ORIGINAL ARTICLE

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Oil price and the economic activity in GCC countries: evidence from quantile regression

Abstract

Research background: The effects of oil price fluctuations on the macroeconomic performance in oil-importing and oil-exporting countries have stimulated considerable research activity. However, the debate is far from being closed.

Purpose of the article: This paper revisits the impact of crude oil price on economic activity in the Gulf Cooperation Council oil-exporting countries. The study covers a relatively long period spanning from 1960 to 2018.

Methods: The empirical investigation accounts for structural breaks, nonlinearity, and non-normal distribution of data. The Kapetanios (2005) structural breaks unit root test and Saikkonen–Lütkepohl (2000a, b, c) cointegration test with structural shifts are implemented to examine the stationary properties of data and the presence of cointegration between variables, respectively. Moreover, the quantile regression is employed to assess whether the impact of oil price on real GDP differs across different states of the economy.

Findings & Value added: Empirical results suggest the absence of long-run cointegrating relationships between oil price and GDP in all countries. The quantile regression reveals that oil price does not affect real GDP in the same way across countries and for different business cycle phases. More specifically, the symmetric quantile regression findings reveal that oil price exerts a positive

impact on GDP in all countries and that the effect is higher during the recession than expansion states. The asymmetric quantile regression shows that GDP reacts to positive oil price changes in all countries. However, only the Emirati and Omani GDPs are affected by negative oil price changes.

Introduction

During the last decades, the world oil market has been shaken by strong turbulences characterized by sharp oil price fluctuations. The most significant instability of oil price occurred during the oil shocks of 1973, 1979, 2008, and 2020, following the 2019–2020 coronavirus pandemic. For the first time in history, the West Texas Intermediate (WTI) futures crude oil price was traded with negative prices in April 2020, due to the exhaustion of the US storage capacity. The history of the world oil market suggests that there has been a close association between oil price fluctuations and macroeconomic performance. Indeed, oil shocks may induce economic instability in both oil-exporting and oil-importing countries. Even more, sharp oil price fluctuations may be responsible for the occurrence of economic and financial crises in some oil-dependent economies. The instability of international oil prices and its impact on macroeconomic performance have become an increasing challenge for economies since it may affect consumers, producers, and governments (Marimoutou *et al*., 2009). These stylized facts have sparked a considerable research effort dealing with the effects of oil price fluctuations on macroeconomic performance. Most empirical studies have debated the issue mentioned above in net oil-importing countries, specifically United States, Japan and the European Union (among others Hamilton, 2003; Zhang, 2008; Hanabusa, 2009; Das *et al*., 2018; Charfeddine *et al*., 2020; Dagoumas *et al*., 2020). However, a review of the existing literature shows that there have been relatively limited studies analyzing the oil price-economic performance relationship in oil-exporting countries (Iwayemi & Fowowe, 2011; Nusair, 2016; Nasir *et al*., 2019; Charfeddine & Barkat, 2020), which represents a critical gap in the existing literature.

This paper contributes to the current debate by revisiting the effects of oil price on economic growth in a sample of the Gulf Cooperation Council (hereafter GCC) oil-exporting countries. Studying the impact of oil price on economic growth in this group of countries is of great interest for several reasons. First, GCC oil-exporting countries are significant players in the world oil market. They produced together about 22134 thousand barrels per day in 2018, representing 23.4% of world oil production. The oil proved reserves of the same countries reached about 527.6 thousand million barrels

in 2018. It represents approximately 30.6% of world oil proved reserves (BP Statistical Review of World Energy June 2019). Second, oil and gas revenues are the primary sources of funding for public expenditure in GCC oil-exporting countries. Therefore, oil shocks can be transmitted into the real economy, mainly through fiscal policy. It would be crucial to investigate the response of economic activity to oil price fluctuations in this group of countries. Third, most GCC countries adopted various economic policies to promote the private sector, reduce oil and other natural resource dependence and, diversify their economies. It is, therefore, vital to examine the oil price-economic activity linkage. GCC oil-exporting countries are importers of capital goods from abroad. The oil price fluctuation may indirectly affect the dynamics of growth through its effects on import prices, mainly those of intermediate inputs and capital goods considered mandatory for the economy. Finally, despite the importance of the oil price-economic activity nexus in GCC economies, there have been relatively few studies focusing on the region. An exhaustive review of the literature reveals that most works on GCC countries focused on the effects of oil price on variables other than economic growth, especially stock markets (Arouri & Rault, 2012; Akoum *et al*., 2012; Jouini & Harrathi, 2014; Mokni & Youssef, 2019 to cite a few). In contrast, only a few works analyzed the impact of oil price on economic growth in GCC oil-exporting countries. Except for studies by Nusair (2016) and Nasir *et al*. (2019), GCC countries are often considered either individually (Alkhathlan, 2013 for Saudi Arabia, Charfeddine & Barkat, 2020 for Qatar) or included in a sample of countries (Mehrara (2008) for a sample of 13 oil-exporting countries including Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates, Moshiri and Banijashem (2012) for six OPEC countries including Kuwait and Saudi Arabia, Moshiri (2015) for a sample of developed and developing countries, including Kuwait and Saudi Arabia).

This paper empirically examines the oil price-economic activity linkage in five GCC oil-exporting countries, namely Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates between 1960 and 2018. Compared to previous studies on the subject, this research presents some new features. First, the proposed empirical approach is based on the quantile regression developed by Koenker and Bassett (1978). To the best of our knowledge, only Li (2013) and Mo *et al.* (2019) perform a quantile analysis of the impact of oil price on economic growth. The first study focuses on the United States, while the latter deals with BRICS countries. This paper is the first attempt that conducts a quantile regression analysis to examine the impact of oil price fluctuations on economic growth in GCC countries. Compared to standard OLS-based techniques, the quantile regression allows checking

the reaction of economic growth to oil price fluctuations for different conditional distributions of the dependent variable. Second, this study is concerned with investigating the asymmetric effects of oil prices on economic activity. This issue is crucial because the economic activity may react differently to positive and negative oil price changes.[1] Finally, the empirical investigation controls for structural breaks that may exist due to the use of a relatively long period. The paper employs the Kapetanios (2005) structural breaks unit root test to check the stationary properties of data, Saikkonen–Lütkepohl (2000a, 2000b, 2000c) cointegration test with structural shifts to investigate the presence of long-run relationships between oil price and economic activity and the Bai and Perron (1998, 2003) multiple breakpoint test to detect dates of breakpoint occurred in the world oil market.

The rest of this paper is structured as follows. The second section reviews the theoretical and empirical studies dealing with the impact of oil prices on economic activity. In the third section, we describe data and empirical methodology. The fourth section is reserved for the discussion of empirical results. Finally, the fifth section concludes the paper and suggests some policy recommendations.

Literature review

From a theoretical point of view, the impact of oil price fluctuations on economic growth in oil-importing countries has been widely debated, and many transmission channels have been identified (Barlet & Crussin, 2009; Gupta & Goyal, 2015). Studies on oil-importing countries confirm the presence of a negative impact of oil price on economic growth (Basnet & Upadhyaya, 2015). Indeed, the increase in oil prices induces production costs to rise and often leads to increased unemployment, high inflation, and weak economic growth. Little attention has been paid to the effects of oil price on economic growth in oil-exporting countries (Charfeddine & Barket, 2020). Moreover, prior studies on oil-exporting countries achieved mixed findings regarding the impact of oil price on economic growth (Hamdi & Sbia, 2013; Emami & Adibpour, 2012; Aleksandrova, 2016). On the one hand, the increase in the oil price has a positive effect on oil revenues and often results in budget surpluses. Governments of oil-exporting countries may use the accumulated petrodollars to stimulate investment and economic growth (El Anshasy & Bradley, 2012; Charfeddine & Barkat,

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[1] See Charfeddine and Barkat (2020) for an excellent review of sources of asymmetry in the oil price-economic activity relationship.

2020). On the other hand, the rise of oil price may increase the cost of intermediate inputs in oil-intensive industrial sectors, thereby leading to a collapse in these sectors. Furthermore, the increase in oil price induces the appreciation of the local currency, which reduces the cost of imported goods and raw materials and consequently increases imports of those goods, considered mandatory for investment and economic growth. Finally, another potential explanation of the detrimental impact of oil price increases on economic activity is the Dutch disease. According to this hypothesis, the rise of oil price generally leads to a change in the structure of the economy by making the economic activity more concentrated on the petroleum industry, which disadvantages the diversification of the economy (Ben-Salha *et al*., 2018). Consequently, the increase in oil price is considered an obstacle to the diversification of the economy and harms economic growth.

On the empirical side, there is relatively limited literature identifying the effect of oil prices on oil-exporting countries' economic growth. For example, Mehrara (2008) estimates a nonlinear model using annual data between 1965 and 2004 for a sample of 13 oil-exporting countries and concludes that negative oil shocks hinder economic growth. Using a vector auto-regressive (hereafter VAR) model, Farzanegan and Markwardt (2009) find a strong relationship between positive oil price changes and industrial production growth in Iran. Mendoza and Vera (2010) also conduct an empirical analysis of the asymmetric effects of oil price changes on production growth in Venezuela during the period 1984–2008. The econometric investigation suggests that the Venezuelan economy has been more sensitive to positive oil price changes than to negative changes. Ito (2012) employs a VAR model to examine the symmetric impact of oil price on real GDP, inflation, and real effective exchange rate in Russia during the period 1995:Q1–2009:Q3. The results show that a rise in oil price led to an increase in real GDP in the long-run, and vice versa. One drawback of Ito's (2012) study is that it assumes that the impact of oil price changes on GDP growth is symmetric. Elmezouar *et al*. (2014) carried out an empirical study covering the period 1982–2012. The cointegration and causality tests reveal that the increase in oil price positively affects real GDP in Algeria.

Some empirical studies have recently examined the effects of oil prices on economic growth in GCC countries. Moshiri and Banijashem (2012) employ a VAR model to study the relationship between oil price changes and economic growth in six OPEC countries, including Kuwait and Saudi Arabia, between 1979 and 2009. Findings show that oil price collapse reduces economic growth, while a rise in oil price has no significant impact. The econometric analysis stresses the importance of taking into account asymmetries in the relationship between the two variables. Moshiri (2015)

investigates the effects of oil price on economic growth in a sample of developed and developing oil-exporting countries, namely Algeria, Iran, Kuwait, Nigeria, Saudi Arabia, Venezuela, Canada, Norway, and the United Kingdom during the period 1970–2010. The study indicates that a fall in oil price harms economic growth, while a rise does not enhance economic growth. The analysis also shows that the heterogeneous reaction of economic growth to oil price in oil-exporting developing countries may be explained by differences in their institutional quality, particularly the efficiency of the government. Nusair (2016) checks the effect of oil price on GCC economies by considering asymmetries in the relationship between oil price and real GDP through the implementation of the nonlinear ARDL modelling. The author concludes that the increase in oil price leads to a rise in real GDP in all countries. Moreover, negative changes in oil price have adverse and significant effects on economic growth only for Kuwait and Qatar, suggesting that a fall in oil price induces a drop in their real GDP. The panel data analysis shows that positive changes in oil price increase real GDP and vice versa. Overall, the author concludes that positive changes in oil prices have a higher impact on real GDP than negative changes.

Using a structural VAR model for the period 1980–2016, Nasir *et al.* (2019) conclude the presence of significant heterogeneity in the reaction of GDP to oil shocks in GCC countries in terms of intensity, persistence, and duration. The authors confirm the existence of significant effects of oil shocks on GDP, inflation, and the trade balance. Furthermore, Alkhathlan (2013) employs the ARDL model and reports that oil revenues positively affect Saudi Arabia's GDP in the short-run. Jawadi and Ftiti (2019) study the impact of oil price changes on economic growth in Saudi Arabia during the period 1970–2016 using the nonlinear threshold effect models. The authors confirm the importance of the oil sector in the Saudi Arabia's economy. Recently, Charfeddine and Barkat (2020) examine the asymmetric short and long-run effects of oil price and oil and gas revenues on Qatar's real GDP based on the A–B structural VAR model and the nonlinear ARDL during the period 2000Q1–2018Q3. Results reveal that the impact of oil price on total real GDP and non-oil real GDP is asymmetric. Indeed, the effects of oil price decreases on real GDP are higher than those of oil price increases in the short-run. Furthermore, the effects disappear after three quarters from the shock occurrence. The presence of asymmetric effects has also been confirmed using the nonlinear ARDL modelling, which suggests that real GDP reaction to positive oil shocks is higher than to negative ones in the long-run.

To summarize, previous studies investigating the impact of oil price on economic growth in oil-exporting countries, particularly GCC, always

adopted VAR and cointegration analyses to check the short and long-run effects. Furthermore, previous studies have increasingly performed estimations of the asymmetric impact of oil price on economic growth. While the findings confirm the presence of asymmetric effects, mixed results regarding the sign and magnitude of the effects have been reached. Surprisingly, we note the absence of studies employing the quantile regression to investigate the impact of oil price on economic growth in GCC countries. This research aims to fill this gap by implementing a quantile analysis to examine the aforementioned issue in GCC economies.

Data and empirical specification

Data

The present study examines the effects of crude oil spot price on economic growth in Gulf Cooperation Council countries. Created in 1981, the council comprises six members, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Except for Bahrain, the other countries are considered as leading crude oil-producers and exporters. The five countries contribute together 22.135 million barrels daily in 2018, representing 23.4% of the world's total oil production. Moreover, Kuwait, Saudi Arabia, Qatar, and the United Arab Emirates have been members of the Organization of the Petroleum Exporting Countries since the 1960s.[2] On the contrary, Bahrain is considered as a crude oil-importing country. According to the Central Intelligence Agency's (2020) World Factbook, about 226,200 crude oil barrels are imported daily by the Bahraini economy, while its crude oil exports were null in 2015.[3] For these reasons, Bahrain is excluded from the sample, since our primary focus is on crude oil-exporting countries. The study covers the period ranging between 1960 and 2018. The data comes from two different sources. The real crude oil spot price is extracted from the BP Statistical Review of World Energy June 2019, while data on real GDP (in millions of 2018 US$) comes from The Conference Board Total Economy Database, April 2019.

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[2] Qatar terminated its membership in the Organization of the Petroleum Exporting Countries in January 2019.

[3] https://www.cia.gov/library/publications/the-world-factbook/geos/ba.html.

Empirical methodology

Given the relatively long period covered by the study, we rely on the Saikkonen–Lütkepohl (2000a, 2000b, 2000c) cointegration test with structural shifts. However, before checking the presence of long-run relationships, the stationary properties of variables should be examined since the cointegration test is performed only in the presence of I(1) variables. This paper relies on the Kapetanios (2005) unit root test that considers up to five unspecified structural breaks.

In the absence of long-run cointegrating relationships, the current study implements the quantile regression instead of the OLS estimator. The quantile regression is an extension of the traditional OLS estimation of the conditional mean to a combination of models for different conditional quantiles of the dependent variable. The quantile regression has many advantages compared to OLS-based techniques. Perhaps the most important of them is that it allows for examining the impact of the explanatory variable (real oil price) on the dependent variable (real GDP) for different levels (low, medium, high) of the dependent variable. The conditional quantile of y given x may be written as follows:

$$Q_\tau(y|x) = x'\beta_\tau \tag{1}$$

where $0 < \tau < 1$, $Q_\tau(y|x)$ represents the τth conditional quantile of the dependent variable y, while x is the independent variable. β_τ measures the impact of the independent variable x on the τth quantile of the conditional distribution of the dependent variable y. The estimation of the conditional quantile functions may be done by solving the following minimization problem:

$$\min_{\beta \in R^k}\left[\sum_{y_t \geq x_t\beta} \tau|y_t - x_t'\beta| + \sum_{y_t < x_t\beta}(1 - \tau)|y_t - x_t'\beta|\right] \tag{2}$$

By considering different values of parameter τ from 0 to 1, one may obtain the complete conditional distribution of y given x. When τ is close to 0 (1), $x_t'\beta$ characterizes the behaviour of y at the left (right) tail of the conditional distribution.

Results

Unit root and cointegration tests results

As a preliminary analysis of data, we perform Kapetanios (2005) multiple structural breaks unit root test for variables in levels and first differences. Results show that real oil price and real GDP of the five GCC oil-exporting countries are integrated of order one. Consequently, it is possible to check the presence of cointegration between real oil price and real GDP via the Saikkonen–Lütkepohl (2000a, 2000b, 2000c) cointegration with structural shifts test. Findings suggest no long-run relationship between real oil price and real GDP in GCC oil-exporting countries. Results of unit root and cointegration tests are reported in Tables 1 and 2.

Quantile regression results

As recommended by many authors, such as Albulescu *et al.* (2019), in the absence of a long-run cointegrating relationship between two or more variables, one may use their first differences to estimate the relationship between them. We expand this suggestion by going beyond estimating the conditional mean effect of real oil price on real GDP by using the quantile regression developed by Koenker and Bassett (1978). It is useful to mention that before implementing the quantile regression developed above, we run the Bai and Perron (1998, 2003) multiple breakpoint test to capture breakpoint dates in the world oil market. We then introduce dummy variables in the quantile regression to account for structural breaks. Results of the Bai and Perron (1998, 2003) test are reported in Table 3.

As shown, the findings suggest the significance of all five breakpoints at least at 10%. The oil price has been subject to five breakpoints since 1960, namely in 1974 (fall of price due to the Arab states Embargo and the reduction of world oil production by 7.5%), 1979 (rise of oil price due to the Iranian revolution and the reduction of world oil production by 7%), 1986 (fall of price due to the decision by some OPEC members to increase their share in the oil market, OPEC output increased by about 4 million barrels per day between mid-1985 and mid-1986), 2005 (rise of oil price due to the abundance of the $22-$28 price band for the OPEC basket of crude oil, weak dollar, Hurricane Katrina, rapid expansion of some Asian economies) and finally 2015 (fall of the oil price by about 70% due to the rising US shale oil production and fall of global oil demand). Given the Bai and Perron (1998, 2003) multiple breakpoint test results, five dummy variables are included in the quantile regression model. The symmetric and asymmetric

effects of oil price on real GDP are subsequently estimated using the quantile regression.

Symmetric effects of oil price on economic growth

The results of the symmetric impact of oil price on GDP are presented in Table 4. We also report the results of the OLS that is considered as benchmark model results.

The OLS estimator suggests that coefficients are positive and statistically significant in all countries, meaning that oil price and real GDP have gone hand in hand since 1960. The highest effects are found in Oman (1.152), while the lowest impact is reported for Kuwait (0.3610). These findings have been reached previously by Nasir *et al.* (2019), who conclude that the effects of oil shocks on economic growth are larger in Oman than in other GCC countries. The table also contains results of the different quantiles, namely the 10ht, 20th, 30th, 40th, 50th, 60th, 70th, 80th, and 90th. While coefficients associated with oil price are positive and statistically significant for all countries and quantiles, it is clear that the effects are heterogeneous when considering the magnitude and evolution of coefficients. Oil price does not affect real GDP in the same way across countries and for different levels of real GDP. In Oman, Saudi Arabia, and the United Arab Emirates, the findings suggest that the impact of oil price on economic growth generally has a decreasing trend when going from lower to higher quantiles.

The impact of oil price on economic growth is higher in periods of low real GDP. These results may be explained as follows. In periods of economic recession (lower quantiles), policymakers in oil-exporting countries may implement expansionary macroeconomic policies that aim to shift aggregate demand and influence the path of the economy. This situation is characterized by a rationalization of public spending and a focus on public and private investments. In these conditions, oil prices (and revenues from oil exports) represent the main revenues of oil-exporting countries and are used to get out from the recession state. In contrast, when the economy is recording good performance (higher quantiles), the impact of oil price on real GDP is always positive but is lower than its impact when the economy is in a recession state. The economy is less dependent on oil price, and the role of oil price and oil revenues during this state in less critical since the economy is well working. In this situation, many countries generally use a share of the accumulated petrodollars to create and invest in sovereign wealth funds (which is the case of many oil-exporting GCC countries). In Kuwait and Qatar, the impact of oil price fluctuations on real GDP is

somewhat different compared to other countries. In Qatar, results suggest that the impact of oil price on economic growth is positive for all quantiles, but with a slight increase when going from lower to higher quantiles. This means that oil price affects the Qatari economy in both recession and expansion states. However, the highest impact is recorded during expansion periods. For Kuwait, findings reveal that the coefficient is positive, and that the highest coefficient is found for the 50th quantile (median effect). Accordingly, oil price exerts its highest impact on real GDP during normal conditions. Figure 1 depicts the quantile regression coefficients for the considered countries.

Asymmetric effects of oil price on economic growth

While the previous analysis allows understanding the impact of oil price on the economic activity for different percentiles of the conditional distribution, it does not capture the asymmetric impact of oil price. In this section, we reexamine the impact of oil price on real GDP by accounting for the presence of potential asymmetric impact. To do so, we start by decomposing oil price into its positive cumulative sum of changes (Oil^+) and negative cumulative sum of changes (Oil^-), such as:

$$Oil^+ = \sum max (\Delta Oil, 0) \; ; \qquad Oil^- = \sum min (0, \Delta Oil) \qquad (3)$$

The effects of the two oil price components on real GDP are then jointly estimated.[4] The findings of the Saikkonen–Lütkepohl (2000a, b, c) cointegration test (reported in Table 5) suggest the absence of long-run asymmetric relationships between the two oil price components and real GDP. Accordingly, we proceed to the implementation of the quantile regression. Table 6 summarizes the findings of the OLS and quantile regression estimates. Moreover, Figure 2 draws coefficients obtained using the quantile regression with their 95% confidence intervals.

A look at the first column of Table 6 (OLS) reveals that positive oil price changes are associated with a rise of real GDP in all countries. The highest coefficient is observed in the United Arab Emirates (0.659), while the lowest is associated with Kuwait (0.120). On the other hand, coefficients of negative oil price changes are positive and statistically significant only in the United Arab Emirates (0.212), which means that only the Emirati economy is affected negatively by decreases of oil price. Another statement that may arise is that coefficients of positive oil price changes are

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[4] Results of Table 1 show that oil^+ and oil^- are stationary at the first difference.

higher than those of negative oil price changes. Our findings corroborate those of Nusair (2016), who employs the nonlinear ARDL and concludes that positive oil price changes affect real GDP in all GCC countries, while there is little evidence that oil price decreases lead to a fall of real GDP. Indeed, out of the five GCC countries considered in the analysis, the impact of negative oil price changes is statistically significant only in the United Arab Emirates. Although our findings represent a strong argument towards considering asymmetries, they are still driven by the mean effect of oil price on economic growth. For instance, the insignificant impact of negative oil price changes may be due to the fact that we are considering the mean effect of oil price on real GDP.

To overcome this issue, we estimate the quantile regression model and examine whether the asymmetric impact of oil price on real GDP varies across the different quantile conditional distributions of the dependent variable. The effects of the two oil price changes (Oil^+, Oil^-) on real GDP are jointly estimated for nine quantiles ranging from 0.1 to 0.9. First, findings confirm those previously reached, since the impact of positive oil price changes on economic growth is confirmed for all countries. In contrast, the negative oil price changes have significant effects only in Oman and the United Arab Emirates. Consequently, even when accounting for the dependent variable distribution, the results strongly confirm that oil price positively increases the impact real GDP in oil-exporting GCC countries. The fall of oil price negatively affects only the United Arab Emirates and Oman. These findings corroborate those reached by many previous studies on the oil price-economic activity relationship. For instance, Mendoza and Vera (2010) investigate the impact of oil shocks on economic growth in Venezuela. The authors conclude that oil shocks have an asymmetric effect on economic activity. The effect of oil price increases on output growth is higher than the effect of oil decreases. Secondly, regarding the impact of positive oil price changes on real GDP for different quantiles, the results are analogous to those obtained when estimating the symmetric effects. The impact of positive oil price changes on real GDP is higher during recession states than in expansion states in all countries, except Kuwait. In these countries, the impact of a rise in oil price on economic growth is higher during low real GDP periods.

Conclusions

The present paper revisits the effects of oil price on the economic activity in a sample of Gulf Cooperation Council countries during more than one-

half century, ranging between 1960 and 2018. The empirical analysis accounts for three main econometric issues that may characterize time series, namely structural breaks, asymmetry, and non-normal distribution of data. The Kapetanios (2005) structural breaks unit root test and Saikkonen–Lütkepohl (2000a, b, c) cointegration test with structural shifts are implemented to examine the stationary properties of data and the presence of cointegration. Moreover, the Bai and Perron (1998, 2003) multiple breakpoint test is implemented to detect dates of structural breaks in the oil market. Finally, the quantile regression is employed to assess whether the impact of oil price on real GDP varies across different states of the economy. This study is the first to estimate the effects of oil price on GCC economic growth based on the quantiles approach. Among others, this issue represents the main contribution of this research.

The empirical investigation begins by implementing Kapetanios (2005) unit root test. By controlling for five structural breaks, the test shows that oil price and real GDP of GCC countries are stationary at first differences. Given these results, we check the presence of a long-run relationship between oil price and real GDP based on the Saikkonen–Lütkepohl (2000) cointegration test with structural shifts. Findings reveal the absence of cointegration between oil price and real GDP in all countries. Accordingly, there is no evidence of the long-run effects of oil price on economic growth in GCC countries. These findings corroborate those of Berument *et al.* (2010), who conduct a country-by-country analysis of the impact of oil shocks on economic growth in a sample of MENA countries and conclude the absence of long-run cointegrating relationships. We then estimate symmetric and asymmetric quantile regression models. To account for structural breaks, we run the Bai and Perron (1998, 2003) multiple breakpoint test. Results of this test suggest the inclusion of five dummy variables in the quantile regression model. The symmetric quantile regression model indicates that oil price positively affects real GDP in all countries. Such results corroborate with many previous studies on the positive effects of oil price on economic growth in oil-exporting countries (Ito, 2012; El Anshasy & Bradley, 2012; Charfeddine & Barkat, 2020). The impact of oil price on economic growth generally has a decreasing trend when going from lower to higher quantiles. Such findings indicate that the highest impact of oil price is reported during recession states and decreases when real GDP grows more and more. Turning to the asymmetric impact of oil price, the quantile regression indicates that real GDP reacts only to positive oil price changes in Kuwait, Qatar, and Saudi Arabia, while in the United Arab Emirates and Oman, both increases and decreases of oil price affect real GDP. These findings are in line with those by Nusair (2016), who con-

cludes that real GDPs in all GCC countries are affected by positive oil shocks, while the effects of oil price decreases on economic growth are significant only in Kuwait and Qatar.

The findings of the current research may have important policy recommendations. Our analysis reveals the strong dependence of GCC economies on oil. To avoid the economic risk that may result from oil price fluctuations and the adverse effects on economic growth and well-being in these countries, GCC economies should diversify their economies by exploiting the accumulated oil revenues to stimulate investment and economic growth. The diversification may also be achieved by encouraging investments in sectors other than petroleum, such as mining and natural gas exploitation, financial services, real estate, and technology. These countries must also develop their private sector through the liberalization of strategic sectors that have been previously dominated by the state. This target may be reached through the adoption of several policies relaxing private investment and privatization. The GCC economies should also enhance their business climate by easing business start-up procedures.

Despite the importance of findings reached in this research, its main drawback is to concentrate only on the impact of oil price on economic growth as a measure of macroeconomic performance. It is also imperative to analyze the outcomes of oil price shocks on other economic variables, such as investment, inflation, current account, budget balance, and on social indicators, such as unemployment, wage inequality, poverty, and well-being. The abovementioned issues could be addressed in future studies.

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Annex

Table 1. Results of Kapetanios (2005) multiple structural breaks unit root test

	Test statistic	Dates of breakpoint
At levels		
gdp_kuw	-8.028*	1969/1979/1991/1998/2005
gdp_omn	-7.057	1967/1978/1985/2003/2011
gdp_qat	-5.035	1973/1980/1987/1996/2005
gdp_sar	-6.873	1972/1981/1989/1998/2009
gdp_uae	-7.454	1966/1973/1981/1988/2008
oil	-7.621	1973/1980/1987/1998/2011
oil$^+$	-7.569	1972/1979/1989/1998/2010
oil$^-$	-5.482	1971/1978/1985/1997/2005
At first differences		
gdp_kuw	-7.986**	1973/1984/1991/2002/2010
gdp_omn	-7.853**	1968/1978/1987/2000/2007
gdp_qat	-9.095***	1973/1980/1987/1998/2011
gdp_sar	-7.523*	1970/1981/1988/2002/2009
gdp_uae	-9.886***	1970/1981/1988/1999/2008
oil	-8.269***	1972/1980/1988/1998/2011
oil$^+$	-8.621***	1972/1979/1991/1998/2011
oil$^-$	-8.439***	1970/1981/1988/1998/2008

Notes: ***, ** and * denote the rejection of the null hypothesis at the 1, 5, and 10% levels.

Table 2. Results of Saikkonen–Lütkepohl (2000a, b, c) cointegration test – the symmetric model

Null hypothesis	*LR*	*p*-value	Critical values		
			1%	5%	10%
Kuwait					
None ($r = 0$)	6.69	0.698	19.71	15.76	13.88
At most 1 ($r \leq 1$)	0.71	0.868	9.73	6.79	5.47
Oman					
None ($r = 0$)	6.33	0.738	19.71	15.76	13.88
At most 1 ($r \leq 1$)	1.08	0.772	9.73	6.79	5.47
Qatar					
None ($r = 0$)	11.02	0.253	19.71	15.76	13.88
At most 1 ($r \leq 1$)	2.72	0.390	9.73	6.79	5.47
Saudi Arabia					
None ($r = 0$)	6.42	0.728	19.71	15.76	13.88
At most 1 ($r \leq 1$)	0.49	0.923	9.73	6.79	5.47

Table 2. Continued

Null hypothesis	*LR*	*p*-value	Critical values		
			1%	**5%**	**10%**
United Arab Emirates					
None ($r = 0$)	7.11	0.649	19.71	15.76	13.88
At most 1 ($r \leq 1$)	1.25	0.726	9.73	6.79	5.47

Notes: The table examines the presence of cointegration between real oil price and real GDP.

Table 3. Results of Bai-Perron (1998, 2003) multiple breakpoint test of L+1 vs. L sequentially determined breaks

	F-statistic	Critical values			Sequential break dates
		1%	**5%**	**10%**	
0 vs. 1	27.740***	13.00	9.10	7.42	1974
1 vs. 2	21.903****	14.51	10.55	9.05	2005
2 vs. 3	60.609***	15.44	11.36	9.97	1986
3 vs. 4	15.721**	15.73	12.35	10.49	2015
4 vs. 5	12.776*	16.39	12.97	10.91	1979

Notes: ***, ** and * denote the rejection of the null hypothesis at 1, 5, and 10% levels. Critical values are from Bai and Perron (2003).

Table 4. Quantile regression results – Symmetric effects of oil price

	OLS	10th	20th	30th	40th	50th	60th	70th	80th	90th
Kuwait	0.361***	0.244**	0.252*	0.327**	0.327**	0.532***	0.474***	0.482***	0.327***	0.278***
	(0.077)	(0.112)	(0.131)	(0.131)	(0.137)	(0.118)	(0.122)	(0.115)	(0.113)	(0.103)
Oman	1.152***	1.267***	1.342***	1.507***	1.113***	1.028***	1.027***	0.719***	0.514**	0.764***
	(0.169)	(0.314)	(0.361)	(0.349)	(0.302)	(0.279)	(0.262)	(0.242)	(0.233)	(0.197)
Qatar	0.796***	0.636***	0.638***	0.636***	0.827***	0.661***	0.790***	0.738***	0.870***	0.860***
	(0.111)	(0.140)	(0.157)	(0.174)	(0.172)	(0.168)	(0.192)	(0.190)	(0.212)	(0.191)
Saudi Arabia	0.879***	1.105***	0.982***	0.841***	0.852***	0.819***	0.790***	0.584***	0.500***	0.744***
	(0.098)	(0.162)	(0.184)	(0.187)	(0.166)	(0.164)	(0.160)	(0.164)	(0.150)	(0.138)
UAE	1.145***	1.223***	1.206***	1.138***	1.091***	1.074***	1.119***	0.919***	0.818***	0.934***
	(0.118)	(0.213)	(0.218)	(0.210)	(0.205)	(0.207)	(0.202)	(0.193)	(0.190)	(0.180)

Notes: The regression contains five dummy variables selected based on Bai and Perron (1998, 2003) multiple breakpoint test. ***, ** and * denote the statistical significance at 1, 5 and 10% levels.

Table 5. Results of Saikkonen–Lütkepohl (2000a, b, c) cointegration test – the asymmetric model

Null hypothesis	LR	*p*-value	Critical values		
			1%	5%	10%
Kuwait					
None ($r = 0$)	17.83	0.555	33.50	28.52	26.07
At most 1 ($r \leq 1$)	3.92	0.944	19.71	15.76	13.88
At most 2 ($r \leq 2$)	3.15	0.319	9.73	6.79	5.47
Oman					
None ($r = 0$)	21.32	0.306	33.50	28.52	26.07
At most 1 ($r \leq 1$)	5.69	0.806	19.71	15.76	13.88
At most 2 ($r \leq 2$)	1.43	0.677	9.73	6.79	5.47
Qatar					
None ($r = 0$)	14.13	0.821	33.50	28.52	26.07
At most 1 ($r \leq 1$)	4.66	0.897	19.71	15.76	13.88
At most 2 ($r \leq 2$)	2.10	0.514	9.73	6.79	5.47
Saudi Arabia					
None ($r = 0$)	14.47	0.801	33.50	28.52	26.07
At most 1 ($r \leq 1$)	6.36	0.735	19.71	15.76	13.88
At most 2 ($r \leq 2$)	0.54	0.911	9.73	6.79	5.47
United Arab Emirates					
None ($r = 0$)	17.56	0.575	33.50	28.52	26.07
At most 1 ($r \leq 1$)	7.83	0.566	19.71	15.76	13.88
At most 2 ($r \leq 2$)	0.97	0.801	9.73	6.79	5.47

Notes: The table reports results of the Saikkonen–Lütkepohl (2000a, b, c) cointegration test to check the presence of cointegration between the positive cumulative sum of changes (Oil^+), the negative cumulative sum of changes (Oil^-), and real GDP.

Table 6. Quantile regression results – asymmetric effects of oil price

	OLS	10th	20th	30th	40th	50th	60th	70th	80th	90th
Kuwait										
Oil^+	0.120*	0.146*	0.160**	0.189***	0.168**	0.235***	0.291***	0.227***	0.174**	0.078
	(0.068)	(0.074)	(0.071)	(0.070)	(0.079)	(0.079)	(0.081)	(0.082)	(0.086)	(0.118)
Oil^-	-0.100	-0.106	-0.125	-0.103	-0.107	-0.001	0.103	0.028	-0.027	-0.052
	(0.091)	(0.099)	(0.095)	(0.093)	(0.106)	(0.106)	(0.108)	(0.109)	(0.115)	(0.158)
Oman										
Oil^+	0.478***	0.827***	0.821***	0.550**	0.324***	0.229**	0.217**	0.233***	0.283***	0.368***
	(0.104)	(0.163)	(0.192)	(0.213)	(0.104)	(0.089)	(0.082)	(0.078)	(0.095)	(0.093)
Oil^-	-0.140	0.263	0.250	-0.027	-0.201	-0.306**	-0.350***	-0.333***	-0.328**	0.222*
	(0.139)	(0.218)	(0.256)	(0.285)	(0.139)	(0.119)	(0.110)	(0.104)	(0.126)	(0.124)

Table 6. Continued

	OLS	10th	20th	30th	40th	50th	60th	70th	80th	90th
Qatar										
Oil^+	0.450***	0.484***	0.537***	0.475***	0.611***	0.591***	0.430**	0.346*	0.277*	0.184
	(0.099)	(0.121)	(0.138)	(0.146)	(0.148)	(0.155)	(0.186)	(0.189)	(0.162)	(0.142)
Oil^-	0.133	0.258	0.296	0.132	0.303	0.299	0.112	-0.036	-0.103	-0.203
	(0.133)	(0.162)	(0.184)	(0.195)	(0.198)	(0.207)	(0.248)	(0.252)	(0.216)	(0.190)
Saudi Arabia										
Oil^+	0.491***	0.540***	0.447***	0.484***	0.477***	0.425***	0.411***	0.355***	0.342***	0.350***
	(0.062)	(0.134)	(0.127)	(0.089)	(0.077)	(0.072)	(0.064)	(0.055)	(0.079)	(0.068)
Oil^-	0.136	0.122	0.046	0.172	0.169	0.110	0.110	0.052	0.030	0.024
	(0.083)	(0.179)	(0.170)	(0.118)	(0.104)	(0.096)	(0.086)	(0.074)	(0.105)	(0.091)
United Arab Emirates										
Oil^+	0.659***	0.669**	0.734**	0.699***	0.626***	0.555***	0.615***	0.600***	0.557***	0.546***
	(0.065)	(0.170)	(0.179)	(0.106)	(0.085)	(0.084)	(0.085)	(0.077)	(0.069)	(0.056)
Oil^-	0.212**	0.160	0.313	0.278*	0.223*	0.136	0.215*	0.193*	0.146	0.136*
	(0.087)	(0.227)	(0.239)	(0.142)	(0.114)	(0.112)	(0.114)	(0.103)	(0.092)	(0.075)

Notes: The regression contains five dummy variables selected based on Bai and Perron (1998, 2003) multiple breakpoint test. ***, ** and * denote the statistical significance at 1, 5 and 10% levels.

Figure 1. The symmetric impact of oil price on economic growth across quantiles. The black line represents the dynamic trace of quantile regression coefficients with their 95% confidence interval (red lines).
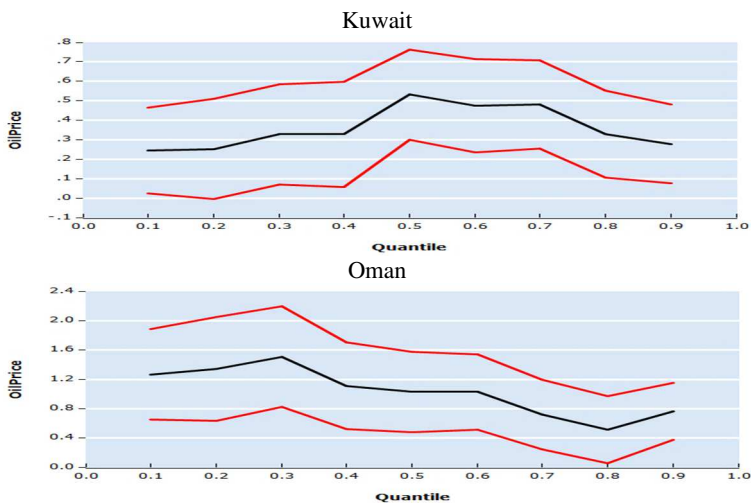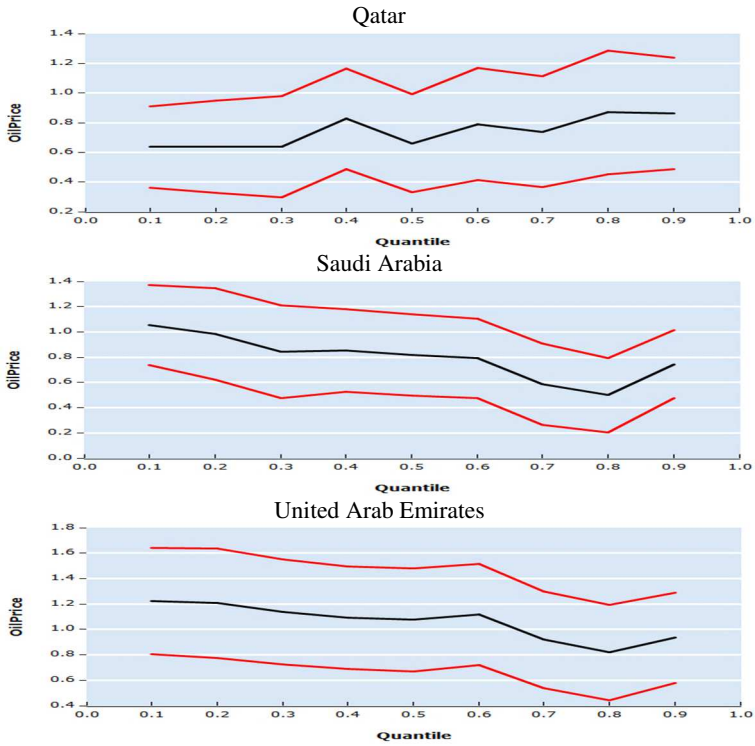
Figure 2. Continued

Figure 2. The asymmetric impact of oil price on economic growth across quantiles
(left column: positive changes of oil price/Right column: negative changes of oil
price). The black line represents the dynamic trace of quantile regression
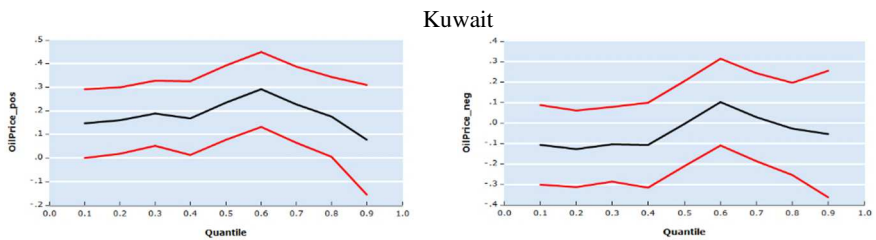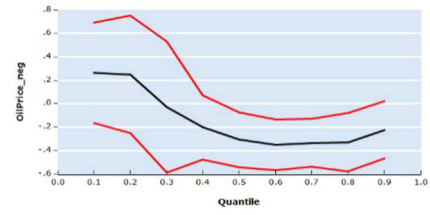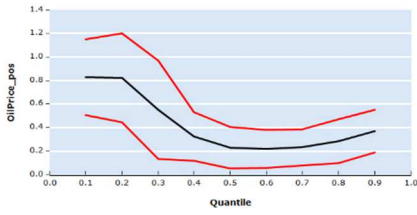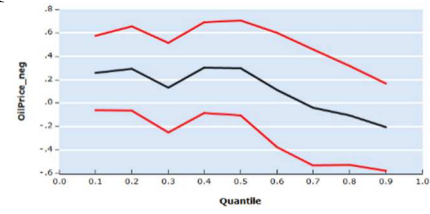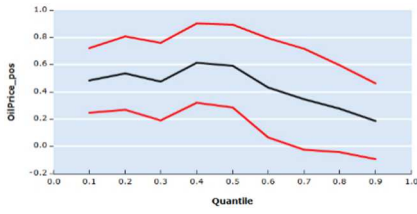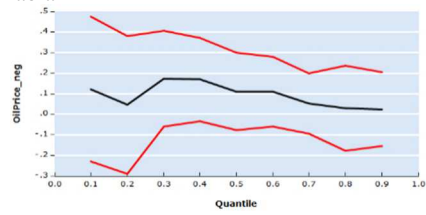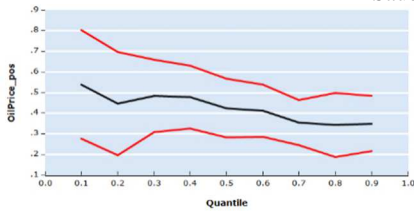coefficients with their 95% confidence interval (red lines).

Figure 2. Continued

Oman

Qatar

Saudi Arabia

United Arab Emirates