EGE AKADEMİK BAKIŞ / *EGE ACADEMIC REVIEW*

Cilt 19 • Sayı 2 • Nisan 2019
SS. 301 / 308
Doi: 10.21121/eab.558475
Başvuru Tarihi: 30.06.2016• Kabul Tarihi: 28.12.2018

The Effects of Oil Prices and Exchange Rates Movements on Economic Growth of the Selected Emerging Oil Dependent Countries

Petrol Fiyatlarındaki ve Nominal Kurdaki Dalgalanmaların Petrole Bağımlı Bazı Gelişmekte Olan Ülkelerin Ekonomik Büyümesi Üzerindeki Etkileri

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ABSTRACT

This study aims to investigate the impacts of volatility of oil prices on the real economic growth. Six heavily oil importer emerging market countries are explored in the study. They are also lower middle oil consumer countries, namely Chile, Philippines, Poland, South Africa, Thailand and Turkey. The quarterly dataset covers the period January 1996- December 2016. To gauge volatility of oil prices, quarterly coefficient of variation for oil prices derived by average daily crude oil prices is used as a proxy, together with the gasoline and diesel fuel average pump prices. The results of panel estimation reveal the following findings: Volatility of oil prices concurrently moves with the volatility of foreign exchange rates, which in turn leads to a change in the GDP growth rates. Moreover, for a three month lag, movements of oil prices and exchange rates adversely affect the GDP growth rate for the emerging oil importing countries under investigation. Thus, these results supports the idea that oil price movements make up some part of the volatiliy of exchange rates and gradually affect the GDP growth rates. These results might be helpful for improving adjustment strategies of the economic activity against oil price movements.

Keywords: Economic Growth, Volatility of Oil Prices and Exchange Rates, Net Oil Importer Emerging Countries, Panel Estimation

JEL Codes: E23, O19, C33

ÖZET

Bu çalışma, petrol fiyatlarının reel ekonomik büyüme üzerideki etkilerini incelemeyi amaçlamaktadır. Çalışma, büyük ölçüde petrol ithalatında dışa bağımlı gelişmekte olan altı ülke temel alınarak yapılmıştır. Kişi başına petrol tüketimi bakımından da düşük orta düzeylerde bulunan bu altı ülke şunlardır: Şili, Filipinler, Polonya, Güney Afrika, Tayland ve Türkiye. Çalışmada kullanılan üç aylık veri seti Ocak 1996-Aralık 2016 arasındaki dönemi kapsamaktadır. Petrol fiyatlarındaki dalgalanmayı temsili olarak göstermek için, benzin ve dizelin ortalama pompa fiyatları ile birlikte, günlük ham petrol fiyatlarındaki dalgalanmadan yola çıkarak hesaplanan petrol fiyatlarının üç aylık varyasyon katsayısı kullanılmıştır. Panel veri yöntemi kullanılarak yapılan tahminler şunları ortaya koymaktadır: Petrol fiyatlarının hareketlendiği dönemlerde aynı zamanda döviz kurları da dalgalanmakta; bu durum GSYİH büyüme oranlarında belirli bir değişim olacağına işaret etmektedir. Ayrıca petrol fiyatlarındaki ve döviz kurundaki dalgalanmalar, üç aylık gecikme dönemi sonrasında ele alınan gelişmekte olan ülkelerin GSYİH büyüme oranları üzerinde aksi yönde etki bırakmaktadır. Sonuçlar; petrol fiyatlarındaki dalgalanmaların kurlardaki dalgalanmaların belirli bir kısmını oluşturduğunu, bu dalgalanmaların zamanla GSYİH büyüme oranlarını da etkilediği düşüncesini desteklemektedir. Ortaya çıkan bu sonuçlar da ekonomik aktivitenin petrol fiyatlarındaki hareketliliğe karşı uyum sağlayacağı stratejilerin geliştirilmesinde yol gösterici olabilir.

Anahtar Kelimeler: Ekonomik Büyüme, Kur ve Petrol Fiyatlarındaki Dalgalanma, Net Petrol İthalatçısı Olan Ülkeler, Panel Tahmini

Jel Kodu: E23, O19, C33

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1. Introduction

Oil has been increasingly the most important source of energy after the Second World War. Today, it covers nearly one third of the world's energy requirements.[1] Moreover, oil has more heated debates in both the public and academic arenas since oil is an important economic input and there is a widespread notion that virtually all economic recessions are associated with increases in oil prices (Gronwald, 2016).

Economic activity depends on many other variables besides oil prices. However, oil prices and macroeconomic uncertainty due to the oil price fluctuations have crucial impacts on the economic activity (Barksky and Kilian, 2004, Aguiar-Conraria and Wen, 2007, Aguiar-Conraria and Sores, 2011, Peersman and Van Robays, 2009 and Taghizadeh-Hesary and Yoshino, 2015). The dataset covers the quarterly period between January 1996 and December 2016. This study specifically aims to explore the link between the volatility of oil prices and the macroeconomic performance by using a panel of six oil importer emerging countries namely Chile, Philippines, Poland, South Africa, Thailand and Turkey. According to the BP Statistical Review of World Energy (2017), these countries have also been lower middle oil consumers, with below 2.25 tonnes per capita oil consumption a year in 2016.

Previous studies generally use VAR or panel VAR to investigate the link between oil price shocks and macroeconomic activity such as Jiménez-Rodríguez and Sánchez (2005 and 2009), Aguiar-Conraria (2007), Aziz and Abu Bekir (2011), Balke and others (2010), Yıldız and Karacaer-Ulusoy (2013), Öztürk (2015) for VAR; Berüment and others (2010) Aziz and Dahalan (2015) and Brini and others (2016) for panel VAR. The VAR/panel VAR methodology basically examines how shock identification is performed, and how one can conduct inference with such models. However, by blending the inter-individual differences and intra-individual dynamics, panel estimation provides more accurate inference of model parameters. Therefore, this study discusses the link between oil price movements and macroeconomic performance from the view of panel estimation. To the best of our knowledge, the link between volatility of oil prices and the macroeconomic performance of net oil importer emerging countries at the same oil consumption pattern has not been analyzed from the view of the model parameters. Thus, this paper is a small step towards closing that gap.

The study is organized as follows: Section 2 provides economic consequences of oil prices. Section 3 includes the methodology together with the data. Section 4 presents the estimation results. Finally, Section 5 concludes.

2. Oil Prices and Economic Consequences

There is a large literature on the economic consequences of oil price fluctuations. Supply and demand elasticities of oil are not constant and changes in response to developments in technology, geopolitical-political circumstances, and economic foundations. A lower price elasticity of oil demand and supply during uncertain economic times means that shocks hitting the oil market generate larger responses in prices but smaller responses in quantities compared to more certain times. Consequently, changes in the demand and supply elasticities in the short run can rationalize opposite movements in oil prices (Van Robays, 2012 and Baumeister, C. and Peersman, 2013). Besides, efforts have been made to analyze the transmission mechanisms whereby oil price shocks affect the macroeconomic activity (Brown and Yücel, 2002).

An oil price increase may also have a negative effect on consumption and investment. Consumption is affected through its positive relation with disposable income, and investment by rising firms' costs and uncertainty, which leads to a postponement of investment decisions (Ferderer, 1996). Therefore, economic policy makers are concerned about large price movements in oil markets.

Inspired by the oil price shocks of the 1970s and 1980s and subsequent events, there are also some studies mainly concentrated on developing empirical models of the effects of higher oil prices on macroeconomic variables such as Hamilton (1983), Mork (1989), Hooker (1996) and Céspedes and Velasco (2012). Then, Kumar (2005) and Zhang (2008) supported the validity of asymmetric impact of oil price changes on economic activities. That is, whether a country is oil rich or oil dependent may lead to asymmetry of the impact of oil price changes on its economic activity.

3. Data and Methodology

This study analyses exploring the link between the volatility of oil prices and the macroeconomic performance by using panel estimation.

To gauge volatility of oil prices, quarterly coefficient of variation for oil prices derived by average daily crude oil prices is used as a proxy. In this calculation,

the average of gasoline and diesel fuel pump prices (henceforth average pump prices) is also taken into account.

Crude oil can mostly be used in the products of gasoline and diesel fuel. So, it can be assumed that there is a relationship between the crude oil prices and the average average pump prices. Therefore, the average pump prices can be reckoned with the volatility of crude oil prices as below:[2]

$$Voil_{it} = \left(\frac{average\ pump\ price_{i\_1t}}{average\ pump\ price_{1t}}\right) * vcoil_t \text{ for } i_{\_1\,t} = \text{Chile, Phillipines, Poland, South Africa, Thailand and } i_{1t} = \text{Turkey} \quad (1)$$

The first term in the right hand side paranthesis shows indexes for average pump prices of the countries taken into account, basing on average pump prices of Turkey. The $\mathrm{vcoil_t}$ above represents the quarterly coefficient of variation calculated by daily crude oil prices. Thus, it is possible to get a measure of quarterly volatility in terms of coefficient of variation for crude oil prices as in Andersen (2003):

$$vcoil_t = \frac{\sigma_{coil_t}}{average(coil_t)}, \text{ where t=1,2, } 90 \quad (2)$$

Since it is also possible to obtain exchange rates daily as crude oil prices, volatility of nominal exchange rates (vfx_{it}) can be calculated by using the same methodology with the quarterly volatility in terms of coefficient of variation for crude oil prices ($vcoil_{it}$).

The parameters used in the model are summarized in Table 1, Figure 1, Figure 2 and Figure 3. Results are based on quarterly data for the period January 1996 through December 2016.

Table 1: Summary of the Variables Used in the Estimations

Variable	Symbol	Period	Number of Observations	Data Source
Real GDP Growth Rate*	G_{it}	1996:1-2016:4*	84*	IMF
Volatility in Nominal Exchange Rates	vfx_{it}	1996:1-2016:4	84	Bloomberg
Volatility in Average Pump Prices	$voil_{it}$	1996:1-2016:4	84	Bloomberg/ World Bank

*Real GDP growth rates according to the changes between the related quarter of the current year and the previous year's same quarter.

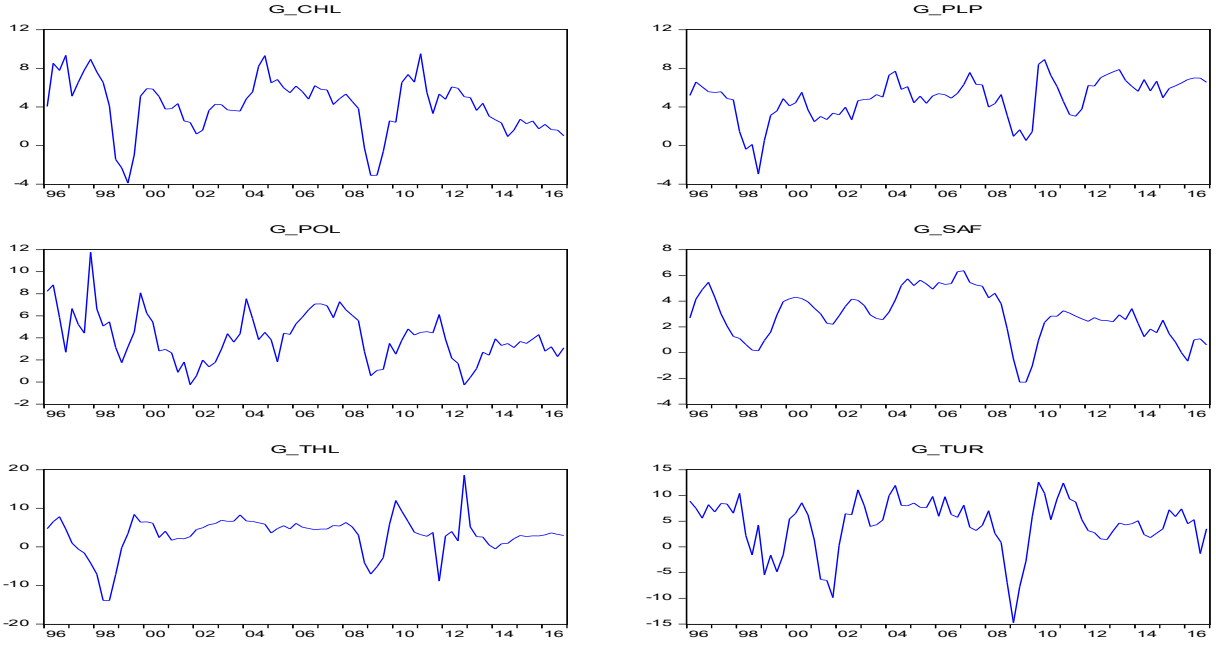

Figure 1: Real GDP Growth Rate (%)

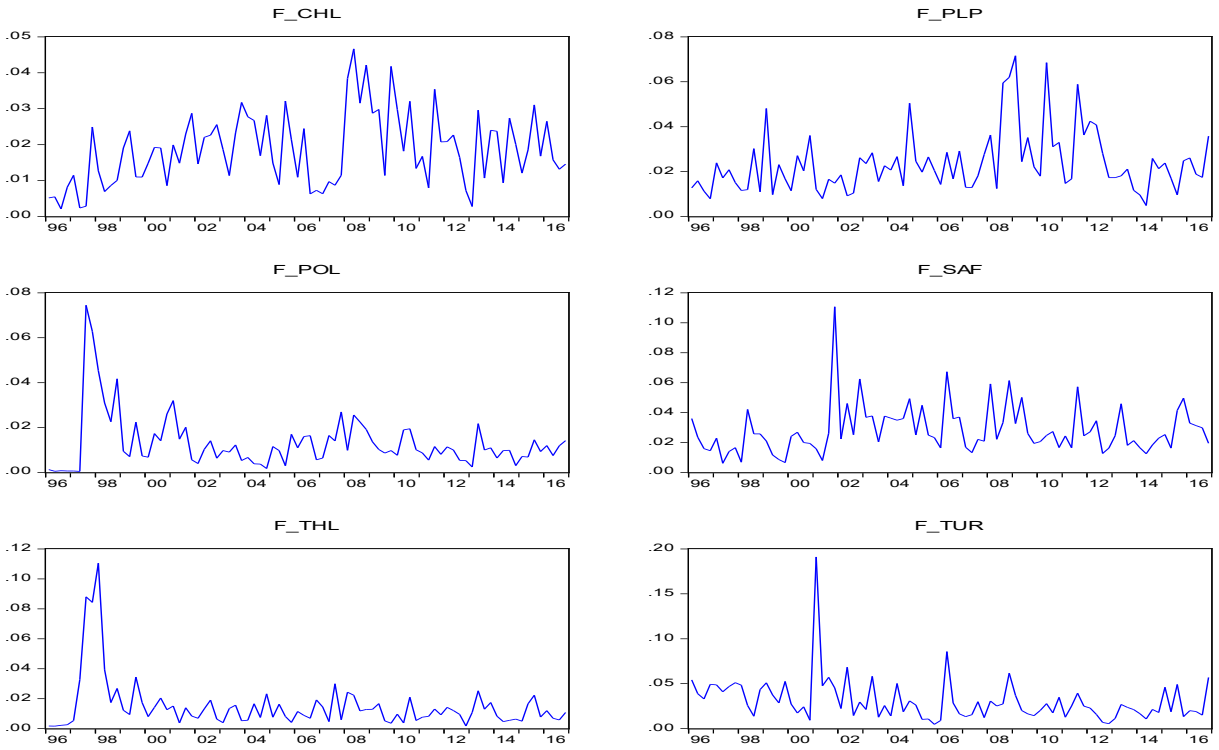

Figure 2: Volatility in FX Rates

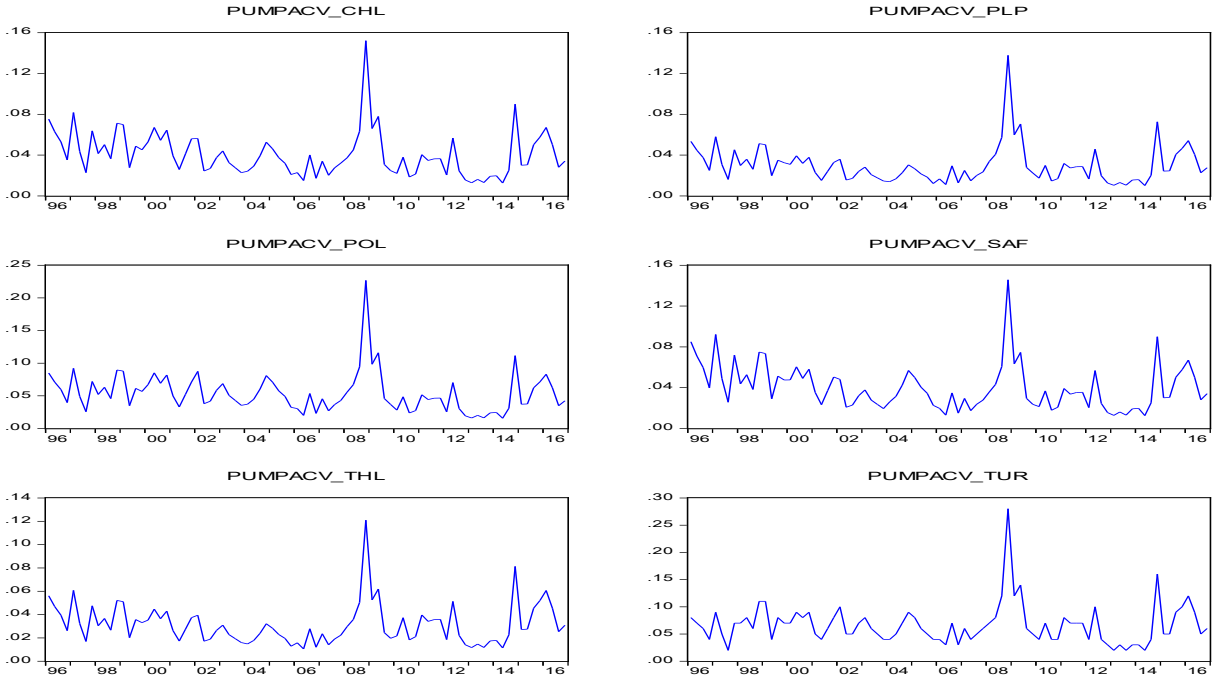

Figure 3: Volatility in Average Pump Prices

In explaining the real GDP growth rates with the volatilities in average pump prices and nominal exchange rates, the time series model of Hamilton (2003) has been extended into a panel fashion including volatility of both exchange rates and oil prices. The dependent variable G_{it} is the real GDP in Equation (3) can be written according to Arellano and Bond (1991):

$$G_{it} = c + \beta G_{it-1} + \zeta_1 vfx_{it-1} + \zeta_2 vfx_{it-2} + \delta_1 \delta voil_{it-1} + \delta_2 \delta voil_{it-2} + \gamma_i + u_{it}, \text{ where } |\beta| < 1 \quad (3)$$

In Equation (3) i and t represent the countries and the quarters, respectively The u_{it} are assumed finite moments and in particular $E(u_{it}) = E(u_{it}\, u_{is}) = 0$ for $t \neq s$.

The hypothesis of these estimations is that an oil price volatility increase may lower the real GDP growth rate as in Kliesen (2008). According to this hypotheses, it is expected that when $\delta<0$, $\zeta<0$ and $\beta>0$ in Equation (3).

Before starting, variables should be tested against the presence of cross-sectional dependence and unit root. The presence of cross-sectional dependence can be tested by using Pesaran (2004), which employs a technique of Lagrange Multiplier to test the presence of correlation across the cross sectional error terms.3 This technique simply says that the null hypothesis tests the presence of cross-sectional dependence against the alternative one. Then, the presence of cross sectional dependence is rejected for all the variables (Table 2).

Table 2: Pesaran's Cross Sectional Dependency Test

	Test Statistics	Probability
G_{it}	7.560	0.0000*
vfx_{it}	-1.193	0.2329
$voil_{it}$	5.546	0.0000*

***, **, and * denote significance at 10% 5% and 1% levels respectively.

Unit root can be tested by using Levin, Lin and Chu (LLC) (2002). Constant and linear time trend, and lag lengths are specified by Akaike's Information Criterion (AIC). According to the tests, all the variables have no unit root at the level with none of individual intercept and trend (Table 3).

Table 3: LLC Tests

	Variables (level)		Variables (first difference)	
G_{it}	-3.12676	No Unit Root	-12.8861	No unit root
vfx_{it}	-2.73446	No Unit Root	-14.3202	No unit root
$voil_{it}$	-4.66182	No unit root	-31.4141	No unit root

AIC is used to choose lag length. All tests include no trend and no intercept.
Maximum lag length is 4.

4. Results of Estimations

In the background of the estimations in I and II in Table 4, volatility of average pump prices and exchange rates are assumed to be the important determinants of the macroeconomic activity. There are as well two different lag structures of the independent variables and there is no autocorrelation in first-differenced errors in these estimations.

Table 4: Results of the Arellano-Bond Dynamic Panel Data Estimation

	I	II
β	0.6526114* (20.55)	0.6616465* (22.31)
ζ_1	-30.03461* (-4.68)	-32.06955* (-5.16)
ζ_2	-6.29994 (-0.96)	
δ_1	-24.51304* (-5.56)	-22.48922 * (-5.47)
δ_2	2.563109 (0.57)	
c	3.0132* (8.45)	2.940705* (10.27)
Wald χ^2	699.21 *(prob. 0.0000)*	706.26 *(prob. 0.0000)*
Arellano-Bond test for zero autocorrelation in first-differenced errors (H_0: no autocorrelation)		
Order 1	-0.84245 *(prob>z, 0.3995)*	-1.1361 *(prob>z, 0.2559)*
Order 2	0.85548 *(prob>z, 0.3923)*	1.1605 *(prob>z, 0.2459)*
Order 3	1.6251 *(prob>z, 0.1041)*	1.1565 *(prob>z, 0.2823)*
Order 4	-1.744 *(prob>z, 0.1812)*	-1.1694 *(prob>z, 0.1177)*
Sargan test (H_0: over-identifying restrictions are valid)		
Sargan Test	508.9731 *(prob>z, 0.1360)*	516.3613 *(prob>z, 0.1978)*

The computed z-statistics are given in parentheses.
***, ** and * denote significance at 10% 5% and 1% levels respectively.

Table 4 shows the negative relationship between volatility in average pump prices and the real GDP

growth rates at 1% level of significance for one lag in coloum II. This may imply that increases in oil prices volatility will lower GDP growth rates three months later. Oil price movements may bring about many implications such as increasing production costs due to the raise in the value of oil imports. Therefore, oil prices volatility, through the influence on income, consumption, disposable income, investment decisions and resource reallocation, may gradually change aggregate output.

Moreover, Table 4 depicts that there is an adverse relationship between real GDP growth rate and exchange rate volatility at the 1% level of significance for the one lag in coloum II. Basically, the volatility in oil prices may partially trigger the volatility of exchange rates. After a while, these movements may pass through the growth paths of GDP. Consequently, these findings maintain that oil price movements have some relationship with the macroeconomic variables as in Davis and Haltiwanger (2001) and Segal (2011).

5. Conclusion

This study investigates the effects of oil prices volatility on the GDP growth rates of the six emerging net oil importer countries. Of course, not all nations are created equal in this regard. The selected net oil importer countries in this study are too small to affect oil prices and have the same level of per capita oil consumption. On the other hand, as in Asteriou and Villamizar (2013), oil price changes are expected to produce statistically significant impacts on the economic growth performances in these countries.[4]

The results of panel estimation meet this expectation and reveal that volatility of oil prices concurrently moves with the other macroeconomic variables such as the exchange rates. Then, the initial influence of changing oil prices will gradually be sizeable especially for the heavily oil dependent countries.

Moreover, due to the lower price elasticities of demand and supply, shocks hitting the oil market generate larger responses in prices than in quantities especially during the economic uncertainty periods. So, the heavily oil dependent countries may be more affected by the volatility of oil prices than the oil rich ones.

The findings supports the negative relationship between economic growth of oil importing countries and the volatility of oil prices as in Gülay and Pazarlıoğlu (2016). To sum up, the heavily oil dependent countries cannot fully isolate themselves from the impacts of volatility of oil prices. However, to understand the way and the lag of the volatility will further help to improve adjustment strategies of the economic activity.

END NOTES

[1] The views expressed in this paper belong to the author only and do not represent those of the institution of the author or its staff.

[2] I would like to express my thanks to Prof. Dr. Harun Öztürkler for his beneficial suggestions in the calculation of the volatility of crude oil prices.

[3] When there is short cross section dimension (say less than 10), and the time dimension of the panel is sufficiently large, Breusch-Pagan (1980) Lagrange Multiplier can be employed to test for cross-sectional independency.

[4] Asteriou and Villamizar (2013) analyze the short-run causal relationship between oil price and the macroeconomy for 50 countries, grouping them as members of the OPEC, other oil exporting countries, and several oil importing countries, by using annual data covering the years between 1967 and 2011.

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