

The Dynamic Impacts of Oil Price Shocks on Turkey's Economic Growth

Atilla Gökçe

Gazi University, Ankara, Turkey

Tel.: +903122161307 E-mail: atilla@gazi.edu.tr

Abstract

This study mainly aims at investigating the dynamic effects of a structural crude oil volatility shock on real economic growth for Turkish economy. To estimate the volatility, exponential GARCH(p,q) model was used and to estimate the dynamic structural relationships between oil price volatility and economic growth, structural VAR model was used. Empirical results suggest that the long-run response of accumulated economic growth to a structural shock in real crude oil price volatility is -0.0164 points. This means that quarterly economic growth decreases by 0.0164 points and this finding is of strong statistical significance.

Keywords: EGARCH, SVAR, oil price volatility

1. Introduction

In today's economic world, especially over the last decade, many countries have been facing with a variety of problems such as geopolitical issues, continuing excessive speculations in oil markets, financial and banking fragility, and inefficient economic recovery despite the extraordinary fiscal and monetary policies, persistent high unemployment and social unrest. One of the greatest problems that the global oil market has confronted with is economic uncertainty that surrounds the global economy. Risk perception in oil markets has increased due to insufficient economic growth rates triggered by Euro-zone debt crisis, current account deficits and economic/political fragility. The increase in risk perception paved the way for high oil price volatility. Increases in volatility have dynamic effects especially on the economic growth of oil-importing developing countries. Because rising volatility causes delays in investment decisions, it has negative effects on outputs and economic growth of specifically developing countries.

Oil price volatility is also a significant determinant of commodity prices and thereby relevant financial markets. The behavior of volatility becomes an important component for derivative valuation and hedging decisions. Because volatility can affect the marginal cost of production, it has immense impact on operating options and thus on the opportunity costs (Pindyck 2004). High volatility of crude oil prices leads to economic instability in exporting and importing countries of oil.

The volatility in oil prices affects economic magnitudes through transmission mechanisms. The rising trend of oil prices eventually leads to increases in price level causing reduction in real money balances held by households and firms. The decline in real money balances affects aggregate demand in the same direction. The inelasticity of oil demand to its price generates an income transfer from oil importing countries to oil exporting countries. This mechanism has a feature that the effects of oil price shocks are symmetric, which means that positive price shocks reduce economic growth while negative shocks lead to an economic growth. (Elder & Serletis 2010).

For instance, central banks do not pursue expansionary policies in case of price declines but do imply tightening policies during price increases. In general, these policies of central banks may lead to an asymmetric prediction between oil price changes and output. Sectorial shocks and uncertainty would increase volatility and fluctuations.

As can been seen in the literature review in this study, most of the empirical studies on the macroeconomic consequences of oil price shocks or volatility have focused on the industrialized countries. This paper, however, assesses empirically the dynamic effects of real crude oil price volatility shocks on the real GDP growth of Turkey, an emerging market economy. The main aim of this study is to investigate the dynamic effects of a structural crude oil volatility shock on real economic growth in Turkey, which is a net oil-importing economy. Exponential GARCH (EGARCH) model is used to estimate the volatility, and structural VAR model for the dynamic structural relationships between oil price volatility and economic growth.

2. Literature

The introduction of the linear negative relationship between oil prices and real economic activity through empirical studies in the mid-1980's gave rise to many other studies on this subject. (Rasche & Tatom 1981), (Hamilton 1983) and (Gisser & Goodwin 1986)'s studies on US economy; (Darby 1982) and (Burbidge & Harrison 1984)'s studies on Japan, Germany, UK, Canada, France, Italy, and Netherlands economies are examples of these studies. Since the decrease in oil prices had small positive effect on real economic activity through the end of the 1980's, the models focused on the asymmetric effect specifications. (Mork 1989), (Lee et al. 1995) and (Hamilton 1996)'s studies are the first examples of these studies. In their studies, non-linear transformations of oil prices for asymmetric specification and Granger causality test are used to verify the opposite moves between oil prices and economic downturns. Among other notable studies conducted using a non-linear relationship between variables, (Hamilton 2003) and (Jiménez-Rodríguez 2002)'s studies can be mentioned. In their studies, they found a non-linear relationship between GDP and oil prices for the US economy.

Studies on modeling oil price volatility and the effects of volatility on economic activity show differences based on the methodology from the above mentioned studies. Some notable studies on these topics are (Ferderer 1996), (Rodríguez & Sánchez 2004), (Hwang et al. 2004), (Guo & Kliesen 2005), (Sadorsky 2006), (Narayan & Narayan 2007), (Rafiq et al. 2009), (Elder & Serletis 2009 and 2010), and (Kilian 2010).

(Rodríguez & Sánchez 2004) examined the effects of oil price shocks for G-7 countries, using multivariate VAR approach on linear and non-linear models. Oil price volatility was found by using GARCH(1,1) model. Two oil-exporting countries, UK and Norway, were added to the data set. The results show that there is evidence of a non-linear impact of oil prices on real GDP growth in both oil importing and exporting countries. (Hwang et al. 2004)'s study examines, using monthly data, the volatility of crude oil prices by first determining the potential maximal price that OPEC can extract based on the microeconomic foundation of the elasticity theory proposed by (Greenhut et al. 1974). In this paper, demand structures and price elasticity of demand are taken into consideration. The price elasticity of demand provides a partial explanation for the pricing behavior of OPEC. The estimation of the price elasticity of demand reveals information on the oil price volatility. Moreover, the paper examines the relationship between oil price volatility and industrial production or the relationship between oil price volatility and stock market for Germany, Italy, Canada, Japan, USA, and UK to demonstrate how oil price movements are important on the overall economy. In (Sadorsky 2006)'s study, TGARCH model is used to find heating oil and natural gas volatility and GARCH model is used to find crude oil and unleaded gasoline volatility. Using various statistical models, daily volatility in petroleum futures price returns is forecasted.

(Narayan & Narayan 2007) examined the volatility of crude oil price using daily data for the period 1991–2006. In this study, EGARCH model is used to find volatility. Their main innovation is volatility in various sub-samples in order to judge the robustness of results. (Rafiq et al. 2009)'s study empirically examines the effect of oil price realized volatility on some main macroeconomic indicators of Thailand. In the study, the effect of the oil price volatility is investigated using the VAR model. Findings show that oil price volatility has significant effect on unemployment and investment. (Elder & Serletis 2009 and 2010) studies, using monthly Canada data in 2009, and quarterly US data in 2010 examined the relationship between the price of oil and investment, paying attention the role of uncertainty of crude oil prices. Their model is based on a structural VAR that is modified to preserve GARCH-in-mean errors. The findings of the study indicate that volatility in oil prices has had negative effect on several measures of investment, durable consumption goods, and aggregate output. The study also emphasizes that the oil price volatility has a tendency to react in a way that it accelerates the negative dynamic response of economic activity to negative price shocks as well as it dampens its response to positive shocks.

There is no yet any publication studying the relationship between oil price volatility and economic growth for Turkish economy; however, there are limited numbers of studies which have examined the effects of changes in oil prices on macroeconomic variables.

(Kibritcioglu & Kibritcioglu 1999) examined the effects of imported crude oil price changes on inflation, using unrestricted VAR model with monthly data. Also, they examined how much of a rise in sectorial and general prices would depend on the rises in oil product prices with 1979, 1985 and 1990 input-output tables. In (Berument & Tasci 2002)'s study, using the 1990 input–output table, the inflationary effects of crude oil prices were investigated for Turkey. It is found in the study that under fixed nominal wages, profits, interests and rent earnings, the effect of rising prices of oil on inflation is limited. However, when returns to the production factors are adjusted to the overall price level, the inflationary effect of oil prices becomes significant. (Demirbas et al. 2009) found that world oil prices and current account deficits were cointegrated and that they moved in the same direction, using Engle-Granger error-correction model with annual data. (Ozlale & Pekkurnaz 2010) examined the net effect of oil price shocks on current account balances for Turkish economy, using structural VAR approach with output gap and exchange rate misalignment as controlled variables. Findings of their study suggest that oil price shocks increased the current account deficit in the first three month-period and then, this effect gradually declined and completely disappeared 10 periods later. In the short run, there found to be a statistically significant relationship between the two variables. This suggests that, even if the other factors are controlled, oil prices are a significant determinant of Turkish current account deficit. (Oksuzler & Ipek 2011) investigated the causal effects of world oil price changes on inflation and growth in Turkey. Granger causality analysis obtained from VAR model confirmed a unidirectional causality from oil prices to economic growth; however, no significant causal relationship between oil prices and inflation was found.

3. Real Oil Price Volatility

In the literature, various methods have been used to estimate real oil price volatility, but in this paper, the most popular conditional heteroscedastic models have been preferred. Several conditional heteroscedastic models have been tried and Nelson's (1991) exponential GARCH (EGARCH) model has provided better fit to the data. The conditional variance equation for EGARCH(p,q) model for real crude oil prices is given in equation (1). EGARCH model has certain advantages. EGARCH model has some advantages: First of all, the restrictions imposed on GARCH model are not necessary for EGARCH model, which means there is no need to impose restrictions on EGARCH model. The parameters of EGARCH model can be interpreted as the following. For instance, the coefficient α gives the magnitude of the conditional shock on the conditional variance. The coefficient β can take negative or positive values since its conditional variance can show oscillatory behavior. It is also observed that the β coefficients give information whether the response of the variance to the shocks is permanent or not. The γ_k coefficients are used to find the asymmetric volatility. If $\gamma_k > 0$, the positive shocks increases volatility greater than the negative shocks do whereas the negative shocks reduces volatility greater than the positive shocks do where $\gamma_k < 0$.

$$\log h_t = \omega + \sum_{i=1}^{p} \alpha_i \frac{|\varepsilon_{t-i}|}{h_{t-i}^{0.5}} + \sum_{j=1}^{q} \beta_j \log h_{t-j} + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{h_{t-k}^{0.5}} \quad (1)$$

4. Structural VAR Model

SVAR approach has been employed to interpret business cycle fluctuations and decompose the dynamic effects of fluctuations on economic policies and frequently used in the last decade. This approach gives quantitative outcome of dynamic effects of the structural shocks ascribed to the underlying variables. That the SVAR approach imposes restrictions on the reduced forms makes it an appealing approach.

This paper aims at investigating the dynamic relationship between the conditional volatility ($cvoil_t$) of real crude oil prices and real GDP growth (r_t). To that end, a covariance stationary bivariate dynamic simultaneous equations model can be written as the following[4], where ε_{it} is $i.i.d$ with zero mean and variance σ_i^2.

$$\begin{aligned} cvoil_t &= \gamma_{10} - b_{12} r_t + \gamma_{11} cvoil_{t-1} + \gamma_{12} r_{t-1} + \varepsilon_{1t} \\ r_t &= \gamma_{20} - b_{21} cvoil_t + \gamma_{21} cvoil_{t-1} + \gamma_{22} r_{t-1} + \varepsilon_{2t} \end{aligned} \quad (2)$$

The model (2) is called a structural VAR (SVAR) since it is assumed to be derived by some underlying economic theory. The exogenous error terms ε_{1t} and ε_{2t} are independent and are interpreted as structural innovations. Realizations of ε_{1t} are interpreted as capturing unexpected shocks to petrol price volatility that are uncorrelated with ε_{2t}, the unexpected shocks to the growth. In model (2), the endogeneity of $cvoil_t$ and r_t is determined by the values of b_{12} and b_{21}.

Model (2) in matrix form

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} cvoil_t \\ r_t \end{bmatrix} = \begin{bmatrix} \gamma_{10} \\ \gamma_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix},$$

which can be summarized as

$$\mathbf{B}\mathbf{y}_t = \boldsymbol{\gamma}_0 + \boldsymbol{\Gamma}_1 \mathbf{y}_{t-1} + \boldsymbol{\varepsilon}_t . \quad (3)$$

We should note that here $E\left[\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_t'\right] = \mathbf{D}$ and $\mathbf{D}$ is a diagonal matrix with elements σ_1^2 and σ_2^2. SVAR can be rewritten by a different notation

$$\begin{aligned} \mathbf{B}(L)\mathbf{y}_t &= \boldsymbol{\gamma}_0 + \boldsymbol{\varepsilon}_t \\ \mathbf{B}(L) &= \mathbf{B} - \boldsymbol{\Gamma}_1 L. \end{aligned} \quad (4)$$

The reduced form of the SVAR can be written as

[4] To adhere uniformity of notation, (Zivot 2000) is mostly referred.

$$\begin{aligned} \mathbf{y_t} &= \mathbf{B}^{-1}\boldsymbol{\gamma}_0 + \mathbf{B}^{-1}\boldsymbol{\Gamma}_1\mathbf{y_{t-1}} + \mathbf{B}^{-1}\boldsymbol{\varepsilon}_t \\ \mathbf{y_t} &= \mathbf{a}_0 + \mathbf{A}_1\mathbf{y_{t-1}} + \mathbf{u_t}. \end{aligned} \tag{5}$$

Wold representation of the reduced form is found by multiplying both sides of (5) by $\mathbf{A}(L)^{-1} = (\mathbf{I}_2 - \mathbf{A}_1 L)^{-1}$ to give

$$\mathbf{y_t} = \boldsymbol{\mu} + \boldsymbol{\psi}(L)\mathbf{u_t} \tag{6}$$

where $\boldsymbol{\psi}(L) = (\mathbf{I}_2 - \mathbf{A}_1 L)^{-1}$ and $\boldsymbol{\mu} = (\mathbf{I}_2 - \mathbf{A}_1)^{-1}\mathbf{a}_0$.

The structural moving average (SMA) representation of $\mathbf{y_t}$ is based on an infinite moving average of the structural innovations $\boldsymbol{\varepsilon}_t$. Substituting $\mathbf{u_t} = \mathbf{B}^{-1}\boldsymbol{\varepsilon}_t$ into (7) gives

$$\begin{aligned} \mathbf{y_t} &= \boldsymbol{\mu} + \boldsymbol{\psi}(L)\mathbf{B}^{-1}\boldsymbol{\varepsilon}_t \\ \mathbf{y_t} &= \boldsymbol{\mu} + \mathbf{B}^{-1} + \boldsymbol{\psi}_1\mathbf{B}^{-1}L + \cdots \\ \mathbf{y_t} &= \boldsymbol{\mu} + \boldsymbol{\Theta}(L)\boldsymbol{\varepsilon}_t. \end{aligned} \tag{7}$$

SMA representation for the bivariate system can be given more explicitly

$$\begin{bmatrix} cvoil_t \\ r_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix} = \begin{bmatrix} \theta_{11}^{(0)} & \theta_{12}^{(0)} \\ \theta_{21}^{(0)} & \theta_{22}^{(0)} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} + \begin{bmatrix} \theta_{11}^{(1)} & \theta_{12}^{(1)} \\ \theta_{21}^{(1)} & \theta_{22}^{(1)} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t-1} \\ \varepsilon_{2t-1} \end{bmatrix} + \cdots \tag{8}$$

where $\theta_{ij}^{(k)}$ gives the dynamic multipliers or impulse responses of $cvoil_t$ and r_t to changes in ε_{1t} and ε_{2t}.

For impulse-response functions of SVAR model, SMA representation (8) is used. The long-run accumulated impact of the structural shocks is captured by the long-run impact matrix

$$\boldsymbol{\Theta}(L) = \begin{bmatrix} \theta_{11}(L) & \theta_{12}(L) \\ \theta_{21}(L) & \theta_{22}(L) \end{bmatrix} = \begin{bmatrix} \sum_{s=0}^{\infty}\theta_{11}^{(s)}L^s & \sum_{s=0}^{\infty}\theta_{12}^{(s)}L^s \\ \sum_{s=0}^{\infty}\theta_{21}^{(s)}L^s & \sum_{s=0}^{\infty}\theta_{22}^{(s)}L^s \end{bmatrix}. \tag{9}$$

SVAR model imposes some restrictions on the system employing the economic theory for the structural shock to remain. Here, the long-term restrictions developed by (Blanchard & Quah 1989) are used.

The accumulated response of a structural shock (ε_{2t}) in GDP growth for Turkish economy to real crude oil price volatility is assumed to be zero in the long run. When considering the magnitude of the Turkish economy and volume of the imported oil in the world economy, this restriction seems to be quite reasonable. When this restriction is taken into account with equation (9), $\theta_{12}(1) = \sum_{s=0}^{\infty}\theta_{12}^{(s)} = 0$. The long-run impact matrix $\boldsymbol{\Theta}(1)$ becomes triangular

$$\boldsymbol{\Theta}(1) = \begin{bmatrix} \theta_{11}(1) & 0 \\ \theta_{21}(1) & \theta_{22}(1) \end{bmatrix}$$

$$\boldsymbol{\Theta}(1) = \Psi(1)\mathbf{B}^{-1} = (\mathbf{I}_2 - \mathbf{A}_1)^{-1}\mathbf{B}^{-1}.$$

5. Data

1987.Q1 − 2011.Q4 period quarterly data was used for real crude oil prices and Turkey's real GDP. Seasonal effect on the variables was adjusted by Census X12 method. Additive seasonal adjustment for real crude oil prices and multiplicative seasonal adjustment for real GDP have been performed. To obtain GDP growth and oil price returns, first-order logarithmic transformation is applied. This procedure allows for finding continuously compounded growth rate:

$$r_t = \ln(1+r_t) = \ln\left(\frac{Y_t}{Y_{t-1}}\right) \tag{10}$$

While real oil prices and real GDP are not stationary in levels, growth rates of these series are stationary. For stationarity, ADF (Dickey & Fuller, 1981), PP (Phillips & Perron, 1988) and KPSS (Kwiatkowski, Phillips, Schmidt & Shin, 1992) tests were applied. The results are summarized in Table 1.

Table 1. Stationary Tests

Variables	ADF	PP	KPSS *LM*-statistics
$cvoil_t$	-16.0991	-15.9249	0.3364
	[0.0001]	[0.0001]	
r_t	-9.5086	-9.5086	0.0326
	[0.0000]	[0.0000]	

Notes: *p*-values are provided in square brackets. For ADF and PP tests H_0: Series has a unit root. The tests were applied with intercept. Optimum lag lengths are 0. The asymptotic critical values of KPSS test for both variables are: 0.7390 for 1%, 0.4630 for 5%, and 0.3470for 10%. For KPSS test H_0: Series is stationary.

6. Empirical results

In this section, the estimation results of the EGARCH model and volatility persistence and asymmetric effect will be explained. The volatility series obtained from the EGARCH estimates will be evaluated by the SVAR model.

6.1. Volatility, Persistency and Asymmetry

For the estimation of oil price volatility, a full and a two sub-periods are used. This way, it was possible to observe persistency and asymmetry in different periods. It was not needed to replicate SVAR estimations for the sub-periods. The estimates are summarized in Table 2.

Table 2. Conditional Variance Estimates

Sample Period	Mean Equation	Conditional Variance Equation	ω	α_1	β_1	γ_1
1987.Q1-2011.Q4	ARMA(2,5)	EGARCH(1,1)	-7.4495*	-0.5377***	-0.75355*	-0.5701*
			(-9.3442)	(-1.9501)	(-4.4691)	(-2.9962)
1987.Q1-1998.Q4	ARMA(4,4)	EGARCH-M(1,1)	-3.1304*	1.5243**	0.6332*	-1.1548*
			(-3.0392)	(2.4873)	(2.6689)	(-2.5937)
1999.Q1-2011.Q4	ARMA(2,4)	EGARCH(1,1)	-1.7614*	1.7502*	0.3060*	-0.2714*
			(-21.7449)	(-18.8469)	(1.02E09)*	(-2.3699)

Notes: *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels respectively. *t*-statistics are provided in parentheses. Error distribution is Gaussian.

The parameter estimates in Table 2 have intriguing implications. The parameters of the conditional shock α are statistically significant and negative for full period and positive for sub-periods. This implies that (in contrast to full period) the conditional shock raises the conditional volatility for sub-periods. Parameter β is statistically significant for full period and $|\beta_j| < 1$. It can be concluded from this that real crude oil price volatility shocks are not persistent in full period. Since the full period parameter is greater in absolute value than that of other periods, it will require more time for this effect to die out. This parameter is reduced (0.3060) for the second sub-period $1999.Q1-2011.Q4$ and it will not require much time for the shocks to die out.

Another interesting parameter in Table 2 is the asymmetric response parameter γ. γ is statistically significant and negative for the full period. This finding is evidence for the existence of asymmetric volatility. The parameter is at its highest absolute value in the first sub-period. According to the findings, the negative shocks seem to reduce oil price volatility more than the positive shocks do by revealing an asymmetric effect of the shocks on oil prices.

Figure 1 shows real crude oil price volatility for full period.

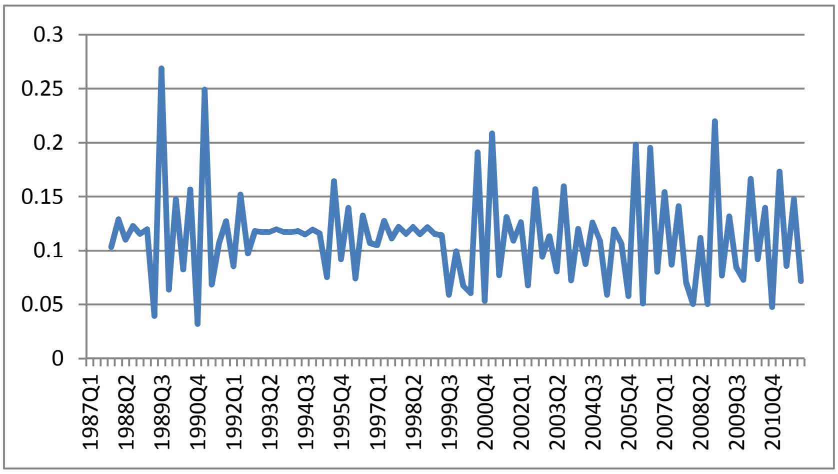

Figure 1. Real Crude Oil Price Volatility

6.2. SVAR Estimates

The lag length of the bivariate VAR model based on five different information criteria is given in Table 3.All the lag lengths determined by these criteria satisfy the stability conditions in the VAR model. Considering Schwarz information criteria and parameter parsimony, the optimum lag length for the VAR model is assumed to be 1. Portmanteau Tests for autocorrelations and Breusch-Godfrey Lagrange Multiplier (LM) tests that use Multivariate Box-Pierce/Ljung-Box Q-statistics for VAR(1) model residuals found no autocorrelation up to 12 quarterly lags.

Table 3. VAR Lag Order Selection Criteria

Lags	LR	FPE	AIC	SCI	HQ
0	NA	1.14e-06	-8.00	-7.94	-7.98
1	31.83	8.65e-07	-8.00	**-8.11**[a]	**-8.21**[a]
2	10.02	**8.40e-07**[a]	**-8.31**[a]	-8.03	-8.20
3	0.59	9.13e-07	-8.23	-7.84	-8.07
4	**11.60**[a]	8.64e-07	-8.28	-7.78	-8.08
5	0.66	9.39e-07	-8.20	-7.59	-7.95
6	1.29	1.01e-06	-8.13	-7.40	-7.83
7	1.10	1.09e-06	-8.05	-7.21	-7.71
8	6.63	1.09e-06	-8.06	-7.11	-7.67

[a] Indicates lag order selected by the criterion. LR: Likelihood ratio, FPE: Final prediction error, AIC: Akaike information criteria, SCI: Schwarz information criteria, HQ: Hannan-Quinn criteria.

In White heteroscedasticity test, the null hypothesis that there is no heteroscedasticity in residuals was accepted. In Jarque-Bera normality test, residuals are normally distributed. VAR model inverse roots of AR characteristic polynomial is on the unit circle. The results of these stability tests are not tabulated.

SVAR estimates can be interpreted. SVAR model parameter estimates are given as

$$\hat{\mathbf{\Theta}}(1) = \begin{bmatrix} 0.0289 & 0 \\ -0.0164 & 0.0234 \end{bmatrix}.$$

The accumulated response of economic growth to a structural shock of real crude oil price volatility is -0.0164 point in the long run. This implies that the quarterly economic growth decreases by 0.0164 point:

$$\hat{\theta}_{21}(1) = \sum_{s=0}^{\infty} \theta_{21}^{(s)} = \underset{[0.0000]}{\underset{(-6.1411)}{-0.0164}} .$$

This parameter has a high t statistics (-6.1411) and a very low p-value. It is clearly seen that unexpected increases in price uncertainty has a negative effect on economic growth.

Figure 2 reports the structural responses of the real GDP growth to conditional volatility shock and real growth shock the magnitude of one standard deviation innovations. Real GDP growth gives an inverse response to the unexpected shocks in the variables.

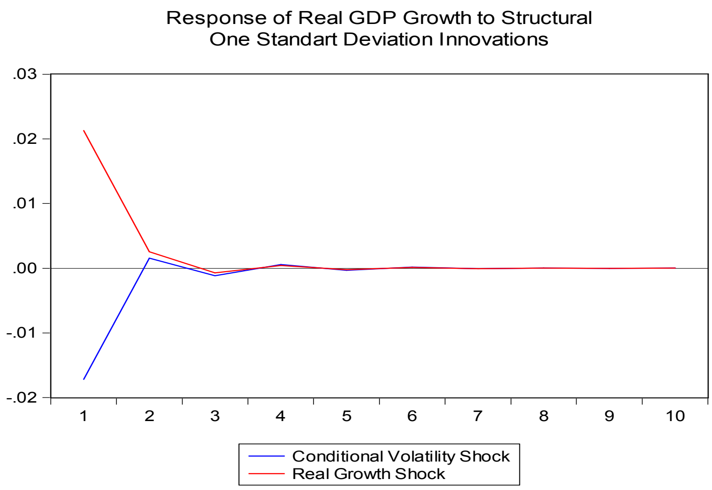

Figure 2. Structural Impulse Response Functions of Real GDP Growth

Real GDP growth gives a negative response to volatility shocks, which is a diminishing effect. Real GDP growth gives a positive diminishing response to real growth shock. The effect of the shocks dies out approximately after 2 quarters.

Table 4. Structural Variance Decomposition of Real GDP Growth [a]

Period	Standard Error	Conditional Volatility Shock	Real GDP Growth Shock
1	0.027382	39.40229	60.59771
2	0.027547	39.26134	60.73866
3	0.027581	39.34163	60.65837
4	0.027590	39.36087	60.63913
5	0.027592	39.36616	60.63384
6	0.027593	39.36760	60.63240
7	0.027593	39.36799	60.63201
8	0.027593	39.36809	60.63191
9	0.027593	39.36812	60.63188
10	0.027593	39.36813	60.63187

[a] Structural factorization was performed.

Table 4 presents the structural variance decomposition results using structural factorization. The primary thought in decomposing forecast error variance hinges on determining the proportion of the variability of the errors in forecasting real GDP growth at time $t+s$ based on information available at time t arising from variability in the structural shocks ε_1 (in conditional volatility) and ε_2 (in growth) between times t and $t+s$. According to variance decomposition results, conditional volatility shocks explain approximately 39.37% of the variability in the real GDP growth forecast error. Of the variation, 60.63% is explained by the shocks itself.

7. Conclusion

Due to economic and political instabilities or fragility in global economies especially in the last decade, stock exchange markets, foreign exchange markets, and commodity exchanges show high volatility. Oil market, however, has become a close-up followed market by industrialized economies and emerging economies, just like the foreign exchange market. Hence, oil price volatility might be a key explanatory variable for macroeconomic stability of countries. Here, Turkey would be a great example among net emerging market economies as a net oil-importing country. This paper has investigated the dynamic effects of real crude oil price volatility on growth rate.

The empirical methodology of the study is composed of two parts. The first part includes the determination of the conditional heteroscedastic model to estimate volatility. Here, the best fitting model to the data set is the exponential GARCH model. This model provides some interpretive and other advantages. These interpretations have been presented in Section 6.1 for full period and two sub-periods. The second part of the empirical methodology includes the structural VAR approach. The SVAR model includes two variables: oil price volatility and real GDP growth. Using the (Blanchard & Quah 1989) approach, a long-run restriction has been added to the model. This restriction is that the changes in GDP growth for Turkish economy will not change crude oil prices in the long run. SVAR model outputs can be interpreted. Empirical results suggest that the accumulated response of economic growth to a structural shock in real crude oil price volatility is -0.0164 points in the long run. This implies that quarterly economic growth decreases by 0.0164 points. This finding is statistically significant and the magnitude of this parameter is noteworthy. Certainly, there are various factors that affect economic growth rates, but this paper has deliberately limited its boundaries in an effort to present the dynamic effect of oil price volatility.

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