

The effect of oil prices on foreign trade deficit in the economics of Bulgaria

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Abstract. *Oil takes up a significant place in global energy consumption and oil prices are notable indicators of countries' economic performances. As a matter of course, the bigger and longer-lasting the increase in oil prices, the bigger effect it has on macroeconomic variables. The present study investigates the relationship between changing oil prices and foreign trade of Bulgaria using annual data between the years 1982-2017 by means of Fourier ADF and Fourier KPSS unit root tests and Arai-Kurozumi co-integration test with a structural break. Presence of co-integration between series was concluded.*

Keywords: oil prices, foreign trade deficit, Bulgaria, structural break tests, Fourier ADF.

JEL Classification: F32, F41.

1. Introduction

Energy, being a fundamental input of economy holds a determining role in countries' economic and political decision-making procedures. On the other hand, the scarcity of fossil fuel sources in particular as well as short-lived political stability and technological insufficiencies make energy even more valuable for the economy. Fuels such as oil, coal and natural gas currently maintain their importance due to higher measures of energy of fossil fuels and especially of oil compared to renewable energy sources as well as lower costs of extraction.

The significance of energy today as an essential source of human life and a fundamental factor of industrialization is indisputable. Importance of energy requires it to be found whenever and wherever needed as well as in any needed quantity and with low cost. Unequal geographic distribution of energy sources leads to imported energy dependence and causes the economy of some countries to be negatively affected by the increasing prices of energy. Particularly the changes in oil prices affects macroeconomic variables through different channels, especially leading to declines in output costs by means of causing changes in input costs which in turn result in a shrinkage of GDP as well as an inflationary effect.

High energy prices caused by oil price increases cause a temporary shift in production function and cause a decrease in output. The decrease in the output and the subsequent increase in the interest rate increases the price level in a certain nominal amount of money by decreasing the real money demand. For this reason, one of the most significant reflections of high oil prices is to reduce GDP and to increase inflationary pressure.

According to Killian (2010), a positive shock in oil prices is a terms of trade shock for a country that imports oil. Such a terms of trade shock can be considered to be a problem impacting production decisions of the economy. As oil is an important input of production, the increase in the prices of this input will concurrently upset the trading equilibrium.

In the present study, the relationship between global real oil prices and the balance of foreign trade in Bulgarian economy is investigated using annual data from 1982-2017 via Fourier ADF and Fourier KPSS unit root tests as well as Arai-Kurozumi co-integration test with a structural break.

2. Economic structure of Bulgaria

Bulgaria, which has been under the influence of the Soviet Union over the course of the Cold War, was involved in the democratization process in 1990s among other Central and Eastern European countries. As per their switch to a capitalist system, Bulgaria held their first multi-party election in 1990, defeating the communist one-party hegemony which had been present since the Cold War era. Adoption of the new constitution and the presidential elections in the following years are considered to be the indicators of democracy and leaving behind the socialist system in the country.

Relations between Bulgaria and the European Union (EU) began diplomatically in 1988. Two years after that, Bulgaria signed a treaty of commerce with European Economic Community and in 1995, submitted their application to EU. Negotiations with EU began in 2000 and in 2007, Bulgaria joined EU as a full member. The membership of Bulgaria in the EU marked a new period in the country whereby the Gross Domestic Product (GDP) per capita appeared to increase steadily. However, the country also appears to be one of the two poorest in the Union in terms of GDP per capita. Main macroeconomic indicators of the Bulgarian economy are given in Table 1.

Table 1. *Macroeconomic indicators*

Year	Current Deficit	Oil Price	GDP (growth rate)	Inflation	Unemployment
2000	0.0564	28.5	4.7	7.1	16
2001	-0.0498	24.44	3.7	6.1	19
2002	-0.0259	25.02	5.9	3.7	18
2003	-0.1044	28.83	5.1	2.2	13
2004	-0.1182	38.27	6.4	5.6	12
2005	-0.1653	54.52	7.1	6.5	10
2006	-0.2392	65.14	6.8	6.7	8
2007	-0.2639	72.39	7.3	11	6
2008	-0.2869	97.26	6	8.1	5
2009	-0.1693	61.67	-3.5	4	6
2010	-0.0552	79.5	1.3	1.1	10
2011	-0.0314	111.26	1.9	5.9	11
2012	-0.0653	111.67	0.03	1.5	12
2013	-0.0155	108.66	0.4	-0.7	12
2014	-0.0351	98.95	1.8	0.4	11
2015	-0.0323	52.39	3.4	2.2	9
2016	0.0019	43.73	3.9	2.2	7
2017	-0.0139	54.19	3.8	3.4	6

Despite improvements in the past years, Bulgarian economy is still fragile. As a result of the collapse of the Soviet market, the country has been through serious financial crises. Later on, the application of the currency board following agreements with the International Monetary Fund (IMF), having the Bulgarian currency Lev pegged to the German Mark and the applications of strict monetary policies led to an increase in growth rates in the country. However, this recovery was not on a sufficient level. Private sector received an increased share by means of privatization policies in the country. Additionally, increase in domestic demand led to an increase in import, which in turn resulted in increase in current deficit.

Following Bulgaria's switch to market economy, an economic crisis erupted in 1996 as a result of unsuccessful reforms. The country's economy which saw positive growth starting in 1994 shrank by 10.9% in 1996. Consumer price inflation on average was 7.8% by 2008 and 0.6% by 2009. It is seen that Bulgaria saw a rise in economic performance following their EU membership in 2007. Increase in GDP per capita appears to be 6.1% between 2004-2007 (OKA).

Despite the social problems unemployment created on a significant scale between the years 2000-2006, rates of unemployment appear to be decreasing in the past years. Active policies by the state towards job creation, as well as increasing employment opportunities in the private sector in the past years played a significant role in handling the issue of unemployment.

3. Literature research

However, the impact of a positive shock in oil prices on current deficits of countries importing or exporting oil, and how such a shock may have affected developed and developing countries has not been investigated in detail. At the present time, due to lack of substitutionary energy sources, crude oil is a significant revenue item for countries which manufacture oil and a cost item for countries such as Bulgaria, which consume rather than manufacture oil. At this point, it is certain that oil trade has a significant position in countries' external equilibrium. The first study looking into the relationship between oil prices and external equilibrium is conducted by Agmon and Laffer in 1978. In their study based on developed countries, Agmon and Laffer (1978) concluded that balance of foreign trade became unstable immediately following the oil price shock, however it recovered right after the initial disturbance.

Karabulut and Danişoğlu (2006) investigated the factors contributing to current accounts deficit in Turkey by means of VECM analysis based on quarterly data of the years 1991-2004. Consequently, it was concluded that the increases in oil prices had a negative impact on current deficit and that there is a positive correlation between oil prices and current deficit.

Demirci and Er (2007) analyzed the effect of changes in crude oil prices on current deficit in Turkish economy using AR-MA, VECM and VAR analysis based on monthly data from the period 1991:12 - 2006:12. It was determined as a result of the analysis that there is a long term relation between oil prices and current deficit and that oil prices affect current deficit negatively.

Erdoğan and Bozkurt (2009) analyzed the determiners of current deficit in Turkey with the help of MGARCH models based on monthly data of the years 1990-2008. As a result of the analysis, it was concluded that balance of foreign trade and oil prices have primal impact on current accounts deficit.

Demirbaş et al. (2009) investigated the effect of changes in oil prices on current deficit in Turkish economy via causality analysis based on data covering the years 1984 to 2008. As a consequence, a positive significant correlation between current deficit and crude oil prices was concluded.

Özlale and Pekkurnaz (2010) investigated the relationship between oil prices and current account balance in Turkey using VAR analysis based on data of the period between 1999 and 2008. As a result of the analysis, it was determined that oil price shocks have a significant effect on current account balance in the short term.

Irhan et al. (2011) investigated the long term co-integrated relationship between the variables included in their study using ARDL bounds testing in order to analyze the determiners of balance of foreign trade in Turkey. The analysis showed that loss in value in real exchange rate affected balance of trade significantly and strongly and that the balance of foreign trade improved strongly as a result of an increase in foreign reel income. It was also concluded that crude oil prices had no significant effect on balance of trade.

Gün (2011) investigated the effect of oil prices on current accounts deficit in Turkey using time series analysis based on data from the years 1975 to 2010. As a result, a strong correlation between oil prices and current accounts deficit was concluded.

Bayat et al. (2012) analyzed whether the changes in oil prices had an impact on balance of foreign trade in Turkey in the given period of time using data of monthly oil prices and foreign trade data for the time period 1992:01 to 2012:04. In the study, nonlinear cointegration, nonlinear and frequency domain Granger type causality analysis were used. The results of the study concluded a unidirectional causality of real oil prices on foreign trade deficit. It was also concluded that the long-term disturbances in balance of foreign trade were not caused by oil price shocks.

Bildirici and Kayıkçı (2012) analyzed the relationship between current account balance and oil prices using Markov Switching autoregression model based on annual data between the years of 1975 and 2009 in Argentina, Mexico, Brazil and Turkey. The analysis concluded that oil prices affected current account balance positively in Brazil, which is an oil exporter country, and negatively in oil importer countries such as Turkey.

Mucuk et al. (2013) analyzed the relationship between international oil prices and the current account deficit in the work for Turkey's economy in 1992:01 - 2013:02 with the help of monthly data. As a result of the study using the VAR analysis method, they found that there is a long-term causality relationship between international oil prices and current account deficit.

Altıntaş (2013) analyzed the relationship between real oil prices and relative export price variables with the help of quarterly data covering the period 1987-2010 in Turkey by the ARDL method and causality test. As a result of the study, it was found that the value of elasticity showing the effect of real oil price on export was positive and meaningful.

Özata (2014) examined the relationship between oil imports, real effective exchange rate, GDP and current account and the relationship between GDP and current accounts with structural vector autoregression test. It was used data for 1998:Q1 - 2012:Q4. As a result of the study, it was determined that the sudden shock in oil prices affected the deficit negatively and this sudden oil shock effect would last for a long time.

Lebe and Akbaş (2015) investigated the ways in which the current deficit in Turkey is affected by changes in imported crude oil prices and the exchange rate based on monthly data covering the time period 1991:12 - 2012:11. The Vector Autoregressive Model and the causality test by Dolado and Lutkepohl (1996) were utilized in the study. The analysis based on the Vector Autoregressive Model suggested real oil prices and exchange rates had significant effect on current deficit. Results from the Dolado and Lutkepohl causality appeared to agree with the results from the Vector Autoregressive Model.

Bayar and Karamelikli (2015), examined the relationship between foreign trade deficit and energy use in Turkey's economy by using 1997:03 - 2005. As a result of the study, foreign trade balance, real effective exchange rate, oil and natural gas prices have been found a

long-term relationship. Also concluded that there was a one-way causality relationship between oil and natural gas prices and foreign trade.

Sarılı (2015) examined the long-term relation between crude oil prices and external terms of trade, and CPI and current account deficit for Turkey's economy. In the study, monthly data was used between January 2005 and November 2014 and VAR analysis was performed. In the analysis, it was determined that a shock in oil prices would have the most effect on foreign trade. In addition, it concluded that the impact of the shocks on the current account deficit is shorter and more limited than the terms of foreign trade.

Güngör et al. (2016) analyzed the effects of changes in oil prices on current deficit in Turkish economy with the use of ARCH-GARCH models based on monthly data covering the period between the years 1992:1 - 2015:12. The analysis concluded that oil prices had a decreasing effect on current deficit and that structural breaks had no significant effect on current deficit.

Alagöz et al. (2017) have examined the impact on macroeconomic variables of oil prices in Turkey, China, South Africa, Mexico, Colombia, Costa Rica with the help of panel data analysis. They used the data from the period 1980-2016 annual data in the analysis. They used panel data analysis in the study. In the analysis, it was concluded that the one-dollar increase in the price of crude oil caused a 0.04% increase in inflation in the said countries and that the increase in the crude oil price had a negative effect on the current account deficit and affected the current account deficit.

Özaytürk and Alper (2017) looked into the effect of importation of oil on current deficit in 11 OECD countries including Turkey (Czechia, Finland, France, Germany, Ireland, Italy, Portugal, Spain, Sweden, Turkey, United Kingdom). The study utilized panel data analysis and was based on the data covering the years between 2000-2013. As a result of the analysis, it was found that there was a positive correlation between gross domestic product, amount of oil imported and the level of financial development and that the amount of oil important had the greatest impact on current deficit.

Şengönül et al. (2018) were examined the impact on exports of oil prices in Turkey by the ARDL bounds testing approach. They used the data from the period 2000:01 - 2016:12 in the analysis. The study concluded that the increase in oil prices in the long term positively affected exports.

Unutur (2018) investigated the relationship between oil prices and balance of foreign trade in Turkey using non-linear co-integration analysis based on monthly data from the year 2000 to 2015. Consequently, a long-term relation between oil prices and foreign trade deficit was found. It was also concluded that the changes in oil prices effected foreign trade deficit with a three periods of delay.

Cangül (2019) had examined the relation on current account balance of crude oil imports for Turkey and EU Countries in between 1996-2016 by the help of VAR analysis. The

results of the study showed that the results were in parallel with the results obtained in the literature.

4. Data and method

The present study analyzes the relationship between oil prices and current deficit in Bulgarian economy using annual data of the period between the years 1982-2017 with the help of time-series. Variables and their sources used in the analysis are shown in Table 2.

Table 2. Variables and sources used in the model

Variables	Using Variable	Elde Edildiği Kaynak
XM	Export-import (constant 2010 US \$)	World Bank WDI
OP	Oil Prices (brent crude oil prices \$/barrel)	OECD data

Table 3. Descriptive statistics of variables

	XM	OP
Average	0.0293	42.3404
Median	-0.044	28.6400
Maximum	0.6545	111.6700
Minimum	-0.2869	12.7200
Std. Error	0.2234	31.1392
Skewness	1.2866	1.1146
Kurtosis	4.0726	2.9174

The descriptive statistics of the variables to be used in econometric analysis (Table 3.) show that the mean values of all variables are neither near the maximum nor the minimum values. The standard deviation of the variables also appear to be scattered from the average. As a result, it can be said that there is no sample deviation in the data set.

4.1. Becker, Enders and Lee (2006) Fourier Function Unit Root Test

The Fourier Function Unit Root Test was developed by Becker et al. (2006) in an attempt to eliminate weaknesses of standardized tests. Fourier examines stationarity using the selected frequency component of a function. The test is designed to allow the best estimation in cases where breaks occur gradually.

KPSS type stasis testing is recommended because the unit rooted zero hypothesis is weak in the stationary series. The greatest advantage of the Fourier KPSS test is that it does not require the location, number and form of the breaks in the series to be determined in advance. The following equation is estimated.

$$y_t = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_t \quad (1)$$

$$y_t = \alpha_0 + \beta_t + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_t \quad (2)$$

k - indicates frequency value, t , trend value and T , number of observations.

Equation (1) tests the null of level stationarity while Equation (2) tests the null of trend stationarity. The test statistic is given by:

$$\tau_{KPSS} = \frac{1}{T^2} \frac{\sum_{t=1}^T \hat{s}_t(k^2)}{\hat{\sigma}^2} \quad (3)$$

Becker, Enders and Lee (2006) suggest that the frequencies in (1) and (2) should be obtained via the minimization of the sum of squared residuals.

The hypotheses of the test are as follows:

$H_0: \rho < 1$ Series is stationary.

$H_1: \rho = 0$ Series is non-stationary.

In the case that the calculated test statistics is greater in absolute value than the table value, H_0 is rejected.

4.2. Enders and Lee (2012) Fourier Unit Root Test

Enders and Lee (2012) proposed a new Dickey Fuller (DF) type root test with Fourier function.

$$y_t = \alpha(t) + \rho y_{t-1} + \gamma_t + \varepsilon_t \quad (4)$$

$$\Delta y_t = \rho y_{t-1} + c_1 + c_2 t + c_3 \sin\left(\frac{2\pi kt}{T}\right) + c_4 \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_t \quad (5)$$

The hypotheses of the test are as follows:

$H_0: \rho = 0$ Series is stationary.

$H_1: \rho < 1$ Series is non-stationary.

In the case that the calculated test statistics is greater in absolute value than the table value, H_0 is rejected.

Fourier unit root test results are shown in Table 4.

Table 4. Unit root test results

OP		Statistic	Critical value (%5)	Fourier
Fourier KPSS Test (Beckers et al., 2006)	Constant	0.2730	0.172	1
	Constant +trend	0.1258	0.054	1
Fourier ADF Test (Enders and Lee, 2012)	Constant	-2.999	-3.81	2
	Constant +trend	-3.2816	-4.35	2
XM				
Fourier KPSS Test (Beckers et al., 2006)	Constant	0.3264	0.172	1
	Constant +trend	0.4037	0.054	2
Fourier ADF Test (Enders and Lee, 2012)	Constant	-2.0110	-3.81	2
	Constant +trend	-3.2034	-4.35	2

Table 4 shows the results of Fourier KPSS and ADF unit root tests. It is known that the H_0 hypothesis is rejected when the calculated test statistic is greater than the table value. Accordingly, it is seen that both variables in the table have unit roots in both test groups. Therefore, it is decided that the variables are stationary in I (1).

Thus it had decided cointegration test for the variables. Arai-Krozumi cointegration test results are shown in Table 5.

Table 5. *Arai-Krozumi Co-integration Test Results for Level and Regime Shift*

	Level shift	Regime shift
KPSS Test Statistic	0.047	0.046
Fraction	0.139	0.139
Critical Value (%5)	0.259	0.257
Break Date	1991	1991

When the results in Table 5 are analyzed, it is seen that the calculated test statistics are less than the critical value, so there is a cointegration relationship between the series. The series moves in the long run. When the structural breakdown dates are examined, it can be seen that the test successfully predicted the effects of serious financial crises as a result of instability and strike waves in Bulgaria during the first half of 1990 and collapse of the Soviet market with the end of communist administration.

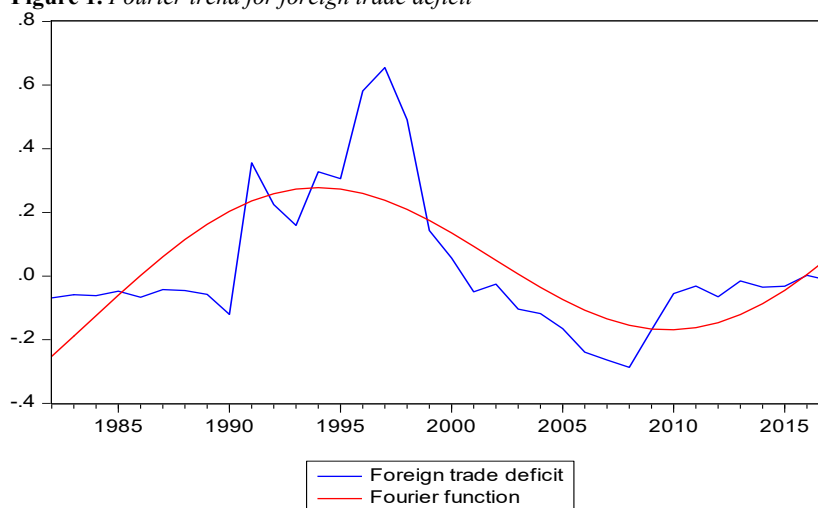
Figure 1. *Fourier trend for foreign trade deficit*

Figure 1 shows the Fourier trend for the foreign trade deficit in Bulgaria for the period 1982-2017. As seen in the figure, one of the largest structural breaks in 1982-2000 was in 1991 and the other in 1997. With the dissolution of the Eastern Bloc in 1989, radical structural, economic and social reforms have been introduced in Bulgaria. The radical structural, economic and social reforms began to come into effect in in Bulgaria with the dissolution of the Eastern Bloc in 1989. Bulgaria underwent a transitional period following the post-socialist era. Political crises during this transitional period brought upon financial instability which triggered outside forces in addition to causing the people of the country to become impoverished. In 1996, an economic crisis began in the country. Leva has decrease in value significantly against the dollar. There were difficulties in the payment of external debts. The economy of the country showing positive growth since 1994 was reduced to 9 percent in 1996. In February 1997, the economic crisis deepened. Thus, the tendency of Fourier function is clearly seen rather than a single break.

Conclusion

The mechanism by which oil prices affect real economic activity is the inclusion of both supply and demand channels. Some researches indicate that the transfer of the effects of rising oil prices as the main channel will lead to recession due to supply-side. In this case, oil price increases affect the potential production in economies. In addition, higher oil prices increase the cost of production and decrease the competitiveness of export industry in the country, leading to a decrease in the overall export volume. In this context, in order to examine the relationship between foreign trade and oil prices for the Bulgarian economy, data for the years 1982-2017 were used. Fourier ADF and Fourier KPSS unit root tests and Arai-Krozumi structural fracture cointegration tests were used to examine this relationship. According to the results, it is determined that there is a relationship between oil price and foreign trade in the long term. When the structural breakdown dates are examined, it can be seen that the test successfully predicted the effects of serious financial crises as a result of instability and strike waves in Bulgaria during the first half of 1990 and collapse of the Soviet market with the end of communist administration.

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