The relationship between Market Size, Inflation and Energy

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Abstract

The aim of this research is to study the relationship among oil prices, market size and inflation in the North of Europe over the period 1980 - 2009 by applying panel data model. The unit root test shows that all variables are stationary in first-order difference. Hausman (1978) test suggests the fixed-effects model. Pedroni (2004) test also shows the variables are not co-integrated. By applying short-term Granger test, it has been specified there is a bilateral relationship among unemployment and market size and oil price is the cause of economic growth and inflation. The oil countries importing should prepare the arrangement to minimize the impact of oil shocks on economic growth.

Resumen

El objetivo de esta investigación es estudiar la relación entre los precios del petróleo, el tamaño del mercado y la inflación en el norte de Europa durante el período 1980-2009 aplicando el modelo de datos del panel. La prueba de raíz unitaria demuestra que todas las variables son estacionarias en diferencia de primer orden. EL test de de Hausman (1978) sugiere el modelo de efectos fijos. El test de Pedroni (2004) también muestra que las variables no son co-integradas. Se ha especificado mediante la aplicación de prueba Granger a corto plazo, que hay que una relación bilateral entre desempleo y tamaño de mercado de aceite, y que el precio es la causa de la inflación y el crecimiento económico. Los países importadores deberían preparar un acuerdo para minimizar el impacto de la crisis del petróleo en el crecimiento económico.

Keywords: Energy prices, Market Size, Inflation, Unemployment
JEL: E31, E32, Q43

1.- Introduction

Considering the increasing importance of oil as the production input in the world, the researchers paid more attention to the effect of this black gold on the economic variables. During 1980-2006, the ratio of oil consumption to total energy consumption has been as much as 36.36% (International Energy Outlook 2007). Since, oil is widely used in different economic sectors, general statistics show the high price of oil influences the economic growth and financial markets (Brown and Yucel, 2002; Jones et al. (2004), Hamilton (2009). We could mention economic crisis to state the significance of oil in the economy of the countries, especially industrial countries, as the war of the Arab against Israel from 1973 to 1974, Iran Revolution in 1978-79, Iran- Iraq war from 1980 to 1988 and the Persian Gulf War from 1990 to 1991.

The economic activities of great countries have influenced oil price and the oil price itself affects the economic variables in the world. If the economic activities of great countries lessen and the total demand decreases, the economy of industrial countries will go into recession. Having entered economic recession, the product of these countries will decrease and the demand for the oil input would decrease too. When the demand for oil decreases, its price in the global market will drop down. On the other hand, an increase in oil price in these countries leads to inflation, the decrease of production and productivity. Oil is one of the raw materials widely used in economy. In the case of oil shock, the consumer price index (CPI) also increases in the oil-importing countries. And as the increase of oil price, the cost of other goods is increased, we will face with decrease of production. Considering the interaction effects of these variables, the aim of this research is to investigate the effect of oil price on the economic activities in the north of Europe.

From the experimental viewpoint, there are so many articles dealing with the effect of oil shock on production and inflation (Hamilton 1983, 1988, 1996, 2000, Hooker 1996, 1999, 2002) (Huntington 1998; Kahn & Hampton 1990; Mork 1989, Mork et al 1994, Tatom 1988). The researches also show that these shocks have been the important source of economic fluctuations in the last three decades (Kim& Loungani 1992). Most researches deal with the effect of oil price in America and Organization for Economic Cooperation and Development (OECD) countries. The oil increases or decreases CPI in America and the economy of America influence the world economy (Takenaka 1991, Hutchison 1993, Lee, Lee & Ratti 2001). In 2001, Abesysinghe has studied the case on Asian economy. Oil exporting countries sell oil in high price but, they import the goods more expensive. Sadorsky (1999) and Kaul and Seyhun (1990) show the fluctuations of oil price has negative effect on stock price, while, Yurtsever and Zahor (2007), Gogineni (2007) prove that oil prices have positive effect on stock price.

In this paper first we explain theoretical basic means the relationship between economic activity and oil price. Then, we develop our method and data. In the third section we show our results and then we present our conclusion.

2.- The Relationship between Economic Activity and Oil Price

All countries around the world take advantage of all needed policies such as monetary and fiscal policies to improve their situation. In other words, the policymakers control economic activities such as production, employment, stock return and interest rate through these policies. Among so many factors affecting economic activities, we can mention oil price. Most researches have shown that oil shock has negative effect on economic activates. Oil shock is equal to the difference between the current price of oil and the maximum price of 4 or 12 last quarters. The fluctuations of oil price could affect the macroeconomic variables in the oil importing and exporting countries. In the oil exporting countries, which are dependent to oil price, oil price decline can affect the capital projects, also the increase of oil price by inflation or Dutch disease affects the economy.

The major effect of oil shock in the oil importing countries is its effect on gross domestic product (GDP). It is believed that oil shock reduces the GDP in these countries. However, Sadorsky (1999) believes the increase of oil price changes the macroeconomic variables based on a lagged model. One reason for this lag is the increase of oil price affects the economic activities by making insecurity and increasing costs. Sometimes the oil price fluctuations affect the economic activities after a threshold. When the oil price changes or its fluctuation breaches the threshold, its effect on economy might be negative. This threshold is different from one country to another. Theoretically, the relationship among oil price and macroeconomic variables are specified as non-linear. The relevant literature shows the increase in the oil price is the primary reason for inflation, while a reduction in the oil prices has not positive effects on price level. Therefore, it could not be harmful to economy. In other words, this relation is non-linear. On the other hand, oil shock can reduce total supply and demand. Since higher energy price means the firms purchase lower energy, so the efficiency of any given capital, labor and potential production is reduced. Decline in the factors efficiency means the real wage falls down. If the labor supply is slightly reduced because of the wage, the potential production will be lowered. So, the direct effect of lower efficiency on economic activities is non-linear (Ferderer, 1996). The relevant literature shows that an increase in the oil price is the primary reason for inflation. About CPI, an increase in the oil price brings about an inflation shock which can intensify inflation through the wage – price spiral. (Hooker 2002)

3.- Methodology and data

The respective sample is the countries of the North of Europe comprising Denmark, Norway, Sweden, United Kingdom and Finland. We have chosen these countries because, the economic structures of these countries are almost similar. To study the effect of oil shock on economic activities, we consider four variables of gross domestic production (GDP) (constant 2000 US$). This variable shows the economic growth and we can study the variable effects on economic growth. Other variable is consumer price index (CPI) that shows the inflation level in the countries. For the survey of oil on economic growth we apply oil stock price (OIL) (oil prices proxied by the crude oil spot barrel prices, measured in US dollars, global oil production proxied by level of crude oil production in millions of barrels pumped per day (averaged by month), and stock market price in each country), and unemployment (UNE). We have chosen these variables because there is the relationship among them and they influence one another. For the data of crude oil price, we use the BP statistical review, and for other macroeconomic variables we apply the world development indicators (WDI) of the World Bank. The time of period is 1980-2009. The countries and the period are limited because of the lack of data for some countries. The variables are regarded as logarithm.

Since, we use the data as the panel data model, in order to avoid the spurious regression, it is necessary to apply the unit root test. The panel unit root test because of the presence of time and cross section dimensions is more powerful than the time series unit root test. However, with regard to the statistical specifications of experimental groups, usually different tests are applied. Here we apply the four tests of unit root. The null hypothesis of these tests is the presence of unit root. The respective tests are: Breitung (2000), Levin and Lin (1992, 1993), Maddala and Wu (1999), Im, Pesaran and Shin (2003). The IPS test allows for heterogeneity in the value of autoregressive coefficient under the alternative hypothesis. Thus, under the alternative hypothesis some series may be characterized by a unit root, while some other series can be stationary.

4.- Results

4.1 Granger Causality

There are many models that show the causality relationship between the variables. Causality model shows that weather this is the variable of X causes Y or this is the variable Y causes X. There are a few researches that study the effects of inflation, unemployment, GDP and oil on each other but hire we apply a Granger causality test and we don't study the effects of these variables and our sample is different. In order to investigate the relationship among OIL, GDP, UNE and CPI variables, we use the Granger causality. If our variables are not integrated, we use the standard Granger causality test, because there is no long-run relationship among variables.

However, if there is an integrated (long-run) relationship among variables, we use the Granger causality based on VECM as following:

$$\Delta GNP_t = \beta_{40} + \sum_{i=1}^{p} \beta_{41i}\Delta GNP_{t-i} + \sum_{i=1}^{p} \beta_{42i}OIL_{t-i} + \sum_{i=1}^{p} \beta_{43i}\Delta CPI_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{44i}\Delta UNE_{t-i} + \beta_{45}ECT_{t-1} + \varepsilon_{4t} \qquad (1)$$

$$\Delta OIL_t = \beta_{30} + \sum_{i=1}^{p} \beta_{31i}\Delta OIL_{t-i} + \sum_{i=1}^{p} p_{32i}\Delta GNP_{t-i} + \sum_{i=1}^{p} \beta_{33i}\Delta CPI_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{34i}\Delta UNE_{t-i} + \beta_{35}ECT_{t-1} + \varepsilon_{3t} \qquad (2)$$

$$\Delta CPI_t = \beta_{20} + \sum_{i=1}^{p} \beta_{21}\Delta CPI_{t-i} + \sum_{i=1}^{p} \beta_{22}\Delta OIL_{t-i} + \sum_{i=1}^{p} \beta_{23}\Delta UNE_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{24}GNP_{t-i} + \beta_{25}ECT_{t-1} + \varepsilon_{2t} \qquad (3)$$

$$\Delta UNE_t = \beta_{10} + \sum_{i=1}^{p} \beta_{11i}UNE_{t-i} + \sum_{i=1}^{p} \beta_{12i}CPI_{t-i} + \sum_{i=1}^{P} \beta_{13i}OIL_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{14i}GNP_{t-1} + \beta_{15}ECT_{t-1} + \varepsilon_{1t} \qquad (4)$$

To test the expression "X_k is not the Granger causality of X_i" we use the null hypothesis based on β_{jk}=0. In This model ECT is error correction term that shows the long run relationship between the variables.

Table 1 shows that all variables are integrated in the first order I (1). Null hypothesis stating the presence of unit root is not rejected for all variables in the level except for GDP and in LL test. However, in the first-order difference, null hypothesis is rejected for all variables. So, in the first-order difference, all variables are stationary in the level of 1%. This means that there is a long run relationship between the variables. Therefore, we apply these variables for analyzing causality in the form of the first-order difference in short run and long run relationship. The Im et al. (2003) panel unit root test considers the presence of a single break. It is a group mean test that combines individual exogenous intercept break tests, developed by Amsler and Lee (1995), for heterogeneity across cross-sections in the panel. Even with the presence of structural breaks, each variable is integrated of order one. The Hausman (1978) test was used

to select the fixed effects or random effects models. This test $\chi^2 = 4.33[0.51]$ shows the random effects model should be applied.

Table 1. Panel unit root tests

Variables	LL	Breitung	IPS	MW
	Variables in level			
GDP	-5.02(0.21)	-2.22(0.22)	-0.02(0.44)	7.41(0.22)
CPI	-1.43(0.17)	-3.02(0.22)	1.11(0.31)	22.23(0.23)
UEN	-2.06(0.21)	0.01(0.39)	-1.02(0.32)	53.1(0.53)
	Variables in first differences			
GDP	-21.04(0.00)	-3.03(0.01)	-20.08(0.02)	100.01(0.00)
CPI	-2.15(0.01)	-4.02(0.00)	-3.68(0.00)	132.04(0.01)
UNE	-3.05(0.02)	-5.03(0.00)	-5.01(0.00)	103.01(0.00)

$\rho-$ values are given in parantheses. LL: Levin and Lin; IPS: Im, Pesaran and Shin; MW: Maddala and Wu

4.2 Co- integration Test

In order to study the long-run relationship among OIL, GDP, UNE and CPI variables Pedroni (2004) co-integration test was used. If H_0 hypothesis is rejected, there is a long-run relationship among the four variables. The maximum lag in the panel co-integration model is 3 based upon SIC criterion. Based upon the statistics of table 3, there isn't a long run relationship among the variables. Therefore, the short-run Granger causality test has been applied for the four OIL, GDP, UNE and CPI variables.

Table 3: Pedroni Panel Co-integration Test

Panel weighted statistics (probability)	
Panel ν-statistic	2.01 (0.21)
Panel ρ-statistic	0.05(0.51)
Panel pp-statistic	-0.41(0.32)
Panel ADF-statistic	2.05(0.04)*
Group statistic (probability)	
Group ρ-statistic	0.23(0.03)*
Group pp-statistic	-2.22(0.47)
Group ADF-statistic	-3.21(0.36)

* shows the statistic is stationary in 10%.

4.3 Granger Causality Test

The results of the short-run Granger causality test are reported in table 4. Equation (1) shows that CPI or in the other word, inflation hasn't any statistically significant effect on economic growth but, oil price has a negative and statistically significant effect on GDP. Because, increasing oil price in the oil importing countries increases production cost and this cost decreases GDP level. However, Sadorsky (1999) believes the increase of oil price changes the macroeconomic variables based on a lagged model. One reason for this lag is the increase of oil price affects the economic activities by making insecurity and increasing costs. Jones et al. (2004) show the magnitude of effect of an oil price shock on GDP is about −0.05 to −0.06% as elasticity, spread over two years. In section 4 the unemployment has a negative and statistically significant effect on GDP. Labor force

is a production factor; capital and labor force open a production capacity. Larsson et al. (2001) with panel co-integration test indicate there is a unique long-run equilibrium relationship between real GDP and the labor force. In terms of equation 2 GDP and unemployment haven't any statistically significant effect on oil price but, CPI has a positive and statistically significant effect on oil price and CPI is the cause of oil price. Because, when general price level in industrial countries increases, the oil exporting countries augment the oil price for covering the imports cost from these countries. In terms of equation 3 unemployment and GDP haven't any effect on CPI but, oil price increases statistically consumer price index. Kibritcioglu and Kibritcioglu (1999), analyzes the impact of oil price on the CPI. They found that a 20% increase in crude oil price has a positive effect on the general price level. The general price level increases 1.08% in terms of the 1990 input–output table for Turkey. Berument and Tasci (2002) indicate that when the factors of income (profit, wage, interest and rent) are adjusted to the general price level that includes the oil price increases, the inflationary effect of oil prices becomes significant. The fourth equation shows that GDP has a negative effect on unemployment. Payne (2010) indicates the same results for GDP.

Table 4: Panel causality test result

Dependent variable	Sources of causation (dependent variables)			
	Short-run			
	ΔGDP	ΔCPI	ΔOIL	ΔUNE
(1) ΔGDP	---	4.01	-0.42*	-0.13*
(2) ΔOIL	2.41	1.15**	---	16.3
(3) ΔCPI	0.09	---	3.09**	4.01
(4) ΔUNE	-2.03****	2.22	0.43	---

*,**,***: the rejection of the null hypothesis of no causality at the 10%, 5%,1% significance level

Overall, the results show there is a bidirectional causality relationship between general price level and oil price in short- run. This means that in short-run an increase in oil price rises inflation in these countries and the inflation in these countries affects oil price. The presence of bidirectional causality lends there is a feedback relationship between these variables. There is the same relationship between unemployment and gross domestic product but in negative. Then, an augmentation in gross domestic product decries unemployment and also a decline in unemployment raises GDP. But, the relationship between oil price and GDP is unidirectional: from oil price to gross domestic product. The oil price increases gross domestic product but GDP hasn't affect on the oil price. But there is not any relationship between gross domestic product and inflation and between oil price and unemployment. This variables haven't any effects on each other.

5.- Conclusion

In this research, we try to study the relationship among inflation, unemployment, oil price and economic activities in the North of Europe over the period 1980 - 2009 by applying panel data model. Having applied the unit root test, IPS, LL,WU and Breitung, it was found that the four variables of UNE, inflation, CPI, oil price and GDP are stationary in the first-order difference. Hausman (1978) test showed that we have to apply the fixed-effects model. The Pedroni (2004) co-integration test showed that there is not long term relationship among the variables, so we apply the Granger causality test for the short-run.

The results show that oil price is the cause of economic growth. As said in theoretical discussion, since energy is one of the important inputs in production, the increase of its price in the oil countries importing leads to the reduction in production. Sadorsky (1999) believes the increase of oil price changes the macroeconomic variables based on a lagged model. One reason for this lag is the increase of oil price affects the economic activities by making insecurity and increasing costs. On the other hand, there is a feedback relationship between unemployment and economic growth, and it is bilateral causality relationship, since the unemployment increases the production and it brings about the need to more labor. On the other hand, because the oil consumption directly and indirectly enters into the family expenditure, its increase causes the inflation. When the general price level includes the oil price increases, the inflationary effect of oil prices becomes important. The relationship between oil price and GDP is unidirectional: from oil price to gross domestic product. But there is not any relationship between gross domestic product and inflation and between oil price and unemployment. So the oil countries importing should prepare the arrangement to minimize the impact of oil shocks on economic growth, for example saving oil to manage these shocks. On the other hand, these countries could decrease their unemployment by increasing gross domestic product. The control of general price level hasn't any effect on GDP then, these countries could decrease inflation without any problem.

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