu_t$$

β_2^{+} and β_2^{-} , α_2^{+} and α_2^{-} measures asymmetry by taking following hypotheses in the short run and long-run:

H_0: $\beta_2^{+} = \beta_2^{-} = 0$

$$H_0 : \sum_{i=0}^{p1} \alpha^{+}{}_{2i} = \sum_{i=0}^{p2} \alpha^{-}{}_{2i} \qquad \text{for all i=0,….,p}$$

The previous literature advocates the real effective exchange rate as an independent variable, and these studies unable to address the issue clearly. So this study uses the interaction term of the real effective exchange rate and oil price.

$$LTB_t = \beta_1 + \beta_2 LOILP_t + \beta_3 LY_t + \beta_4 LYW_t + \beta_5 LREER_t + \beta_6 (LREER_t * LOILP_t) + \mu_t \tag{9}$$

The ARDL bounds approach specification of above model as follows:

$$\Delta LTB_t = \alpha_0 + \sum_{i=1}^{l} a_{1i} \Delta LTB_{t-1} + \sum_{i=0}^{p} \alpha_{2i} \Delta LOILP_{t-i} + \sum_{i=0}^{q} \alpha_{3i} \Delta LY_{t-i} + \sum_{i=0}^{r} \alpha_{4i} \Delta LYW_{t-i} + \sum_{i=0}^{s} \alpha_{5i} \Delta LREER_{t-i} + \sum_{i=0}^{t} \alpha_{6i} (\Delta LREER_{t-i} * \Delta LOILP_{t-i}) \tag{10}$$
$$+ \beta_1 LTB_{t-1} + \beta_2 LOILP_{t-1} + \beta_3 LY_{t-1} + \beta_4 LYW_{t-1} + \beta_5 LREER_{t-1} + \beta_6 (LREER_{t-1} * LOILP_{t-1}) + \mu_t$$

We take partial derivatives of equation (9) to confine the marginal effects of changes in the two variables with respect to the oil price, as follows:

$$\delta LTB_t / \delta LOILP_t = \beta_2 + \beta_6 LREER_t \tag{11}$$

In the partial derivative if (β_2 and β_6) are positive that shows high OILP, and the high LREER would improve the LTB. But if these two coefficients have different signs that indicate the threshold effect exists that trade balance impact of oil price varies with the level of the LREER. So, to evaluate the marginal effect is necessary within the sample. Similarly, this would apply in case of the nonlinear model.

The non-linear ARDL specification:

$$\Delta LTB_t = \alpha_0 + \sum_{i=1}^{l} a_{1i} \Delta LTB_{t-1} + \sum_{i=0}^{p1} \alpha^{+}{}_{2i} \Delta LOILP^{+}{}_{t-i} + \sum_{i=0}^{p2} \alpha^{-}{}_{2i} \Delta LOILP^{-}{}_{t-i} + \sum_{i=0}^{q} \alpha_{3i} \Delta LY_{t-i} + \sum_{i=0}^{r} \alpha_{4i} \Delta LYW_{t-i} + \sum_{i=0}^{s} \alpha_{5i} \Delta LREER_{t-i} + \sum_{i=0}^{t} \alpha_{6i} (\Delta LREER_{t-i} * \Delta LOILP_{t-i}) \tag{12}$$
$$+ \beta_1 LTB_{t-1} + \beta_2^{+} LOILP_{t-1}^{+} + \beta^{-}{}_2 LOILP^{-}{}_{t-1} + \beta_3 LY_{t-1} + \beta_4 LYW_{t-1} + \beta_5 LREER_{t-1} + \beta_6 (LREER_{t-1} * LOILP_{t-1}) + \mu_t$$

4. Results and Discussions

There are preliminary tests that are used to check the nature and structure of the data of each variable. The descriptive statistics and correlation have offered the feature of variables. The mean of annual trade balance of Saudi Arabia, Kuwait and the United Arab Emirates are 1.995, 2.129, 1.488; oil price 42.035, real effective exchange rate 134.772, 105.954, 87.231; real GDP (Home Country) 410493.3, 81934.64, 206238.4 and real GDP (Foreign Country) 35914499, respectively. The maximum value of annual trade balance are 3.616, 4.362, 2.562; oil price 111.669, REER 242.594, 130.225, 122.164, real GDP (Home Country) 690068.8, 141997.3, 387259.4 and real GDP (Foreign Country) 50924105, for Saudi Arabia, Kuwait and United Arab Emirates, respectively. For Saudi Arabia, Kuwait and United Arab Emirates the minimum values of annual trade balance are 1.056, 0.228, 1.038; oil price 12.716, REER 93.629, 89.821, 60.104; real GDP (Home Country) 207527.3, 24348.02, 93974.81 and real GDP (Foreign Country) 21444141, respectively.

4.1 Stationarity Tests

Different types of stationarity tests like the Augmented Dicky Fuller (1979) and Phillips Peron (1988) test are used to study the data. The results are presented in Table 1 that concludes nonstationarity of all variables in level and becomes stationary at first difference except trade balance that is stationary at a level as well in all countries case.

Table 1: Stationarity Tests Results

Variable	**ADF Test**		
	Level		1st Difference
Saudi Arabia			
	Intercept	Intercept & trend	Intercept
TB	-2.931*	-3.318*	-5.437***
OILP	-1.323	-2.015	-5.434***
REER	-2.591	-0.973	-3.190**
Y	1.246	-3.086	-4.201***
YW	0.119	-2.142	-4.791***
Kuwait			
TB	-2.155	-3.053	-5.554***
OILP	-1.323	-2.015	-5.434***
REER	-0.683	-1.006	-3.944***
Y	-0.723	-2.466	-3.473**
YW	0.119	-2.142	-4.791***
United Arab Emirates			
TB	3.098**	-1.802	-5.601***
OILP	-1.323	-2.015	-5.434***
REER	-0.396	-2.788	-4.745***
Y	2.203	-2.305	-4.038***
YW	0.119	-2.142	-4.791***
Variable	**PP Test**		
	Level		1st Difference
Saudi Arabia			
	Intercept	Intercept & trend	Intercept
TB	-3.010**	-3.339*	-4.857***
OILP	-1.377	-2.120	-5.434***
REER	-2.591	-0.973	-3.171**
Y	0.850	-3.075	-4.215***

YW	0.096	-2.142	-4.663***
Kuwait			
TB	-2.281	-2.973	-5.721***
OILP	-1.377	-2.120	-5.434***
REER	-1.254	-1.368	-3.979***
Y	-1.360	-1.947	-3.493**
YW	0.096	-2.142	-4.663***
United Arab Emirates			
TB	-2.929**	-2.789	-7.407***
OILP	-1.377	-2.120	-5.434***
REER	-0.337	-2.175	-4.984***
Y	2.203	-2.524	-4.0311***
YW	0.096	-2.142	-4.663***

*, **, and *** shows 10%, 5% and 1% significance level

The ARDL model can be employed under this condition of mixed order of integration. We continue our analysis from symmetric ARDL model and consider it as a benchmark then next part will explain asymmetric ARDL models.

4.2 ARDL Bound Test for Co-integration

Pesaran et al. (2001) developed the F-statistic for long run cointegration and computed values put in table 2 that show the confirmation that the long-run relationship between variables as computed F-values are higher than upper bounds.

Table 2: Bound Test Results (ARDL)

Linear ARDL Model	F-Statistic		Lowe bound I(0)	Upper bound I(1)
(Saudi Arabia)	4.845	10%	2.46	3.46
(Kuwait)	16.977	5%	2.95	4.09
(United Arab Emirates)	6.228	1%	4.09	5.53

The optimal number of lags is selected on the base of AIC criteria that assume maximum lags ARDL (3, 0, 0, 0, and 0), ARDL (1, 2, 0, 0, and 0) and ARDL (2, 3, 3, 3, and 2) for Saudi Arabia, Kuwait United Arab Emirates, respectively.

4.3 Linear ARDL Model Results

Saudi Arabia results in table 3 explain oil price is significant positively affect trade balance meaning that 1% increase in oil price improves a 0.219% trade balance in the long run. The LREER, real GDP (Home Country) are significant negatively, and real GDP (Foreign Country) is significant positively. The coefficient of LOILP is insignificant in SR. Real effective exchange rate, real GDP (Home Country) are significant with a negative sign, and real GDP (Foreign Country) is significant positively.

The Kuwait results illustrate oil price affect significantly both in the LR and SR, implying that 1% increase in LOILP leads to 0.816% and 0.953% improvement in the trade balance. Control variables such as real GDP (Foreign Country) are significant with negative sign whereas LREER and real GDP (Home Country) are insignificant.

United Arab Emirates results indicate that long-run and short-run trade balance affected by oil prices positively implying that 1% increase in LOILP leads to improve LTB by 0.343% and 0.235%, respectively. The coefficient associated with LREER and real income (Foreign Country) is significant positively and negatively. The variable real domestic GDP (Home Country) is not significant in the LR, but it is highly significant in the SR with expected sign.

The results are in line to the findings of Rafiq et al. (2016); Nasir et al. (2018) and Nasir et al. (2019) that finds a positive ink of oil price with the trade balance in oil-exporting economies.

The ECT term is significant with a negative sign that insures of long-run adjustment of variables. Moreover, the diagnostic test results show that the model is free from problems related to normality, correlation, specification and heteroskedasticity.

Table 3: Linear ARDL Estimation and Diagnostic Tests Results

(Without Interaction Term)

	Saudi Arabia	Kuwait	United Arab Emirates
Long-run			
LOILP	0.219* [0.127]	0.816*** [0.117]	0.343** [0.141]
LREER	-1.766** [0.760]	0.889 [0.643]	2.114** [0.846]
LY	-1.849** [0.748]	-0.024 [0.456]	-0.668 [0.718]
LYW	1.708* [0.976]	-2.613** [1.039]	-1.986** [0.825]
Constant	1.884 [9.049]	33.057*** [9.727]	29.944*** [6.531]
Short-run			
D(LTB(-1))	0.005 [0.147]	----	0.460** [0.171]
D (LTB(-2))	-0.258 [0.163]	----	-----
D(LOILP)	0.108 [0.073]	0.953*** [0.082]	0.235*** [0.058]
D(LOILP(-1))	------	0.166** [0.073]	-0.016 [0.081]
D(LOILP(-2))	-------	-------	-0.156** [0.070]

D (LREER)	-0.872*** [0.257]	0.543 [0.392]	0.713** [0.268]
D (LREER(-1))	------	-------	-0.182 [0.246]
D (LREER(-2))	--------	-------	-0.319 [0.198]
D(LY)	-0.914*** [0.296]	-0.015 [0.277]	1.646*** [0.318]
D(LY(-1))	-------	--------	-0.840 [0.523]
D(LY(-2))	-------	-------	0.879* [0.427]
D (LYW)	0.844* [0.470]	-1.595** [0.649]	-3.469*** [1.160]
D (LYW(-1))	-------	--------	1.297 [1.033]
ECT	-0.494*** [0.142]	-0.610*** [0.048]	-0.484*** [0.125]
Diagnostic Tests			
R^2	0.821	0.977	0.970
Adj. R^2	0.775	0.969	0.940
LM Test	2.026 (0.153)	2.442 (0.119)	0.497(0.618)
J.B Test	4.768(0.092)	0.327(0.849)	2.308(0.315)
Hetero Test	0.385(0.903)	1.427(0.255)	1.900(0.098)
Functional Form Test	0.575(0.455)	0.022(0.885)	2.298(0.149)
CUSUM	S	S	S
CUSUMSQ	S	S	S

*, **, and *** shows 10%, 5% and 1% significance level; () and [] are p-values and standard error.

The cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) techniques are for stability checking, and results are presented by Figs. 1A, 2A, 3A, 4A, 5A, and 6A.

In the results of linear ARDL model (with interaction term), it is necessary to compute the marginal effect within the sample by using the estimated coefficients because the sign of the estimated coefficients (linear oil price and interaction term) are different as shown in table 1A in appendices.

Table 4 shows the marginal effect at a different level of the real effective exchange rate.

$$\delta LTB_t / \delta LOILP_t = 0.835 - 0.444 LREER_t$$

Moreover, Saudi Arabia, the marginal effect of oil price on trade balance analyzed at minimum, the mean and maximum level of LREER is -0.040, -0.102 and -0.224 respectively, meaning that, a one percent increase in LOILP will affect LTB negatively by 0.040%, 0.102% and 0.224% at minimum, the mean and maximum level of the LREER, respectively.

$$\delta LTB_t / \delta LOILP_t = 2.640 - 0.889 LREER_t$$

Kuwait case, the marginal effect of oil price on trade balance analyzed at minimum, the mean and maximum level of LREER is 0.903, 0.842 and 0.760, respectively. So, in simple meaning, a one percent increase in LOILP will affect LTB positively by 0.903%, 0.842 % and 0.760 % at minimum, the mean and maximum level of the LREER, respectively.

$$\delta LTB_t / \delta LOILP_t = -3.174 + 1.724 LREER_t$$

United Arab Emirates, the marginal effect of oil price on trade balance analyzed at minimum, the mean and maximum level of LREER are -0.107, 0.157 and 0.424, respectively. So, in simple meaning, a one percent increase in LOILP will affect LTB negatively by 0.107% at the minimum level of the LREER. But at the mean and maximum level of the LREER, will affect positively trade balance by 0.157 % and 0.424 %, respectively.

There are possible reasons for this impact of oil price when we check interacting effect with real effective exchange rate. These countries have different level of economic condition and institutional factors. These countries depending on oil extraction and this revenue source affect their other sectors especially manufacturing sector. Due to appreciation of the currency these economies move toward imported products that affect their trade balance on different level of exchange rate. Even though United Arab Emirates economy is in the process of diversification but still its trade balance affected by oil price fluctuations.

Table 4: Marginal Effect

		Minimum	Average	Maximum
Saudi Arabia	Real Effective Exchange Rate	1.971411	2.109626	2.38488
	Marginal Effect	-0.0403	-0.1017	-0.2238
Kuwait	Real Effective Exchange Rate	1.953378	2.023012	2.114695
	Marginal Effect	0.903447	0.841542	0.760036
United Arab Emirates	Real Effective Exchange Rate	1.7789	1.932032	2.086944
	Marginal Effect	-0.1071764	0.156768	0.423891

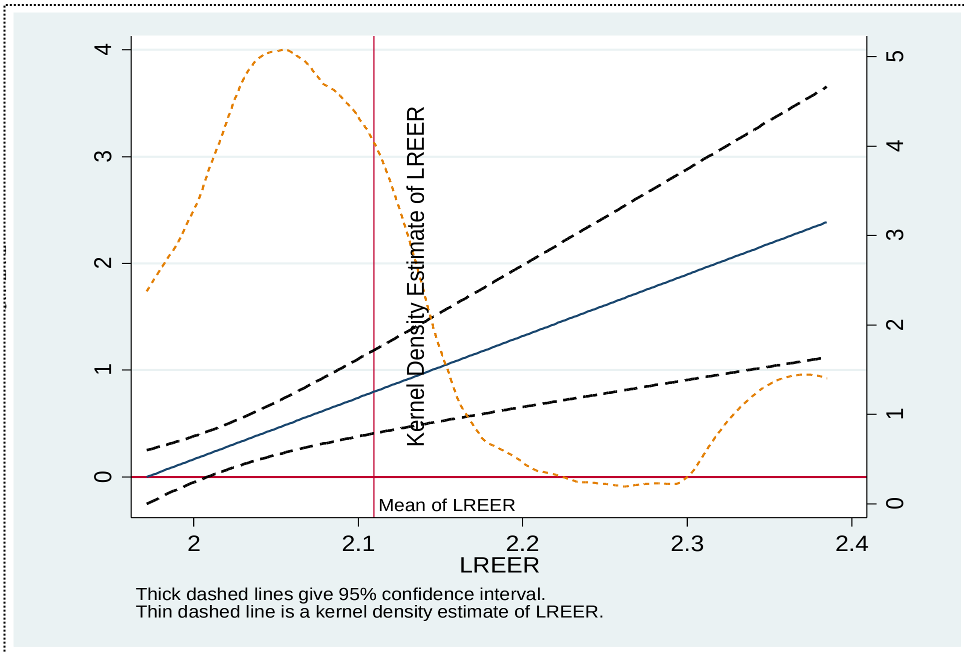

Figure 1: Marginal Effect Graph (Saudi Arabia)

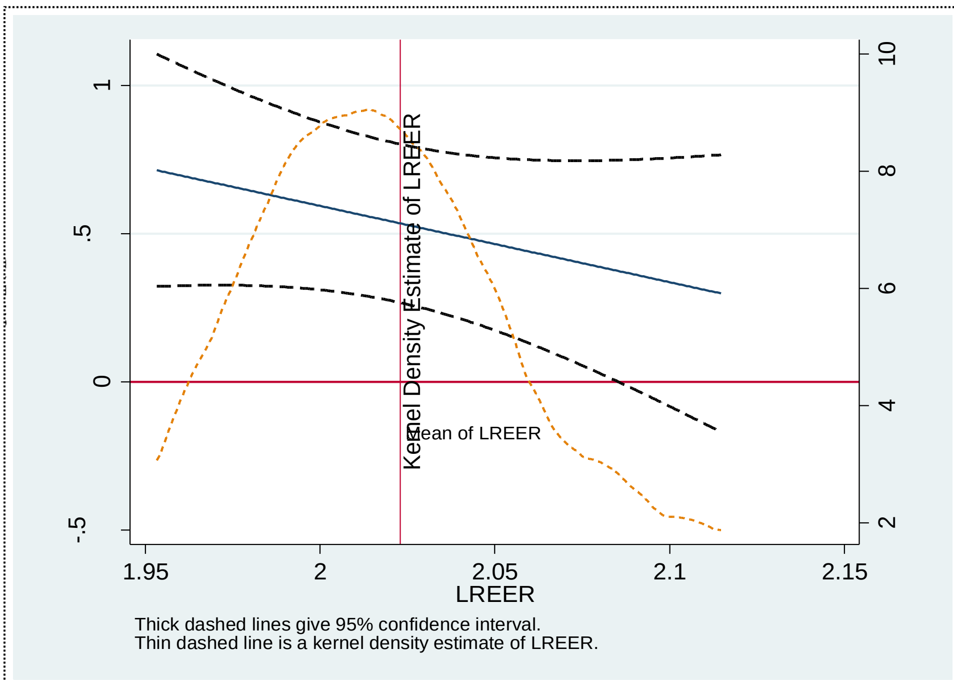

Figure 2: Marginal Effect Graph (Kuwait)

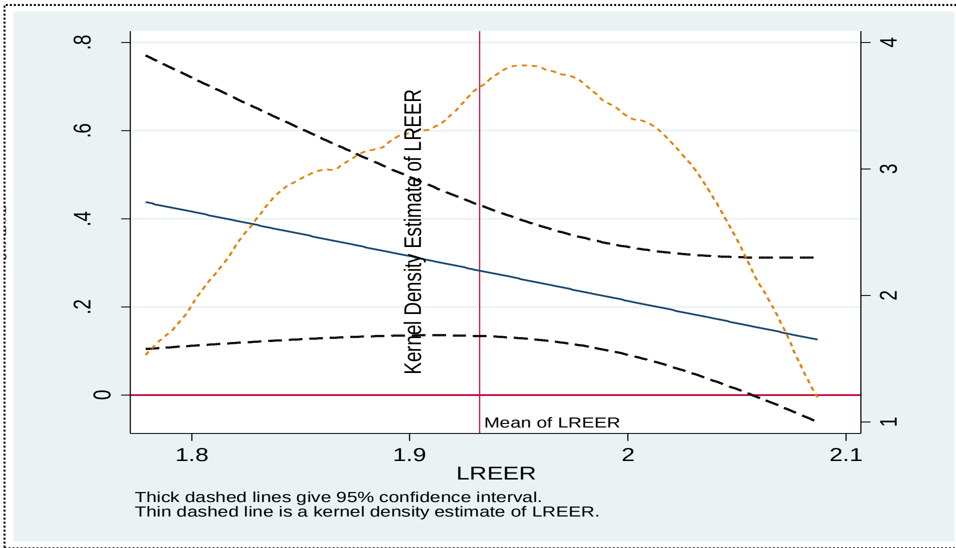

Figure 3: Marginal Effect Graph (United Arab Emirates)

4.4 Nonlinear ARDL Model

Pesaran et al. (2001) developed the F-statistic for long run cointegration, and results in table 5 show the confirmation that long-run association between variables.

Table 5: Results of NARDL Bound Test

Linear ARDL Model	F-Statistic		Lowe bound I(0)	Upper bound I(1)
(Saudi Arabia)	12.380	10%	2.33	3.42
(Kuwait)	4.219	5%	2.80	4.01
(United Arab Emirates)	6.612	1%	3.90	5.42

The optimal number of lags for Kuwait (ARDL (1, 2, 0, 2, 0, 2)); for Saudi Arabia ARDL (1, 2, 2, 2, 0, 2)); and for United Arab Emirates (ARDL (2, 1, 1, 0, 1, 2)) are chosen on the base of AIC criteria . Before going to applied NARDL estimation, it is important to check the residual diagnostic test and results (bottom of table 6) that shows no proof of serial correlation, heteroskedasticity, and well specified.

The nonlinear results for Saudi Arabia show oil price decrease value is 0.285, explaining that a 1% decrease in oil prices 0.285% deteriorates trade balance in the LR. The estimated elasticity of LOILP increase is insignificant in the LR. The results for Saudi Arabia, the increase in oil price are 0.343 that implying the 0.343% improvement in the LTB due to a 1% increase in LOILP in SR. The coefficient of LOILP decrease is 0.725 that implying the 0.725% deteriorate in the LTB as 1% decrease in oil price. The variables like LREER and real GDP (Foreign Country) are significant, while real GDP (Home Country) is insignificant.

Kuwait, the LR and SR positive oil price fluctuations affect the LTB significantly implying that LOILP increase of 1% results in a cumulative LTB improves of 0.699%, 1.240%, respectively. While negative oil price changes significantly affect long-run and short-run meaning that oil price decrease of 1% results in a cumulative deteriorates trade balance of 1.412% and 0.922%, respectively. The other control variables, like real GDP (Home Country) and LREER are significant. The real GDP (Foreign Country) is significant in LR while it is insignificant in SR.

United Arab Emirates, the SR and LR positive oil price fluctuation explaining that cumulative trade balance improvements by 0.485% and 0.442% due 1% increase oil price, respectively. Whereas, negative LOILP changes have no significant effect in both SR and LR trade balance. The LREER and real GDP (Foreign Country) are significant, with positive signs and negative signs, respectively. The variable real GDP (Home Country) is significant in SR but insignificant in LR. The values of ECT term are with a negative sign and significant that insured the adjustment of variables towards the LR.

The results are in line up with Ahad and Anwer (2019) who find oil price effect on the trade deficit in a nonlinear way. Similarly, the study of Baek and Kwon (2019) also found a nonlinear link of oil price on trade balances in major African economies.

Table 6: Nonlinear ARDL Estimation Results (Without Interaction Term)

	Saudi Arabia	Kuwait	United Arab Emirates
Long- run			
LOILP_POS	-0.133 [0.078]	0.699*** [0.119]	0.485*** [0.156]
LOILP_NEG	0.285* [0.145]	1.412*** [0.144]	-0.111 [0.202]
LREER	-0.319 [0.208]	4.497*** [0.887]	1.806* [0.939]
LY	0.032 [0.326]	1.714*** [0.455]	-0.695 [0.617]
LYW	2.038*** [0.650]	-5.043*** [1.002]	-4.026*** [1.419]
Constant	-26.696** [10.974]	41.661*** [10.657]	58.479*** [19.456]
Short-run Estimates			
D(LTB(-1))	----	----	0.248** [0.091]
D(LOILP_POS)	0.343** [0.143]	1.240*** [0.121]	0.442*** [0.0937]
D(LOILP_POS(-1))	0.499*** [0.146]	0.638*** [0.120]	------
D(LOILP_NEG)	0.725*** [0.115]	0.922*** [0.099]	0.119 [0.081]
D(LOILP_NEG(-1))	0.233* [0.118]	------	------
D(LREER)	-0.922*** [0.278]	1.164** [0.499]	0.592*** [0.165]
D(LREER(-1))	0.579* [0.305]	0.338 [0.342]	--------
D(LY)	0.026 [0.262]	1.119*** [0.332]	1.354*** [0.306]
D(LYW)	0.104 [1.312]	-1.143 [1.025]	-2.175** [0.981]
D(LYW(-1))	-2.919** [1.394]	-2.940** [1.171]	1.179 [0.894]
ECT	-0.801*** [0.120]	-0.653*** [0.045]	-0.328*** [0.116]
Diagnostic Tests			
R^2	0.969	0.991	0.957
Adj. R^2	0.947	0.983	0.934
J.B Test	0.899(0.6380)	1.595(0.450)	1.110(0.574)
LM Test	0.745(0.489)	0.414(0.671)	2.522(0.103)
Hetero Test	1.043(0.455)	0.539(0.853)	1.574(0.169)
Functional Form Test	0.396(0.537)	0.146(0.709)	2.461(0.131)
CUSUM	S	S	S
CUSUMSQ	S	S	S
W_{LR} W_{SR}	3.053(0.093) 10.630(0.000)	4.238(0.042) 4.139(0.036)	9.769(0.004) 0.430(0.517)

*, **, and *** shows 10%, 5% and 1% significance level; () and [] are p-values and standard error.

$W_{LR,}$ $W_{SR:}$ Wald test for the null hypothesis of the long run and short run symmetry, respectively.

The cumulative sum (CUSUM), and the cumulative sum of squares (CUSUMSQ) results are presented by Figs. 7A, 8A, 9A, 10A, 11A,and 12A in appendices. The study employed the Wald test for long-run (W_{LR}) and short-run (W_{SR}) to verify the appropriateness of an asymmetric model and results reported in table 6. Saudi Arabia, no evidence of LR asymmetry but SR asymmetry exists. In the case of Kuwait, results indicate confirmation of SR and LR asymmetry. The findings are in favour of long-run asymmetry in case United Arab Emirates while short-run asymmetry does not exist. The asymmetric behaviour of positive and negative LOILP changes on the trade balance express by following dynamic multiplier graphs. In the following figures 4, 5 and 6 of the multiplier graph, the vertical axis shows the magnitude of the effect, and the horizontal axis shows the years to long-run relationship equilibrium achievement.

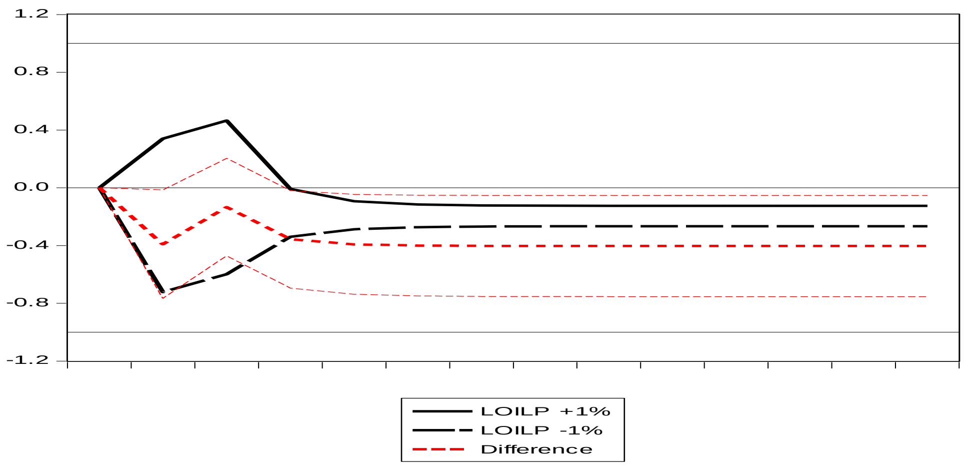

Figure 4: Dynamic Multiplier Graph (Saudi Arabia)

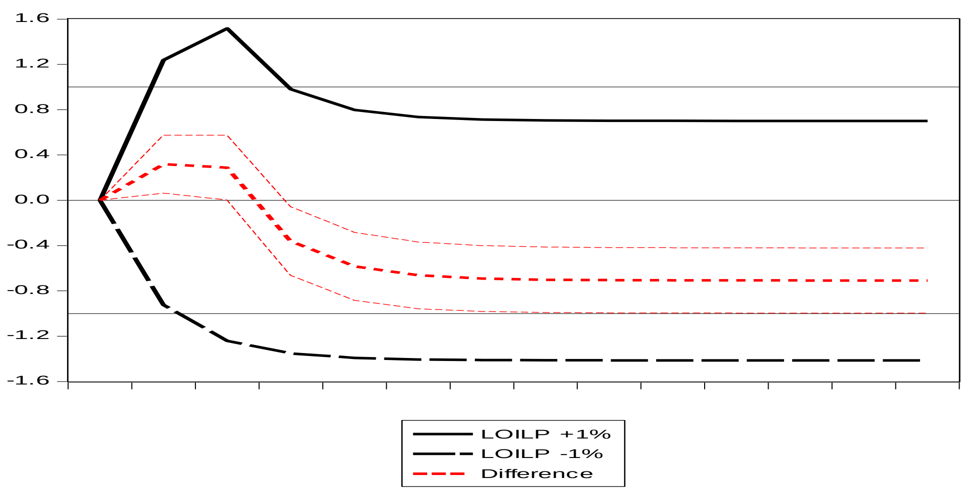

Figure 5: Dynamic Multiplier Graph (Kuwait)

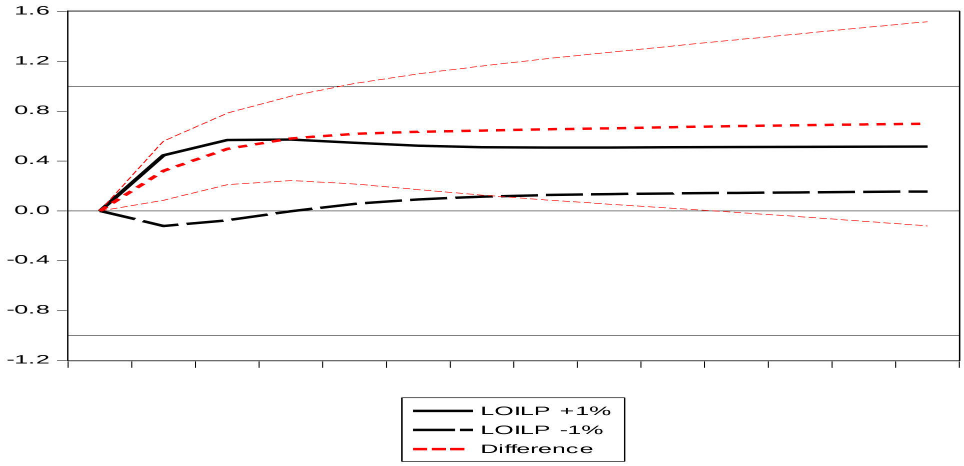

Figure 6: Dynamic Multiplier Graph (United Arab Emirates)

Furthermore, the study also revealed the asymmetric effect of oil price on trade balance by employing NARDL (with interaction term) and also calculated the marginal effect that is reported in table 2A and table 3A, respectively. Next, this study employed the Granger causality test to check the causal relationship among variables and results are put in table 4A. For the case of Saudi Arabia, the results show one-way causality runs from the LREER and real GDP (home country) to LOILP. The results show the evidence of bidirectional causality runs from LOILP to real GDP (foreign country), real GDP (foreign country) to trade balance, real income (home country) to LREER and real GDP (home country) to real GDP (foreign country). For the case of Kuwait, the results show one-way causality runs from LOILP and real GDP (foreign country) to trade balance; oil price to real income (home country) and LREER; and real GDP (foreign country) to real GDP (home country). The results show the confirmation of bidirectional causality runs from LOILP to real GDP (foreign country). Finally, in the United Arab Emirates, one-way causality runs from LTB to LOILP and real GDP (foreign country) to LTB. The findings also express bidirectional causality runs from LOILP to real GDP (home country) and real GDP (foreign country).

5. Summary and Concluding Remarks

We analyze the impact of oil price fluctuation on the trade balance for period 1980-2017 in Saudi Arabia, Kuwait and United Arab Emirates. The study employs linear and nonlinear ARDL models simultaneously and finds the heterogeneous response of these countries to oil price fluctuations. The nonlinear ARDL output specifies an asymmetric behaviour of oil price on the trade balance. The study also tested the moderating effect of real effective exchange rate (LREER) on the oil trade relationship and resulted interaction term between of oil price and the LREER has an adverse impact on the trade balance in Saudi Arabia and Kuwait while the positive impact in United Arab Emirates. The marginal effect of oil price evaluated at the minimum level of the LREER is positive in Kuwait and negative in Saudi Arabia and United Arab Emirates. And that shows positive at the maximum level of the LREER in Kuwait and United Arab Emirates while negative in Saudi Arabia that suggests that the impact of oil price on trade balance varies with the level of the LREER. There are possible reasons for this impact of oil price when we check interacting effect with real effective exchange rate. These countries depending on oil extraction and this revenue source affect their other sectors especially manufacturing sector. Due to appreciation of the currency these economies move toward imported products that affect their trade balance on different level of exchange rate. Even though United Arab Emirates economy is in diversification process but still its trade balance affected by oil price fluctuations.

For Saudi Arabia, the findings show one-way causality runs from LREER and real GDP (home country) to oil price. The results of Granger Causality test show the evidence of bidirectional causality runs from oil price to real GDP (foreign country), real GDP (foreign country) to trade balance, real income (home country) to LREER and real GDP (home country) to real GDP (foreign country). For the case of Kuwait, the results show one-way causality runs from LOILP and real GDP (foreign country) to trade balance; oil price to real income (home country) and LREER; and real GDP (foreign country) to real GDP (home country). The results show the evidence of bidirectional causality runs from oil price to real GDP (foreign country). Finally, in the United Arab Emirates, one-way causality runs from trade balance to oil price and real GDP (foreign country) to LTB. The results also show bidirectional causality runs from LOILP to real GDP (home country) and real GDP (foreign country).

6. Contribution in Literature

On the behalf of findings, this study contributes to the literature in several ways: Firstly, it is the unique study which reveals linear and nonlinear behavior of oil price with interacting effect of exchange rate in these countries separately and it also prove the asymmetric behavior of oil price that support the theoretical channels. Secondly, the analysis of GCC member countries is of interest to government officials, policymakers as well as researchers as these are highly depending on oil extraction. Finally, it provides precious suggestions based on findings with interaction term that will open the path for research in future related to trade balance.

7. Future Research Directions

The future research can look at more oil-exporting countries that have a large availability of data and can extend this research by using specific oil price of a country-wise oil price. The main focus of oil-exporting countries is increasing oil production by ignoring their future impact on oil prices. Most of the studies concentrated on oil production and oil export on macroeconomic variables. The study outcomes are related to oil and total trade balance in these countries and this can be further extended by taking bilateral trade with trading partners.

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APPENDICES

Appendix A. Variables Description and Data Sources

The trade balance is measured by the ratio of exports to imports and used as the dependent variable. The reason behind to use this definition of the trade balance is because the ratio is the unit free measure (Bahmani-Oskooee 1991). The annual average price per barrel of Brent is used as the main independent variable. The real GDP (Home Country), real GDP (Foreign Country) and real effective exchange rate are control variables. The data is collected from different sources like WTO (the trade balance), oil price (BP statistic), real GDP foreign and home country (WDI) and real effective exchange rate (Bruegel database) for 1980-2017.

Table 1A: Results of Linear ARDL Estimation and Diagnostic Tests

(With Interaction Term)

	Saudi Arabia	Kuwait	United Arab Emirates
Long-run Estimates			
LOILP	0.835*** [0.242]	2.640*** [0.685]	-3.174** [1.448]
LREER	-0.227 [1.464]	-0.521*** [0.067]	-0.825 [1.514]
LY	0.0686 [0.195]	-1.493** [0.534]	-0.166 [0.659]
LYW	0.278 [0.273]	1.779 [1.084]	-3.007*** [1.015]
(LOILP*LREER)	-0.444*** [0.115]	-0.889** [0.350]	1.724** [0.742]
Constant	-4.132* [2.058]	-8.798 [10.734]	42.474*** [11.125]
Short-run			
D(LTB(-1))	------	0.163*** [0.056]	0.398** [0.178]
D(LOILP)	2.238*** [0.408]	1.925*** [0.497]	-0.742** [0.345]
D(LOILP(-1))	------	------	0.156 [0.350]
D(LOILP(-2))	------	-------	0.445 [0.281]
D(LREER)	-0.178 [1.150]	0.221 [0.352]	-0.625 [1.142]
D(LY)	-0.454 [0.346]	-1.089*** [0.353]	1.803*** [0.313]
D(LY(-1))	0.067 [0.320]	------	-0.701 [0.523]
D(LY(-2))	-0.412* [0.213]	------	0.669* [0.380]
D (LYW)	-0.272 [1.264]	1.297 [0.793]	-3.912*** [1.120]
D (LYW(-1))	-3.071**	------	1.223

	[1.308]		[1.016]
D (LOILP*LREER)	-0.827*** [0.207]	-0.649** [0.258]	0.502** [0.182]
D (LOILP*LREER(-1))	0.162*** [0.049]	------	-0.084 [0.175]
D (LOILP*LREER(-2))	0.104*** [0.034]	------	-0.277* [0.143]
ECT	-0.906*** [0.109]	-0.729*** [0.0746]	-0.437*** [0.121]
Diagnostic Tests			
R^2	0.975	0.948	0.971
Adj. R^2	0.958	0.931	0.943
LM Test	2.145(0.159)	1.668 (0.218)	0.505(0.613)
J.B Test	1.225(0.542)	1.011(0.603)	2.707(0.258)
Hetero Test	1.011(0.479)	1.105(0.396)	1.795(0.119)
Functional Form Test	0.256(0.618)	0.024(0.878)	2.816(0.113)
CUSUM	S	S	S
CUSUMSQ	S	S	S

*, **, and *** shows 10%, 5% and 1% significance level; () and [] are p-values and standard error.

Table 2A: Nonlinear ARDL Estimation and Diagnostic Tests (With Interaction Term)

	Saudi Arabia	Kuwait	United Arab Emirates
Long- run Estimates			
LOILP_POS	0.183 [0.232]	-4.859*** [1.461]	-2.087** [0.936]
LOILP_NEG	0.625*** [0.208]	-3.994*** [1.219]	-2.608** [1.052]
LREER	0.459** [0.206]	0.124*** [0.037]	-0.441 [0.629]
LY	0.074 [0.270]	1.531*** [0.468]	-0.056 [0.433]
LYW	2.169*** [0.552]	-3.730*** [0.839]	-4.917*** [1.352]
(LOILP*LREER)	-0.165* [0.095]	2.713*** [0.713]	1.229** [0.492]
Constant	-29.060*** [8.573]	26.443** [10.163]	63.211*** [15.998]
Short-run Estimates			
D(LTB(-1))	-----	------	0.354*** [0.085]
D(LTB(-2))	-------	------	0.171* [0.084]

D(LOILP_POS)	1.355*** [0.296]	-0.069 [0.654]	-0.410* [0.222]
D(LOILP_NEG)	1.784*** [0.325]	-0.263 [0.585]	-0.826*** [0.219]
D(LOILP_NEG(-1))	-0.279 [0.196]	-0.810*** [0.188]	-------
D(LREER)	-0.786*** [0.099]	0.089** [0.033]	0.052 [1.841]
D(LY)	0.059 [0.218]	1.003** [0.342]	1.724*** [0.265]
D(LYW)	-0.297 [1.288]	-1.377 [1.063]	-3.616*** [0.935]
D(LYW(-1))	-2.967** [1.230]	-3.069** [1.361]	--------
D (LOILP*LREER)	-0.499*** [0.146]	0.637* [0.319]	0.467*** [0.109]
D (LOILP*LREER(-1))	0.235*** [0.062]	0.354*** [0.067]	--------
ECT	-0.804*** [0.109]	-0.655*** [0.048]	-0.379*** [0.111]
Diagnostic Tests			
R^2	0.968	0.992	0.968
Adj. R^2	0.949	0.983	0.950
LM Test	0.974(0.396)	0.728(0.507)	2.347(0.121)
J.B Test	0.903(0.637)	0.964(0.617)	1.119(0.571)
Hetero Test	1.038(0.455)	0.785(0.665)	0.857(0.597)
Functional Form Test	0.008(0.929)	0.479(0.503)	3.206(0.097)
CUSUM	S	S	S
CUSUMSQ	S	S	S

*, **, and *** shows 10%, 5% and 1% significance level; () and [] are p-values and standard error.

Table 3A presents the marginal effect at a different level of the LREER in case of NARDL with an interaction term.

Table 3A: Marginal Effect

OIL_POS		Minimum	Average	Maximum
Saudi Arabia	Real Effective Exchange Rate	1.971411	2.109626	2.38488
	Marginal Effect	-0.142283	-0.165088	-0.210505
Kuwait	Real Effective Exchange Rate	1.953378	2.023012	2.114695
	Marginal Effect	0.440515	0.629432	0.878167
United Arab Emirates	Real Effective Exchange Rate	1.7789	1.932032	2.086944
	Marginal Effect	0.09927	0.28747	0.47785

OIL_NEG				
Saudi Arabia	Real Effective Exchange Rate	1.971411	2.109626	2.38488
	Marginal Effect	0.299717	0.276912	0.231495
Kuwait	Real Effective Exchange Rate	1.953378	2.023012	2.114695
	Marginal Effect	1.305515	1.494432	1.743168
United Arab Emirates	Real Effective Exchange Rate	1.7789	1.932032	2.086944
	Marginal Effect	-0.42173	-0.23353	-0.043146

Table 4A: Results of Granger Causality
(Saudi Arabia, Kuwait and United Arab Emirates)

Dependent Variable	Independent Variable					
SA (Saudi Arabia)						
	LOILP	LTB	LREER	LY	LYW	Direction of Causality
LOILP		0.969	3.491*	3.168*	4.188**	LREER→LOILP LY→LOILP LYW→LOILP
LTB	0.863		6.751**	0.814	4.027*	LREER→LTB LYW→LTB
LREER	2.671	4.911**		9.351***	0.344	LTB→LREER LY→LREER
LY	0.026	0.311	17.747***		19.055***	LREER→LY LYW→LY
LYW	6.423**	8.736***	0.004	4.519**		LOILP→LYW LTB→LYW LY→LYW
KW (Kuwait)						
	LOILP	LTB	LREER	LY	LYW	Direction of Causality
LOILP		0.206	1.842	2.314	4.188**	LYW→LOILP
LTB	3.042*		0.0001	0.003	3.983**	LOILP→LTB LYW→LTB
LREER	6.496**	8.931***		1.481	1.268	LOILP→LREER LTB→LREER
LY	5.289**	0.047	0.022		4.097*	LOILP→LY LYW→LY
LYW	6.423**	1.344	0.012	0.017		LOILP→LYW
UAE (United Arab Emirates)						
	LOILP	LTB	LREER	LY	LYW	Direction of Causality
LOILP		5.440**	2.691	3.964*	4.189**	LTB→LOILP LY→LOILP LYW→LOILP
LTB	0.574		0.222	1.88	3.142*	LYW→LTB
LREER	3.431*	0.854		13.944***	2.994*	LOILP→LREER LY→LREER

						LYW→LREER
LY	4.615**	10.745***	1.662		11.981***	LOILP→LY LTB→LY LYW→LY
LYW	6.423**	2.667	0.157	3.275*		LOILP→LYW LY→LYW

Note: *, ** and *** shows at 10%, 5% and 1% significance level, respectively.

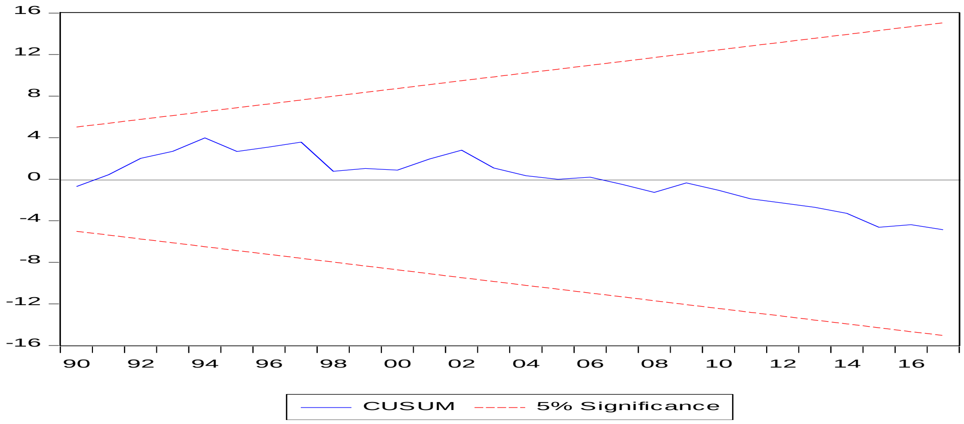


Figure 1A: Plot CUSUM (Saudi Arabia)

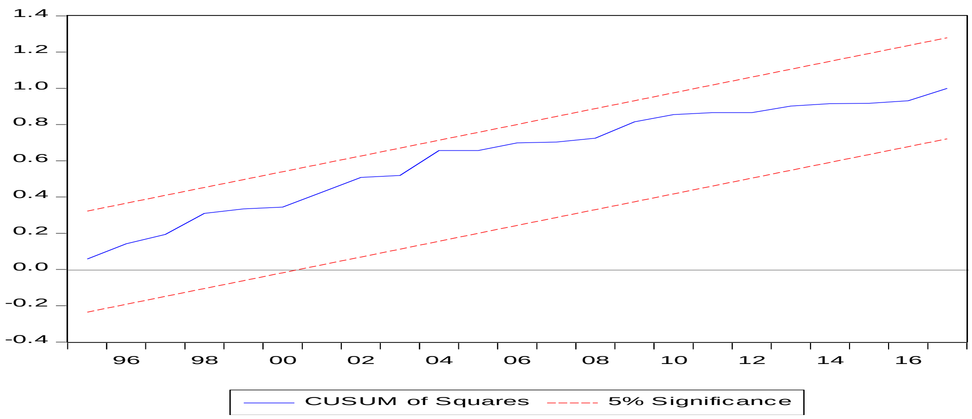


Figure 2A: Plot of CUSUMQ (Saudi Arabia)

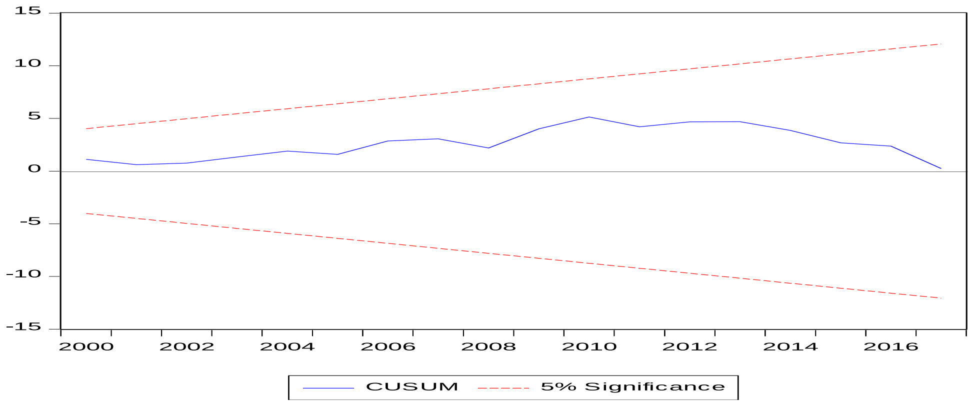


Figure 3A: Plot CUSUM (Kuwait)

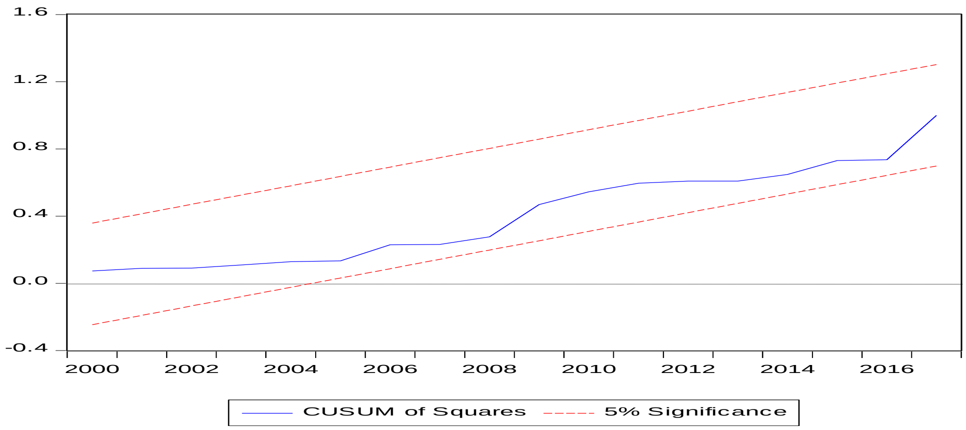


Figure 4A: Plot of CUSUMQ (Kuwait)

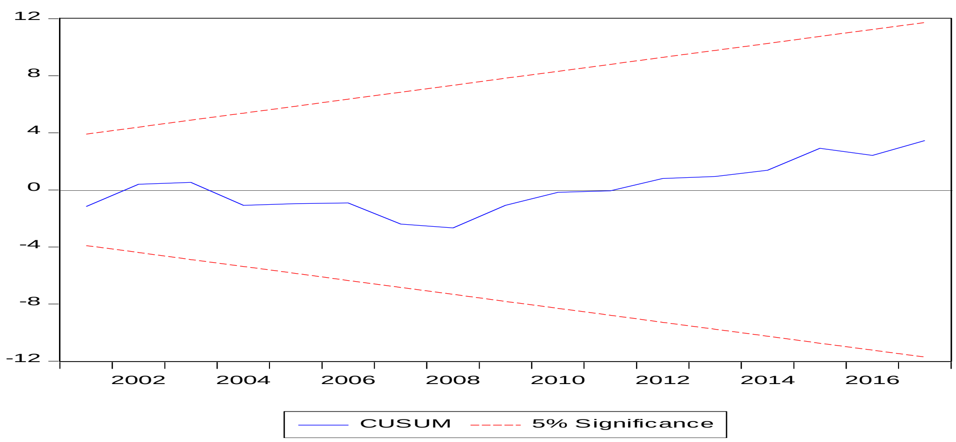


Figure 5A: Plot CUSUM (United Arab Emirates)

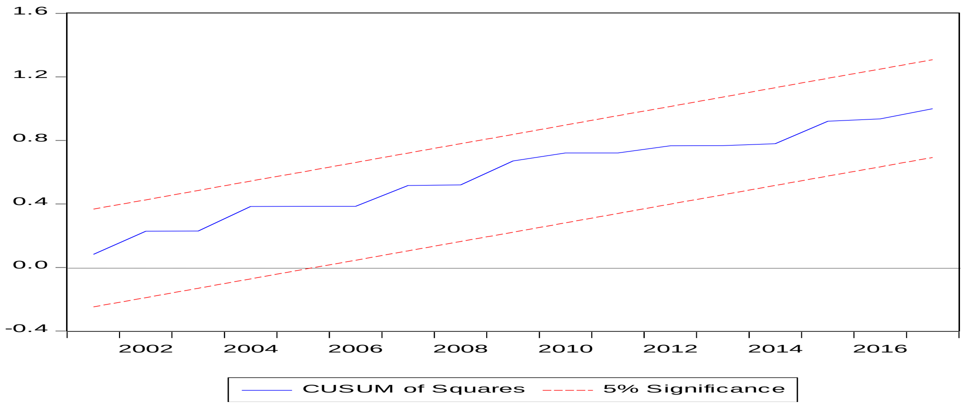
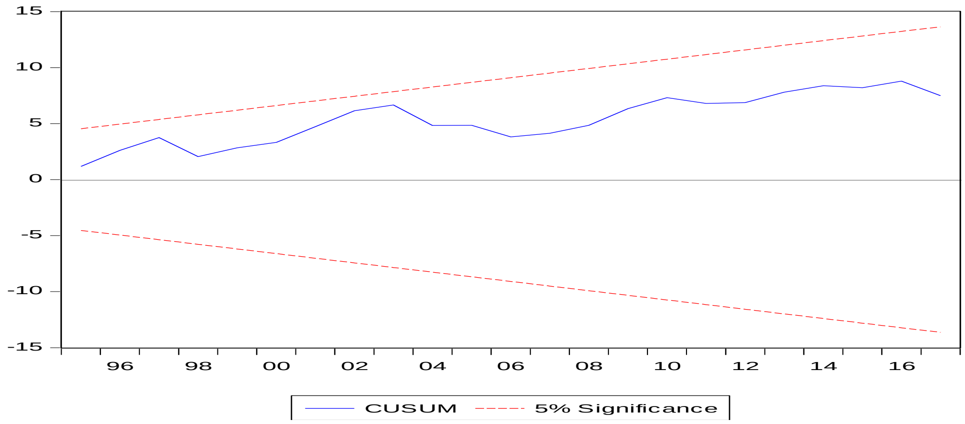


Figure 6A: Plot of CUSUMQ (United Arab Emirates)



. **Figure 7A: Plot CUSUM (Saudi Arabia)**

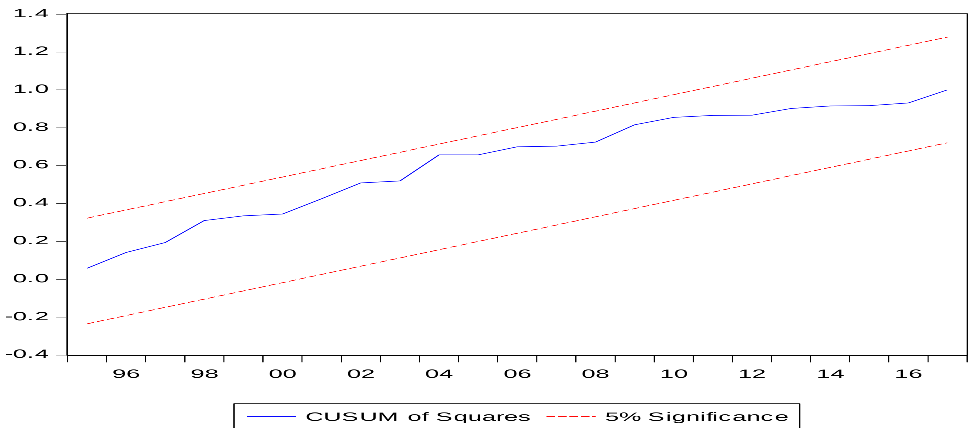


Figure 8A: Plot of CUSUMQ (Saudi Arabia)

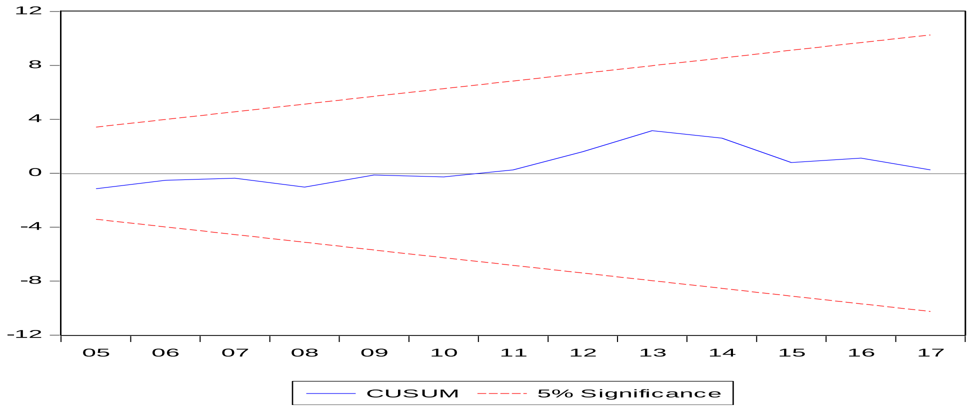


Figure 9A: Plot of CUSUM (Kuwait)

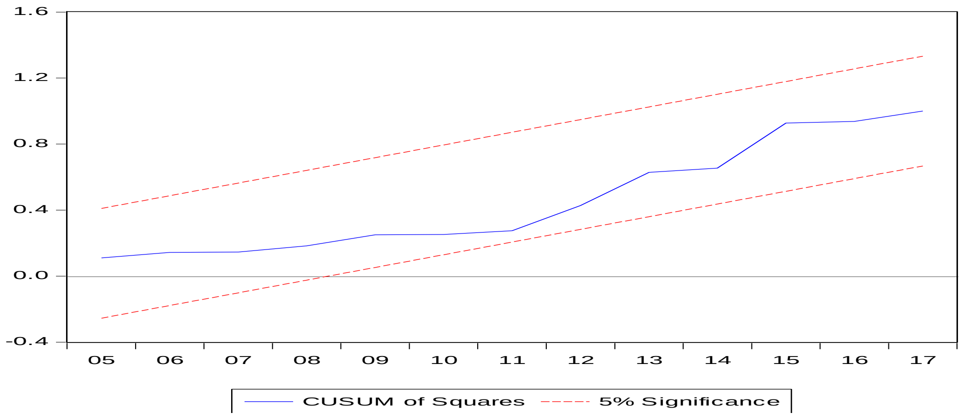


Figure 10A: Plot of CUSUMQ (Kuwait)

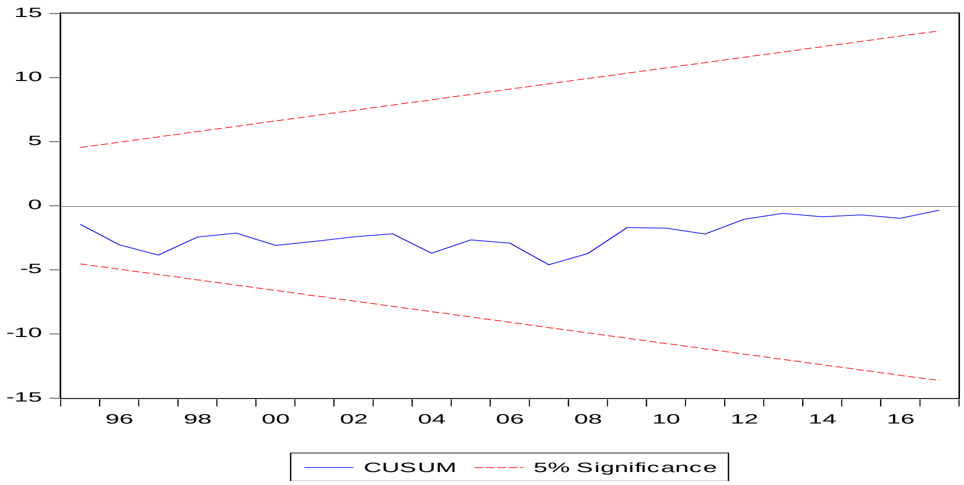


Figure 11A: Plot CUSUM (United Arab Emirates)

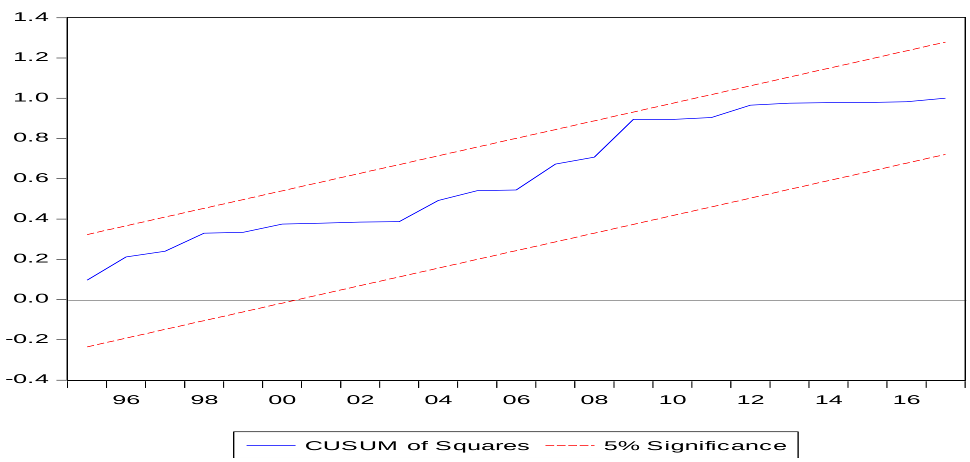


Figure 12A: Plot of CUSUMQ (United Arab Emirates)