

## -RESEARCH ARTICLE-

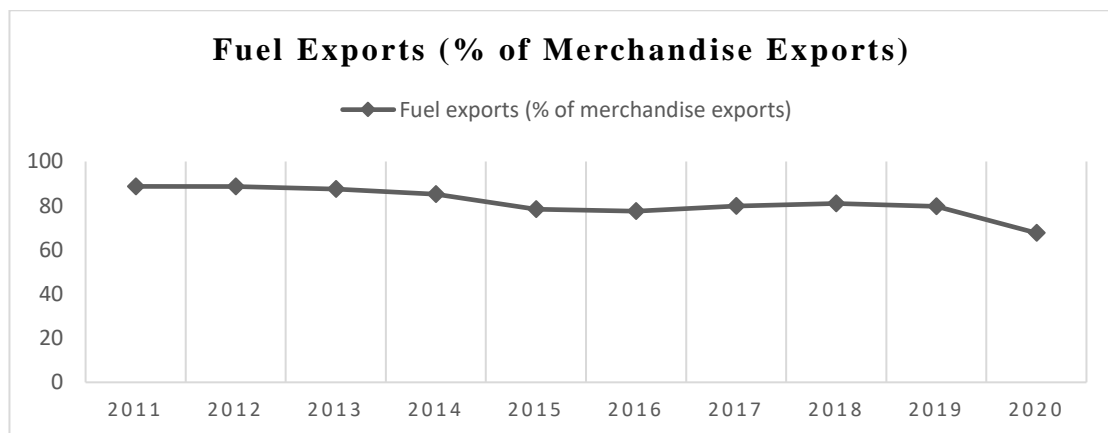
**OIL PRICES AND TERMS OF TRADE OF SAUDI ARABIA: AN EMPIRICAL ANALYSIS****Musaddag Elrayah**Department of Management, School of Business,  
King Faisal University, P.O Box:400,  
Al-Ahsa, 31982, Saudi Arabia.Email: [melrayah@kfu.edu.sa](mailto:melrayah@kfu.edu.sa)<https://orcid.org/0000-0002-1802-150X>**—Abstract—**

The trade terms indicate the exporting countries' profits from international commerce. The terms of trade of oil-exporting economies are substantially associated with oil prices. Oil price fluctuations affect the terms of commerce, exports, and imports. The present study proposes a framework for examining the relationship between terms of trade and oil prices in the context of Saudi Arabia, one of the essential oil-exporting nations. The Autoregressive Distributed Lag model assesses the cointegration, short- and long-run relationships between oil prices and terms of trade during the past two decades. The World development indicators and the Saudi Arabian monetary agency provided the variable data. The results reveal that oil prices and terms of trade are truly cointegrated and that the imbalance between the variables is corrected by 35% every year. The study shows a positive long- and short-term correlation between the variables, indicating that fluctuations in oil prices will significantly impact the terms of trade. The model is fit according to the diagnostic tests, and estimates are BLUE. According to the study's findings, oil-exporting and producing economies, such as Saudi Arabia, are dependent on oil prices when negotiating trade terms. The work provides theoretical evidence for the relationship between trade terms and oil prices and corroborates findings from more recent research.

**Keywords:** Oil prices, exports, trade, commodities, imports.**1. INTRODUCTION**

The global oil demand has increased significantly, particularly in the growing economies of Brazil, Russia, China, and India. The increasing demand has had a

favorable impact on the economies and prosperity of oil-exporting nations such as Saudi Arabia and a substantial increase in their current account surpluses (Akinwale, 2018). The economic performance and data have shown that despite the rising demand that has strengthened the economies of oil-exporting nations, there are considerable challenges regarding the absorption of these earnings since the economies remain inadequately diversified. Similarly, Saudi Arabia's economy is poorly diversified because its oil trade is the primary driver of economic growth and development (Algaeed, 2018; Alghamedi & Misfer, 2012). In addition, the higher revenues within the country have led to an increase in purchasing power, which has manifested itself in increased imports, and for Saudi Arabia, an oil-exporting nation, the elasticity of import demand relative to income is more than one. United Arab Emirates, Saudi Arabia, and Russia accounted for two-thirds of the oil-exporting countries' purchases (Alkhathlan, 2013; Arouri & Rault, 2012). After 2014, however, a major dip in oil prices was witnessed, resulting in a significant reduction in the import intensity of Saudi Arabia and other oil-exporting nations. (Chen, Liao, Tang, & Wei, 2016; Cheon & Urpelainen, 2012).



**Figure 1:** Fuel exports (% of merchandise exports), Saudi Arabia 2011 – 2020

**Source:** databank.worldbank.org

Figure one above represents the fuel exports of Saudi Arabia for the year range 2011 to 2020 as a Percentage of the merchandise exports. The figure indicates that the line is declining towards 2019 and 2020, which can be observed to impact the pandemic of COVID-19 (Gazdar, Hassan, Safa, & Grassa, 2019). The pandemic has caused significant difficulties for the export and commercial sectors, as precautionary measures have compelled the closure or restriction of operations. As a result of the severe restrictions imposed as a result of the pandemic, systems and operations for most of the countries were shut down, which also restricted travel, transportation, and movement in most of the countries, resulting in fewer imports of fuel and energy, the effects of which can be seen in Saudi Arabia's exports. (Gazdar et al., 2019).

The World Bank reported in 2015 that since 2010, developments and innovations in the techniques of production of crude oil and related products have resulted in the efficiency in the utilization and production of the oil in Saudi Arabia (Cheon & Urpelainen, 2012; Dauvin, 2014; Gazdar et al., 2019). However, comparative examples may also be witnessed in other oil-exporting economies, such as the United Arab Emirates, which negatively influenced oil prices and provided Saudi Arabia with significant competition in the oil export market. (Jawaid & Waheed, 2011; Mahran, 2012). The unprecedented decrease in the price of the oil in the world market forced Saudi Arabia to reconsider fiscal and economic policies for attaining a significantly higher level of economic growth, and the sharp decrease in the prices of oil made adverse impacts on the collection of the revenues, resulting in the public sectors spending significantly on long term projects, and the welfare projects (Moradbeigi & Law, 2016). The decline in oil prices on the global market is primarily due to geopolitical issues in the Middle East, changing agreements and associations with the United States, sanctions against Russia, the rise of other oil economies (such as central Asian countries and Iran), and conflicts among Sub-Saharan African oil producers.

The present study focuses on the nexus between terms of trade and oil prices. Trade terms are a significant parameter related to trade for deciding on the pattern of gains from trade between different countries. Multiple studies have put forward various concepts of terms of trade. This study considers net barter terms related to trade as represented by world development indicators. The net barter terms of trade are defined as the percentage ratio of export unit value indexes to import unit value indexes (Nwachukwu, Mba, Jiburum, & Okosun, 2013). The present study considers 2000 as the base year and represents welfare gains from an international trade perspective. Favorable and significant movements in terms of trade result in greater gains from the trade, whereas the unfavorable movements result in adverse impacts on the gains of trade (Pesaran & Shin, 1995; Su, Khan, Tao, & Nicoleta-Claudia, 2019).

In contrast, unfavorable terms of trade indicate a proportional and equal increase in the export price over the import price of the country, whereas negative terms of trade indicate a reduction in the export price over the import price of the country (Su et al., 2019). Therefore, development in terms of trade might be recommended as a crucial aspect of Saudi Arabia's economic growth. (Su et al., 2019).

The terms of trade in the case of Saudi Arabia have been observed to be fluctuating along with the fluctuations of the oil prices, and this study significantly identifies the gaps in research on the terms of trade for the oil-exporting country, Saudi Arabia, over the previous few years, where significant volatility can be observed when it comes to the prices of crude oil (H. Suleiman & Muhammad, 2011). Saudi Arabia's oil prices increased from 26.81 in 2000 to 95.86 in 2008 before falling to 49.85 in 2015 and recovering to approximately 70.59 in 2018. (Su et al., 2019). For Saudi Arabia, similar movements can be observed in the case of terms of trade as well. This concept behind

terms of trade assumes added importance for the oil-exporting country Saudi Arabia, as it is essential for structurally transforming the country's economy (H. Suleiman & Muhammad, 2011; M. Suleiman, 2013). According to this, the study moves further, intending to study the dependence of the oil-exporting country Saudi Arabia on the terms of trade when it comes to crude oil prices (Williams, 2011).

The remainder of the paper is structured as follows: the second section presents the literature review, the third section discusses research methodology, the fourth section includes data analysis, results, and interpretation, and the fifth section focuses on discussion and conclusion, implications of the research, and limitations and recommendations for future research.

## 2. LITERATURE REVIEW

### 2.1 International Trade Theory

Trade theory falls in the sub-field of economics that sheds light on the trade patterns between different countries and regions of the world, the origin of trade, and the welfare implications of the ongoing trade activities across the globe. Economic and trade policies have also been developed to evaluate the effects of continuing trade between countries and the guidelines on the trade (Markusen, Melvin, Maskus, & Kaempfer, 1995). Different authors, researchers, and economists have explained and added to this theory according to their research and analysis. Adam Smith, a Scottish philosopher, and economist, also known as the father of economics, explains the theory of trade by stating that trade occurs between two countries when they find an absolute advantage in the production of goods that specifically meet their needs and when their needs and production of goods are relative to each other. Adam Smith adds to the absolute advantage when one nation produces commodities with less labor and input. (Leamer & Levinsohn, 1995).

The Ricardian model sheds light on the advantage obtained through trade, primarily due to technological and natural resource differences between countries. The Ricardian model is predicated on two basic assumptions: first, that labor is the primary input that leads to the production of the desired goods, and second, that the relative proportions of labor in the nations in which the goods are created and traded for other vary. In addition to Ricardian's model, the specific factor model also needs to be elaborated to explain the trade theory further as it extends to a particular model of factor. It also needs to be elaborated to explain the trade theory further as it is an extension of the Ricardian model. Jacob Viner, a Canadian economist who had his major interest in the Industrial Revolution, explains the specific factor model. Jacob Viner significantly highlights the effects of the migration of labor from rural to urban areas due to the industrial revolution taking place all across the globe. According to the specific factor model, Jacob considers labor as a mobile factor while considering capital as an immobile factor (Zhang, 2008).

This model was named as such by Jacob because specific components, such as physical capital, are not transferable between countries. Therefore, the theory predicts that if an increase in the price of a particular good is noticed, the producers of that good will receive a profit in real terms.

Early in the 20th century, Swedish economists Eli Heckscher and Bertil Ohlin developed an international trade theory known as the Heckscher-Ohlin model or H-O model. This model describes how various endowment factors impact patterns of international trade. The theory predicts a broad way of international trade, according to which a country will typically export items that make effective use of locally abundant resources and import goods that make great use of locally limited resources. In addition to these critical assumptions, the H-O model is founded on the notion that labor and capital freely circulate across and among different sectors of an economy. The second distinction between the endowment components is that the quantities of labor and capital in the two countries are distinct. In addition, long-term technological parity exists between nations (Feenstra, 2015). And last, the demographic preferences of people based on diet, culture, aesthetics, design, and other things are identical throughout nations.

## 2.2 Terms of Trade and Oil Prices:

Terms of Trade (TOT) can be defined simply as the ratio of export prices to import prices or the relative price of exports concerning imports. In addition, the terms of commerce can be further defined as the ratio of the number of imported items a country's economy can purchase per unit of exported commodities. (Mendoza, 1997). It is assumed that the government has improved its terms of trade when the country can spend to buy more imports for a given level of exports of the country. Terms of trade of a country are greatly influenced by the exchange rate, which can be explained that a significant rise in the value of the currency of the country ultimately reduces the price rates of the imported goods; however, it does not directly influence the price of the goods or commodities the country exports. With an increase in the price of a country's exported goods on international markets, its terms of trade would improve; conversely, an increase in the cost of imported goods will have the opposite effect (De Gregorio & Wolf, 1994). As the ratio of imports to exports per unit, terms of trade are typically viewed as an indicator of a country's economic health. Any fluctuation in the prices of imports and exports directly influences the country's terms of trade. Therefore it is mandatory for the economists, other policy setters, and analysts of the country to understand the factors that cause the changes in the prices of the exports and imports to keep the terms of trade of the country balanced, ensuring the prosperity of the economy of the country (Kindleberger, Kindleberger, van der Tak, & Vanek, 1956). Improvement in the prices of exports of the country marks a positive change in the country's trade terms.

Furthermore, the terms of trade of a country are also affected by the exchange rates, inflation rates, and prices of the imported and exported commodities (Schmitt-Grohé & Uribe, 2018). However, several other factors also influence the country's trade terms,

mainly related to the specific industries or the capital or labor of the industry on which the country's exports primarily rely (Jääskelä & Smith, 2013). Along with the prices of the goods and commodities, the quality of the goods also affects the terms of trade; a high-quality product is sold at a higher price, which implies making more money and, consequently, having more capital to sell the product. Positive fluctuations in terms of commerce can be described as follows: if a country can import more goods for every unit of commodities it sells, the country's trade terms have improved, which is proof of the country's strengthening economy. To enhance the economy, the country must put in efforts to increase the exports so that with more significant export unit numbers, a more incredible amount of imports is achieved to safeguard the terms of trade from deteriorating. The terms of trade are more often related to the ratio of imports and exports. It also depends on the world supply and demand of certain goods and commodities in the international market, which indicates the pattern of gains from different countries and regions. This notion is applied to several sectors of the economy, with the agriculture and manufacturing sectors of the country having the most influence. If a country is highly dependent on the foreign currency it earns through exports, a significant change in its terms of trade could lead to serious balance of payment concerns.

A drastic increase in the oil prices was observed in 1970, which affected the world's macroeconomics with its adverse consequences, and a subsequent abrupt decline was observed in the following year. Therefore, this year's sharp fluctuation in oil prices greatly affected the number of industrial and developing countries. In the next decade 1980s, there were also fluctuations in the non-oil primary commodities. Over two decades, such changes in oil prices and related commodities caused a significant shock to the global economy, which had the most considerable impact on developing nations. From 1983 to 1984, countries' trade terms that exported non-oil commodities increased by approximately 7%. However, in the years that followed, these countries' trade terms fell by approximately 18%, indicating an unexpected depression in the economics of oil prices. It, directly and indirectly, affected the economics of the entire world. (Backus & Crucini, 2000) (Alharbi, 2021). This significantly impacted developing economies' trade terms, which was exacerbated by their reliance on imported capital goods. The Organization of Petroleum Exporting Countries (OPEC) has been blamed for the sudden increase in oil prices, and the subsequent sharp decrease in prices has also been linked to the OPEC's weakening. Saudi Arabia is one of the largest oil producers and is among the most prominent members of the OPEC (Jouini, 2013). Being the largest producer of oil Saudi Arabia can effectively influence the world economy. While looking at the other side of the picture, it is also clear that Saudi Arabia also depends on the revenues generated from oil and oil-derived products because it is vulnerable to the global market of oil. Over the past few decades, the production of crude oil by Saudi Throughout these years, Arabia has been stable and has supplied around one-eighth of the world's crude

oil. Stable economic growth has also been witnessed for the nation as a whole, particularly in the last decade of the 20th century, when oil output increased.

Saudi Arabia stands 18<sup>th</sup> on the list of the world's economies in terms of GDP and 26<sup>th</sup> on the world's economies concerning exports (Dibooglu & Aleisa, 2004). Saudi Arabia constitutes the world's largest exporter of crude oil worth 145 US billion dollars, Ethylene Polymers worth 11.1 billion US dollars, and Propylene Polymers worth 5.88 billion US dollars. Among the most eminent importers of this oil from Saudi Arabia are China, Japan, the United States, South Korea, Pakistan, and others. The average value of Saudi Arabia's terms of trade for the previous two decades, from 2000 to 2019, is 118.3 percent, with a minimum value of approximately 80.02 percent in 2016 and a maximum value of almost 145 percent in 2005. (Khamis, Anasweh, & Hamdan, 2018). According to this research, the terms of the trade value of the most recent year, 2019, is approximately 108.8 percent, indicating that the value of Saudi Arabia's exports has steadily increased over the past few years, so contributing to an increase in imports and exports per unit of exchange. In recent years, the economy of the Kingdom of Saudi Arabia has been thriving and is among the top 20 in the world (Foudeh, 2017). Trade openness is a country's economy concerning international trade, its imports, and exports in the global market. The trade openness of Saudi Arabia over the last 20 years has an average value of 76% and the maximum value of trade openness, which mainly relies on the oil in the international market and global oil market, reached the value of 120.6%.

The following hypothesis can be generated:

**H1: Terms of trade are greatly influenced by oil prices.**

### **3. RESEARCH METHODOLOGY**

#### **3.1 Materials and Method**

Using data from 2000 to 2020, this study examines the relationship between terms of trade and oil prices in the context of Saudi Arabia. The dependent variable in terms of trade, with net barter terms of trade serving as a proxy; the independent variable is oil prices; and the control variables are trade openness, exports, and GDP per capita. Initially, the stationarity of the collected data is examined using the Augmented Dickey-Fuller test (Akinwale, 2018). The null hypothesis states that information is non-stationary. Therefore, given the small sample size, the autoregressive distributed lag method analyzes cointegrating relationships between the two key variables. This model can be used regardless of whether the variables are stationary at the first or level difference or if one variable is stationary while the other is not at the level or first difference (Akinwale, 2018). In addition, Pesaran and Shin (1995) advocated using the ARDL approach for small samples. The model is estimated using the following equation.

$$\Delta \ln ToT_t = \beta_0 + \beta_1 \ln ToT_{t-1} + \beta_2 \ln OP_{t-1} + \beta_3 \ln TO_{t-1} + \beta_4 \ln EXP_{t-1} + \beta_5 \ln GDP_{t-1} + \sum_{i=1}^p \varphi_i \Delta \ln ToT_{t-i} + \sum_{j=1}^q \varphi_j \Delta \ln OP_{t-j} + \sum_{k=1}^r \varphi_k \Delta \ln TO_{t-k} + \sum_{l=1}^s \varphi_l \Delta \ln EXP_{t-l} + \sum_{m=1}^t \varphi_m \Delta \ln GDP_{t-m} + \varepsilon_t \quad (1)$$

Where;

- ToT = Terms of trade
- OP = Oil Prices
- TO = Trade Openness
- EXP = Exports
- GDP = GDP Per Capita

$\beta_i$  are representing the long-run multipliers, whereas,  $\varepsilon_t$  is representing the white noise error term. This equation is tested and estimated for long-term relationship estimation with an F-test application using the hypothesis below:

$$H_0 : \beta_1 = \beta_2 = 0; 0; H_0 : \beta_1 \neq \beta_2 \neq 0 \quad (2)$$

After the establishment of cointegration long-run estimation is applied through:

$$\ln ToT_t = \beta_0 + \sum_{i=1}^p \beta_i \ln ToT_{t-i} + \sum_{j=1}^q \beta_j \ln OP_{t-j} + \sum_{k=1}^r \beta_k \ln TO_{t-k} + \sum_{l=1}^s \beta_l \ln EXP_{t-l} + \sum_{m=1}^t \beta_m \ln GDP_{t-m} + \varepsilon_t \quad (3)$$

Whereas, the  $\beta_0$  represent the long-run estimates, and short-run is represented as below:

$$\Delta \ln ToT_t = \beta_0 + \sum_{i=1}^p \varphi_i \Delta \ln ToT_{t-i} + \sum_{j=1}^q \varphi_j \Delta \ln OP_{t-j} + \sum_{k=1}^r \varphi_k \Delta \ln TO_{t-k} + \sum_{l=1}^s \varphi_l \Delta \ln EXP_{t-l} + \sum_{m=1}^t \varphi_m \Delta \ln GDP_{t-m} + \theta ECM_{t-1} + \varepsilon_t \quad (4)$$

In the equation above  $\varphi_i$  represents the short-run estimates, whereas  $\theta$  is the representation of the error correction term coefficient.

Furthermore, the residual diagnostic tests are applied, serial correlation test is utilized, with a null hypothesis stating that no serial correlation is present. Moreover, the heteroskedasticity test is applied with the null hypothesis that no heteroskedasticity exists. The normality test is applied with the null hypothesis that there is a normal distribution of the residuals in the data. Then the CUSUM test is used, according to which the graphs are drawn to analyze the model's stability (Akinwale, 2018).

### 3.2 Data and Variables

Below is the representation of the formulas and definitions of the critical variables and the sources from which the data has been collected for all of the variables.



**Table 1: Definitions of Key Variables**

<b>Variables</b>	<b>Definitions</b>
<i>Terms of trade</i>	Terms of trade are defined as the factor representing the ratio between export prices and import prices of a country. The formula for it is “ <i>Terms of Trade Formula = (Index of Export Prices Index of Import Prices) x 100</i> ” <b>Proxy:</b> <i>Net barter terms of trade:</i> It represents the ratio between the price of a country's export goods and the import goods.
<i>Oil prices</i>	Oil price is the spot price of a barrel of the benchmark crude oil, which is generally represented as a reference price for sellers and buyers.
<i>Trade openness</i>	Trade openness is referred to as the orientation of a country's economy in international trade. The formula for it is “ <i>(Imports + Exports)/ Total GDP.</i> ”
<i>Exports</i>	Exports are elaborated as services and goods data produced in one country but sold to the buyers in another country and calculated by “ <i>Total exported goods and services - Total imported goods and services.</i> ”
<i>GDP per capita</i>	GDP per capita represents the total GDP of a country as divided by its total population.

World development indicators are used to collect the data for net barter terms of trade as a proxy for terms of trade. The information regarding oil prices is provided by the Saudi Arabian Monetary Agency or SAMA. The data for Arabia's Trade openness, Exports, and GDP per capita are also obtained from the World Bank's website via the world development indicators database.

#### **4. RESULTS**

The testing procedure begins with a descriptive analysis. The initial review of the data suggests that the mean value for the terms of trade is 118.83, with the base value of 100 established in 2000. Variations in the factor range from a minimum of 82.08 to a maximum of 149.5. The variance in terms of trade is modest, and the factor is reportedly standard since the estimates of skewness and kurtosis fall within predetermined levels. Similarly, the mean number for oil prices is 62.45, representing the average price for the past 20 years. The values for the factor fluctuated between 110.22 and 29.84. Trade openness reported a mean value of 56 and fluctuated between the values of 70 and 40. Similarly, GDP per capita presented a mean value of 1059 and fluctuated between 3907 and 273. Finally, exports can have a mean value of 2120 and fluctuate between 3452 and 1022. All of the variables were normal according to the skewness and kurtosis tests.

The evaluation of the stationary qualities and attributes of the data follows the descriptive test evaluation. Variables must be cointegrated at levels 1, 0, or both for the ARDL methodology to be implemented in the current study. This is one of the method's primary requirements. Unit root tests permit the evaluation of the stationarity and integration order features of variables. Unit root tests are not required in ARDL, as the method can be completed even if unit roots are present in the data. However, they are still performed to ensure that the variables do not have a unit root issue and that their order of integration does not exceed one, as this improves the quality of the results and the significance of unit root tests in the study of time series data cannot be overlooked. Therefore, the study used the Augmented Dickey-Fuller test to evaluate the variables' stationary qualities and order of integration. According to [Table 3](#), all variables were non-stationary at a constant level but stationary at the first difference, although they were non-stationary at a continuous. As the variables are stationary at the initial contrast, the variables are cointegrated at level one, and further testing of variable correlations is conducted using the ARDL approach.

The results of the ARDL estimation are presented in [Table 4](#). The results of the ARDL estimation indicate that there is a positive and significant association between oil prices and terms of trade. A unit increase in the oil prices will increase the terms of trade by 58%. Similarly, the other factors also impact the dependent factor, indicating a cointegrating relationship between terms of trade and oil prices and other control factors, as indicated by the significance of the F bounds test. The limits test estimate is greater than the lower and upper bound values at a significance level of 5%, proving the cointegrating relationship. Cointegration is the occurrence of integrated variables that, when linearly combined, have one less unit root than the integration order chosen for the variables in the model. ([Dritsakis, 2004](#); [Franses, 2001](#)). The research variables can cointegrate if they have similar stochastic trends that lead them to cancel the effects of each other ([Hendry & Juselius, 2000](#)).

The long-run and short-run associations are represented in [Table 5](#). The results from the table indicated a long-run association between the oil prices and terms of trade as the p-value for the factor is 0.01 and the t-value is 2.95. A one percent increase in the values of the oil prices will result in a 22% increase in terms of trade. Similarly, there is a long-run association between exports and terms of trade. A one percent increase in exports results in a twenty-five percent increase in trade; the p-value and t-value are also significant. As evidenced by the t-value and p-value, trade openness is significantly associated with trade terms. In addition, a unit increase in trade openness resulted in a 42 percent rise in terms of commerce. Significant p and t values imply that the GDP per capita has a substantial and positive relationship with the terms of trade.

**Table 2: Descriptive Statistics**

<b>Variable</b>	<b>Mean</b>	<b>Median</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Std. Dev.</b>	<b>Skewness</b>	<b>Kurtosis</b>
ToT	118.8316	119.0026	149.5085	82.08547	23.15536	-0.040031	1.539918
OP	62.45105	61.10000	110.2200	23.06000	29.84758	0.276906	1.799417
TO	56	57	70	40	15.4	5.5	38.1
GDPPC	1059.2	791.6	3907.7	273.0	692.1	1.7	2.3
EXP	2120.7	2200.0	3452.7	1022.4	19.0	0.9	1.3

**Table 3: Unit Root Test**

	Constant	Linear+ Trend		Constant	Linear+ Trend
OP	-1.523566	17.272	dOP	-3.132195	14.8596**
TOT	-1.30085	4.287	dTOT	-3.239953	3.372**
EXP	0.61186	16.040	dEXP	-3.077692	19.501***
TO	-1.972371	15.718	dTO	-3.762318	16.718**
GDPPC	0.105293	12.757	dGDPPC	-3.4913	13.777**

**Table 4: ARDL Estimates And Bounds Test**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTOT(-1)	0.64623	0.102374	6.312436	0.000
LOP	0.582802	0.050423	11.55824	0.000
LOP(-1)	-0.50225	0.056484	-8.89191	0.000
EXP	0.54633	0.101334	5.332446	0.000
TO	0.483812	0.060433	12.65825	0.000
GDPPC	-0.60326	0.036472	-7.80292	0.000
C	1.338292	0.380175	3.520199	0.0034
R-squared: 0.970268; F-statistics: 78.43675; Prob(F-statistics):0.000000				
Model selection:-Maximum lags: 4 (Automatic selection); Akaike info criterion; ARDL(1, 1)				
Bounds test				
	Value	Significance	Lower bound 95%	Upper bound 95%
F-statistic	6.244563	5%	3.62	4.16

The long-run and short-run associations are represented in [Table 5](#). The results from the table indicated a long-run association between the oil prices and terms of trade as the p-value for the factor is 0.01 and the t-value is 2.95. A one percent increase in the values of the oil prices will result in a 22% increase in terms of trade. Similarly, there is a long-run association between exports and terms of trade. A one percent increase in exports results in a twenty-five percent increase in trade; the p-value and t-value are also significant. As evidenced by the t-value and p-value, trade openness is significantly associated with trade terms. In addition, a unit increase in trade openness resulted in a 42 percent rise in terms of commerce. Significant p and t values imply that the GDP per capita has a substantial and positive relationship with the terms of trade.

The study results also indicate the presence of short-run relationships. The estimates in the short run are more significant than the long-run estimates, meaning that all factors are more substantial and effective in the short run. In the short run, a percentage increase in the oil prices will increase the terms of trade by 58%. Similarly, a percentage increase

in exports, trade openness and GDP per capita will result in 38%, 35%, and 25% in terms of trade. The cointegrating equation is significant and negative. -0.35 is the rate of adjustment for the error correction term. The primary factor indicates that the imbalance between the factors can be addressed by 35 percent within a year.

**Table 5: Long-Run And Short-Run Associations**

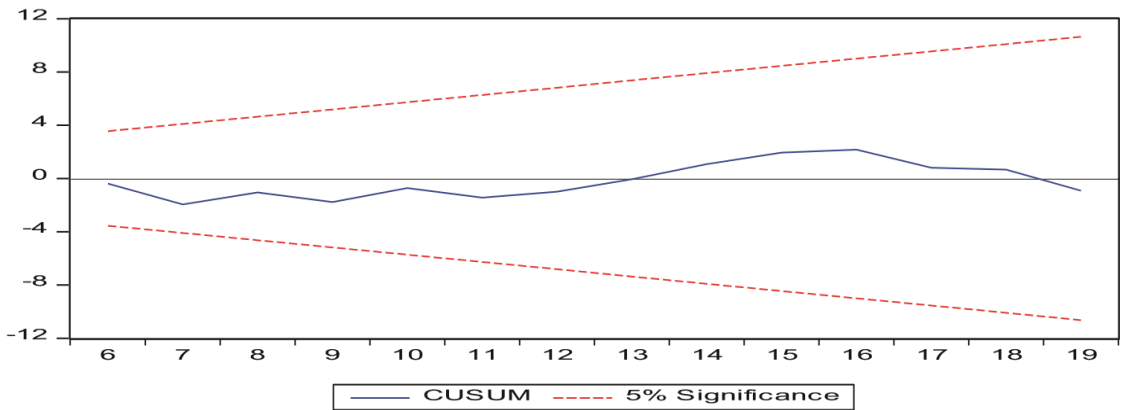
		<b>Long-run relationships</b>		
Variable	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
OILP1	0.227697	0.07705	2.955237	0.0104
EXP	0.256708	0.06305	3.017543	0.0004
TO	0.426603	0.07225	4.062231	0.0210
GDPPC	0.127898	0.08806	2.000219	0.0102
C	3.782943	0.31246	12.26436	0.000
		<b>Short-run relationship</b>		
D(OILP1)	0.582802	0.04324	13.47784	0.000
D(EXP1)	0.381121	0.05334	10.28704	0.000
D(TO1)	0.352613	0.01313	11.56883	0.000
D(GDPPC1)	0.255812	0.05523	4.078851	0.000
CointEq(-1)*	-0.35377	0.08196	-4.31642	0.0007

After the short-run and long-run relationships were evaluated, the researcher assessed the estimates' robustness. The present study is based on time-series data, and econometric time series models are subject to numerous issues; autocorrelation, heteroscedasticity, misspecification, and normality (Gujarati, 2011). Therefore, to ensure the robustness of the estimates and evaluate whether the estimates are BLUE or not, a series of robustness tests are applied to rule out issues, as discussed before. Based on the p-value of the serial correlation test of the Breusch Godey Lagrange Multiplier test, the serial correlation is absent from the model, as shown in Table 6. Thus, it is permissible to accept the null hypothesis for the tests claiming that there is no serial correlation. The Jarque-Bera test was used to examine the residuals' normalcy. The results imply that the residuals are normally distributed, as the test's p-value is 0.67, which is more than 0.05. The next test applied was for the evaluation of homoscedasticity. It can be seen that the results indicate that the estimates and residuals are homoscedastic as the p-value of the Breusch-Pagan-Godfrey test is 0.13. Therefore, the test's null hypothesis states that the absence of heteroscedasticity can be accepted. Often, the model can be misspecified, i.e., the model indicates errors and doesn't depict a clear picture of the estimates and their effect. The model's specification was studied by applying the RAMSEY RESET test. The results indicate that the null hypothesis can be accepted as the p-value of the test is 0.31, which means that the model is correctly

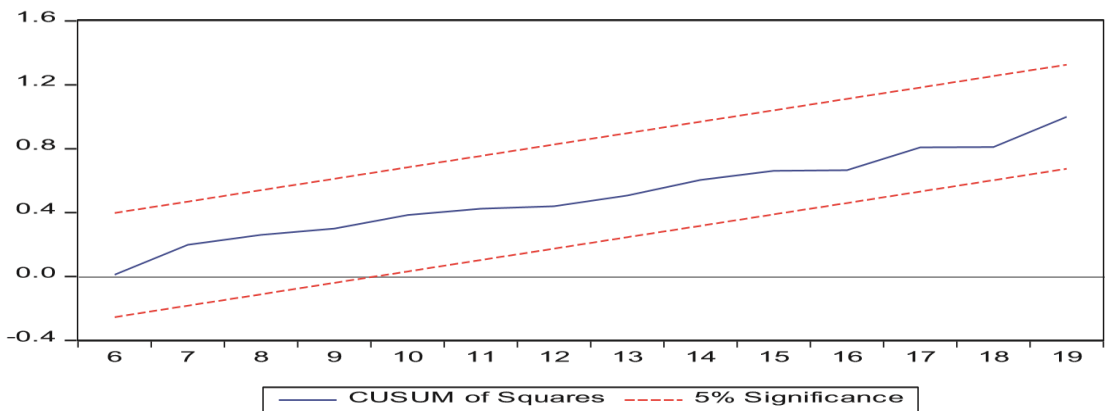
specified. The structural breaks within the model were tested by applying the CUSUM and CUSUMSQ tests (figures 2 and 3). The test results indicate that the model is free from structural breaks and the estimates are stable, as indicated by the CUSUM and CUSUMSQ.

**Table 6: Robustness Tests**

Item	Diagnostic test	Test statistic	P-Value
Serial Correlation	Breusch-Godfrey LMtest	0.180257	0.9138
Normality	Jarque-Bera	0.791559	0.673155
Heteroskedasticity	Breusch-Pagan-Godfrey	5.588568	0.1334
Model Specification	Ramsey RESET Test	1.052151	0.3119



**Figure 2: CUSUM**



**Figure 3: CUSUMSQ**

## 5. DISCUSSION AND CONCLUSION

Numerous studies have been carried out to evaluate the effect of oil prices on macroeconomic factors. Polbin (2017) studied the relationship between terms of trade and economic growth. The study results indicated that increases in the oil prices led to favorable terms of trade which ultimately led to an economic boom in the short-run followed by negative contributions to economic growth in the long run. However, concerning Saudi Arabia's economy, most of its exports consist of oil products (78.67% in 2018), leading to the significant dependency of Saudi Arabia on oil prices (HAQUE & IMRAN, 2020). The present study results are supported by Naziri, Nemati, Darabi, and Raisi (2015) and Haque, Yunus, and Shaik (2021), that oil prices significantly influence the terms of trade. The present study's findings are also supported by the results of Allegret, Mignon, and Sallenave (2015), who showed that for oil-exporting economies, the oil prices imply a positive influence on the terms of trade. The stability in oil prices and related products is essential for reducing the fluctuations in the trade terms. However, an individual country can't influence oil prices and can neither reduce the volatility. It can only alternate the supply and try to control the effects of the trade terms and macroeconomic effects (Nyangarika, 2018).

The influence of oil prices on macroeconomic variables remains one of the most critical issues for oil-producing and exporting nations. Furthermore, the relationship between oil prices and economic growth and macroeconomic performance has been investigated. Evaluating the relationship between macroeconomic conditions and oil prices occupies a significant portion of academic and scientific literature. However, the present analysis takes a different approach and examines the correlation between trade terms and oil prices. Theoretically, the volatility and fluctuations in oil prices are expected to alter and influence the terms of trade. However, the present study presents an empirical overview of the overall impact and association between these factors in the context of Saudi Arabia, one of the world's leading oil-exporting economies. The present study examined the relationship between the variables of interest using the ARDL approach from 2000 to 2020. After assessing the time series data for unit root, the results indicated that they were stationary and integrated at the first difference level. As the value of the F-statistic was more significant than the lower and upper bounds, the Bounds cointegration results revealed that variables were connected over the long term. After confirming the existence of cointegration between the variables, the long-run and short-run connections and robustness of the components were examined. The results demonstrate the existence of a long-term and short-term relationship between trade terms and oil prices. Changes and swings in exports, oil prices, trade openness, and GDP per capita lead to variations in terms of trade.

## 6. IMPLICATIONS

The present study has various consequences for theory, practice, and policymaking. This research continues ongoing research on the correlation between macroeconomic indicators and oil prices. The majority of prior research has focused on the volatility and co-movement of macroeconomic indicators, whereas the present study examines the direct relationship between oil price fluctuations and their consequences on the terms of trade. Changes in oil product prices have an indirect effect on the conditions of trade. Some researchers have reported a good correlation between the two characteristics, while others have reported negative or conflicting results. [Bokan, Dossche, and Rossi \(2018\)](#) argued that as oil prices increase, the global terms of trade deteriorate. In addition, the extensive association and correlation between these elements are acknowledged worldwide; nonetheless, there is a dearth of empirical studies documenting the consequences and nature of their interaction. Thus, the present study attempts to supplement the developing literature on oil price effects and shocks to the macroeconomy.

Moreover, there is a lack of literature covering the overall impact of volatility and shift in oil prices for the Middle East and Saudi Arabia. Thus, the present study presents findings focused on Saudi Arabia. The policymakers and managers can use the current study's findings to develop effective policies for promoting trade with other countries. Oil is a significant commodity, and as a manufacturer of oil, Saudi organizations can leverage their unique position to develop substantial trade relations with other economies. Thus, policies enabling increasing exports can be developed following the significance of the present study results.

## 7. LIMITATIONS AND RECOMMENDATIONS

The present study is subject to some limitations. The study uses data only from the last 20 years, whereas the oil-based trade has been dominant in Saudi Arabia for a more extended time. Thus, future researchers can increase the sample to evaluate the significance of the variables' long-run relationships. Moreover, the present study only places oil prices as a direct determinant of terms of trade, factors like trade openness, exchange rate, economic growth, inflation rate, and export infrastructure to evaluate all possible factors influencing the terms of trade. Lastly, the present study only examines the relationship between oil prices and terms of trade for Saudi Arabia; however, data from neighboring middle eastern nations and other oil-producing economies can be included to assess the overall relationship between trade duration and oil prices in oil-producing countries.



## 8. ACKNOWLEDGMENT

This work was supported through the Annual Funding track by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Project No. AN000693].

## REFERENCES

- Akinwale, Y. O. (2018). An empirical analysis of short run and long run relationships between energy consumption, technology innovation and economic growth in Saudi Arabia. *International Journal of Energy Economics and Policy*, 8(4), 139-146. Retrieved from <http://hdl.handle.net/11159/2148>
- Algaeed, A. H. (2018). The oil price volatility and a revisited Saudi import demand function: An empirical analysis. *International Journal of Energy Economics and Policy*, 8(6), 59. doi:<https://doi.org/10.32479/ijeep.624>
- Alghamedi, A., & Misfer, A. (2012). *Assessing the impact of stock market development on economic growth in Saudi Arabia: An Empirical Analysis*. Durham University, Retrieved from <http://etheses.dur.ac.uk/6367/>
- Alharbi, A. (2021). Economic effects of low oil prices in Saudi Arabia. *International Journal of Information Technology*, 13(1), 195-200. doi:<https://doi.org/10.1007/s41870-020-00432-w>
- Alkathlan, K. A. (2013). Contribution of oil in economic growth of Saudi Arabia. *Applied Economics Letters*, 20(4), 343-348. doi:<https://doi.org/10.1080/13504851.2012.703310>
- Allegret, J.-P., Mignon, V., & Sallenave, A. (2015). Oil price shocks and global imbalances: Lessons from a model with trade and financial interdependencies. *Economic Modelling*, 49, 232-247. doi:<https://doi.org/10.1016/j.econmod.2015.04.009>
- Arouri, M. E. H., & Rault, C. (2012). Oil prices and stock markets in GCC countries: empirical evidence from panel analysis. *International Journal of Finance & Economics*, 17(3), 242-253. doi:<https://doi.org/10.1002/ijfe.443>
- Backus, D. K., & Crucini, M. J. (2000). Oil prices and the terms of trade. *Journal of international Economics*, 50(1), 185-213. doi:[https://doi.org/10.1016/S0022-1996\(98\)00064-6](https://doi.org/10.1016/S0022-1996(98)00064-6)
- Bokan, N., Dossche, M., & Rossi, L. (2018). Oil prices, the terms of trade and private consumption. *Economic Bulletin Boxes*, 6. Retrieved from <https://ideas.repec.org/a/ecb/ecbbox/201800063>
- Chen, H., Liao, H., Tang, B.-J., & Wei, Y.-M. (2016). Impacts of OPEC's political risk on the international crude oil prices: An empirical analysis based on the SVAR models. *Energy Economics*, 57, 42-49. doi:<https://doi.org/10.1016/j.eneco.2016.04.018>

- Cheon, A., & Urpelainen, J. (2012). Oil prices and energy technology innovation: An empirical analysis. *Global Environmental Change*, 22(2), 407-417. doi:<https://doi.org/10.1016/j.gloenvcha.2011.12.001>
- Dauvin, M. (2014). Energy prices and the real exchange rate of commodity-exporting countries. *International Economics*, 137, 52-72. doi:<https://doi.org/10.1016/j.inteco.2013.11.001>
- De Gregorio, J., & Wolf, H. C. (1994). Terms of trade, productivity, and the real exchange rate. In (pp. 1-18): National Bureau of Economic Research Cambridge, Mass., USA. Retrieved from [https://www.nber.org/system/files/working\\_papers/w4807/w4807.pdf](https://www.nber.org/system/files/working_papers/w4807/w4807.pdf).
- Dibooglu, S., & Aleisa, E. (2004). Oil prices, terms of trade shocks, and macroeconomic fluctuations in Saudi Arabia. *Contemporary Economic Policy*, 22(1), 50-62. doi:<https://doi.org/10.1093/cep/byh005>
- Dritsakis, N. (2004). Cointegration analysis of German and British tourism demand for Greece. *Tourism management*, 25(1), 111-119. doi:[https://doi.org/10.1016/S0261-5177\(03\)00061-X](https://doi.org/10.1016/S0261-5177(03)00061-X)
- Feenstra, R. C. (2015). *Advanced international trade: theory and evidence*: Princeton university press.
- Foudeh, M. (2017). The long run effects of oil prices on economic growth: The case of Saudi Arabia. *International Journal of Energy Economics and Policy*, 7(6), 171. Retrieved from <https://www.researchgate.net/profile/Musa-Foudeh/publication/322028799>
- Franses, P. H. (2001). How to deal with intercept and trend in practical cointegration analysis? *Applied Economics*, 33(5), 577-579. doi:<https://doi.org/10.1080/00036840121713>
- Gazdar, K., Hassan, M. K., Safa, M. F., & Grassa, R. (2019). Oil price volatility, Islamic financial development and economic growth in Gulf Cooperation Council (GCC) countries. *Borsa Istanbul Review*, 19(3), 197-206. doi:<https://doi.org/10.1016/j.bir.2018.07.005>
- Gujarati, D. N. (2011). *Econometrics by example (Vol. 1)*: Palgrave Macmillan New York.
- HAQUE, M. I., & IMRAN, M. (2020). Oil prices and terms of trade of Saudi Arabia: An empirical analysis. *The Journal of Asian Finance, Economics, and Business*, 7(9), 201-208. doi:<https://doi.org/10.13106/jafeb.2020.vol7.no9.201>
- Haque, M. I., Yunus, M. I., & Shaik, A. R. (2021). The Correlates of Terms of Trade in Oil Exporting Countries of Gulf Cooperation Council Region. *International Journal of Energy Economics and Policy*, 11(4), 543. doi:<https://doi.org/10.32479/ijeep.11366>
- Hendry, D. F., & Juselius, K. (2000). Explaining cointegration analysis: Part 1. *The Energy Journal*, 21(1). doi:<https://doi.org/10.5547/ISSN0195-6574-EJ-Vol21-No1-1>

- Jääskelä, J. P., & Smith, P. (2013). Terms of Trade Shocks: What Are They and What Do They Do? *Economic Record*, 89(285), 145-159. doi:<https://doi.org/10.1111/1475-4932.12039>
- Jawaid, S. T., & Waheed, A. (2011). Effects of terms of trade and its volatility on economic growth: a cross country empirical investigation. *Transition Studies Review*, 18(2), 217-229.
- Jouini, J. (2013). Return and volatility interaction between oil prices and stock markets in Saudi Arabia. *Journal of Policy Modeling*, 35(6), 1124-1144. doi:<https://doi.org/10.1016/j.jpolmod.2013.08.003>
- Khamis, R., Anasweh, M., & Hamdan, A. (2018). Oil prices and stock market returns in oil exporting countries: Evidence from Saudi Arabia. *International Journal of Energy Economics and Policy*, 8(3), 301. Retrieved from <https://www.researchgate.net/profile/Allam-Hamdan/publication/325291540>
- Kindleberger, C. P., Kindleberger, C. P., van der Tak, H. G., & Vanek, J. (1956). The terms of trade: Published jointly by the Technology Press of Massachusetts Institute of Technology.
- Leamer, E. E., & Levinsohn, J. (1995). Chapter 26 International trade theory: The evidence. In *Handbook of International Economics* (Vol. 3, pp. 1339-1394): Elsevier, 1339-1394. doi:[https://doi.org/10.1016/S1573-4404\(05\)80006-1](https://doi.org/10.1016/S1573-4404(05)80006-1).
- Mahrán, H. A. (2012). Financial intermediation and economic growth in Saudi Arabia: An empirical analysis, 1968-2010. *Modern Economy*, 3(5), 626. doi:<http://dx.doi.org/10.4236/me.2012.35082>
- Markusen, J. R., Melvin, J. R., Kaempfer, W. H., & Maskus, K. E. (1995). International trade: theory and evidence (pp. 281-285). *New York: McGraw-Hill*.
- Mendoza, E. G. (1997). Terms-of-trade uncertainty and economic growth. *Journal of Development Economics*, 54(2), 323-356. doi:[https://doi.org/10.1016/S0304-3878\(97\)00046-1](https://doi.org/10.1016/S0304-3878(97)00046-1)
- Moradbeigi, M., & Law, S. H. (2016). Growth volatility and resource curse: Does financial development dampen the oil shocks? *Resources Policy*, 48, 97-103. doi:<https://doi.org/10.1016/j.resourpol.2016.02.009>
- Naziri, M. K., Nemati, M., Darabi, H., & Raisi, G. (2015). Review of the terms of trade in selected countries and Iran. *International Journal of Life Sciences*, 9(6), 75-78. Retrieved from <https://www.nepjol.info/index.php/IJLS/login>
- Nwachukwu, M. U., Mba, H. C., Jiburum, U., & Okosun, A. E. (2013). Empirical analysis of fuel price and subsidy reform in Nigeria. *OPEC Energy Review*, 37(3), 314-326. doi:<https://doi.org/10.1111/opeec.12003>
- Pesaran, M. H., & Shin, Y. (1995). An autoregressive distributed lag modelling approach to cointegration analysis. 1-24. doi:<https://doi.org/10.1017/CCOL0521633230.011>
- Polbin, A. (2017). Econometric estimation of the impact of oil prices shock on the Russian economy in VECM model. *Voprosy ekonomiki*, 10(2). Retrieved from <https://ideas.repec.org/a/nos/voprec/2017-10-2.html>

- Schmitt-Grohé, S., & Uribe, M. (2018). How Important Are Terms-of-Trade Shocks? *International Economic Review*, 59(1), 85-111. doi:<https://doi.org/10.1111/iere.12263>
- Su, C.-W., Khan, K., Tao, R., & Nicoleta-Claudia, M. (2019). Does geopolitical risk strengthen or depress oil prices and financial liquidity? Evidence from Saudi Arabia. *Energy*, 187, 116003. doi:<https://doi.org/10.1016/j.energy.2019.116003>
- Suleiman, H., & Muhammad, Z. (2011). The real exchange rate of an oil exporting economy: Empirical evidence from Nigeria *FIW Working Paper, No. 72*. Retrieved from <https://www.econstor.eu/handle/10419/121075>
- Suleiman, M. (2013). Oil demand, oil prices, economic growth and the resource curse: An empirical analysis. University of Surrey (United Kingdom).
- Wei-Bin, Z. (2013). *International Trade Theory: Capital, Knowledge, Economic Structure, Money, and Prices over Time*. B: Springer-Verlag.
- Williams, A. (2011). Shining a Light on the Resource Curse: An Empirical Analysis of the Relationship Between Natural Resources, Transparency, and Economic Growth. *World Development*, 39(4), 490-505. doi:<https://doi.org/10.1016/j.worlddev.2010.08.015>