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THE RELATIONSHIP BETWEEN ENERGY PRICES AND MACROECONOMIC VARIABLES: EVIDENCE FROM OIL-IMPORTER TURKEY AND OIL-EXPORTER RUSSIA[1]

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ABSTRACT

For a country, energy is one of the most important inputs in terms of economic and social development. Therefore, it is extremely important to have a sustainable energy policy and to ensure price stability in a market environment. In this context, this study examines the impact of oil price changes on inflation and industrial production for a net oil importer country and net oil exporter country by dependency relationship between Turkey and Russia. The impact of energy price changes is analysed for Turkey and Russia for the period 1995:01-2014:12 with monthly data by using the SVAR method. The findings suggest that energy price changes affect inflation and industrial production in both countries.

Keywords: *Energy Prices, Economic Activity, Structural Vector Autoregression (SVAR).*

ENERJİ FİYATLARI İLE MAKROEKONOMİK DEĞİŞKENLER ARASINDAKİ İLİŞKİ: PETROL İTHALATÇISI TÜRKİYE VE PETROL İHRACATÇISI RUSYA'DAN KANITLAR

ÖZET

Bir ülke için ekonomik ve sosyal kalkınma anlamında enerji en önemli girdilerden birini oluşturmaktadır. Dolayısıyla enerji politikalarının sürdürülebilir olması ve fiyat istikrarının sağlandığı bir piyasa ortamında gerçekleştirilmesi son derece önem arz etmektedir. Bu doğrultuda bu çalışmada, Türkiye ve Rusya arasındaki enerji bağımlılığı ilişkisinden hareketle; net ithalatçı bir ülke ile net ihracatçı bir ülke için enerji fiyat değişimlerinin enflasyon ve sanayi üretimi üzerindeki etkisi incelenmektedir. Net ithalatçı Türkiye ile net ihracatçı Rusya açısından enerji fiyat değişimlerinin etkisi 1995:01-2014:12 dönemini kapsayan aylık veriler kullanılarak SVAR yöntemi ile analiz edilmiştir. Analiz sonucunda, enerji fiyat değişimlerinin enflasyon ve sanayi üretimi üzerinde her iki ülke için etkili olduğu tespit edilmiştir.

Anahtar Kelimeler: *Enerji Fiyatları, Ekonomik Aktivite, Yapısal VAR.*

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1. Introduction

Energy has an important place in human life. Countries' energy needs have increased after the Industrial Revolution because it has become a driving force in industrialization. Due to the unequal distribution of energy in the world, the energy and policies of countries can be different. Some countries lack adequate energy resources. As a result of this, energy importation of these countries increases and they become dependent on energy suppliers to maintain their economic growth. For that reason, any rapid changes in energy prices affect these countries more deeply. In respect to this, both oil-exporter and oil-importer countries consider energy price effects when they make social and economic policies. Oil-importer countries rely on crude oil as the main source of energy, while oil-exporter countries rely on oil revenues to meet their budget needs (Baghestani, 2014:21).

There is a growing literature that attempts to assess the impact of energy prices on macroeconomic variables. This study aims to take a closer look at the factors that underline the relationship between energy prices and macroeconomic variables which catch the attention scholars since 1970s when the recessions emerged as a result of oil price shocks in the US and in some European countries (Iwayemi & Fowowe, 2011: 603). Since then, crucial role of oil-prices for the well-being global economy has been underlined by various economists and politicians. Frequently, this leads to studies which examine the casual relationship between energy prices and macroeconomic variables. The majority of studies have found a negative relationship between rapid changes in oil prices and GDP, and this causal relationship is used as a signal for the conception that rapid oil price changes cause economic recessions.

The variables chosen in the studies which examine the relationship between macroeconomic performance and oil prices vary among the examined countries. There is no consensus on these variables. Different economic and social structures of countries-e.g. being oil-importer or oil-exporter- are important reasons of the non-consensual situation. Researchers examine the relationship between oil prices and macroeconomic performance through the variables like industrial production, economic growth, unemployment, wages, inflation and interest rate. Several studies suggest a negative effect on industrial production but a positive effect on inflation of oil prices and show that increasing oil prices cause low productivity as a result of increasing production costs. Oil price shocks may have asymmetric effects on economic activities. Rises in oil prices are associated with lower output growth, but decreases in oil prices do not cause higher output growth (Iwayemi & Fowowe, 2011:603). Rising oil prices can be an indicator of the classic supply side shocks; because it causes a decrease in energy sources which are one of the important inputs of production. Hence, productivity and output growth decline. Declining productivity leads to a fall in real wages and rise unemployment rate and thereby cause an acceleration in inflation rate. On the other hand, if consumers perceive oil price rises as temporary, they will be in a tendency to save less and to borrow more. This leads to an increase in equilibrium interest rate. Correspondingly, rising oil prices end up with reducing GDP growth and rising inflation and interest rate (Ciner, 2001:204-205; Brown & Yücel, 2002:195; Cologni & Manera, 2008:857; Du et all., 2010:4142-4143; Filis & Chatziantoniou, 2014:713).

From a theoretical perspective, oil price changes affect the performances of macroeconomic variables through the following six transmission channels (Brown & Yücel, 2002):

- Supply-side shock effect
- Wealth transfer effect
- Inflation effect
- Real balance effect
- Sector adjustment effect
- Unexpected effect

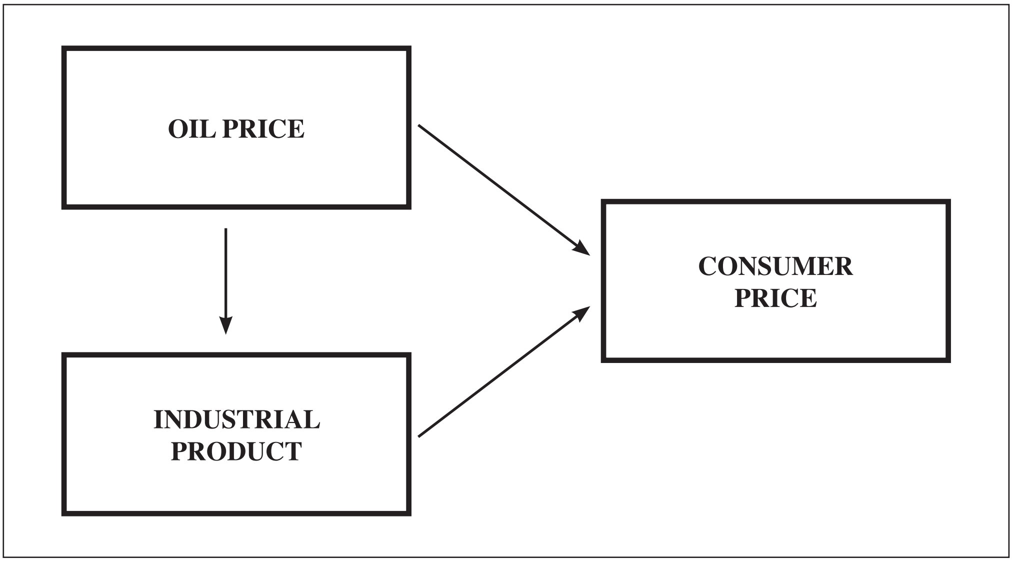
Our study investigates the effects of oil price shocks on inflation and industry. Therefore, in this study, two channels of the transmission mechanism is focused upon:

Oil price ↑ ➡ Output ↓

Oil price ↑ ➡ Inflation ↑

We assume that the oil price shock is considered to be our exogenous shock that triggers inflationary pressures and effects industrial production in the economy. According to the transmission mechanism of oil price shock, the transfer between inflation and oil prices working both directly and indirectly.

Figure 1: Diagrammatic Sketch for the Transmission Mechanisms of Oil Price Shock



Russia is one of the EU's largest suppliers of energy. Russia was the world's largest producer of crude oil including lease condensate and the third-largest producer of petroleum and other liquids (after Saudi Arabia and the United States) in 2014, with an average liquid production of 10.9 million barrels per day (b/d). Russia was the second-largest producer of dry natural gas in 2013 (second to the United States), producing 22.1 trillion cubic feet (Tcf). A number of individual EU countries are also heavily dependent on Russian supplies for certain energy resources, in particular natural gas. Russia is a major producer and exporter of oil and natural gas, and its economy largely depends on energy exports. Oil and natural gas revenues accounted for 50% of Russia's federal budget revenues and 68% of total exports in 2013.

Russian reserves of oil and gas are the driving force of its economy, which indirectly makes the country vulnerably to fluctuations in world energy and fuel prices. The case of a fall in the price of oil can be reduced by usage of a foreign ex-change reserve, which can cover the losses. Russia exported more than 4.7 million barrels per day (b/d) of crude oil and lease condensate in 2014, based on data from the Federal Customs Service of Russia. Countries in Asia and Europe received more than 98% of Russia's crude oil exports. Asia accounted for 26% of Russia's crude oil exports, and Europe—which depends on Russia for more than 30% of the region's oil supply—accounted for 72% of Russian crude oil exports. Russia's economy largely depends on energy exports: oil and natural gas revenues accounted for 68% of total export value in 2013.

Russia and Europe are interdependent in terms of energy. Europe is dependent on Russia as a source of supply for both oil and natural gas, with more than 30% of European crude and natural gas supplies coming from Russia in 2014. Russia is dependent on Europe as a market for its oil and natural gas and the revenues those exports generate. In 2014, more than 70% of Russia's crude exports and almost 90% of Russia's natural gas exports went to Europe (EIA, Russia Country Report,2014:21).

Besides this, Turkey is an increasingly important transit hub for oil and natural gas supply headed to Europe and other Atlantic markets from Russia, the Caspian region, and the Middle East. Turkey is primed to become a significant natural gas pipeline hub. However, currently most of its natural gas pipeline connections only bring natural gas into the country, as growing demands have left little natural gas for export. Since 2010, Turkey has experienced some of the fastest growth in total energy demand among countries in the Organization for Economic Cooperation and Development (OECD). Unlike several other OECD countries in Europe, Turkey's economy has avoided the prolonged stagnation that has characterized much of the continent for the past several years (EIA,Turkey Country Report,2014:1).

The motivation of this paper lies in several points. First; the world economy still runs on oil. Sharp fluctuations in the oil price provoke significant shifts in the wealth of nations. While the most of the existing studies on the theoretical and empirical understanding of the macroeconomic consequences of oil prices have focused on the US economy, studies on the relationship between oil exporter and oil importer countries are still very rare. Mounting empirical researches are in tendency to study the impact of oil prices on macro economy more common in developed, net oil importer countries. In contrast to these studies, the purpose of this paper is to investigate the impact of oil price changes in macroeconomic performance for net oil exporter Turkey and net oil importer Russia comparatively. Secondly, few works conduct a Structural Var model in their estimations. Finally, the third point, which is the main motivation of this paper is that , there is no study to -the best of our knowledge-, investigating the effect of energy prices between Russia and Turkey by employing VAR model in the literature. In order to fill this gap, the paper is organized as follows. In the first section the empirical literature about the relationship between oil prices and macroeconomic performance was reviewed with some selected studies. In the second section econometric model, method and data are introduced, and the final section presents empirical findings and concluding remarks.

2. Literature Review

Empirical studies which have questioned the impact of oil price changes on macro economy have received a great interest since the 1970s when the recessions in USA and oil price shocks in some European countries started. This has led to the proliferation of studies aiming to explore a causal link between oil shocks and macroeconomic activities. The analysis of macroeconomic impacts of oil price shocks and determining the optimal monetary policies in response to these impacts have long become one of the popular themes in the literature.

In the recent literature, the first studies which investigated the effects of changes in oil prices on the real income for USA and the other developed economies belong to Darby (1982) and Hamilton (1983). Darby were not satisfied about his study results because the considered variables were not able to explain the recession in the USA. On the other hand, Hamilton found significant results about the relationship between oil price changes and real income growth in the 1948-1972 and 1973-1980 periods for US economy. This negative correlation between oil price movements and economic growth reflects a causal link for oil prices through total economic activities. After Hamilton (1983), a large number of researches were carried out in various branches. Accordingly, studies in the recent literature reveal the relationship between oil price changes and macro economy, but there are different results about direction and intensity of this relationship in these studies.

Hamilton (2003) and Jiménez-Rodríguez (2004) examined the non-linear relationship between oil prices and macroeconomy. Jimenez-Rodriguez (2004) analyzed the relationship between oil prices and macroeconomic variables for OECD countries. The results of study which were found by using Granger causality test and multivariate VAR analysis suggest that changes in oil prices cause different results in macroecenomic variables in different countries. More recently, Hamilton (2008), in the paper “Oil and the Macroeconomy”, discusses the effects of oil price changes on economic growth in the US economy. He clearly states that there are several studies carried out on this subject arguing that the relationship between oil price changes and economic growth is hard to determine, at least through statistical analyses. There might be an undetectable force affecting both economic growth and oil price. The effects of heavy oil price changes have a great influence on unemployment in capital and energy intensive industries (Davis-Haltiwanger, 2001).

In 1986, Gisser and Goodwin reached similar results in Hamilton’s (1983) work. They analyzed the impact of oil price increases on macroeconomic performance through the real GDP, general price level, unemployment rate and real investments. The results of the study suggest that there is a causal relationship between oil price shocks and macroeconomic variables. Rotemberg and Woodford (1996) and Schmidt and Zimmerman (2007) found negative impact of oil price shocks on industrial production in developed country groups. However, the similar results reached in their studies show that this negative impact of oil price changes on economy could change in time and could lead to different effects. Eltony and Al-Awadi (2001) suggest that symmetric oil price shocks are important in explaining the fluctuations of macroeconomic variables in Kuwait. Raguindin ve Reyes (2005) analyze the effect of oil price shocks on the Philippines' economy covering period 1981-2003. The results suggest that these shocks led to a decrease in real GDP. However, in their asymmetric model, oil price decreases play an important role in each macroeconomic variable's fluctuations than oil price increases.

Mercan and Peker (2009) examined the relationship between oil prices and macroeconomic performance for Turkey in the 1992-2009 period with monthly data and inflation as representatives of macro economy. They concluded that impacts of oil price changes could become different cyclically. Hereunder, in the short term, oil price increases induce an increasing effect on inflation, but there isn't a strong effect in the long run. Farzagenan and Markwardt (2009) analyzed a model which contains real GDP, real public consumption expenditures, real import, real effective exchange rate, inflation and real oil price changes covering the period 1975-2006 with quarterly data. They found a positive relationship between oil price increases and industrial output growth for the Iranian economy which is quite vulnerable in the face of oil price fluctuations.

Soytaş et al. (2009) examined the long- and short-run transmissions of information between the world oil price, Turkish interest rate, Turkish Lira-US dollar exchange rate, and domestic spot gold and silver price. The results also show that, the world oil price has no predictive power of the precious metal prices, the interest rate or the exchange rate market in Turkey. The short-run price transmissions between the world oil market and the Turkish precious metal markets have implications for policy makers in emerging markets and both local and global investors in the precious metals market and the oil market.

Gronwald et al. (2009) examined the relationship between energy and macro economy for Kazakhstan's economy from 1994 to 2007. They use real GDP, inflation and exchange rate to analyze the relationship of oil price shocks and macroeconomic variables. Accordingly, they found oil price increases affect macroeconomic variables in a negative way in the inspected period. Öksüzler and İpek (2011) studied the effects of oil price changes on macroeconomic variables for Turkey covering the period 1987-2010 using monthly data. They take economic growth and inflation as macroeconomic variables and use VAR methodology to explain the relationship between these variables and energy prices. The results demonstrate that rapid increases in oil prices effect economic growth and inflation positively. Du et al. (2012) investigate the impact of oil prices on seventy macroeconomic indicators in China from 1997 to 2011 with monthly data. They concluded that the impact of oil prices on macroeconomic variables can be asymmetric. Ftiti et al. (2014) used industrial production, inflation and trade deficit as the base macroeconomic variables in their study which analyzed the relationship between oil prices and macroeconomic performance of the Indian economy. The results suggest that oil price changes have different effects on different macroeconomic variables and these effects can be higher in the short run with reference to the long run. Cunado et al. (2015) examined the macroeconomic impact of oil price shocks through economic activities and price channels for four Asian economies- Japan, South Korea, India and Indonesia- in the 1997-2014 periods with quarterly data. Similar to Ftiti et al. (2014), they provide evidence that effects of oil price shocks tend to be different for different type economic activities and prices.

The relationship between oil prices and macroeconomic performance was documented by Hooker (1996) via interest rate, inflation rate, import prices, unemployment rate and the real GDP for the USA from 1973 to 1994. The results suggest that there is not any causality between these macroeconomic variables and oil prices in the 1970s for the USA economy. Similarly, Bernanke et al. (1997) analyzed the impact of oil price changes on macro economy for the US economy. Their findings show that oil price changes affect economy, but impacts of these changes become significant with tight monetary policy. Du et al. (2010) attempted to explain the relationship between oil prices and macroeconomic variables for China, which has an important place in the world energy production. They analyzed the impact of oil price changes in China on the real GDP, inflation, money supply and interest rate in 1995-2008 periods. The results of the study show that effects of oil price changes on macroeconomic performance manifest itself especially on real GDP and inflation. However, it is stated that these generated effects on macroeconomic variables could be weak. Iwayemi and Fowowe (2011) also discuss the theoretical ramifications of the relationship between oil price movements and macro-economic performance. Their findings support the view that increases in oil prices affect macroeconomic variables presented with inflation, exchange rate, real GDP, government spending and net export, but these effects do not occur heavily during the period 1985-2007 in Nigeria.

While the impact of oil price shocks on oil-importer countries' economies is empirically validated in the literature, studies examining the relationship between oil prices and macro-economy have been rare for oil exporter countries compared to the degree of oil-importer countries. Accordingly, the studies of Olomola and Adejumo (2006), Mehrera (2008) and Zouari-Ghorbel (2009) analyzed different impacts of oil price shocks in oil-exporter countries. Jimenez-Rodriguez and Sanchez (2005) also examined different effects of oil prices changes in oil-importer and oil exporter countries separately. They concluded that oil price increases may reveal helpful results for oil exporter countries, while it may have reverse situation in the case of oil-importer countries. Similar results are also seen in the studies of Mendoza and Vera (2010), Korhonen and Ledveya (2010), Bjornland (2009) and LesCaroux and Mignon (2009).

3. Methodology and Data Description

3.1. Empirical Methodology

We examine the dynamic relationship among the spot price oil (OIL), the consumer price index (CPI) and the industrial production index (IPI) in two countries; the net importer Turkey and the net exporter Russia by employing a Structural VAR model. The vector autoregression (VAR) is an econometric model used to capture the linear interdependencies among multiple time series. VAR models generalize the univariateautoregressive model (AR model) by allowing for more than one evolving variable. All variables in a VAR are treated symmetrically in a structural sense; each variable has an equation explaining its evolution based on its own lags and the lags of the other model variables.

The structural representation of the VAR model of order p takes the following general form:

$$A_0 y_t = c_0 + \sum_{i=1}^{p} A_i y_{t-i} + \varepsilon_t$$

Where y_t is a mx1 vector of endogenous variables, A_i are mxm autoregressive coefficient matrices, ε_t is an mx1 vector of structural disturbances, assumed to have zero covariance and be serially uncorrelated. A_0 is a mxm matrix containing the contemporaneous relations among the variables. In order to get the reduced form of the model (1) we multiply both sides of the equation with A_0^{-1}. Let e_t be the reduced form errors, where e = A_0^{-1} ε_t is assumed to be the white noise processes. The structural disturbances can be derived by imposing suitable restriction on A_0. The ordering of the variables and the exclusion restriction in our model are as follow:

$$\begin{bmatrix} e_{1t}^{OIL} \\ e_{2t}^{CPI} \\ e_{3t}^{IPI} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} = \begin{bmatrix} \varepsilon_{1t}^{OIL\ SHOCK} \\ \varepsilon_{2t}^{CPI\ SHOCK} \\ \varepsilon_{3t}^{IPI\ SHOCK} \end{bmatrix}$$

This methodology allows us to measure the dynamic feedback effects among the variables. SVAR (Structural Vector Autoregression) approaches processes for models are listed below: (McCoy, 1997:7):

- Performing stability analysis of the variables in the model
- Determination of values of variables in the model (level or difference)
- Determining the number of delays
- Estimating the reduced VAR model and then to put sufficient constraints for the estimation of the structural parameters.

3.2. Data Description

We obtained monthly data from 1995: 01 to 2014: 12 for Turkey and Russia from the International Financial Statistics (IFS) online database.. Consumer price index and industrial production index are transformed to natural logarithms. The variables and sources are listed below in Table 1 and Table 2 provides descriptive statistics for the supporting data set.

Table 1: Variables and Sources

Variables	Description	Sources
SPO	Spot Crude Oil Prices ($/Brent)	OPEC
TCPI	Consumer Price Index (Turkey)	IFS
RCPI	Consumer Price Index (Russia)	IFS
TIPI	Industrial Production Index (Turkey)	IFS
RIPI	Industrial Production Index (Russia)	IFS
D1 (Dummy Variable)	D1 = 0 Introduced before the 2008:05 D1= 1 among 2008:05- 2009:05 D1= 0 Introduced after the 2009:05	

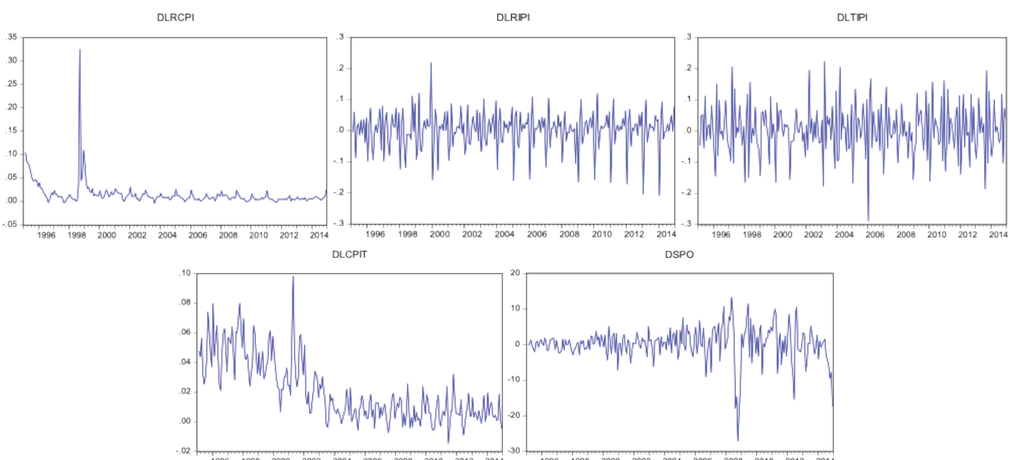
Table 2: Descriptive Statistics for Oil Prices, Inflation and Industrial Production

Series	Mean	SD	Skewness	Kurtois	J-B Stat.
TURKEY					
SPO	0.187	4.874	-1.448	8.985	440.228
CPI	0.577	0.669	0.992	5.150	85.254
IPI	0.003	0.080	-0.045	3.518	2.755
RUSSIA					
SPO	0.187	4.874	-1.448	8.985	440.228
CPI	0.0146	0.025	7.993	89.386	76859.98
IPI	0.002	0.0607	-0.748	4.806	54.790

In order to determine time series characteristics of data, standard time series unit root tests can be applied. To ensure robustness we use several unit root tests, including the augmented Dickey and Fuller (1979) (ADF) test, the Phillips and Perron (1988) (PP) testand Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The aim of these tests is determining whether the shocks disappear over time or not. H_0 means series are not stable in ADF and PP tests while it means stable series in KPSS test. Thereby, it is important to use these tests together for reliability of findings obtained from unit root analyses.

Graphs of series used in the model are as follows;

Figure 2: Stationary Graphs of Series Used in Model



Inclusion of fixed and trend variables of regression model in unit root analysis cause different results. Thus, unit root test is estimated for both level and trend-intercept models. Variables are non-stationary by level, so they are rendered stationary state by taking first difference. Table 3 shows unit root test results of first difference values of used variables in the model:

Table 3: Unit Root Test Results

Level	Series	ADF	PP	KPSS
Intercept	Spo	-1.782032[0.3889]	-1.600341[0.4808]	1.876910
	Tcpi	0.440797[0.9843]	2.835970[1.0000]	1.938687
	Tipi	-0.853104[0.8015]	-2.149822[0.2256]	2.020667
	Rcpi	-2.576063[0.0994]	-4.524223[0.0002]	1.807910
	Ripi	-0.801126[0.8165]	-1.569460[0.4967]	1.978964
Trend and Intercept	Spo	-3.061528[0.1181]	-2.873634[0.1730]	0.217367
	Tcpi	-3.028022[0.1269]	-3.057115[0.1192]	0.150061
	Tipi	-3.497572[0.0420]	-8.049601[0.0000]	0.107155
	Rcpi	-2.011585[0.5916]	-3.182935[0.0904]	0.468330
	Ripi	-2.889384[0.1680]	-6.364056[0.0000]	0.199315
1st Difference	**Series**	**ADF**	**PP**	**KPSS**
Intercept	Spo	-14.62873[0.0000]	-43.59228[0.0001]	0.278005*
	Tcpi	-10.93147[0.0000]	-58.28912[0.0001]	0.182226*
	Tipi	-14.52044[0.0000]	-143.1714[0.0001]	0.084253*
	Rcpi	-14.08596[0.0000]	-30.77133[0.0000]	0.116019*
	Ripi	-14.22082[0.0000]	-46.24561[0.0001]	0.082967*
Trend and Intercept	Spo	-14.62873[0.0000]	-43.59228[0.0001]	0.278005*
	Tcpi	-10.92147[0.0000]	-59.78077[0.0001]	0.091626*
	Tipi	-14.48381[0.0000]	-143.2335[0.0001]	0.083661*
	Rcpi	-14.09854[0.0000]	-30.84098[0.0000]	0.038017*
	Ripi	-14.18936[0.0000]	-46.13702[0.0001]	0.069301*

Note: Numbers in brackets represents prob values. * indicate significance at the 1%.

According to our results, reported in Table 3, all variables are non-stationary at levels, but they became stationary after taking first differences in the SVAR model forecast. A critical element in the specification of VAR models is the determination of the lag length of the VAR. Lag length of series used in model as follows:

Table 4: Lag Length Table of Turkey

Lag	LogL	LR	FPE	AIC	SC	HQ
0	139.9199	NA	3.55e-06	-1.197532	-1.137181	-1.173180
1	511.6239	727.0334	1.55e-07	-4.331489	-4.029731*	-4.209725
2	525.0973	25.87839	1.58e-07	-4.309228	-3.766064	-4.090053
3	558.0833	62.19375	1.36e-07	-4.458883	-3.674313	-4.142298
4	575.3601	31.96596	1.35e-07	-4.470133	-3.444157	-4.056137
5	614.5585	71.14430	1.10e-07	-4.674525	-3.407142	-4.163117
6	658.8182	78.77040	8.58e-08	-4.923508	-3.414719	-4.314690*
7	674.7724	27.83200	8.60e-08	-4.923104	-3.172910	-4.216875

Table 4 continued

8	697.2963	38.49911	8.14e-08	-4.980584	-2.988983	-4.176944
9	715.3902	30.28924	8.02e-08	-4.999032	-2.766025	-4.097981
10	734.9819	32.10626	7.80e-08	-5.030677	-2.556264	-4.032215
11	779.1929	70.89347	6.12e-08	-5.279233	-2.563413	-4.183360
12	809.5434	47.59815*	5.43e-08*	-5.405669*	-2.448443	-4.212385

Table 5: Lag Length Table of Russia

Lag	LogL	LR	FPE	AIC	SC	HQ
0	167.1751	NA	2.79e-06	-1.437666	-1.377315	-1.413314
1	418.2117	491.0142	3.52e-07	-3.508473	-3.206715*	-3.386709*
2	443.3344	48.25339	3.25e-07	-3.588850	-3.045686	-3.369675
3	458.7729	29.10862	3.26e-07	-3.583902	-2.799332	-3.267317
4	469.4984	19.84457	3.42e-07	-3.537431	-2.511455	-3.123434
5	476.1398	12.05392	3.72e-07	-3.454976	-2.187593	-2.943569
6	497.6168	38.22339	3.55e-07	-3.503231	-1.994443	-2.894413
7	512.6082	26.15251	3.59e-07	-3.494346	-1.744151	-2.788116
8	536.9599	41.62310	3.34e-07	-3.567929	-1.576328	-2.764288
9	542.3565	9.034002	3.68e-07	-3.474507	-1.241500	-2.573456
10	574.1255	52.06201	3.22e-07	-3.613441	-1.139028	-2.614979
11	645.2392	114.0324	1.99e-07	-4.099024	-1.383204	-3.003151
12	702.4899	89.78530*	1.39e-07*	-4.462466*	-1.505241	-3.269182

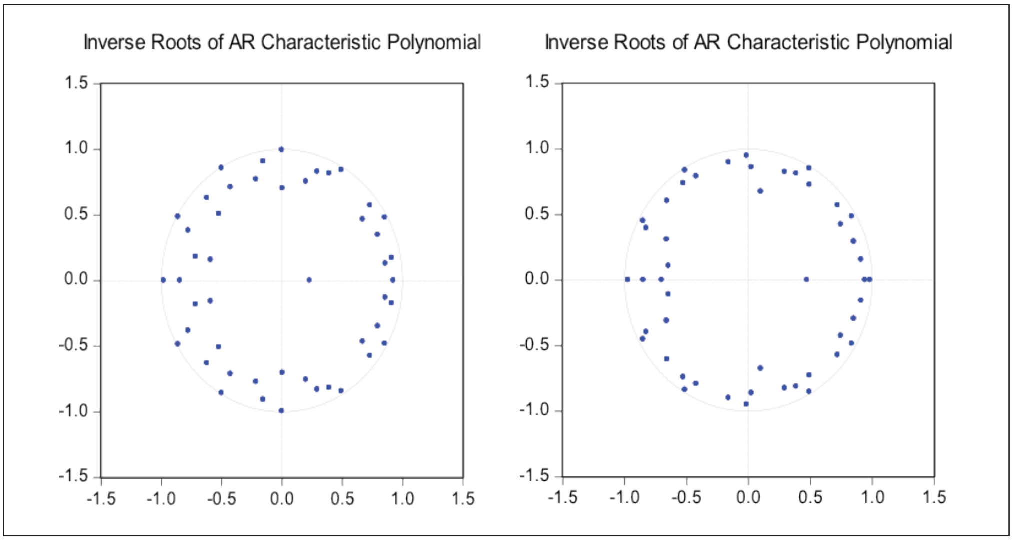
There are different information criteria available for choosing a more parsimonious model, and we have applied the Schwarz (1978) information criterion (SC) and the Akaike (1974) information criterion (AIC). The lag length was determined 12.

4. Empirical Results

4.1. Structural VAR Results

In order to test the stability of model, we used inverse roots of AR characteristic polynomial graph. As seen in Figure 1, none of the roots are out of circle both for Russia and Turkey. Notwithstanding, the results of the stability tests for all variables revealed that no root lies outside of the unit circle, reflecting the satisfaction of the VARs stability conditions. The roots that are under 1 means stability condition is realized for established models. In the following graphs, while the left circle belongs to the model for Russia, right circle belongs to the model for Turkey.

Figure 3: Inverse Roots of AR Characteristic Polynomial Graphs



Another crucial point to note in VAR model is the absence of autocorrelation problem in the error terms of VAR model. The VAR residual serial correlation LM test is also conducted for further confirmation of serial independence of residuals. The results of the VAR residual serial correlation LM tests have been presented in the Table 6. Table 6 and Table 7 show LM test results for 12th lag length of error terms of VAR models for respectively Russia and Turkey. It is observed from Table10 that the marginal significance at LM statistics for autocorrelation at any lag h (h = 1, ...,11) is not large enough to reject the null hypothesis of 'no serial correlation'.

Table 6: LM Test Results for Russia

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Sample: 1995M01 2014M12		
Included observations: 227		
Lags	LM-Stat	Prob
1	24.22879	0.0846
2	42.60078	0.0003
3	33.68035	0.0060
4	25.25809	0.0654
5	16.14000	0.4432

Table 6 continued

6	15.07562	0.5191
7	12.80201	0.6872
8	22.26191	0.1349
9	21.33220	0.1661
10	27.33307	0.0379
11	9.523981	0.8903
12	20.21080	0.2109
Probs from chi-square with 16 df.		

Table 7: LM Test Results for Turkey

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Sample: 1995M01 2014M12		
Included observations: 227		
Lags	LM-Stat	Prob
1	22.07882	0.1407
2	32.66681	0.0082
3	26.42578	0.0483
4	19.99410	0.2205
5	24.53789	0.0784
6	12.48897	0.7097
7	11.70522	0.7640
8	25.60074	0.0599
9	12.92681	0.6781
10	31.10463	0.0130
11	15.17175	0.5121
12	33.52530	0.0063
Probs from chi-square with 16 df.		

4.2. Impulse Response Functions

The purpose of the VAR models including the SVAR framework is to examine the dynamic adjustments of each variable involved in exogenous stochastic structural shocks. The impulse response functions show how a residual shock in the model affects the current and future values of all the endogenous variables. Thus, we only present the analysis of impulse response functions. In this study, impulse response functions are based on the parameter estimates obtained from the following constraint matrix. The matrix constraints have been created departing from both economic theory and practical literature.

Table 8: Constraint Matrix

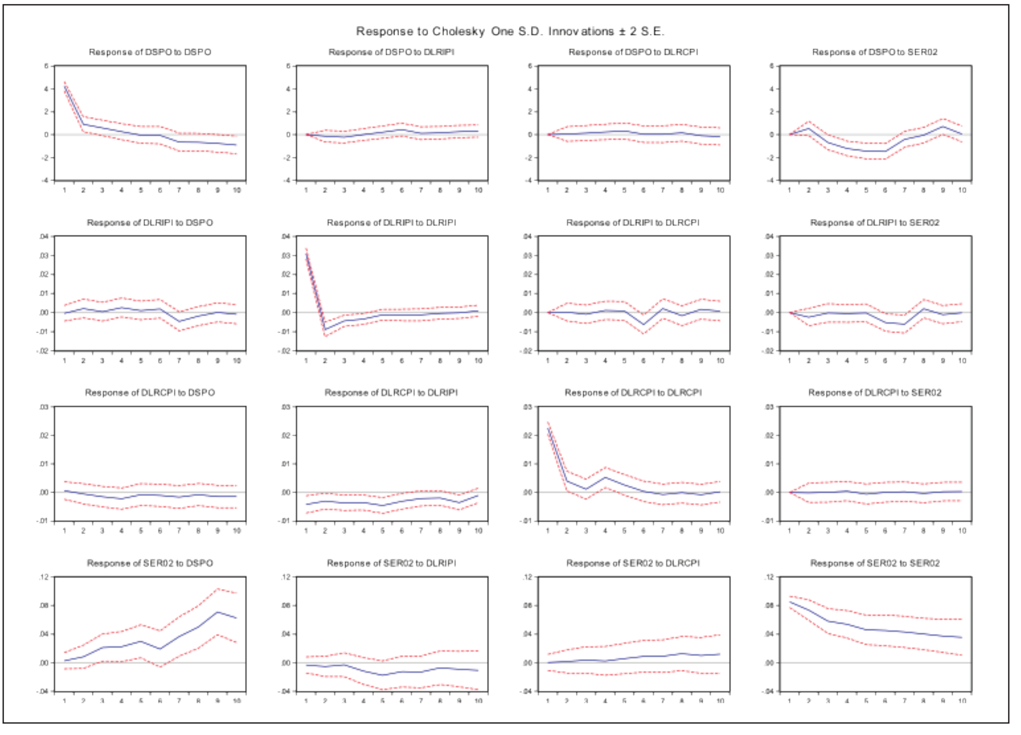
	OIL	IPI	CPI	D
OIL	*	0	0	0
IPI	*	0	*	*
CPI	0	*	*	0
D	0	0	0	*

Note: *; variables affect each other, 0; there is no correlation between the variables.

Impulse response functions (IRF) represent the response of variables in a standard deviation shock for all variables in the system. The IRF shows how a residual shock to one of the innovations in the model affects the contemporaneous and future values of all endogenous variables The impulse response functions are reported in Figure 4 and Figure 5. The variables in the following graphs are located in their response to each other for Russia. Impulse response analysis supports that the effect of the shock applied any of the variables on the other variables. The effects of shock are expected to disappear over time. Bottom and upper dashed lines in the chart represent the confidence interval of the middle shock.

Oil-price shock is defined as one standard deviation change in oil price in Figure 4 for Russia in the long term. The impact of industry production of oil price shocks shows the first month of uncertainty. After it is observed that the negative effects until the end of the fourth month, the impact of an oil price shock on inflation is positively and increasingly. This major effect continues until the end of the eighth month. The impact of a positive shock on inflation in the industry production occurs within two months. Inflation is affected in a negative way before, and then positive. An immediate and harsh negative effect is seen between the fifth and seventh months on inflation.

Figure 4: Response of Macroeconomic Variables of Russia for Oil-Price Shock



Oil-price shock is defined as one standard deviation change in oil price in Figure 5 for Turkey in the long term. The impact of oil price shock on industrial production is uncertainty in the first month. In the second month, a negative effect arises. The effect is lost at the end of the fourth month. The impact of an oil price shock on inflation shows uncertainty firstly. After that, a small positive effect is seen. The impact of a positive shock on inflation in the industry production is negative. The effect occurs sharp and harsh. After that, the effects continue in the form of ups and downs.

Figure 5: Response of Macroeconomic Variables of Turkey for Oil-Price Shock

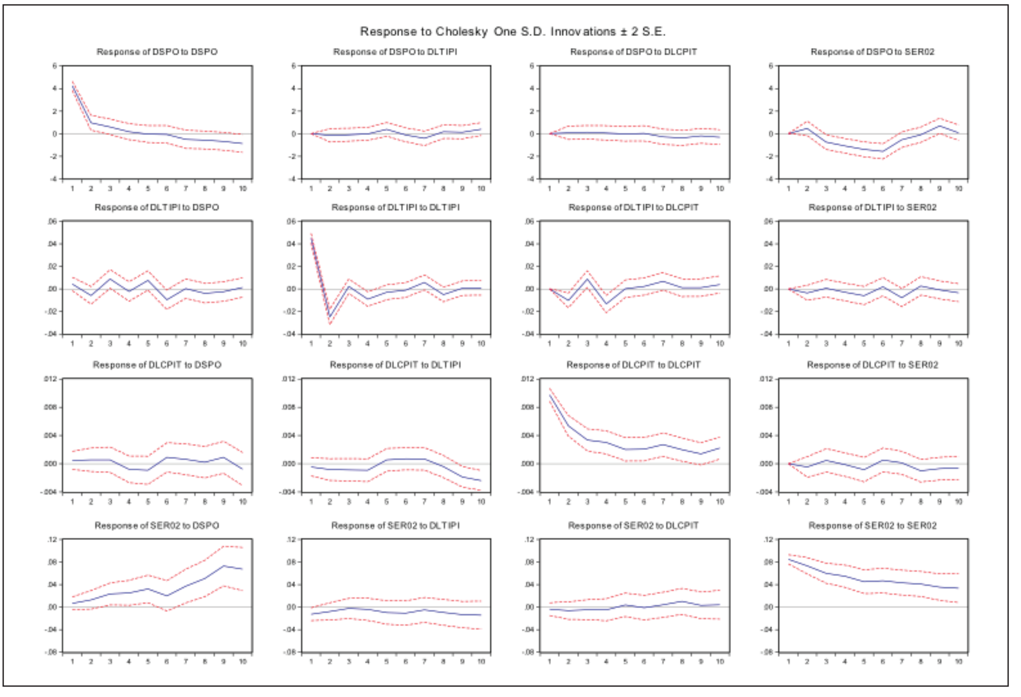


Table 9: Summary of the SVAR Findings

Country	Response to positive OIL Shocks		Response to positive CPI Shocks		Response to positive IPI Shocks	
	CPI	*IPI*	*OIL*	*IPI*	*OIL*	*CPI*
Russia	+	-	-	-	+	-
Turkey	+	-	0	-	0	-

Table 9 present a summary of the SVAR findings. Signs of variables were found as estimated. As a result, empirical findings are consistent with theoretical expectations.

5. Conclusion

The impacts of energy price changes on both developed and developing economies have been discussed thoroughly since 1980s. Macroeconomic efficiency of Turkey- which is a net oil importer country- is affected by energy price changes significantly. Despite of widespread research area about developed and developing countries, studies that examine the energy price effects from the point of distinction of oil importer and oil exporter countries are quite a little. Therefore, we examine the impact of energy price changes on macroeconomic variables for oil importer Turkey and oil exporter Russia separately. SVAR method which shows the net impacts of oil shocks is used with monthly data in analyses. The results show that oil shocks effect inflation and industrial production.

As a result of theoretical and empirical analyses, it can be stated that oil shocks have important effects on macroeconomic efficiencies both net oil-exporting and net oil-importing countries. In this regard, similar and different effects were investigated for both Turkey and Russia. We find evidence suggesting that oil shocks affect the level of inflation positively and the impact of oil shocks on industrial production is negative in both countries. These results -pointed in this study-are similar to results of Farzanegan & Marwardt (2009), Filis & Chatziantoniou (2014) and Ftiti et all. (2014).

Consequently, energy price is an important factor that affects macroeconomic efficiency for net oil importer Turkey. Hence, policy makers and industrial sector should take economic decisions considering the oil price shocks. Moreover, oil price shocks reveal inflationist pressure for an oil exporter country. This is important to consider that energy price changes have direct and indirect effects in determining economic variables in oil exporter countries, too.

Our results may seem controversial, but, as referred before, the results concerning the relationship between these variables widely on the countries studied, the period covered and especially on the methodology applied. It would be interesting to extend the period and the country sample in future research and eventually, perform a panel analysis. Nonetheless, this article provides some useful insights on the relationship between energy prices and economic variables.

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