Title: Oil prices and Economic Growth in Developed Countries

Yutaka Kurihara
Professor
Aichi University

Abstract

This article examines the relationship between oil prices and economic growth. From both economic theory and empirical analysis, the relationship between oil prices and economic growth is unclear. Existing studies have shown that oil-exporting countries have enjoyed economic growth in general; however, the effects on the economies are different for oil-importing countries. Using empirical methods, oil price increases cause positive economic growth in the United States, European Union, and Japan. The empirical analysis also shows that appreciation of each domestic currency brings economic growth. However, VAR results show that these effects at best last long only one year or so.

Keywords: commodity price, economic growth, exchange rate, oil price

1. Introduction

This article examines the relationship between oil prices and economic growth. Much research (e.g., Baldwin, 1965; Chambers & Gordon, 1966; Frankel & Romer, 1996) has considered which exports may act as so-called engines of growth for the economy. Are examples. Oil has received much attention as it is a main exporting product for some countries and many countries cannot mine natural resources including oil. Oil is necessary for the achievement of economic stability and growth. The price of oil has been unstable and it is very difficult to predict the price as well as supply and demand. Technological advancements make accurate prediction of supply levels more difficult to achieve. Recently, prices have been falling or stable. Also, like other commodities, oil has been traded for speculation is some cases. Other natural resources are cheaper than oil, and available infrastructure plays an important role in economical production of oil. Most developed countries have relied on enterprises and market forces, including commodity markets, to direct economic development, which requires sufficient investigation and examination.

Commodity prices, including oil and exchange rates, greatly impact economic growth. Of course, the impact of oil price fluctuations is considered to be different for oil-importing and -exporting countries. In general, oil price increases are good news for oil-exporting countries and bad news for importing countries. Jayaraman and Lau (2011) showed that the commodity price boom with rising oil prices has brought considerable economic growth to Papua, New Guinea. On the other hand, the United Nations Economic and Social Commissions for Asia and Pacific (2008) and Asian Development Bank (2005, 2008) showed that small countries with no oil resources have been hit by increases in worldwide oil prices. Olomola (2006) and Akpan (2009) indicated that for net-oil exporting countries, a price surge directly increases income as a result of higher export earnings and rising oil prices promote economic growth. Aliyu (2009) showed that oil prices and appreciation of domestic currency relate positively with economic growth. Darby (1982), Cerralo (2005), and Bjørnland (2009) showed that oil price surges result from increases in demand rather than from supply sides effects. Oriakhi and Iyoha (2003) indicated that oil price changes determine government expenditure, which in turn determines the growth of the Nigerian economy. These articles have demontrated empirically that surges in oil prices cause economic growth.

On the other hand, Olsen and Flo (1992) showed that oil price volatility and resulting shocks because negative economic growth. Gounder and Bartleet (2007) noted that demand-side shocks of energy crisis could result in high inflation and high unemployment rates. Khuran, Liu, and Rehana (2015) showed that oil price controls are more worthwhile than monetary contraction. FEDs when oil prices increase, FEDs adjust interest rates to promote stable inflation. Khuram et al.

Also indicated that surges in oil prices have a positive effect on national income in oil-producing countries. The other effect is negative because increased oil prices decrease demand and worsen the balance of current accounts in oil-producing countries. This situation generally causes depreciation of the domestic currency, which relates positively with growth in developing countries in general (Khuram et al., 2015); however, these changes correlate negatively with growth in developed countries (Rodrik, 2008). Also, Okonju (2009) noted that crude oil prices have been more volatile than any other commodity prices, which in general causes negative effects on economic growth.

Olaokun (2000) showed that oil price surges cause negative effects on the economies of Ghana and Nigeria but has a positive effect on Russia's economy. Olaokun also noted that oil shocks do not affect output and inflation in Nigeria. Moreover, Yahia and Metwally (2007) analyzed the case of Libya and found that there is no long-term relationship between Libyan and oil exports and non-oil GDP.

In general, depreciation of domestic currency makes import prices expensive but encourages exports and leads to positive economic growth. On the other hand, Tille (2003), Hsing (2005), and Aliyu (2009) indicated that appreciation in exchange rates makes import prices cheaper and causes economic growth. Moreover, Hildegart and Magdalena (2015) showed that commodity price formation in the long-run is determined by supply and demand factors, which is separate from the US real exchange rate.

Depreciation of a domestic currency leads economic contraction in demand and output. Depreciation in exchange rates makes import prices higher and decreases money value. An increase in interest rates caused by the above situation has a negative effect on investment and consumption. Government has to pay more money for debt. These side effects are sometimes very difficult to overcome.

In the field of empirical analysis, Jayaraman and Lau (2011) showed that economic growth and international reserve are co integrated. Few studies have considered co integration of each variable.

After the worldwide financial crisis in 2008, commodity transactions have increased greatly, instead of US dollar and US stocks. Typical commodity prices, namely, gold prices, for example, have risen enormously. The relationship between exchange rates and stock prices has been analyzed not only in business but also in academic fields; however, the empirical results seem ambiguous about the relationship and a clear consensus has not been reached. The relationship varies depending on the time, span, currency (exchange rate), kinds of stocks, and so on. One reason may be the omission of some important factors. Commodity price is one possibility when analyzing the relationship between exchange rates and stock prices (Kurihara, 2013).

There is some possibility that the relationship between exchange rates and commodity prices and also the relationship between commodity prices and stock prices should be taken into account when analyzing the relationship between exchange rates and stock prices. Despite the importance of this issue, it has not been discussed a lot in spite of the fact that some studies have examined the relationship between exchange rates and stock prices. Considering commodity prices, including oil price, is important to achievement of sound economic growth. This article examines the relationship between oil price and economic growth. It is structured as follows. Section 2 provides a methodology for empirical analyses. Section 3 shows the empirical results and analyzes them. Finally, this article ends with a brief summary.

2. Methodology for Empirical Analyses

The relationship between oil price and economic growth is empirically analyzed in this article. The basic estimation equation is as follows (1):

Growth = a + bREER + cOIL

Growth denotes real GDP, REER denotes real exchange rate (which is different from each case), and OIL denotes oil prices for each country (countries).

Based on the model of Khuran et al. (2015), this equation is based on the hypothesis that economic growth has a relationship with real exchange rate and oil prices.

Equation (1) is the basic version; however, if all variables are found to be integrated at the same order, other methods apply. This fact should be taken into account as there is some possibility that serious problems may occur in the estimation. The existence of stable long-run dependencies among the variables should be examined.

If there is evidence of co integration, then another estimation method instead of ordinary least squares (OLS) should be examined and employed.

Quarterly data for the variables are taken from International Financial Statistics (IFS) and from 1990 to 2015(Q1). For the case of the EU, the sample period is from 2000 to 2015(Q1), because of the introduction of the euro.

3. Empirical Methods and Results

First, the augmented Dickey-Fuller test is employed. This calculation starts with the unit root tests of all of the variables considered to determine whether the series is stationary. Standard inference procedures do not usually apply to regressions that contain an integrated dependent variable or integrated repressors, as this violates the assumption of white noise disturbance. REER for the United States is SDR and for the European Union and Japan is the US dollar.

The results are shown in Table 1. All of the variables are significant at the rate of each variable, in case in which I (1) exists. The results show the existence of a long-run relationship among the variables at the first difference.
<Table 1 approx. here>
For estimation of equation (1), first the OLS is employed. Instead of using the level, the first order is used for estimation. Also, one-time lag of GDP is included as an explanatory variable to obtain more stable results (see Table 2).
<Table 2 approx. here>

As indicated by the unit root tests shown in Table 1, all of the variables are not stationary. The finding that many macro time series may contain a unit root has spurred the development of nonstationary time series analysis. A linear combination of two or more nonstationary series are said to be co integrated. Following the ADF, the present approach uses a co integration test. It is known that a linear combination of two or more nonstationary time series may be stationary. If such a stationary linear combination exists, the nonstationary time series is said to be co integrated.

The stationary linear combination may be interpreted as a long-run equilibrium relationship among the variables. The purpose of the co integration test is to determine whether or not groups of nonstationary series are co integrated. The results show that trace test indices co integration at 5% (at most 1), which confirms that oil prices and economic growth can be interpreted as having a long-run equilibrium relationship between the variables. Both variables are nonstationary. Note, however, that the relationship between the two variables is significant. Rising oil prices influence economic growth.

VAR is used for estimation (see Tables 3a, 3b, and 3c). The lag interval is four according to the Akaike Information Criterion (AIC) test. The sample period is the same

Table 1: ADF Test

	Level	First Difference
US		
GDP	-1.994	-8.902***
REER	-2.040	-3.926***
EU		
GDP	-2.185	-7.283***
REER	-1.707	-3.146**
Japan		
GDP	-0.637	-2.746*
REER	-1.676	-2.946**
OIL	-1.224	-3.397**

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

Table 2: OLS

	USGDP		EUGDP		Japan GDP	
C	3.495*** (12.592)	0.462** (2.090)	2.621*** (8.316)	0.405* (1.795)	-0.817*** (-2.934)	-0.374* (-1.792)
REER	-0.005 (-0.093)	-0.050** (-2.054)	-0.007 (-0.163)	0.007 (0.307)	-0.125*** (-4.682)	-0.064*** (-3.066)
OIL	0.036*** (3.941)	0.008* (1.866)	0.028*** (3.195)	0.005 (0.981)	0.023*** (3.041)	0.013** (2.421)
GDP(-1)		0.841*** (16.240)		0.808*** (13.520)		0.638*** (7.447)
Adj.R2	0.259	0.866	0.124	0.788	0.314	0.646
F-Statistic	11.469	130.200	5.240	75.359	14.733	37.531
Prob(F-S stat)	0.000	0.000	0.008	0.000	0.000	0.000
D.W.	0.280	1.312	0.236	1.088	0.790	1.417

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

Table 3a: VAR Test for Oil Price, Real Exchange Rate, and Economic Growth: US

	USGDP	USREER	OIL
USGDP(-1)	1.128*** (10.949)	-0.305 (-1.117)	0.275 (0.142)
USREER(-1)	-0.076* (-1.925)	1.0282 (9.842)	-1.848** (-2.497)
OIL(-1)	-0.007 (-1.158)	-0.005 (-0.131)	0.757*** (6.717)
Adj.R2	0.727	0.645	0.537
F-Statistic	55.408	37.992	24.652
Akaike AIC	3.107	5.057	8.972
Schwartz SC	3.260	5.211	9.126

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

Table 3b: VAR Test for Oil Price, Real Exchange Rate, and Economic Growth: EU

	EUGDP	EUREER	OIL
EUGDP(-1)	1.063*** (10.672)	-0.480 (-1.670)	3.697** (2.320)
EUREER(-1)	-0.010 (-0.303)	1.124*** (12.134)	0.289 (0.562)
OIL(-1)	0.003 (0.614)	-0.013 (-0.739)	0.816*** (8.306)
Adj.R2	0.791	0.725	0.552
F-statistic	78.032	54.749	26.136
Akaike AIC	3.396	5.514	8.939
Schwartz SC	3.549	5.668	9.093

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

Table 3c: VAR Test for Oil Price, Real Exchange Rate, and Economic Growth: Japan

	JapanGDP	JapanREER	OIL
JapanGDP(-1)	1.019*** (10.077)	0.328 (0.808)	1.874 (1.260)
JapanREER(-1)	-0.056** (-2.139)	1.028*** (9.756)	0.266 (0.689)
OIL(-1)	0.008 (1.215)	0.029 (1.083)	0.907*** (9.060)
Adj.R2	0.733	0.655	0.503
F-statistic	57.138	39.798	21.686
Akaike AIC	3.668	6.444	9.043
Schwartz SC	3.821	6.598	9.196

Note) ***, **, and * denote significant at 1, 5, and 10% level.

Moreover, impulse responses are performed based on this study. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. For stationary series, the impulse responses should die out to zero and the accumulated responses should asymptote to constant. Based on the equations in Table 3, the impulse response function is as shown in Figures 1a, 1b, and 1c.

Figure 1a: Oil Price, Real Exchange Rate, and Economic Growth: US

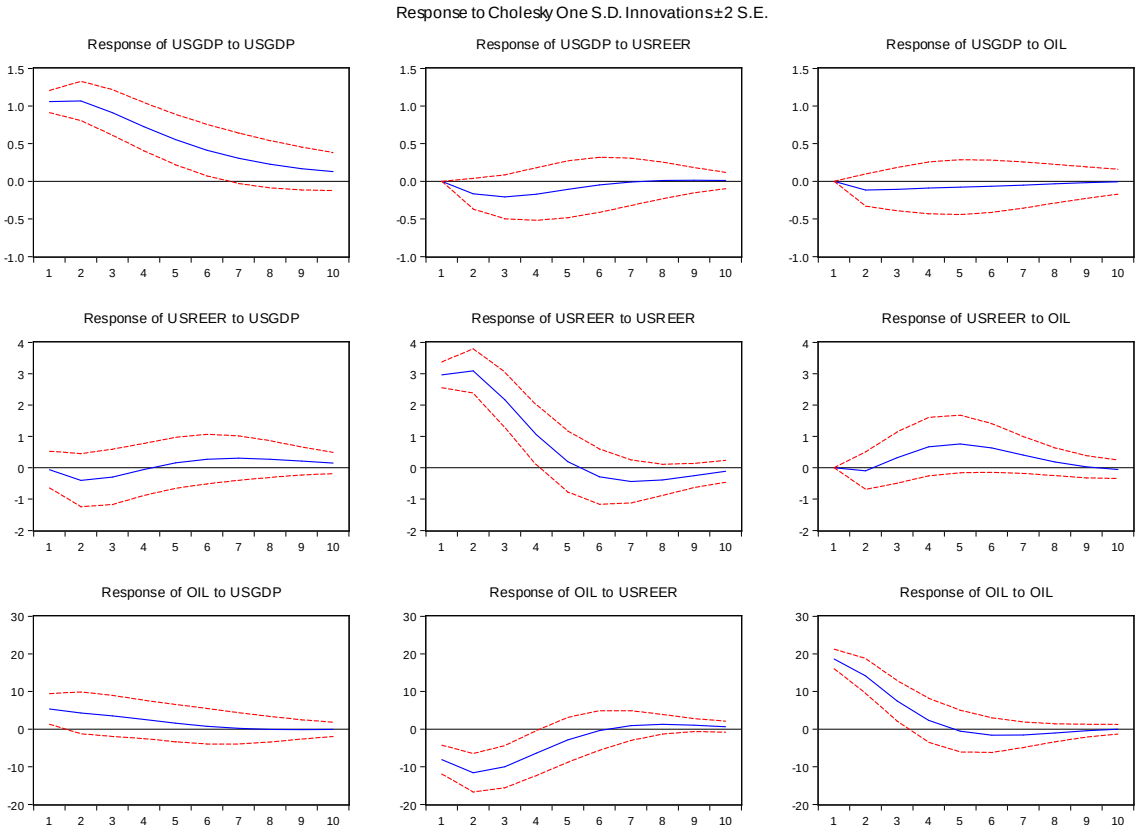


Figure 1b: Oil Price, Real Exchange Rate, and Economic Growth: EU

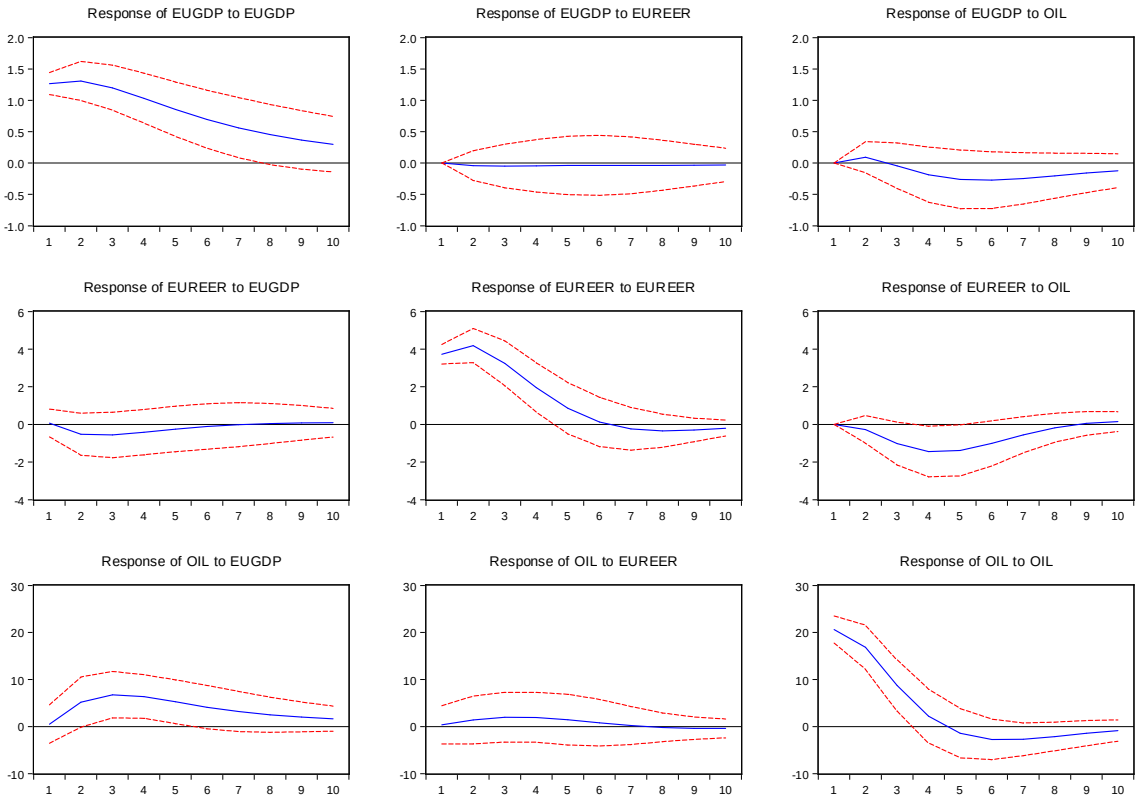
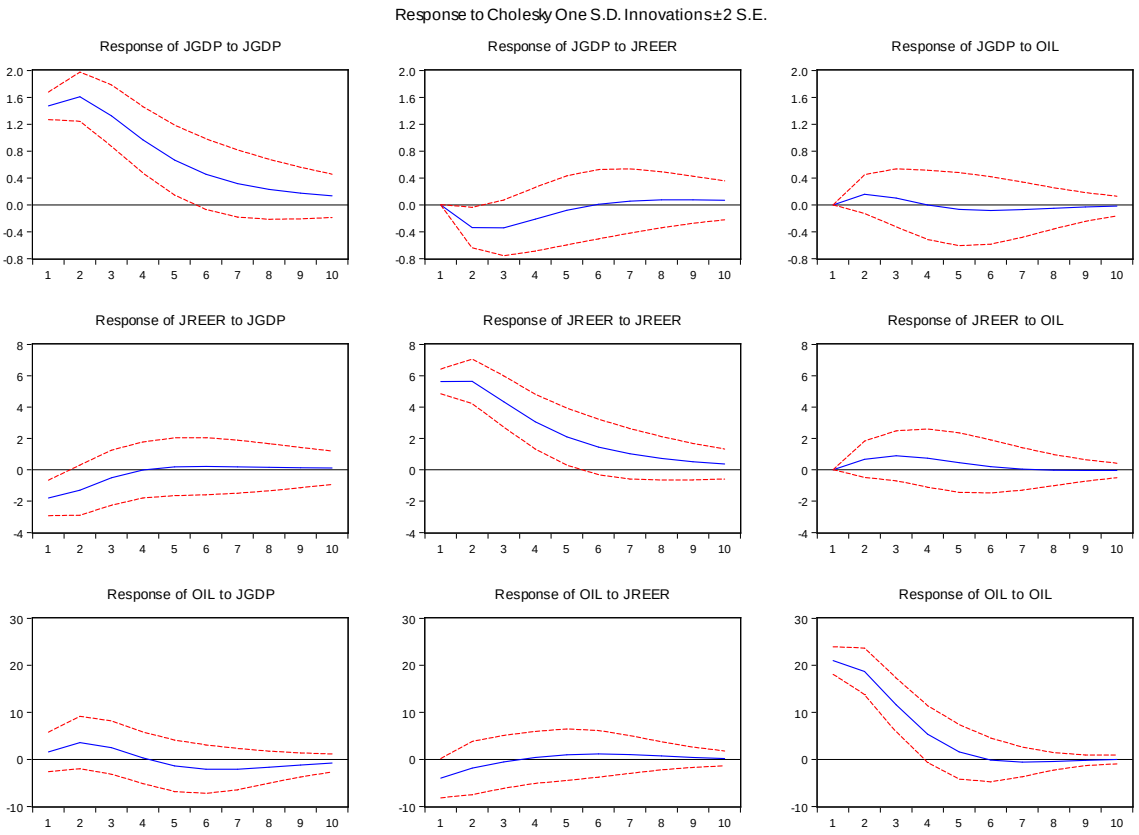


Figure 1c: Oil Price, Real Exchange Rate, and Economic Growth: Japan



The results shown in Figures 1a, 1b, and 1c are clear and interesting. Rising oil prices impact the economy positively. Strong demand for oil has positively influenced the economies. However, the impact continues at best one year or so. To attain economic growth, supply-side improvements would be needed. Moreover, exchange rate depreciation may cause economic growth. Expanding exports via domestic currency depreciation to foreign countries would be one of the reasons. On the other hand, the effect does at best last one year or so. After that, this situation will damage the economy. Too much dependence on exchange rates to boost the economy may have good effects on the economies; however, it does not last long and may cause side effects.

4. Conclusions

This article empirically examined the relationship between oil price and economic growth. Existing theory and empirical analysis have not clarified the relationship between oil prices and economic growth. Generally, existing studies have shown that oil-exporting countries have enjoyed economic growth; however, the effects on the economies are different for oil-importing countries. Using empirical methods, this study showed that oil price increases cause economic growth positively for the United States, the European Union, and Japan. Also, this study showed that appreciation of each domestic currency brings economic growth. However, the effect on the economies lasts at best one year or so.

These results contain some important implications. Strong demand for oil usually relates to a boost in the economy. It would be natural to obtain the results in this article. Supply-side improvements are necessary to boost the economy in developed and non-oil-exporting countries. Also, prices of oil have become too complex. Speculation in financial markets for oil has been very active and prices changes are influenced by various factors. Other natural resources instead of oil, such as LNG, have been used for industries especially for the United States. Some political aspects are relevant.

For exchange rates, dependence on exchange rates to boost the economies has some merit; however, overdependence on this technique may damage the economy. It is clear that improvements to the competitiveness of the economies would be the most important way to boost the economies. This study omitted exchange rate volatility, additional countries, time span, and so on, because of data availability. Further study is needed.

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