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Article

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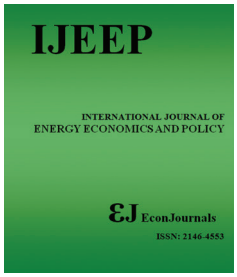

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Oil Price Volatility Shocks and the Macroeconomic Indicators: Evidence from Saudi Arabia

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ABSTRACT

This study investigates whether the positive and negative shocks in oil price volatility have an asymmetric effect on the volatility measures of the macroeconomic variables in the context of Saudi Arabia-a major oil exporting country in the region. The empirical results suggest that a positive shock in the oil price volatility tends to generate higher volatility in inflation, forex reserves, public spending and stock prices, whereas, a negative shock in the oil price volatility does not seem to have any significant impact on the volatility measures of most of these variables. The crucial inference that emerges from these findings is that the unfavourable events in the oil markets that cause higher volatility in oil prices seem to generate higher macroeconomic uncertainty. However, the favourable oil market events that are believed to reduce uncertainty, do not seem to have a stabilizing impact on the macroeconomic environment of the Saudi economy.

Keywords: Oil Price Volatility Shocks, Asymmetric Causality Test, Macroeconomic Uncertainty
JEL classification: E30, F41, Q43

1. INTRODUCTION

Oil price shocks are widely recognized as one of the main sources of volatility in crucial macroeconomic indicators such as inflation, output growth, and stock prices. This holds true not only for the economies that are net importers of oil but for the oil-exporting economies as well. In literature, a number of studies have demonstrated that there exists a positive association between the oil price and economic growth in the context of oil exporting countries {see e.g., Osintseva (2022)}. With reference to GCC economies, a number of studies such as Awartani et al. (2013) and Jouini et al. (2014) examined the impact of oil price shocks on stock markets and found that the oil price shocks have a significant positive impact on the stock markets of the region. However, while examining the impact of oil price uncertainty, Alqahtani et al. (2019) found that an increase in oil price uncertainty has a negative impact on the stock markets of the GCC region.

In the seminal work, Mork (1989) demonstrated that the positive and negative changes in oil price are expected to have an asymmetric impact on the various macroeconomic variables. Following this study, several other researchers have focused on analysing this asymmetric impact of oil price shocks on various macroeconomic variables in the context of oil exporting countries. For example, Mehrara (2008), using a nonlinear dynamic panel framework for thirteen oil-exporting countries, observed that negative shocks in oil prices have a substantial effect on output growth, however, the positive shocks seem to have less or no influence. Further, Moshiri (2015) while using data from six OPEC countries, observed that a decrease in oil price causes a reduction in revenues and economic stagnation, however, higher oil prices do not lead to sustained economic growth. Extending this literature, Hashmi et al. (2021), Fenech and Vosgha (2019), and Raheem et al. (2019) while examining the influence of oil price fluctuations on the stock price, found that the surge in oil prices does not seem to have a same effect as that of a fall in its price. In a recent study,

however, Al Refai et al. (2022) found that both positive and the negative oil price changes have significant and symmetric impact on the stock markets of the GCC economies. Contrary to this, a few studies, such as Hatemi (2012) found that neither positive nor negative oil price shocks seem to have any significant impact on the stock markets of these economies.

Most of the studies, in the existing literature, have primarily focussed on investigating the impact of variations in oil prices and have completely ignored to examine the effect of volatility shocks in oil prices on the volatility of various macroeconomic indicators. It is important to note that the greater concern with regard to oil has been the volatility generated by its price fluctuations and the manner with which it spills over to other crucial variables. It is widely believed that the frequent fluctuations in oil prices impede the ability of economic agents to make efficient production and allocative decisions and thereby, generate economic uncertainty that has serious implications for the macroeconomic stability of an economy (see e.g., Bourghelle et al. (2021), Aimer and Lusta (2021)). Oil price volatility (here after OPV), in particular, can often transmit to other crucial macroeconomic indicators such as inflation, output growth, and stock price and thereby cause higher economic uncertainty (Jouini and Harrathi (2014), Rafiq et al. (2009)). In this context, it is therefore more appropriate to link a measure of OPV, rather than changes in oil prices, with the volatility measures of other macro variables. Further, as discussed above, the crucial aspect of this relationship is that an increase and a decrease in the volatility of oil prices may not have a symmetric impact on the volatility of these macro variables as economic agents do not respond in a similar manner to a positive and a negative shock. Therefore, examining the impact of OPV in an asymmetric framework gains crucial importance as it will provide insights on whether the positive and negative shocks in OPV transmit in symmetric fashion to the volatility measures of the given macroeconomic indicators. In particular, from the policy perspective, it helps to understand whether the favourable events in the oil market that cause reduction in OPV and the unfavourable events that generate higher OPV have symmetric impact on the macroeconomic environment of the economy.

With this background, unlike previous studies, this study, while using GARCH volatility measures, examines the effect of positive and negative shocks in the OPV on the volatility of various macro variables. More specifically, the study focuses on investigating whether the negative and positive shocks in the OPV have symmetric impact on the volatility measures of the major macroeconomic variables by applying the asymmetric causality test proposed by Hatemi (2012), in the context of Saudi Arabia - a major oil exporting country in the region. The empirical results suggest that a rise in the volatility of oil prices tends to generate higher volatility in inflation, forex reserves, public spending and stock prices, whereas a decrease in OPV does not seem to have any impact on the volatility of most of these variables. The subsequent sections of the study are structured as follows: section 2 presents the methodology, section 3 elaborates on the data and findings, and section 4 presents concluding remarks.

2. ECONOMETRIC METHODOLOGY

The empirical investigation conducted in this study is carried out by using the asymmetric causality test proposed by Hatemi (2012) and Hatemi et al. (2016). Unlike the traditional Granger causality test, the main benefit of employing this methodology is that it enables us to distinguish the impact of positive OPV shocks from that of the negative shocks on the volatility measures of different macroeconomic variables. By following this approach, we can examine whether the favourable economic events (causing lower volatility in oil prices) and the unfavourable events (resulting in higher OPV) tend to have an asymmetric impact on the volatility of different macro variables. Further, this test employs bootstrap simulations with leverage adjustments which provide critical values that are more robust than the asymptotic ones. Therefore, this approach is more suitable when the underlying variables do not follow a normal distribution and their volatility changes over time.

Firstly, by using a simple GARCH model, we construct the volatility measures for monthly changes in oil prices (σ_t^O), forex reserves (σ_t^f), public investment (σ_t^I), stock prices (σ_t^S) and inflation (σ_t^π).[1] Next, we calculate the change in volatility measures of oil $\Delta\sigma_t^O (= \sigma_t^O - \sigma_{t-1}^O)$, forex reserves $\Delta\sigma_t^f \left(= \sigma_t^f - \sigma_{t-1}^f\right)$, inflation $\Delta\sigma_t^\pi \left(= \sigma_t^\pi - \sigma_{t-1}^\pi\right)$, public investment $\Delta\sigma_t^I \left(= \sigma_t^I - \sigma_{t-1}^I\right)$ and stock returns $\Delta\sigma_t^S \left(= \sigma_t^S - \sigma_{t-1}^S\right)$.

Following Hatemi-J (2012), the positive and the negative shocks in the volatility measure of a given variable *i* are defined as:

$$\Delta\sigma_t^{i+} = Max\left(\Delta\sigma_t^i, 0\right) \text{ and } \Delta\sigma_t^{i-} = Min\left(\Delta\sigma_t^i, 0\right),$$

For example, for OPV, the positive and negative shocks are derived as:

$$\Delta\sigma_t^{O+} = Max\left(\Delta\sigma_t^O, 0\right) \text{ and } \Delta\sigma_t^{O-} = Min\left(\Delta\sigma_t^O, 0\right)$$

Finally, for testing the asymmetric impact of positive and negative OPV shocks, we define the data vector of positive components as $x_t^+ = \left(\Delta\sigma_t^{i+}, \Delta\sigma_t^{O+}\right)$, where $\Delta\sigma_t^{i+}$ denotes the positive shocks to the volatility measure of a given macro variable *i.* Similarly, the vector of negative components is given by $x_t^- = (\Delta\sigma_t^{i-}, \Delta\sigma_t^{O-})$, where $\Delta\sigma_t^{i-}$ denotes the negative volatility shocks in a given macro variable *i*. In order to estimate the influence of positive oil volatility shocks on the positive components of a given macro variable *i,* the below given VAR (vector autoregressive) model of the order *p* is estimated while using the data vector $x_t^+ = (\Delta\sigma_t^{i+}, \Delta\sigma_t^{O+})$.

$$x_t^+ = v + A_1 x_{t-1}^+ + \ldots + A_p x_{t-p}^+ + \ldots + e_t^+ \quad (1)$$

where, x_t^+ represents 2 × 1 vector of variables, *v* denotes 2 × 1 vector of intercepts and e_t^+ denotes 2 × 1 vector of error terms. A_r denotes 2 × 2 matrix of coefficients for the lag order *r* (r =

1 The more details about GARCH specifications can be obtained from the authors.

1,…*p*) and the optimal lag structure is decided by following Hatemi (2012).

In the similar manner, to estimate the impact of negative OPV shocks on the negative components of a given macro variable *i*, the following VAR model of order *p* is estimated while using the data vector $x_t^- = (\Delta\sigma_t^{i-}, \Delta\sigma_t^{O-})$.

$$x_t^- = v + A_1 x_{t-1}^- + ... + A_p x_{t-p}^- + ... + e_t^- \quad (2)$$

Subsequently, the null hypothesis that the row *k*, column *j* element in $A_r = 0$, for $r = 1,...p$, is tested using the Wald Statistic, and the bootstrap critical values which are simulated for different levels of significance.[2]

3. DATA AND EMPIRICAL RESULTS

For oil prices, we use the monthly statistics on Western Texas Intermediate obtained from the Energy Information Administration (www.eia.gov). The data on CPI inflation, public spending and foreign reserves is obtained from the Saudi Central Bank (www.sama.gov.sa). Similar, the data on the stock price index is obtained from Tadawul Saudi Stock Exchange (www.saudiexchange.sa). The sample period ranges from January 2011 to December 2022. The descriptive statistics for the variables are present in the Table 1.

Following the procedure discussed in section 2, we estimate equation 1 and 2 while considering the respective positive and negative components of all the macro variable.[3] The results are presented in Table 2. It is clearly evident that the null hypothesis of no causality is rejected at the 5% level of significance in case of all the specifications of positive components. The results indicate that an increase in the volatility of oil prices $(\Delta\sigma_t^{O+})$ tend to cause an increase in the volatility of inflation $(\Delta\sigma_t^{\pi+})$, forex reserves $(\Delta\sigma_t^{f+})$, public spending $(\Delta\sigma_t^{I+})$ and the stock prices $(\Delta\sigma_t^{S+})$. On the other hand, except for the volatility of forex reserves $(\Delta\sigma_t^{f-})$, in all other specifications of the negative components, the null hypothesis of no causality cannot be rejected at the conventional level of significance; thereby, implying that a decrease in OPV $(\Delta\sigma_t^{O-})$ does not seem to cause any reduction in the volatility measures of most of these macro variables $(\Delta\sigma_t^{\pi-}, \Delta\sigma_t^{I-}, \Delta\sigma_t^{S-})$. In case of forex reserve, it appears that a positive shock in OPV causes higher volatility in forex reserves and a negative shock leads to a decrease in its volatility.

It is evident from these findings that a positive shock in the volatility of oil prices easily transmits to the different macro variables, however, a negative shock in the oil volatility does not seem to have any favourable impact on the macroeconomic environment of the economy. These findings underline the fact that the unfavourable events in oil markets, such as geopolitical disruptions as specified by Pan et al. (2023), lead to higher macroeconomic uncertainty and thereby, highlight the Saudi economy's vulnerability to such events. Further, these findings are crucial as they provide insights on the extent to which the Saudi economy is immune to the negative volatility shocks originating from the oil price fluctuations.

2 To simulate the bootstrap critical values, we use the GAUSS Code made available by Hacker and Hatemi J. (2010).

3 Prior to estimation, we conducted a comprehensive analysis of the time series properties of all the variables by employing conventional unit root tests. These results can be obtained from the authors.

Table 1: Descriptive statistics

Variables	Mean	Median	Standard Deviation	Maximum	Minimum	Skewness
Oil Price	4.16	4.13	0.36	4.70	2.81	-0.49
Inflation	5.02	5.05	0.06	5.08	4.88	-0.84
Public Spending	14.16	14.1	0.21	14.55	13.8	0.50
Foreign Reserve	11.7	11.8	0.36	12.31	10.3	-1.15
Stock Price Index	8.96	8.95	0.17	9.37	8.63	0.48

Table 2: Asymmetric causality test

Null hypothesis	Test value	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%
$\Delta\sigma_t^{O+} \nRightarrow \Delta\sigma_t^{\pi+}$	8.07*	13.4	7.49	5.00
$\Delta\sigma_t^{O+} \nRightarrow \Delta\sigma_t^{f+}$	22.9*	24.0	10.8	7.03
$\Delta\sigma_t^{O+} \nRightarrow \Delta\sigma_t^{I+}$	19.0*	27.7	9.03	4.53
$\Delta\sigma_t^{O+} \nRightarrow \Delta\sigma_t^{S+}$	7.57*	20.3	6.11	2.92
$\Delta\sigma_t^{O-} \nRightarrow \Delta\sigma_t^{\pi-}$	7.60	35.7	15.8	9.12
$\Delta\sigma_t^{O-} \nRightarrow \Delta\sigma_t^{f-}$	15.1*	22.9	12.2	9.41
$\Delta\sigma_t^{O-} \nRightarrow \Delta\sigma_t^{I-}$	9.32	23.6	11.9	7.06
$\Delta\sigma_t^{O-} \nRightarrow \Delta\sigma_t^{S-}$	0.06	10.3	3.95	2.47

*Denotes the significance at 5% level. The notation $\Delta\sigma_t^{O} \nRightarrow \Delta\sigma_t^{i}$ implies that variable $\Delta\sigma_t^{O}$ does not cause variable $\Delta\sigma_t^{i}$.

The crucial inferences that emerges from these findings is that the unfavourable events in the oil markets that cause higher volatility in oil prices seem to generate higher macroeconomic uncertainty. However, the favourable events that are believed to reduce uncertainty, do not seem to have any significant stabilizing impact on the macro environment of the Saudi economy. The findings suggest that policymakers should consider the asymmetric nature of the transmission mechanism with respect to such volatility shocks while choosing the policy decisions. Further, in line with previous studies, such as Hasanov and Razek (2023) and Gunwant and Rather (2021), these findings highlight the fact that despite implementing several economic reforms, the Saudi economy continues to be characterized by lower degrees of competitiveness and higher levels of market imperfections.

4. CONCLUSION

Unlike the previous studies that examine the impact of oil price changes on various other variables, this study investigates the impact of OPV shocks on the volatility measure of various macro variables in the context of a major oil exporting country. In particular, we examine the impact of positive and negative OPV shocks on the volatility measures of different macroeconomic variables in the context of Saudi Arabia. The findings suggest that an increase in the OPV tends to generate higher volatility in inflation, forex reserves, public spending and stock prices, whereas a decrease in oil volatility does not seem to have any impact on the volatility measures of most of these variables. These findings underline the fact that the positive shocks to the volatility of oil prices generate higher volatility in different macroeconomic indicators, whereas a negative shock in the OPV does not seem to have any favourable impact on the macroeconomic environment of the economy.

The crucial inferences that emerge from these findings is that the unfavourable events in the oil markets that cause higher volatility in oil prices seem to generate higher macroeconomic uncertainty. However, the favourable events that are believed to reduce the uncertainty, do not seem to have any significant stabilizing impact on the economic environment of Saudi economy. The findings suggest that policymakers should consider the asymmetric transmission of such volatility shocks while choosing the policy decisions.

REFERENCES

Alqahtani, A., Klein, T., Khalid, A. (2019), The impact of oil price uncertainty on GCC stock markets. Resources Policy, 64, 101526.

Al Refai, H., Zeitun, R., Eissa, M.A.A. (2022), Impact of global health crisis and oil price shocks on stock markets in the GCC. Finance Research Letters, 45, 102130.

Aimer, N., Lusta, A. (2021), The asymmetric impact of oil price shocks on economic uncertainty: Evidence from the asymmetric NARDL model. OPEC Energy Review, 45(4), 393-413.

Awartani, B., Maghyereh A.I. (2013), Dynamic spillovers between oil and stock markets in the Gulf Cooperation Council countries. Energy Economics, 36, 28-42.

Bourghelle, D., Jawadi, F., Rozin, P. (2021), Oil price volatility in the context of Covid-19. International Economics, 167, 39-49.

Fenech, J.P., Vosgha, H. (2019), Oil price and Gulf Corporation Council stock indices: New evidence from time-varying copula models. Economic Modelling, 77, 81-91.

Gunwant, D.F., Rather, S.R. (2021), Transmission of world price shocks-evidence from GCC countries. The Journal of Economic Asymmetries, 24, 200-207.

Hacker, R.S., Hatemi-J, A. (2010), HHcte: GAUSS Module to Apply a Bootstrap Test for Causality with Endogenous Lag Order. Statistical Software Components No. G00012. Boston College Department of Economics.

Hasanov, F.J., Razek, N. (2023), Oil and non-oil determinants of Saudi Arabia's international competitiveness: Historical analysis and policy simulations. Sustainability, 15(11), 9011.

Hashmi, S.M., Chang, B.H., Bhutto, N.A. (2021), Asymmetric effect of oil prices on stock market prices: New evidence from oil-exporting and oil-importing countries. Resources Policy, 70, 101946.

Hatemi, J.A. (2012), Asymmetric causality tests with an application. Empirical Economics, 43(1), 447-456.

Hatemi-J, A., El-Khatib, Y. (2016), An extension of the asymmetric causality tests for dealing with deterministic trend components. Applied Economics, 48(42), 4033-4041.

Jouini, J., Harrathi, N. (2014), Revisiting the shock and volatility transmissions among GCC stock and oil markets: A further investigation. Economic Modelling, 38(2), 486-494.

Mehrara, M. (2008), The asymmetric relationship between oil revenues and economic activities: The case of oil-exporting countries. Energy Policy, 36(3), 1164-1168.

Mork, K.A. (1989), Oil and the macroeconomy when prices go up and down: An extension of hamilton's results. Journal of Political Economy, 97(3), 740–744.

Moshiri, S. (2015), Asymmetric effects of oil price shocks in oil-exporting countries: The role of institutions. OPEC Energy Review, 39(2), 222-246.

Osintseva, M.A. (2022), Influence of oil factor on economic growth in oil-exporting countries. International Journal of Energy Economics and Policy, 12(1), 217-224.

Pan, Z., Huang, X., Liu, L., Huang, J. (2023), Geopolitical uncertainty and crude oil volatility: Evidence from oil-importing and oil-exporting countries. Finance Research Letters, 52, 103565.

Rafiq, S., Salim, R., Bloch, H. (2009), Impact of crude oil price volatility on economic activities: An empirical investigation in the Thai economy. Resources Policy, 34(3), 121-132.

Raheem, I.D., Olabisi, N.O. (2019), What is new? The role of asymmetry and breaks in oil price-output growth volatility nexus. OPEC Energy Review, 43(1), 67-91.