

# Asymmetric Effect Of Oil Prices On Economic Growth: Evidence From Turkey<sup>1</sup>

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## Abstract

This study investigates the impact of changes in oil prices on the real economic activity of Turkey. For this purpose, we employ Nonlinear Autoregressive Distributed Lags (NARDL) model which enables us to test the short-run and long-run asymmetries concurrently and allows us to measure the corresponding reaction of economic growth to changes in its regressors. The empirical results confirm the asymmetric effect of oil price changes on economic growth. Particularly, rises in oil prices have a negative influence on economic growth in the long run and this impact has a larger magnitude relative to declines in oil prices which are found to be statistically insignificant. That is to say, the output growth does not respond to the reductions in oil prices but rises in oil prices.

**Key Words:** oil price, asymmetry, economic growth, NARDL

## Petrol Fiyatlarının İktisadi Büyüme Üzerindeki Asimetrik Etkisi: Türkiye Örneği

### Özet

Bu çalışma, petrol fiyatlarındaki değişimlerin Türkiye'nin reel ekonomik aktivitesi üzerindeki etkisini araştırmaktadır. Bu amaçla, kısa ve uzun dönemli asimetrielerin eşzamanlı olarak test edilmesine imkan veren ve ekonomik büyümenin açıklayıcı değişkenlerdeki değişimlere reaksiyonunun ölçülmesine olanak sağlayan Doğrusal Olmayan Gecikmesi Dağıtılmış Otoregresif (NARDL) modeli kullanılmıştır. Ampirik sonuçlar, petrol fiyatlarındaki değişikliklerin ekonomik büyüme üzerindeki asimetrik etkisini doğrulamaktadır. Özellikle, petrol fiyatlarındaki artışların uzun dönemde ekonomik büyüme üzerindeki etkisi negatif olmakla birlikte bu etkinin şiddeti petrol fiyatlarındaki düşüşlerin etkisine oranla daha büyüktür ve ayrıca modelde petrol fiyatlarındaki düşüşlerin etkisi istatistiksel olarak anlamsız bulunmuştur. Bir başka deyişle, iktisadi büyüme petrol fiyatlarındaki düşüşlere tepki göstermezken, petrol fiyatlarındaki artışlara tepki vermektedir.

**Anahtar Kelimeler:** Petrol fiyatları, asimetri, iktisadi büyüme, NARDL

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## Introduction

Despite the constant growth of renewable energy sources, crude oil and its byproducts still represent a large fraction of global energy consumption. 1973 and 1979 oil crises accompanied by considerable macroeconomic fluctuations, together with the heavy dependence on oil have attracted many economists and policymakers for decades to understand the dynamics of the linkage between oil price and key macroeconomic variables.

Many researchers have proposed that fluctuations in oil prices have substantial impacts on economic activity and macroeconomic policies. Theoretically, this is due to the supply and demand channels through which oil prices affect real economic activity. The supply channel operates through the cost of production; rises in oil prices are likely to reduce overall economic activity and create inflationary pressures as well as a potential rise in aggregate demand in oil rich countries, and fall in oil abundant countries (Jimenez-Rodriguez, 2008). The empirical evidence is broadly consistent with the theoretical literature (see, e.g. Rasche and Tatom, 1977, 1981; Hamilton 1983; Burbidge and Harrison, 1984; Kim and Loungani, 1992; Rotemberg and Woodford, 1996; Carruth, Hooker, and Oswald, 1998; and Hamilton, 2003).

Furthermore, the first wave of empirical researches studying the association between oil prices and macroeconomic variables have mainly concentrated on the linear models and confirm a negative linear link between crude oil prices and economic activity (see Rasche and Tatom, 1981; Hamilton, 1983; Burbidge and Harrison, 1984; among others). However, recently, the attention of researchers has moved towards the use of nonlinear approaches, which is due to the overestimation of the positive effects of oil price declines occurred by the mid-1980s by the linear models. This trend can be traced back to the nonlinear approaches of Mork (1989), Lee et al. (1995), and Hamilton (1996 and 2003). Besides, there are several other studies (see e.g. Mory, 1993; Mork, 1994; Brown and Yucel, 2002; Cunado and Garcia, 2005; and among others) confirming the asymmetric impact of oil price shocks on economic activity (Jimenez-Rodriguez and Sanchez, 2012).

In the late 1980s and early 1990s, several developing countries including Turkey perform financial liberalizations, which meant removing or significantly limiting government control of interest and exchange rates, banking sector, and capital inflows and outflows. Such policy changes have important ramifications on the impact of oil prices on economic growth. When oil prices increase, the energy-dependent developing countries face balance of payment deficits as they now have to spend more dollars on imports, which ultimately affects their economic growth negatively. However, developing countries that have undertaken financial liberalization may significantly be less likely to experience economic slowdown at the times of oil price shocks because short- and long-term capital inflows to these economies may

easily finance their balance of payment deficits. This straightforward argument indicates that the aforementioned negative association between oil prices and economic growth may actually not exist for developing countries with liberalized financial markets.

Considering these arguments, in this study, we examine the link between crude oil prices and economic growth by taking into account the recent developments in the Turkish financial markets. The underlying assumption is that the omission of financial liberalization variables may bias the direction of causality between oil prices and economic growth. To settle this issue (Gujarati, 1995), we include a proxy variable for financial liberalization into our model to account for the recent changes in the global economic environment. For this purpose, we use nonlinear ARDL model which enables us to test the short-run and long-run asymmetries concurrently and allows us to measure the corresponding reaction of economic growth to changes in the regressors.

The rest of the study is organized as follows: The second section provides the literature review while section three describes the data and the methodology. The fourth section presents the empirical results and finally Section five concludes the study.

### **Literature Review**

Starting with the pioneering studies by Rasche and Tatom (1977, 1981), Hamilton (1983), and Burbidge and Harrison (1984), in the last three decades, a large body of studies investigated the impacts of oil prices on various economic variables (for a comprehensive literature review, see Hamilton, 2003; and Kilian, 2008). These earliest studies have solely concentrated on the symmetric relationship between oil prices changes and aggregate economic performance and achieved a statistically significant empirical relationship between these two. However, by the mid-1980s, the attention of researchers has moved towards the asymmetric impact of oil prices.

One of the first and key empirical studies, Hamilton (1983), empirically assessed the effect of energy supply disruptions on economic activity. He argued that the connection between oil price evolution and economic output was not due to a historical coincidence and rises in oil price reduced US output growth for the period 1948-1972.

Hamilton's study was extended by Mork (1989) using a longer sample period including the oil price collapse in 1986. Mork took into account the impacts of oil price controls during the 1970s and considered the possibility of an asymmetric reaction of the US economy to the fluctuations oil prices. His findings suggested that oil price declines didn't have a statistically significant effect on the US economy as oil price increases did. This study was extended by Mork et al. (1994) including some OECD countries

into the model and found that most countries showed evidence of asymmetric effects, with Norway as an exception.

On the other hand, Lee et al. (1995) proposed a measure taking the price volatility of oil into account. This was due to the argument that an oil shock is more likely to have a greater effect on GDP in an environment in which oil prices are more stable. Using the same instruments as Mork (1989) and extending the sample period to the post-1988, they reported the asymmetric effect of oil price shocks. On the other hand, Hooker (1996a) found that oil prices do not Granger-cause many U.S. macroeconomic variables for the period 1973-1994 and 1948-1994, although he observed Granger-causality for the period 1948-1973. Thus, he concludes that a simple asymmetry is not enough to describe the oil price – GDP nexus for the period after 1986. However, in direct response to Hooker (1996), Hamilton (1996) suggests another form of non-linear transformation of real oil prices. He argued that rises in oil prices are mostly the adjustments of earlier drops and he put emphasis on the positive difference between the level of oil price in quarter  $t$  and the maximum oil price level of the previous four quarters and denoted this as “net oil price increase” (NOPI). The introduction of this variable in a VAR model for the U.S. economy was able to reestablish a significant relationship between oil prices and real GDP for the periods highlighted above.

Moreover, Hamilton (2003) reports a clear evidence of nonlinearity. He, also, investigates the nonlinear transformations of oil prices proposed in the earlier literature and argues that, based on the nonlinearity test proposed by Hamilton (2001), the formulation of Lee-Ni-Ratti formulation is the best for summarizing the non-linearity (Jimenez and Rodriguez, 2004).

Jimenez-Rodriguez and Sanchez (2005) also confirm the nonlinearity between oil price and GDP. Their findings also suggest that while oil price increase would have a negative effect on the oil importing countries' GDP but Japan's, while it positively affects the GDP for the oil exporter countries. They showed that oil prices would have nonlinear impacts on inflation and the real economy.

Finally, regarding the recent studies, Jimenez-Rodriguez and Sanchez (2009) combines linear VAR and nonlinear approaches of Mork (1989), Lee et al. (1995), and Hamilton (1996) and estimate the impacts of oil shocks on the real economy of major industrialized OECD economies. They show that oil prices would have nonlinear impacts on inflation and the real economy. Moreover, Cologni and Manera (2009), Engemann et al. (2010), and Lian et al. (2014) among others find an asymmetric connection between economic activity and oil price shocks. However, it is also worth mentioning that Kilian and Vigfusson (2009) hold a position that there is a little evidence of a nonlinear association between oil prices and GDP growth in the US. In particular, they show that the censored oil price VAR models commonly used in the empirical literature may produce inconsistent estimates of the true effects of unexpected

energy price rises, due to a censoring bias and are likely to have overestimated the impact of positive energy price shocks.

Overall, it is clear from the literature that the majority of the studies report a nonlinear connection between oil prices and the macroeconomic variables, especially for the period after the 1980s. However, in this context, there are relatively few studies devoted to developing economies, and almost none in the context of Turkey.

### **Data**

Investigating the response of economic growth to changes oil prices, controlling for financial liberalization, is more relevant to the Turkish case since Turkey is an oil-dependent developing country which undertook financial reforms in the 1980's. Over the past decade, the Turkish economy expanded at a rate of 5% on average, even at more than 8% per year in 2010 and 2011. Therefore, Turkey's demand for oil and other energy sources has increased dramatically and will likely to grow in the future. Although Turkey is strategically located at the crossroads between oil-rich Former Soviet Union and Middle East countries, and the European demand plays an important role in the transit of oil, Turkey has very limited domestic reserves and imports nearly all of its oil needed. In 2013, Turkey's total liquid fuel consumption averaged 734,800 barrels per day. More than %90 of crude oil consumption and significant quantities of petroleum products came from imports. According to the International Energy Agency (IEA), Turkey's crude oil imports are expected to double over the next decade.

The model subject to empirical analysis employed in this study is based on the conventional neoclassical aggregate production model where, in addition to a proxy for financial development, investment and oil prices are treated as separate inputs. The economic growth model is defined as:

$$Y_t = f(oil_t, inv_t, credits_t)$$

(1)

where  $Y_t$  represents the real GDP.  $oil_t$ ,  $inv_t$ , and  $credits_t$  are the real oil price, real fixed capital formation, and domestic credit to private sector as a share of GDP (as a proxy for financial liberalization) respectively. The subscript  $t$  denotes the time period, 1987Q1-2010Q4.

This study employs quarterly data covering 1987 to 2010 for Turkey and the dataset was mainly extracted from the International Financial Statistics (IFS) database. The real GDP variable ( $Y_t$ ) is obtained through deflating nominal GDP with the GDP deflator (2005=100), while the real oil price ( $oil_t$ ) is calculated by dividing average world crude oil price by the US CPI and the investment variable ( $inv_t$ ) is proxied by the gross fixed capital formation. When empirically analyzing the impact of financial markets on economic growth, several measures (proxies) of financial system have been used (World Bank, 1989,

King and Levine 1993a, 1993b; Roubini and Sala-i-Martin, 1992). Following the literature, we define the proxy for financial development as domestic credit to private sector (% of GDP) and denoted as  $credits_t$ . The data series are seasonally adjusted and transformed into natural log prior to the analysis.

### Econometric Methodology

For our purpose in this study, we employ nonlinear ARDL model recently advanced by Shin et al. (2011) to jointly examine the long- and the short-run asymmetries between crude oil prices, financial development, and economic growth.

The general linear autoregressive distributed lag (ARDL) cointegration model (Pesaran and Shin 1999; Pesaran, Shin, and Smith 2001) with series,  $x_t$  and  $y_t$  ( $t = 1, 2, \dots, T$ ) has the following structure:

$$\Delta y_t = \alpha + \omega y_{t-1} + \theta x_{t-1} + \delta z_t + \sum_{i=0}^{p-1} (\varphi_i \Delta y_{t-i}) + \sum_{i=0}^{q-1} (\gamma_i \Delta x_{t-i}) + \mu_t \quad (2)$$

where  $z_t$  is a vector of regressors with fixed lags and  $\mu_t$  is an iid stochastic process.

Equation (2) assumes linear adjustment in the long- and the short-run. However, the linear ARDL model becomes inappropriate when there is an asymmetric (nonlinear) relationship between series. Shin, Yu, and Greenwood- Nimmo (2011), to settle this issue, developed the model of nonlinear autoregressive distributed lags by decomposing the regressors into positive and negative sums through the partial sums decomposition process:

$$x_t = x_0 + x_t^+ + x_t^- \quad (3)$$

where

$$x_t^+ = \sum_{i=1}^t \Delta x_i^+ = \sum_{i=1}^t \max(\Delta x_i^+, 0), \quad x_t^- = \sum_{i=1}^t \Delta x_i^- = \sum_{i=1}^t \min(\Delta x_i^-, 0) \quad (4)$$

The long-run equilibrium relationship then can be derived as:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t \quad (5)$$

where  $\beta^+$  and  $\beta^-$  are the asymmetric long-run parameters associated with positive and negative changes in  $x_t$ , respectively. As shown in Shin et al. (2011), combining Equations (5) and (2) we can obtain the following asymmetric ECM which is known as NARDL (p,q) model:

$$\Delta y_t = \alpha + \omega y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \delta z_t + \sum_{i=0}^{p-1} (\varphi_i \Delta y_{t-i}) + \sum_{i=0}^{q-1} (\gamma_i^+ \Delta x_{t-i}^+ + \gamma_i^- \Delta x_{t-i}^-) + \mu_t \quad (6)$$

where  $\theta^+ = -\omega\beta^+$  and  $\theta^- = -\omega\beta^-$  are the long-run effects of positive and negative changes in  $x$  on  $y$ , respectively, whereas the short run impacts of changes in  $x$  on  $y$  are measured by  $\sum_{i=0}^{q-1} \gamma_i^+$  and

$\sum_{i=0}^{q-1} \gamma_i^-$ . Hence, in this setting, NARDL model enables us to capture both the asymmetric long-run and short-run effects of changes in underlying exogenous variables on dependent variable.

When asymmetry is identified, the cumulative dynamic multipliers associated with the unit changes in  $x_{t-1}^+$  and  $x_{t-1}^-$  can be derived respectively as:

$$m_h^+ = \sum_{i=0}^h \frac{\partial y_{t+i}}{\partial x_{t-1}^+}; \quad m_h^- = \sum_{i=0}^h \frac{\partial y_{t+i}}{\partial x_{t-1}^-}$$

(7)

In the economic literature, the empirical studies on non-linear cointegration have primarily relied on regime switching type models. However, NARDL approach has a number of advantages over the existing class of regime-switching techniques (Greenwood-Nimmo et al., 2011). First, the NARDL (p, q) model can be estimated simply by the standard OLS. Second, the test for an asymmetric (nonlinear) cointegration relationship between the variables can be easily carried out by means of bounds-testing procedure advanced by Pesaran et al. (2001) and Shin et al. (2011), based on a modified F-test (denoted as  $F_{PSS}$ ), which remains valid irrespective of whether the regressors are I(0), I(1) or mutually cointegrated. Third, long- and short-run asymmetries can be estimated using standard Wald tests. In particular, the associated joint null hypotheses for the long-run symmetry is  $\theta^+ = \theta^-$  whereas for short-run symmetry, the joint null hypotheses are  $\sum_{i=0}^{q-1} \gamma_i^+ = \sum_{i=0}^{q-1} \gamma_i^-$  (Greenwood-Nimmo et al., 2011).

### Empirical Findings

We first start the analysis by performing ADF and KPSS tests to confirm that I(2) variables are not involved in the model. The results are presented in Table I and the findings verify that none of the variables is I(2). Therefore, we proceed to the cointegration test that we perform for both the linear and nonlinear specifications.

Table 1. ADF and KPSS Test Results

Variable	Deterministic Component	k	ADF	KPSS
growth	C	1	-0.245	4.49
	C/T	1	-2.81	0.211
$\Delta$ growth	C	4	-5.263***	0.0408***
	C/T	4	-5.236***	0.0348***
oil	C	3	-1.524	1.66
	C/T	2	-3.739	0.193
$\Delta$ oil	C	2	-6.133***	0.108***
	C/T	2	-6.203***	0.0314***
credits	C	4	0.316	1.23
	C/T	4	-1.174	0.397
$\Delta$ credits	C	4	-3.531***	0.393**
	C/T	4	-3.951**	0.0656***
inv	C	3	-2.247	0.911
	C/T	3	-2.628	0.248
$\Delta$ inv	C	4	-4.560***	0.0585***
	C/T	4	-4.536***	0.0503***

\*\*\* and \*\* denote significance at the 1% and 5% levels, respectively  
k denotes the optimal lag structure of the ADF test, based on the AIC

Table 2 reports the cointegration test results. There is no evidence of cointegration in the linear model, while the long run relation exists when the nonlinear form is specified. In other words, we can evaluate the economic growth dynamics and its relation to other variables. Therefore, it can be argued that any wrong specification may result in a misleading conclusion concerning the cointegration between the specified variables.

Table 2. Bounds Tests for Linear and Nonlinear Cointegration

Model Specification	F-Statistics	95% Lower Bound	95% Upper Bound	Conclusion
Linear	0.33	3.408	4.55	No cointegration
Nonlinear	13.22	2.788	4.073	Cointegration

Notes: the critical values are from Narayan (2005) Case III, given the small sample size. The optimal lag order is based on SIC

Performing general to specific method to determine the lag length in each case, we reach the final model specification and Table 3 reports the results. As a starting point, the long run coefficient of investment, as expected, is significantly positive at 1% significance level. The results suggest that a 1% increase in investment is related to the increase in the economic growth by approximately 0.25% holding the oil price and credits to GDP constant. The results also suggest an asymmetric long- and short run relation between oil price and economic growth. In the long run, the growth effect of positive changes in oil prices seems to be negative and statistically significant at 5%, while negative oil price changes are

found to be insignificant (positive). Therefore, our findings indicate an incomplete pass-through effect of oil price to the economic growth. The results suggest that a 1% rise in oil price would account for the decline of 0.04% in the expected economic growth in the long run. We should also note that there exists a long- and the short-run nonlinear relationship between credit to GDP and economic growth.

Prior to further inferences, we evaluate the adequacy of our model. The ARCH test for conditional heteroscedasticity and the Breusch-Godfrey Lagrange Multiplier test for serial correlation indicate that the model is correctly specified.

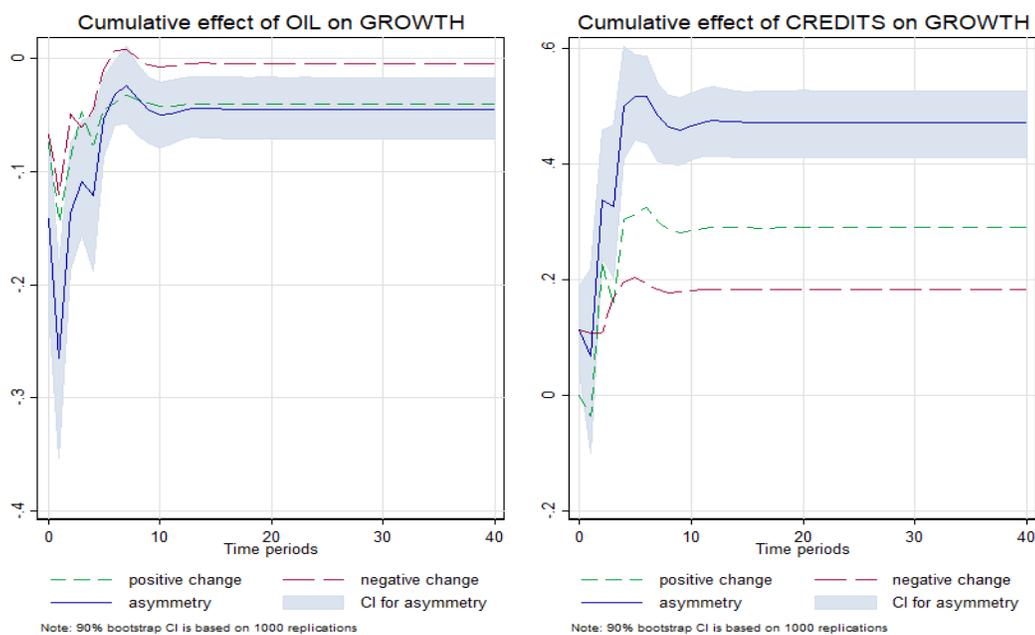
Table 3. Estimation Results of the NARDL Final Model

Dependent Variable : $\Delta$ growth		
Variable	Coefficient	Std. Dev.
constant	3.623***	0.476
growth <sub>(t-1)</sub>	-0.85***	0.113
oil_pos <sub>(t-1)</sub>	-0.034**	0.014
oil_neg <sub>(t-1)</sub>	0.004	0.018
credits_pos <sub>(t-1)</sub>	0.246***	0.045
credits_neg <sub>(t-1)</sub>	-0.155***	0.025
$\Delta$ growth <sub>(t-1)</sub>	0.252**	0.108
$\Delta$ growth <sub>(t-2)</sub>	0.197**	0.103
$\Delta$ oil_pos	-0.074**	0.036
$\Delta$ oil_pos <sub>(t-1)</sub>	-0.081**	0.035
$\Delta$ oil_pos <sub>(t-4)</sub>	-0.057*	0.03
$\Delta$ oil_neg	0.068**	0.028
$\Delta$ oil_neg <sub>(t-1)</sub>	0.089***	0.028
$\Delta$ oil_neg <sub>(t-3)</sub>	0.058**	0.026
$\Delta$ oil_neg <sub>(t-4)</sub>	0.043*	0.026
$\Delta$ credits_pos <sub>(t-1)</sub>	-0.285***	0.098
$\Delta$ credits_pos <sub>(t-3)</sub>	-0.185***	0.084
$\Delta$ credits_neg	-0.113**	0.052
$\Delta$ credits_neg <sub>(t-1)</sub>	0.094*	0.056
$\Delta$ credits_neg <sub>(t-2)</sub>	0.084*	0.049
inv	0.245***	0.039
F <sub>PSS</sub>	13.22	
L <sup>+</sup> <sub>oil</sub>	-0.04**	
L <sub>oil</sub>	0.005	
L <sup>+</sup> <sub>credits</sub>	0.29***	
L <sub>credits</sub>	-0.182***	

$W^{LR}_{oil}$	5.223(0.025)
$W^{SR}_{oil}$	20.26(0.000)
$W^{LR}_{credits}$	139.4(0.000)
$W^{SR}_{credits}$	10.04(0.002)
LM (1)	0.223(0.6369)
LM(2)	1.917(0.3835)
ARCH(1)	0.436(0.5089)
ARCH(2)	2.074(0.3545)

The subscripts “+” and “-” refer to positive and negative partial sums, respectively, whereas  $L^+$  and  $L^-$  are the estimated long-run coefficients defined by  $\beta^+ = -\theta^+/\omega$  and  $\beta^- = -\theta^-/\omega$ , respectively.  $F_{PSS}$  is the F-test proposed by Pesaran, Shin and Smith (2001) for the joint null of  $\omega = \theta^+ = \theta^- = 0$ . WLR and WSR are the long-run and short-run symmetrical Wald tests, respectively, on the null of  $\theta^+ = \theta^-$  and  $\sum_{i=0}^{q-1} \gamma_i^+ = \sum_{i=0}^{q-1} \gamma_i^-$  LM test is for serial correlation and ARCH is for detecting the presence of ARCH effect. p – values are displayed in brackets. \*\*\* and \*\* denote significance at the %1 and %5 levels, respectively.

Furthermore, the analysis of the dynamic structure among the variables considered in the model can be illustrated by the cumulative dynamic multipliers. This enables us to trace the evolution of output growth following oil price and credit shocks.



(a)

(b)

Figure 1. Cumulative Dynamic Multipliers

In Figure 1 (a), the upper and lower dashed lines represent the cumulative dynamics of output growth with respect to a 1% decline and rise in oil prices, respectively. The figure indicates a relatively stronger effect of positive price shocks in the short run. The equilibrium adjustment is reached in about 8 periods (2 years). Thereafter, one can observe that the reaction of output growth to the negative changes becomes statistically zero. In sum, the results reveal that output growth is more sensitive to an increase in oil prices in the short – and the long-run and the output growth does not react to negative shocks in the long-run. In the long-run equilibrium, the pass-through of positive oil shocks to output growth is about 0.04%. Overall, the behavior of the dynamic multiplier is in line with short- and long-run asymmetry.

In Figure 1 (b), the upper and lower dashed lines represent the cumulative dynamics of output growth with respect to a 1% rise and a decline in credits, respectively. The figure reveals a relatively stronger effect of positive price shocks in the short run. The equilibrium adjustment is reached in about 6 periods (1.5 years). In the long run, the effect of an increase in credits on output growth is larger than that of a decrease. In the long-run equilibrium, the pass-through of positive credit shocks to output growth is about 0.29% while the pass through is 0.18% regarding the negative shocks. The behavior of the dynamic multiplier is in line with short- and long-run asymmetry.

### **Conclusion**

In this study, the effect of oil price shocks on the real economic activity of Turkey is empirically examined. For this purpose, we adopt nonlinear autoregressive distributed lags (NARDL) model. The model allows us to test the short-run and long-run asymmetries contemporaneously and enables us to measure the corresponding reaction of economic growth to changes in its regressors. The empirical results confirm the asymmetric effect of oil price changes on economic growth. Particularly, an increase in oil price has a negative effect on economic growth in the long run and this effect has a larger magnitude relative to declines in oil prices which are found to be statistically insignificant. That is to say, the output growth does not respond to oil price reduction but rises in oil prices. Therefore, our findings indicate an incomplete pass-through effect of oil price to economic growth, which is consistent with various studies in the literature. This finding has important policy implications for an oil importer country like Turkey. It can be argued that higher oil prices has an inflationary pressure on consumers and producers, leading to less spending on other goods and thus reduce economic output. Therefore, monetary policy and fiscal policy should be designed in balance to stabilize inflation and enhance aggregate output in case of increasing oil prices.

Furthermore, the findings indicate a positive effect of an increase in credits on the real economic activity of a larger magnitude than that of decreases in credits which have a negative effect on economic growth. In conclusion, our findings indicate empirical evidence against the linear approach assuming that

oil prices and credits to GDP (proxy variable for financial liberalization) have symmetric impacts on the real economy.

**References**

- Brown, Stephen P. A. and Mine Yücel (2002) “Energy Prices and Aggregate Economic Activity: an Interpretative Survey”, *Quarterly Review of Economics and Finance*, 42 (2), pp. 193–08.
- Burbidge, John and Alan Harrison (1984) “Testing for the Effects of Oil Price Rises Using Vector Autoregressions”, *International Economic Review*, 25, pp. 459-484.
- Carruth, Alan A., Mark A. Hooker and Andrew J. Oswald (1998) “Unemployment Equilibria and Input Prices: Theory and Evidence from the United States”, *Review of Economics and Statistics*, 80 (4), pp. 621-628.
- Cologni, Alessandro and Matteo Manera (2009) “The Asymmetric Effects of Oil Shocks on Output Growth: A Markov-Switching Analysis for the G-7 Countries”, *Economic Modelling*, 26 (1), pp. 1-29.
- Cunado, Juncal and Fernando Perez de Garcia (2005) “Oil Prices, Economic Activity and Inflation: Evidence for Some Asian Countries”, *The Quarterly Review of Economics and Finance*, 45 (1), pp. 65-83.
- Engemann, Kristie M., Kevin Kliesen and Michael Owyang (2010) “Do Oil Shocks Drive Business Cycles? Some U.S. and International Evidence”, *Working Paper, Federal Reserve Bank of St. Louis*.
- Greenwood-Nimmo, Matthew, Yongcheol Shin and Till van Treeck (2011) “The Nonlinear ARDL Model with Multiple Unknown Threshold Decompositions: An Application to the Phillips Curve in Canada”, *Mimeo: Leeds University Business School*.
- Gujarati, Damodar N. (1995) *Basic Econometrics*, Mcgraw-Hill, New York.
- Hamilton, James D. (1996) “This is What Happened to the Oil Price - Macroeconomy Relationship?”, *Journal of Monetary Economics*, 3(2), pp. 215-220.
- Hamilton, James D. (2003) “What is an Oil Shock?” *Journal of Econometrics*, 113, pp. 363-398.
- Hamilton, James D. (1983) “Oil and the Macroeconomy Since World War II”, *Journal of Political Economy*, 91, pp. 228-248.
- Hooker, Mark A. (1996) “What Happened to the Oil Price - Macroeconomy Relationship?”, *Journal of Monetary Economics*, 38(2), pp. 195-213.
- Jiménez-Rodríguez, Rebeca (2008) “The Impact of Oil Price Shocks: Evidence from the Industries of Six OECD Countries”, *Energy Economics*, 30(6), pp. 3095–3108.
- Jiménez-Rodríguez, Rebeca and Marcelo Sánchez (2005) “Oil Price Shocks and Real GDP Growth: Empirical Evidence for some OECD Countries”, *Applied Economics*, 37 (2), pp. 201-228.
- Jiménez-Rodríguez, Rebeca and Marcelo Sánchez (2012) “Oil Price Shocks and Japanese Macroeconomic Developments”, *Asian-Pacific Economic Literature*, 26 (1), pp. 69-83.
- Kilian, Lutz (2008) “The Economic Effects of Energy Price Shocks”, *Journal of Economic Literature*, 46 (4), pp. 871–909.
- Kilian, Lutz and Robert J. Vigfusson (2009) “Are the Responses of the U.S. Economy Asymmetric in Energy Price Increases and Decreases?”, *Working Paper, University of Michigan*.
- Kim, In-Moo and Prakash Loungani (1992) “The Role of Energy in Real Business Cycle Models”, *Journal of Monetary Economics*, 29 (2), pp. 173-189.
- Lee, Kiseok, Shawn Ni and Ronald A. Ratti (1995) “Oil Shocks and the Macroeconomy: The Role of Price Variability”, *Energy Journal*, 16, pp. 39-56.
- Lian, An, Jin Xiaoze and Ren Xiaomei (2014) “Are the Macroeconomic Effects of Oil Price Shock Symmetric? A Factor-Augmented Vector Autoregressive Approach”, *Energy Economics*, 45: 217-228.
- Mork, Knut Anton, Oystein Olsen and Hans Terje Mysen (1994) “Macroeconomic Responses to Oil Price Increases and Decreases in seven OECD Countries”, *Energy Journal*, 15, pp. 19-35.
- Mork, Knut Anton (1989) “Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton’s Results”, *Journal of Political Economy*, 91, pp. 740-744.

- Mory, Javier F. (1993) "Oil Prices and Economic Activity: Is the Relationship Symmetric?" *Energy Journal*, 14, pp. 151–161.
- Narayan, Paresh (2005) "The Saving and Investment Nexus for China: Evidence from Cointegration Tests", *Applied Economics*, 37, pp. 1979–1990.
- Pesaran, Hashem and Yungcheol Shin (1999) "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis", in S. Strom (eds.) *Econometrics and Economic Theory in the 20th Century*, Cambridge University Press, Cambridge.
- Pesaran, Hashem, Yungcheol Shin and Richard J. Smith (2001) "Bounds Testing Approaches to the Analysis of Level Relationships", *Journal of Applied Econometrics*, 16, pp. 289–326.
- Rasche, Robert H. and John A. Tatom (1977) "Energy Resources and Potential GNP", *Federal Reserve Bank of St. Louis Review*, 59, pp. 10-24.
- Rasche, Robert H. and John A. Tatom (1981) "Energy Price Shocks, Aggregate Supply and Monetary Policy: the Theory and the International Evidence", in K. Brunner and A. H. Meltzer (eds.): *Supply Shocks, Incentives and National Wealth*, Carnegie-Rochester Conference Series on Public Policy 14, pp. 9-93.
- Rotemberg, Julio J. and Michael Woodford (1996) "Imperfect Competition and the Effects of Energy Price Increases on Economic Activity", *Journal of Money, Credit, and Banking*, 28 (4), pp. 549– 77.
- Shin, Yongcheol, Byungcheol Yu and Matthew Greenwood-Nimmo (2011) "Modeling Asymmetric Cointegration and Dynamic Multipliers in an ARDL Framework", in William C. Horrace and Robin C. Sickles (eds.): *Festschrift in Honor of Peter Schmidt*, Springer Science & Business Media, New York.
- World Bank (1989) *World Development Report*, Oxford University Press, New York.