Oil Price Movements and Macroeconomic Variables: Evidence from High and Upper Middle Income Countries

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Submitted to the
Institute of Graduate Studies and Research
in partial fulfilment of the requirements for the Degree of

Master of Science
in
Economics

Eastern Mediterranean University
June 2013
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

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ABSTRACT

This study investigates the relationship between oil price movements and macroeconomic variables such as GDP, CPI and unemployment rate for high income and upper middle income OECD countries. Second generation econometric methods are used, because the estimation results are more robust. Durbin-H panel co-integration test confirm that, there is long term relationship between oil prices and macroeconomic variables. Oil price has statistically significant impact in all of the regressions except on unemployment rate in single and double regression models for the overall countries. So, the increase in oil price affects macroeconomic variables negatively. Also, analysis of long term coefficients for each of the country is applied and found that, oil price movements have mixed effects (positive or negative) on macroeconomic variables. On the other hand, the impact of oil price movement on macroeconomics actually depends on the country's oil dependency.

Keywords: Oil Price, Gross Domestic Production, Consumer Price Index, Unemployment Rate

ÖZ

Bu çalışma petrol fiyatlarındaki dalgalanmaların yüksek gelirli ya da üst orta gelir düzeyine sahip OECD ülkelerinin temel makro ekonomik değişkenleri (Gayri Safi Yurtiçi Hasıla, Tüketici Fiyat Endeksi, İşsizlik Oranı) üzerindeki etkilerini araştırmaktadır. Çalışmada ikinci jenerasyon ekonometrik metodlar kullanılmıştır, çünkü bu metodların ölçüm sonuçları daha güvenilirdir. Durbin-H panel eşbütünleşme analizine göre, petrol fiyatları ve makro değişkenler arasında uzun dönemli bir ilişki bulunmaktadır. Petrol fiyatlarının yapılan tüm regresyonlar sonucunda, tüm ülkelerin geneli için, değişkenler üzerinde istatistiksel açıdan anlamlı etkisi olduğu gözlemlenmiş, ancak işsizlik oranı tekli ve ikili regresyonlarda bu sonuçların dışında kalmıştır. Sonuç olarak, petrol fiyatlarındaki artış makro ekonomik değişkenleri negatif yönde etkilemektedir. Aynı zamanda her ülke için yapılan uzun dönem katsayı tahmini, petrol fiyatlarındaki dalgalanmaların makro değişkenler üzerinde hem pozitif hem de negatif yönde etki ettiğini göstermiştir. Öte yandan, makro ekonomilerde petrol fiyat dalgalanmalarının etkileri ülkelerin petrol bağımlılığıyla doğrudan ilgilidir.

Anahtar Kelimeler: Petrol Fiyatları, Gayri Safi Yurtiçi Hasıla, Tüketici Fiyat Endeksi, İşsizlik Oranı

To my family

ACKNOWLEDGMENTS

I would like to thank to my supervisor Asst. Prof. Dr. Kamil Sertoğlu for his collaboration, exemplary guidance, continuous supports and encouragements throughout my university education and my study. Otherwise, without his supports and helps, my efforts would not have had meaning.

Also, special thanks to Assoc. Prof. Dr. Salih Katırcıoğlu for his invaluable guidance and valuable contributions to my thesis.

I would like to thank to my department chair Prof. Dr. Mehmet Balcılar for his confidence and supports during my master education and also thanks to all of my instructors which I had chance to work with them during my master education.

I am grateful to Asst. Prof. Dr. Mehmet Mercan for his help and precious recommendations and thanks to my friends for being supportive.

Finally, I would like to express profound gratitude to my mother Özay Candemir, my father İrfan Candemir and my brother Ali Candemir. Their affection and trust were the best motivation and a great guide in my life. I dedicate them all my achievements and success.

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ADF test: Augmented Dickey Fuller test

AIC: Akaike Information Criteria

AUG Full: Augmented Mean Group Estimator

CADF test: Cross Sectionally Augmented Dickey Fuller unit root test

CCE Full Robust: Common Correlated Effects Mean Group Estimator

CIPS test: Cross Sectionally Augmented Panel unit root test

CPI: Consumer Price Index

DSGE model: Dynamic Stochastic General Equilibrium model

Durbin-H test: Durbin Hausman test

G7 countries: Group of Seven countries

GDP: Gross Domestic Product

IMF: International Monetary Fund

IRF: Impulse Response Functions

LM_{adj} test: Bias Adjusted Cross Sectional Dependence Lagrange Multiplier test

LM test: Lagrange Multiplier test

MADF test: Multivariate Augmented Dickey Fuller test

N: Cross Sectional Dimension

OAPEC: Organization of Arab Petroleum Exporting Countries

OECD: Organisation for Economic Co-operation and Development Countries

OIL: Oil Price

OPEC: Organization of the Petroleum Exporting Countries

PP test: Phillips Perron test

SIC: Schwartz Information Criterion

SURADF: Seemingly Unrelated Regression Augmented Dickey Fuller test

T: Time Dimension

TFP: Total Factor Productivity

UK: United Kingdom

US: United States

UR: Unemployment Rate

VAR model: Vector Auto Regression model

VDC: Variance Decomposition

VECM: Vector Error Correction Model

WB: World Bank

Chapter 1

INTRODUCTION

Energy related topics are very common in the literature of economics especially since the oil crisis in 1973. So, energy economics became one of the hottest topics in the world's agenda. Also, oil is very important energy source in the world, because it is used almost in all of the sectors. On the other hand, oil price movements do not only affect energy markets. At the same time, it affects the total performance of the economy as a whole. This means that, oil is one of the most important actors of the economy which creates certain changes in macroeconomic variables such as GDP, inflation and unemployment rate.

Moreover, 1973 oil crisis had started because of an OPEC oil export embargo applied by most of the oil producers (which were Arab countries) to the Western European countries and US, because they were supporting Israel during the Yom Kippur War. This was a starting point of the oil crisis in 1973 and the price of oil started to increase. For instance, car producers started to produce new cars which were less oil consuming. Especially, in order to save the country from the crisis, some countries shifted to other alternative sectors like electronics such as in Japan. By this way, the economy of the Japan partly got rid of the oil crisis. At the end of the 1973 oil crisis, oil price movements affected all the economy of the countries and they realized that, there was big relationship between oil price and macroeconomic variables. The oil price movement affects macroeconomic variables such as

economic growth, unemployment rate, inflation, Consumer Price Index (CPI), Gross Domestic Production (GDP) and income level, etc.

If we look at the relationship between unemployment rate and oil price movements, there will be negative relation between these two variables. Unemployment means people who do not have any job, however actively looking for a job. On the other hand, unemployment rate is a measure of division of the number of people unemployed and labor force. Many factors may affect unemployment, because it is very sensitive in the economy. So, high oil prices have negative effect on unemployment.

According to Dogrul and Soytas (2010), increases in oil prices cause increases in the cost of production in many sectors. So, this decreases production and increases the unemployment rate in the whole economy.

On the other hand, inflation is another macroeconomic variable which is heavily affected from oil price movements. Inflation is an increase in price level of the goods and services during a period. If inflation increases, consumers will buy fewer amounts of goods with same amount of money. Since the purchasing power of the consumers will decrease. Increase in oil prices may create inflation in the country. According to Cavalcanti and Jalles (2013), if the price of oil increases, it will increase the cost of production and this will cause a decrease in the economic activity and increase the inflation in Brazil and US. We can say that, both increase and decrease in oil price has an impact on inflation.

Another important macroeconomic variable is economic growth. It plays strategic role in the economy, because economic growth shows us the increase in the total amount of goods and services, output in the economy. The increase of oil prices may prevent economic growth and this may cause a decrease in the amount of the total output in the country. The impact of increase in oil price on economic growth is negative. Loscos et al. (2012) found that, oil price shock does not only affect energy markets. It affects all economy such as there is an impact on stock exchange prices, inflation rate and prevents economic growth in G7 countries etc.

In addition to these macroeconomic variables, we cannot skip Gross Domestic Product (GDP) without looking relationship between oil price movements and GDP. GDP is related with all parts of the economy such as consumption, investment, government expenditure, export, import and etc. It is the market value of all final goods and services which are produced in the country over the period of time. According to Chang and Wong (2003), the impact of the oil price movement was insignificant on GDP, inflation and unemployment rates in Singapore economy. Also, it has opposite effect on GDP in the economy of Singapore. As a result, oil price movements may have negative impact on GDP while increasing oil prices.

These are some of the variables that can be affected from oil price movements. There are many other macroeconomic and microeconomic factors which oil price movements have impact on them.

1.1 Aim of the Study

The aim of the study is to focus on the relationship between oil price movements and the overall performances of the countries such as GDP, unemployment rate and Consumer Price Index (CPI). We analyse twenty-six OECD (Organisation for Economic Co-operation and Development) countries which are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Switzerland, Sweden, Spain, Turkey and United States (US). These twenty six countries are all high income OECD countries except Turkey and Mexico. Both Turkey and Mexico are upper middle income OECD countries. If the average income of the people is $ 12,476 or more, country is high income. If the average income of the people is between $ 4,036 and $ 12,475, country is upper middle income. (WB, 2012). Oil is very important in OECD countries, because they consume huge amount of oil every day. If we look at the top fifteen world oil consuming countries, US is the top oil consumer with 18.949 thousand barrels per day, than third oil consuming country is Japan with 4.464 thousand barrels per day, with 2.289 thousand barrels per day Canada which is number nine, with 2.230 thousand barrels per day South Korea which is number ten, with 2.133 thousand barrels per day Mexico which is number eleven, and France consume 1.792 thousand barrels per day. (WB, 2012). Because of this reason, oil price fluctuation may affect macroeconomic variables of the OECD countries.

Moreover, the panel data is constructed during the time period between 1980 to 2011. The data is annual data which is collected from World Bank and International Monetary Fund. On the other hand, panel data analysis is not used too much in the

literature for this topic. So, this analysis will provide important messages to the policy makers and this will be our contribution to the literature. On the other hand, there isn't study which is analyses twenty-six OECD countries in the literature. Generally, most of the authors focused on the small group of OECD countries not like twenty six or all of the countries. There are thirty-four OECD countries, but we could not reach the data of other eight countries like Chile, Czech Republic, Estonia, Germany, Poland, Slovak Republic, Slovenia and UK. There was data, but we could not find the data both from World Bank and IMF between 1980 – 2011 periods. Also, we use current technics and second generation econometrics methods in order to estimate the results. So, new methods give more confident and current results. In addition to these, we use Gauss 9.0 in order to estimate Durbin Hausman co-integration tests and CADF unit root tests and Stata 11 in order to see whether we have long run relationship between variables or not. Moreover, Eviews program is used in most of the studies for estimation of results such as Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests in order to see if the series are stationary or not, Johansen co-integration test, AIC and SC criteria for choosing the optimal lag. Also, vector error correction model (VECM) and they use variance decomposition (VDC) and impulse response in order to see the relationship between oil price movement and total economic activity.

Finally, we will compare the estimation results of this study with the other estimations and try to see if there is any difference between the old studies and our study.

1.2 Structure of the Study

This study will start with brief literature review. In this part, we will look at the old published papers and journals in order to see the relationship between oil price movements and macroeconomic variables and see the findings of the authors. On the other hand, the history of oil will be briefly explained between 1970-2008 periods. Then, explanation of variables, time interval for the study and the source of data will be written in the data part. Also, panel data analysis will be used for methodology and in this part, all of the econometric tests will be explained with details which will be done in this study. According to consistent data between 1980 –2011, empirical results will be obtained and compared with other findings which are already done in the literature. Finally, the study will finish with concluding remarks.

Chapter 2

LITERATURE REVIEW

In this chapter, we will focus on the research findings about oil price movements and impact on macroeconomic variables which is done by other researchers. Also, we will see which type of econometric methods do they use and what are their findings and what are the impacts on the economy?

Hamilton (1983) investigates the relationship between oil and macroeconomy since World War II for US. He finds that, there were recessions during World War II in all over the world especially in US and also the price of crude oil increased sharply, but it was not because of recessions. But, during 1948 – 1972 periods, he finds that, there is correlation between oil price movements and recessions and they are statistically significant, because oil price movements affect recessions in US in 1972. Also, post – OPEC macroeconomic performance may be influenced by energy price increases.

Mork (1989) searches the impact of oil price movements on macroeconomy according to Hamilton's results. There are two variables which are real oil price increases and decreases. According to estimation results, there is negative impact of oil price increases. Also, two of the variables have negative coefficients and they are significant at 5 percent level. For oil price decreases, they are not significant and they conclude that, the impact of oil price decreases is different from oil price increases.

The estimation result shows that, there is negative correlation with oil price rises, is not an artefact of Hamilton's data.

Ferderer (1996) investigates the relationship between oil price movements and macroeconomy in US. This study shows us, oil price movements have opposite effect on the macroeconomy, but it increases both the oil price level and oil price volatility. Also, Ferderer finds that, there is asymmetric relationship between oil price changes and output growth, so this means that, both oil price movements have asymmetric impacts on the macroeconomic variables.

Hamilton (1996) analyses the relationship between oil price and macroeconomy. He used quarterly data and found that, there is consistency between recent and historical data. There is correlation between oil shocks and recessions. On the other hand, starting from the first quarter of 1948 to third quarter of 1973, increases in oil price is a measure of oil price and this shows it has negative and statistically significant relation to GDP for this subsample. In contrast, if the data changes and starts from 1973: IV to 1994: II, relationship between oil price and GDP growth are not statistically significant. Also, when he uses full sample which starts from 1948: I end to 1994: II, the relation will be statistically significant.

Hooker (1996) searches on the relationship between oil and macroeconomy. He finds that, Granger Causality analysis is not sufficient to explain the oil price movements for US macroeconomic indicator variables in data after 1973. Three hypotheses are analysed, but none of them are supported by data. These are; 1) responsibility of sample stability issues, 2) oil prices are endogenous, 3) linear and symmetric specifications are not able to represent the oil price interactions. On the other hand,

increase in oil prices during 1970 has significant effects, but the effects of decrease in price of oil during 1980 are not easy to analyse and decompose. Moreover, these results show that, there exists an important impact for the large body of research that accepts oil prices as an explanatory variable.

Keane and Prasad (1996) search on the employment and wage effects of oil price changes according to sectors. This study is different from other studies, because this study focuses on the impact of oil price changes on microeconomic variables by using micro panel data. They find that, increase in oil price causes a decrease in real wages of all workers and increase the relative wage of skilled workers. On the other hand, increase in oil price has negative impact on aggregate employment in short term and positive impact in long term. Also, oil price fluctuations may cause a change in the share of employment and relative wages across industries.

Davis and Haltiwanger (2001) study on the impact of oil price movements on sectoral job creation and destruction in US manufacturing sector between 1972 – 1988 periods. They find that, increase in price of oil decrease the employment growth suddenly in US. In contrast, decrease in oil price affects the employment growth less. On the other hand, there is asymmetric effect to oil price movements in US. Increase in price of oil increases with durability of product, energy and capital intensity as an impact of two year employment. Moreover, job destruction is more sensitive than the job creation in short term except young plants to oil price movements and monetary shocks.

Eltony and Al-Awadi (2001) studies on the effect of oil price movements on seven macroeconomic variables for Kuwait such as oil price of Kuwaiti blend crude, oil

revenue, government development expenditure and current expenditure, consumer price index, money demand and value of imports of goods and services. They use vector error correction model (VECM) and vector auto regression model (VAR) in order to estimate the effect of oil prices on macroeconomic variables. According to estimated results, there is high level of interrelation between macroeconomic variables. Also, causality passing from the oil prices and oil revenues to government development expenditure and current expenditure and later to other variables. Another finding of the estimation is that, the significance of the consumer price index in order to explain the necessary part of the variations for both government development and current expenditures.

Papapetrou (2001) searches on the dynamic relationship between oil price movement, stock market, economic activity and employment in Greece. They use multivariate vector auto regression approach. They find that, oil price affects economic activity and employment. The certain amount of movements in output growth and employment growth could be explained by oil price movements. Moreover, there is negative impact of oil price movement on industrial production and employment. Negative impact on industrial production means that, there is an increase in interest rate and lower growth.

Hunt et al. (2002) search the impact of high oil price on macroeconomy by using IMF's multicounty model which is called Multimod. The aim of this study to analyse the impact of oil price movements on economic activity and inflation in the industrial countries. Since the aim is to analyse the impacts of increase in oil prices, one can use this framework symmetrically to check the results of oil price declines. They find that, there are negative correlations between oil prices and economic activity and also

oil prices are significantly correlated with microeconomic variables like output, employment and real wages. Also, oil price movements cause an increase in the core inflation. Final result is an asymmetric relationship between oil price movements and following changes in economic activity.

Chang and Wong (2003) investigate the relationship between oil price movements and macroeconomy in Singapore. GDP, CPI and unemployment rates have been used as macroeconomic variables in addition to oil prices. Also, they use variance decomposition (VDC) and impulse response analysis in order to see the relationship between oil price movements and total economic activity. They find that, oil price movements have negative and insignificant effect on real GDP and on unemployment rate. Also, it causes both inflationary and insignificant effect on Singapore economy. However, oil price movements do not have too much negative effect on macroeconomic performance of Singapore economy. All the analysis shows that, the impact of oil price movements on Singapore economy would be worthless.

Cunado et al. (2003) investigate the effect of oil price movements on macroeconomic variables like inflation and industrial production indexes for many European countries by using quarterly data. They use co-integration test in order to see structural breaks and use transformation of oil price data for accounting the non-linear relationship. According to estimation results, there are impacts on inflation in short run and also oil prices have opposite impacts on production growth rates in short run. Moreover, oil price movements affect real activity affects not only inflation.

Hamilton (2003) studies on the nonlinear relationship between oil price movements and GDP growth. He finds that, the increases in oil prices are more important than decrease in oil prices. One more important thing is that, increases have significantly less predictive content if they did correction on earlier decreases. Estimation of a linear functional form using exogenous disruptions in petroleum supplies as instruments is alternative way to comment on oil shock.

Barsky and Kilian (2004) investigate the relationship between oil and macroeconomy since 1970. They find that, the increase of oil prices causes recessions in the economy, higher inflation and it decreases productivity of the countries and reducing economic growth and also, there is a long term impact on economic growth.

Ayadi (2005) analyses the relationship between oil price movements and the Nigerian economy. The aim of the study is to see the impact of oil price movements on GDP, real exchange rate and etc. Vector auto regression (VAR) model has been used on macroeconomic variables between 1980 – 2004 periods and Ayadi finds that, oil price movements cause the decrease in the growth of GDP in oil importing countries. On the other hand, increase in oil prices cause an increase in output in oil exporting countries. Moreover, oil price movement has impact on real exchange rate which affects industrial production in Nigeria. One more important thing is that, impact of oil price movements on industrial production is not statistically significant. Final result is that, the increase in oil price does not raise the industrial production in Nigeria.

Cunado and Gracia (2005) studies on the impact of oil prices on economic activity, consumer price index and inflation in some Asian countries such as Japan,

Singapore, South Korea, Malaysia, Thailand and Philippines. According to estimation results, there is significant effect of oil prices on economic activity and consumer price indexes. Also, there is limited effect in short run and more significant effect if the oil prices are in local currencies. On the other hand, oil prices do not have any impact on economic activity in long run. In addition, Japan, South Korea and Thailand have oil price and economic growth relation in short run when oil prices used as a local currency. Final result is the significant effect of oil prices with local currencies on inflation and there is asymmetric relationship between oil prices and inflation rate in Japan, Thailand, South Korea and Malaysia. Moreover, if oil price changes, there is relation between oil prices and economic growth only in South Korea.

Hamilton (2005) searches the relationship between oil and the macroeconomy. He finds that, oil price movements affect the macroeconomic variables such as inflation. According to Hamilton, monetary policy controls the long term inflation rate and therefore this shows the reaction of central bank to the oil shock.

Rodriguez and Sanchez (2005) analyse the impact of oil price movements on real economic activity of the some main industrialized OECD countries. They find that, the effect of oil prices is nonlinear on real GDP, but the increase of oil price has more effect than the decrease of oil price on GDP growth. Also, it is not statistically significant in most of the cases. Also, they divide the countries into two groups which are oil importing and exporting countries. The increase of oil price has negative effect on economic activity among oil importing countries except Japan in linear and nonlinear models. On the other hand, they focus on two oil exporting countries which are United Kingdom and Norway. The increase of oil price affects

the economic activity of UK negatively and significantly. In contrast, Norway has some benefits from the increase of oil prices.

Lardic and Mignon (2006) search on the effect of oil price on GDP in 12 European countries by using asymmetric co-integration approach. According to estimation results, there is asymmetric co-integration between oil price and GDP in 12 European countries, but, there is not standard co-integration between them. Also, increase of oil prices affects economic activity more than decrease of oil prices. Moreover, increase of oil prices causes inflation and affect unemployment rate in long run as well.

Mellquist and Femermo (2007) analyse the impact of oil price movements on unemployment in Sweden. They apply linear regression analysis and use Granger causality tests in order to see if there is direct relationship between them or not. According to linear regression analysis, there is positive relationship between changes in oil prices and unemployment, but they cannot conclude that, the impact of oil price changes on unemployment is both positive and negative in Sweden, because, the coefficients of the Granger causality are sometimes positive and sometimes negative.

Lardic and Mignon (2008) argue the long run relationship between oil prices and economic activity by using co-integration approach for the economies of US, G7, Europe and Euro area. Moreover, the increase of oil prices causes higher effect on GDP than the decrease of oil prices. According to estimation results, they reject the standard co-integration and accept asymmetric co-integration which is found between oil price and GDP in all of these countries.

Alvarez et al. (2009) studies on the effect of oil price movements on consumer price inflation in Spain and Euro Area. They find that, the effect of oil price changes on inflation is limited and the effect of oil price changes on inflation is higher in Spain than in euro area. Another important finding is that, crude oil price movements play an important role on inflation. Moreover, they find both direct and indirect effects. Direct effects cause an increase in spending of refined oil products by households and indirect effects lose importance.

Chen (2009) investigates the oil price through into inflation across countries in 19 industrialized countries over time. Estimation result tells us, oil prices have decreasing impact on inflation. Also, gaining value of domestic currency of the country, monetary policy is more active as a reaction to inflation and openness of trade are highly effective in order to explain the decrease in oil price pass through.

Farzanegan and Markwardt (2009) focus on the impact of oil price movements on Iranian economy. The economy of Iran is very sensitive to oil price movements. In this research, they analyse dynamic relationship between oil price movements and important macroeconomic variables such as GDP, inflation, etc by using VAR approach. This study shows that, there is an asymmetric impact of oil price movements on inflation. For instance, both positive and negative oil price movements have increasing and significant effect on inflation. Also, there is positive relationship between positive oil price changes and output growth. There is an extra impact of oil price movements on real government expenditures. On the other hand, the increase of oil prices causes to increase real industrial GDP per capita and CPI inflation significantly.

Nakov and Pescatori (2009) investigate the relationship between oil and great moderation. They focus on the size of the greater US macroeconomic stability since the mid-1980. Also, it can be responsible by changes in oil movements (shocks) and oil elasticity of gross output. They use Dynamic Stochastic General Equilibrium (DSGE) model and apply counterfactual simulations. There are two important explanations of Great Moderation which are smaller non-oil shocks and better monetary policy. They find that, oil had very important role for stabilisation. In addition, oil reduces the volatility of inflation and GDP growth. Reduction in volatility of inflation means better monetary policy and reduction in volatility of GDP growth means lower Total Factor Productivity (TFP) shocks.

Rafiq et al. (2009) analyses the effect of crude oil price movement on macroeconomic variables such as unemployment and investment in Thailand. They use vector auto regression system, granger causality test, impulse response functions and variance decomposition and find oil price movement has significant effect on macroeconomic variables like on investment and unemployment. The result of impulse response functions show us, there is a high effect of oil price movement on investment and unemployment rate during short period of time. On the other hand, there is one way causality passing from oil price movement to investment, unemployment rat, interest rate and trade balance.

Dogrul and Soytas (2010) investigate the relationship between oil price, interest rate and unemployment in an emerging market according to efficiency wage model of Carruth et al. (1998) for Turkey. The contribution of the study is to show causality between unemployment, crude oil prices, and real interest rate in an emerging market. Toda-Yamamoto procedure has been used in this study and it is a new

technique. According to findings of the new technique, they find that, both real oil price and interest rate improve the estimation of unemployment in the long run in Turkey. Also, oil price movement and interest rate movement have negative and insignificant effect on unemployment. On the other hand, unemployment movement has negative and significant effect on oil price, but later it has insignificant effect on it in Turkey. Also, according to Toda-Yamamoto procedure, both real oil price and real interest rate have an effect on unemployment in long run in Turkey.

Korhonen and Ledyaeva (2010) argue that, the impact of oil price movements on oil producer and oil consumer countries. They use data of Russia who is an important oil producer in the world. Also, they find that, there is direct impact from a positive oil price movement is positive and large and there is negative indirect impact but very small. So, we can conclude that, the net effect is positive. This is the case for Russia who is an oil producer country. "However, the evidence for oil importing countries is mixed. The direct effects of positive oil price shocks are negative for Japan, the US, China, Finland, Germany, Switzerland and UK". (Korhonen and Ledyaeva (2010)). Also, there are negative indirect impacts for Russia, Finland, Germany and Netherlands. As a result, they find that, increase of oil prices raise the GDP of Russia.

Alvarez et al. (2011) study on the effect of oil price movements on Spanish and euro area consumer price inflation. Result of the study shows us there is inflationary effect of oil price movements in both economies although it is limited. Moreover, the effect of oil price movement on Spanish inflation is greater than in the euro area. There are some direct impacts that have been increased during the last 10 years because of the increasing expenditure share of households on refined oil product in Spain and euro

area. At the same time, there is a decreasing importance of indirect and second round effects in both economies.

Chang et al. (2011) investigate the impact of oil prices on macroeconomic variables which are GDP, inflation and unemployment in 17 countries. They use vector error correction model (VECM) in order to see co-integration, impulse response functions (IRF) and variance decomposition (VDC). Also, variance auto regression (VAR) is used for non-co-integrated series in order to see the relationship between oil price and macroeconomic variables. Increase in oil prices has increasing and positive impact on GDP for oil exporting countries and oil price movements have negative effect on GDP in short term for small, open economies and there is ambiguous impact of oil price movement on GDP in order to grow faster in large economies. On the other hand, if oil price movement is positive, the impact on CPI is little in oil exporting countries.

Loscos et al. (2011), analyses the effect of oil price movement on GDP growth and inflation in Spain economy and the economy of its seventeen regions. They use Qu and Perron (2007) and Bai and Perron (1998, 2003a and 2003b) methodology and procedure in order to see structural breaks and the relationship between oil price and GDP, CPI inflation. Also, oil price movements do not have significant impact on GDP and/or CPI inflation. There is nonlinear relationship between oil prices and macroeconomic variables such as CPI and GDP. For the economy of Spain, after 1970 the impacts of oil price movements on macroeconomic fluctuations fall. For instance, the impacts of oil price movements on GDP falls between 1980 and 1990. After 1986, the impacts of oil price movements gain importance back on inflation. On the other hand, they found some results for Spain's 17 regions, the impacts of oil

price movements lose importance on inflation and it has positive and significant effect. Also, the effect of oil price movements on GDP become important at the level of disaggregation.

Masih et al. (2011) investigate the relationship between real oil prices, interest rate, economic activity, real stock returns and oil price movements in an emerging market by using Vector Error Correction model (VECM) in South Korea. The aim of the study is to see the effect of crude oil prices on the economy of South Korea during the Asian Financial Crisis of 1997. They use time series techniques like co-integration test in order to see the relationship between oil price movement and economic activity of South Korea and also they use variance decomposition and impulse response function techniques. They find that, there is long run equilibrium relationship between variables. On the other hand, oil price movement has significant effect on stock market. Also, there is connection between economy shocks, monetary policy instruments and stock markets. There are two negative impacts because of oil price movements on the profitability of the firm which separates direct and indirect effect. Direct negative impact is because of increase the production cost of the firms and there is a negative indirect impact because investors made a forecast about the decrease in profit margins of firms and made decisions that have impacts on the stock market indexes.

Mehrara and Mohaghegh (2011) investigate macroeconomic dynamics in the oil exporting countries by using panel VAR approach. Also, they investigate the effect of oil price movements on macroeconomic variables such as economic output, money supply, price index, GDP, etc. They find that, oil price movements are not an essential reason of inflation. Also, there are macroeconomic fluctuations because of

money, because money is not neutral in oil exporting countries. On the other hand, oil price movements have significant effect on economic output and positive and significant effect on money supply. Another important finding is that, money shocks are the important reason of GDP fluctuations.

Segal (2011) investigates the effect of oil price movements on macroeconomic variables and tries to find an answer to the question: what are the main reasons of increase in oil price till 2008 and what are the consequences of this increase to world economy. Within this respect, there are three arguments; first argument is that, oil prices have never been as important as is popularly thought. Secondly, oil prices have effects on output like monetary policy. If oil prices increase the inflation, monetary authorities increase the interest rate and reduce growth. According to second argument, third argument is that, high oil prices did not cause the decrease in growth in recent years, because it did not raise the inflation. Also, Segal finds that, there are some effects on global recession between 2008 – 2009 periods because of oil prices. On the other hand, if the oil prices are high, there are some effects on the macroeconomy in recent years and there was no effect in 1980. Also, if increase in oil prices do not raise the inflation, then interest rate does not respond them.

Ashley and Tsang (2012) focus on the relationship between oil price, real output growth and growth rate for six countries which are net oil importers. They use new technique in order to estimate and interpret the results better. On the other hand, they find that, oil price growth rate has statistically significant effect on future output growth which continue more than four years. In contrast, there is no significant effect on output growth when the change of persistency is less which means less than four years but more than one year. Moreover, the oil price growth rate has statistically

significant effect on output growth if the persistency is a year or less than a year in some of these countries.

Loscos et al. (2012) investigate the impact of oil price movements on macroeconomic evolution of G7 (group of seven) countries. They use Qu and Perron (2007) methodology in order to see structural breaks and they find that, there are three breaks and they have nonlinear relationship between 1970 – 2008 periods. In addition, they find that, there are long term multipliers and the impact of oil price movements on output and inflation is highest in 1970. In contrast, this effect finish at the end of 1990, but later the impact on output and especially on inflation is high in 2000. The effect of oil price movements on output and inflation is lighter in 2000 with respect to 1970. So, this shows the oil price movements lose some of the control on the economy. As a result, they find that, there is significant effects on inflation and GDP because of oil price movement in 1970 and same effect in the 21st century in G7 countries.

Cavalcanti and Jalles (2013) search for the macroeconomic effects of oil price movements in Brazil and in the United States for the last 30 years. They found that, the increase of oil prices has negative impact on economic growth and positive impact on inflation in US. However, importance of these impacts falls over time. On the other hand, increase of oil price has positive effect on inflation, but oil price movements does not have impact on real output growth. Also, they summarize that, negative oil movements cause a decrease in consumption and aggregate demand. Also, it causes an increase in prices, decrease the employment and appreciation of exchange rate. Appreciation of exchange rate affects competitiveness in a negative manner.

Chapter 3

HISTORY OF OIL (1970 – 2008)

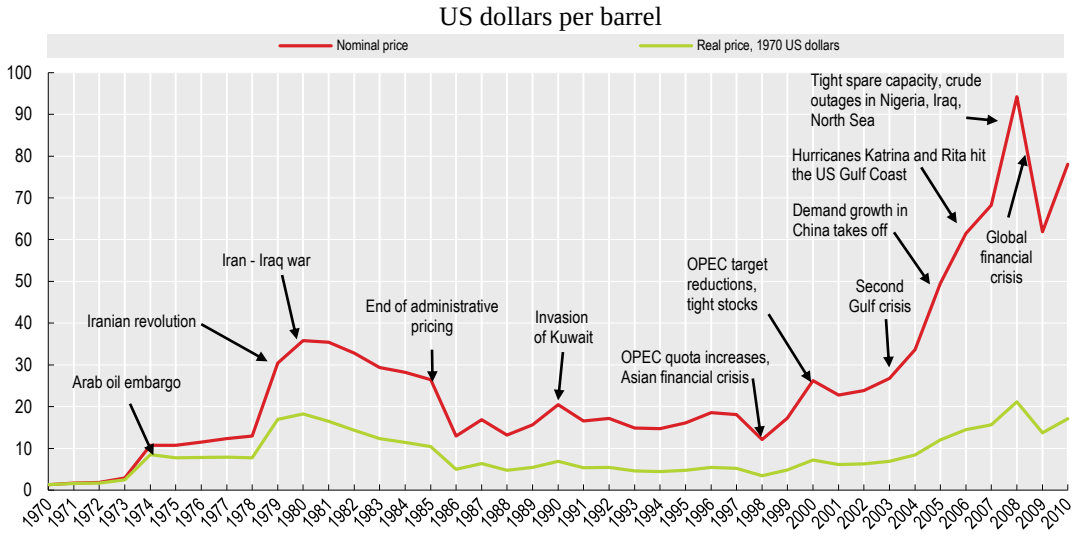
Oil has economic, strategic and daily importance in people's life. Oil price movements (ups and downs, but especially ups) may cause oil crisis in the world. In the history, first oil shock had started in 1973 in US, because the production of oil was at the highest level in US and then Nixon's administration (Richard Nixon was the president of US from 1969 to 1974) was following to control of the US oil production capacity. The main finding was that, production of oil should decrease in US. On 6 October 1973, Syria and Egypt attacked to Israel and OAPEC (Organization of Arab Petroleum Exporting Countries) which were Arab members of OPEC, Egypt, Syria and Tunisia announced the declaration of oil export embargo on 17 October 1973. Another important thing was that, this embargo which was done by Saudi Arabia never had an effect on US oil crisis.

As a result, 1973 oil crisis started because of an OPEC oil export embargo applied by most of the oil producers (which were Arab countries) to the Western European countries and US, because they were supporting Israel during the Yom Kippur War. This was a starting point of the oil crisis in 1973 and the price of oil started to increase. Moreover, twelve countries (Iraq, Kuwait, Libya, Qatar, Saudi Arabia, United Arab Emirates, Venezuela, Indonesia, Nigeria and Ecuador) came together and established OPEC (Organization of the Petroleum Exporting Countries) in Baghdad conference in 1960 and the aim of the OPEC was to control and reduce the

price of oil. Also, it was organized for preventing the pressure by Seven Sisters which were owned by US, British and Dutch nationals. Seven Sisters means the combination of seven oil companies which are Anglo-Persian Oil Company (BP), Gulf Oil, Standard Oil of California (SoCal), Texaco (now Chevron), Royal Dutch Shell, Standard Oil Company of New Jersey (Esso) and Standard Oil Company of New York (now Exxon Mobil). The aim was to control the petroleum reserves, but the impact declined while the influence of OPEC and state owned oil companies increased. On the other hand, OPEC restricted its activities because of the following two reasons. First reason was; their aim was obtaining a larger share of profit from Western oil companies and second reason was; they wanted to get a greater control over the members' production level. Also, it started to enlarge its economic and political strength, therefore the major Western oil companies, at the same time the oil importing nations faced with a unified bloc of exporters. Until 15 August 1971, US were using Bretton Woods Accord and suddenly and unilaterally US took out of this system and took off from the Gold Exchange Standard. Moreover, after this time, they measured only the value of $ US in terms of gold and all other currencies in terms of $ US. Also, they switched from fixed exchange regime to floating exchange regime. Another important thing was that, all of the currencies and $ US started to depreciate, because the worth of oil prices was in terms of $ US in all over the world and this showed that, oil producers was losing money because of depreciation. So, their real income was coming down, because they were selling oil with same price, but there was depreciation of $ US. In addition, starting from 1971, OPEC started valuing the oil in equivalence of gold price. After mid-1970, oil shock has been started and after 1971, OPEC tried to balance oil prices to reflect the depreciation of

the currency. On the other hand, Persian Gulf Countries increased the price of oil to double in 1974.

Figure 1: Crude Oil Spot Prices



Source: OECD Factbook 2011: Economic, Environmental and Social Statistics

As it can be seen from Figure 1, both nominal and real crude oil spot prices are given. Also, oil prices increased sharply between 1973 –1974 because of oil export embargo and it was stable between 1974 –1978 and in 1979 and 1980 nominal oil prices increased from $14 to $35 because there was revolution in Iran and war between Iran and Iraq. According to Sill (2007), the increase in oil prices caused to save energy by consumers and firms. Also, most of the people (who work in a job and using car) started to buy fuel efficient cars and most of the firms bought energy saving equipment in order to consume less oil. In addition, the production of oil increased in out of the OPEC countries.

On the other hand, the price of oil prices decreased because of reduction in world petroleum consumption between 1981 –1986. This was a second oil shock in the world. Then, the first Persian Gulf War (occupation of Kuwait) caused a decrease the

production of oil in Kuwait in 1990 so the price of oil increased double. Between 1997 and 1998, there was crisis in East Asia and the countries are Thailand, South Korea and other countries. They tried to change their currency and faced with some serious financial problems in Asian countries. Then, the price of oil with dollar terms reduced and this was the lowest price level since 1972. Between 1999 and 2000, after Asian financial crisis, the price of oil started to increase and then in 2003 because of Venezuelan unrest and second Persian Gulf War the price of oil continued to climb until 2008.

As a result, we conclude that, oil crisis affected all the economies in the world especially the macroeconomic variables such as inflation, unemployment rate, economic growth, GDP, etc. For instance, Sill (2007) investigate the impact of oil prices on macroeconomics and he found that, increase in oil prices decrease the GDP and real output growth in US economy and the important thing is that, increase in oil price do not have any significant effect on inflation of US in general. This is the brief explanation of the history and evolution of oil in the near history.

Chapter 4

DATA AND METHODOLOGY

4.1 Data

In this study, twenty-six OECD countries are selected and sample period starts from 1980 end to 2011. Starting year is 1980, because, there is lack of data before 1980 in most of the countries. The data series include oil prices and three macroeconomic variables for twenty-six OECD countries which are GDP per capita (constant 2000 $US), CPI (2005=100 $US) and unemployment rate (% of total labor force). The data is obtained from World Bank and International Monetary Fund. These macroeconomic variables are used in order to see the relationship between oil prices and the macroeconomics of twenty-six OECD countries. Moreover, Dubai Oil Prices are used as an oil price variable and in order to analyse in the model, we divide Dubai oil prices and CPI of each country and find the oil price for each country. All the variables which are oil prices, CPI, GDP are in terms of US dollar and unemployment rate is in terms of percentage. On the other hand, we use CPI and unemployment rate without doing any changes on them, but GDP is transformed into natural logarithms in $ US. In addition, for estimating the results, Gauss-9 package program and Stata-11 package program are used in order to estimate the results.

4.2 Methodology

In this study, first of all, Lagrange Multiplier (LM) test which is developed by Breusch-Pagan (1980) and then Bias Adjusted Cross Sectional Dependence Lagrange Multiplier (LM_{adj}) test which is developed by Pesaran et al. (2008) have been tested in order to see whether there is cross section dependence between countries or not. Secondly, Cross Sectionally Augmented Dickey Fuller (CADF) unit root test has been used as a second generation test and also it takes care of cross section dependency and structural breaks. CADF test is developed by Pesaran (2006). On the other hand, Durbin Hausman (Durbin-H) test has been used in order to measure if there is co-integration between series or not which is developed by Westerlund (2008) and this is the second generation econometric estimation test too. Finally, in order to test the possibility of long run relationship between variables, Common Correlated Effects Mean Group Estimator (CCE Full Robust) that is developed by Pesaran (2006) and Augmented Mean Group Estimator (AUG Full) that is developed by Bond and Eberhardt (2009) and Eberhardt and Teal (2010) have been used.

4.3 Cross Section Dependency Test

According to Breusch and Pagan (1980) and Pesaran (2004), while there is cross section dependency between series, if it is not taken into consideration, then all the estimation results are affected while doing analysis. Because of this reason, cross section dependency should be tested in both series and co-integration equation. If cross section dependency is taken into consideration, then estimation results will be biased and inconsistent. There are two ways to understand the relationship between cross section dependency and series.

First one is LM test statistics, developed by Breusch and Pagan (1980) and it is used, if the panel's time dimension (T) is greater than the cross sectional dimension (N). On the other hand, second test is Pesaran's (2004) CD test, it is used, if both T > N or N > T. In these tests, if the ensemble average is zero, but the individual average is different from zero, then results will be biased.

Lagrange Multiplier (LM) test is showed below;

$$CDLM1 = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2} \sim \chi^{2}_{\frac{N(N-1)}{2}} \quad (1)$$

In order to solve and fix the biased problem, Pesaran et al. (2008) are modified the LM test statistics and it becomes Bias Adjusted Cross sectional Dependence Lagrange Multiplier (LM_{adj}) test.

The LM_{adj} test is showed below;

$$LM_{adj} = \left(\frac{2}{N(N-1)}\right)^{1/2}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2}\frac{(T-K-1)\hat{\rho}_{ij}-\hat{\mu}_{Tij}}{\upsilon_{Tij}} \sim N(0,1) \quad (2)$$

Note: $\hat{\mu}_{Tij}$: average; υ_{Tij} : variance

According to LM_{adj} test, the results are standard normal distribution. The hypothesis of the test is;

H_0: There is no cross section dependency.

H_1: There is cross section dependency.

If the probability value is less than 0.05 (5% significance level), then we conclude that, H_0 will be rejected. In other words, there exists cross section dependency between series in panel.

4.4 Panel Unit Root Test

In most of the studies, the general conclusion is that, panel unit root tests which take into consideration both panel's time dimension and cross sectional dimension are statistically more powerful than the time series unit root tests that take care only with the time dimension. Because, variability of the data increases when the cross sectional dimension is added into the analysis.

On the other hand, there is one problem in the panel unit root test. The problem is whether the relationship between cross sections that creates panel are independent. So, panel unit root tests are seperated into two categories namely first and second generation tests. Also, first generation tests are seperated into two subcategories namely homogenous and heterogeneous. In addition, Hadri (2000), Levin et al. (2002) and Breitung (2005) support homogenous models. In contrast, Maddala and Wu (1999), Choi (2001), and Im et al. (2003) support heterogeneous models.

Another important thing is that, in first generation unit root tests, cross sections that creates panel are accepted as independent between them and if one unit of cross sections has shock, the impact of the shock is accepted for all units with same level. However, the impact of the shock should affect each unit of cross sections with different levels. So, second generation unit root tests are developed in order to solve this problem. In addition, multivariate ADF (MADF) test by Taylor and Sarno (1998), the panel Seemingly Unrelated Regression Augmented Dickey Fuller

(SURADF) test (Breuer et al. 2002) and (Bai and Ng, 2004), CADF (Pesaran, 2006) and Carrion-i Silvestre et al.'s (2005) test (PANKPSS) are most popular second generation unit root tests.

If there is cross-section dependency between countries, Pesaran's (2006) CADF unit root test must be used. For example, in this study, there is cross-section dependency. So, CADF unit root test is used in order to see if the series are stationary or not. Panel unit root test can be done for each of the country by using CADF. This test is used when T > N and N > T. So, for stationary test, CADF critical values are used by using Pesaran's (2006) table. If computed CADF value is greater than CADF critical value, it means than, H_0 will be rejected. In other words, series are stationary.

CADF test statistics estimation;

$$Y_{i,t} = (1 - \emptyset_i)\mu_i + \emptyset_i y_{i,t-1} + u_{i,t} \qquad i = 1,2,\ldots..,N \;\; ve \;\; t = 1,2,\ldots..,T \tag{3}$$

$$u_{it} = \gamma_i f_t + \varepsilon_{it} \tag{4}$$

f_t : common effect for each country, ε_{it} : individual specific error.

By using equation (3) and (4), the unit root hypothesis is written like;

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i f_t + \varepsilon_{it} \qquad i = 1,2,\ldots..,N \;\; ve \;\; t = 1,2,\ldots..,T \tag{5}$$

H_0: $\beta_i = 0$; Series are not stationary.

H_1: $\beta_i < 0$ i=1, 2,…., N_1, $\beta_i = 0$ i=N_1+1, N_1+2,…, N. Series are stationary.

Also, panel unit root test is done for each of the countries by using CADF test and panel unit root test is used for all of the countries by taking the average of the unit root tests in order to obtain CIPS (Cross-Sectionally Augmented Panel unit root test). CIPS is the general unit root test statistic for panel developed by Pesaran (2006).

CIPS test statistics;

$$CIPS = N^{-1} \sum_{i=1}^{N} CADF_i \quad (6)$$

4.5 Durbin-H Panel Co-integrationTest

Pedroni (1999 and 2004), Westerlund (2007 and 2008) and Westerlund and Edgerton (2007) investigate that, the long run relationship between variables are done by using panel co-integration analysis. In this study, Durbin-H panel co-integration analysis is used and that is developed by Westerlund (2008). Panel co-integration relations with variables (oil prices, GDP, CPI and unemployment rate) are done and cross section dependency are found between series. So, in order to measure the existence of co-integration, Durbin-H panel co-integration method is used. Moreover, dependent variable should be I(1) and independent variables should be I(1) or I(0) in order to use panel co-integration method. (Westerlund, 2008).

Hypothesis are;

H_0 : There is no co-integration.

H_1 : There is co-integration.

In order to decide, whether reject hypothesis or not, we look at the computed test statistics and compare with the critical value of the normal distribution table. When the computed test statistic is greater than 1.645 (5% significance level), H_0 is rejected and it means that, there exist co-integration. According to Westerlund (2008), the

existence of co-integration relation in Durbin-H method, there are two ways to test namely with Durbin-H group statistic and Durbin-H panel statistic. In Durbin-H group stat, differentiation between cross sections for autoregressive parameter is allowed. On the other hand, in Durbin-H panel co-integration analysis, autoregressive parameter is same for all cross sections.

4.6 Estimation of Long Term Co-integration Coefficients

In this study, after finding the co-integration relations between series, long term co-integration coefficients are estimated by using Common Correlated Effects Mean Group Estimator (CCE Full Robust) that is developed by Pesaran (2006) and Augmented Mean Group Estimator (AUG Full) that is developed by Bond and Eberhardt (2009) and Eberhardt and Teal (2010). The aim of this test is to see whether or not if there is any relationship between variables in the long run.

Chapter 5

EMPIRICAL RESULTS

In this study, we check the existence of cross section dependency in co-integration equation and variables by using LM_{adj} test in Gauss package program with Gauss codes and the estimation results are showed below the table.

According to Table 1, the probability values of oil price, GDP, CPI and UR (unemployment rate) and probability values of co-integration equation are less than 0.05. So, we conclude that, H_0 is rejected and there is cross section dependency in series and co-integration equation.

Table 1: Results of Cross Section Dependency (LM_{adj}) Test

Variables & Co-integration equation CD tests	**OIL**	**GDP**	**CPI**	**UR**
	Test Stat. & Prob.	**Test Stat. & Prob.**	**Test Stat. & Prob.**	**Test Stat. & Prob.**
CD LM1 (Breusch,Pagan 1980)	6401.02* (0.00)	2293.13* (0.00)	1849.87* (0.00)	881.08* (0.00)
CD LM2 (Pesaran 2004 CDLM)	238.32 (0.00)	77.19 (0.00)	59.81 (0.00)	21.81 (0.00)
CD LM (Pesaran 2004 CD)	77.10 (0.00)	41.61 (0.00)	33.46 (0.00)	20.61 (0.00)
Bias-adjusted CD test (Pesaran et al. 2008)	256.41 (0.00)	232.93 (0.00)	250.36 (0.00)	227.76 (0.00)
Bias-adjusted CD test for co-integration equation	29.78 (0.00)	70.93 (0.00)	60.27 (0.00)	70.93 (0.00)

Note: *: Although the estimated coefficients seem larger, some estimates in the different articles provide the same coefficients in terms of magnitude.

At the same time, there is cross section dependency between countries which creates panel. Also, we conclude that, because of any reason, if there is any shock related with oil price, GDP, CPI and UR in any country then the other countries will be affected. Thus, before applying the economy policies in the country, they should take into consideration of other countries' economy policies and oil price, GDP, CPI and UR. After that, second generation unit root test and panel co-integration analysis are carried out.

Table 2-A: Results of CADF Panel Unit Root Test (without difference)

Countries and Variables	Test Statistics				Critical Values		
	OIL	GDP	CPI	UR	1%	5%	10%
Australia	-1.06	-1.48	-2.95	-3.67	-4.69	-3.88	-3.49
Austria	-0.29	-2.65	-2.31	-2.82	-4.69	-3.88	-3.49
Belgium	-0.29	-1.66	-3.38	-2.42	-4.69	-3.88	-3.49
Canada	-0.28	-1.46	-3.30	-4.67**	-4.69	-3.88	-3.49
Denmark	-0.32	-3.80***	-3.19	-3.44	-4.69	-3.88	-3.49
Finland	-0.24	-1.25	-1.59	-1.52	-4.69	-3.88	-3.49
France	-0.20	-2.47	-3.06	-2.42	-4.69	-3.88	-3.49
Greece	-1.01	-1.68	-1.97	-1.33	-4.69	-3.88	-3.49
Hungary	-2.09	-0.90	-1.66	-2.18	-4.69	-3.88	-3.49
Iceland	-2.24	-1.27	-1.62	-3.90**	-4.69	-3.88	-3.49
Ireland	-0.61	-1.52	-3.02	-1.35	-4.69	-3.88	-3.49
Israel	-9.76*	-3.01	-1.41	-2.46	-4.69	-3.88	-3.49
Italy	-0.29	-1.03	-2.00	-2.90	-4.69	-3.88	-3.49
Japan	0.05	-1.73	-1.74	-1.39	-4.69	-3.88	-3.49
Korea Rep.	-1.10	-1.23	-2.41	-2.68	-4.69	-3.88	-3.49
Luxembourg	-0.35	-1.40	-4.58**	-1.82	-4.69	-3.88	-3.49
Mexico	-2.92	-2.52	-2.18	-2.68	-4.69	-3.88	-3.49
Netherland	-0.26	-2.59	-1.84	-1.41	-4.69	-3.88	-3.49
New Zealand	-0.56	-1.90	-2.13	-2.69	-4.69	-3.88	-3.49
Norway	-0.35	-2.32	-2.18	-2.09	-4.69	-3.88	-3.49
Portugal	-0.79	-1.85	-2.69	-1.00	-4.69	-3.88	-3.49
Spain	-0.89	-1.59	-2.51	-2.32	-4.69	-3.88	-3.49
Sweden	-0.20	-0.31	-1.81	-1.97	-4.69	-3.88	-3.49
Switzerland	-0.10	-0.87	-1.42	-0.59	-4.69	-3.88	-3.49
Turkey	-25.93*	-2.40	-1.58	-2.85	-4.69	-3.88	-3.49
US	-0.99	-2.00	-4.52**	0.72	-4.69	-3.88	-3.49
CIPS stat. for all countries (Panel)	-2.04	-1.80	-2.43	-2.22	-2.81	-2.66	-2.58

Note: *, ** and * respectively 1%, 5% and 10% significance level. This shows if the series are stationary.**

The estimation results of panel CIPS statistics for all countries are less than Pesaran's (2007) critical values, so we conclude that, all the series are not stationary without taking the differences. In other words, the series are not stationary in I(0) and we do not reject $H_{0.}$ The series should be stationary in order to estimate the Durbin-H co-integration analysis. At least dependent variable should be I(1) and independent

variables should be I(1) or I(0) in order to use panel co-integration method. Because of this reason, the first difference of the series are taken and looking the results one more time. The results of the CADF unit root test with difference is below the table;

Table 2-B: Results of CADF Panel Unit Root Test (with difference)

Countries and Variables	**Test Statistics**				**Critical Values**		
	OIL	**GDP**	**CPI**	**UR**	**1%**	**5%**	**10%**
Australia	-2.90	-5.30*	-6.03*	-6.31*	-4.69	-3.88	-3.49
Austria	-3.41	-4.01**	-3.21	-3.28	-4.69	-3.88	-3.49
Belgium	-3.41	-3.12	-3.05	-1.66	-4.69	-3.88	-3.49
Canada	-3.39	-3.74***	-3.11	-4.22**	-4.69	-3.88	-3.49
Denmark	-3.32	-3.25	-2.04	-3.57***	-4.69	-3.88	-3.49
Finland	-3.42	-4.24**	-2.39	-3.51***	-4.69	-3.88	-3.49
France	-3.49	-3.46	-3.43	-3.09	-4.69	-3.88	-3.49
Greece	-2.23	-2.34	-4.16**	-0.98	-4.69	-3.88	-3.49
Hungary	-1.17	-3.14	-5.21***	-2.62	-4.69	-3.88	-3.49
Iceland	-4.30**	-4.29**	-3.46	-4.20**	-4.69	-3.88	-3.49
Ireland	-3.63***	-1.39	-4.22**	-1.57	-4.69	-3.88	-3.49
Israel	-7.53*	-3.36	-4.46**	-3.41	-4.69	-3.88	-3.49
Italy	-3.36	-4.22**	-2.59	-2.25	-4.69	-3.88	-3.49
Japan	-3.54***	-2.00	-3.29	-2.56	-4.69	-3.88	-3.49
Korea Rep.	-3.60***	-4.11**	-4.03**	-4.23**	-4.69	-3.88	-3.49
Luxembourg	-3.40	-3.13	-2.82	-3.72***	-4.69	-3.88	-3.49
Mexico	-5.66*	-3.85***	-4.21**	-4.95*	-4.69	-3.88	-3.49
Netherland	-3.43	-3.50***	-2.49	-2.84	-4.69	-3.88	-3.49
New Zealand	-2.95	-2.48	-3.80***	-3.45	-4.69	-3.88	-3.49
Norway	-3.22	-3.55***	-4.93*	-3.76***	-4.69	-3.88	-3.49
Portugal	-3.10	-3.19	-3.40	-3.61***	-4.69	-3.88	-3.49
Spain	-3.09	-3.56***	-3.92**	-2.97	-4.69	-3.88	-3.49
Sweden	-3.44	-2.94	-5.35*	-2.34	-4.69	-3.88	-3.49
Switzerland	-3.51***	-2.57	-3.45	-1.05	-4.69	-3.88	-3.49
Turkey	-5.89*	-3.92**	-3.78***	-4.25**	-4.69	-3.88	-3.49
US	-3.31	-6.28*	-3.65***	-7.96*	-4.69	-3.88	-3.49
CIPS stat. for all countries (Panel)	-3.60*	-3.50*	-3.71*	-3.40*	-2.81	-2.66	-2.58

Note: *, ** and * respectively 1%, 5% and 10% significance level. This shows if the series are stationary.**

Above the table shows us, all the series are stationary in all significance levels which are 1%, 5% and 10% after taking the first difference of the series according to panel CIPS statistic values for all countries. So, we conclude that, H_0 is reject and series are all I(1) in general.

On the other hand, after analysing the cross section dependency test and panel unit root test, now Durbin-H panel co-integration test is done with three types that are single regression, double regression and multiple regression and estimation results are below;

Table 3-A: Single Regression: Results of Durbin-H Panel Co-integration Test

	Durbin-H Group Stats. & Prob. Values	**Durbin-H Panel Stats. & Prob. Values**	**Critical Value (5% significance level)**	**Decision**
Model 1 GDP=f(OIL)	3.01 (0.00)	3.22 (0.00)	1.645	There is co-integration.
Model 2 CPI=f(OIL)	6.10 (0.00)	8.25 (0.00)	1.645	There is co-integration.
Model 3 UR=f(OIL)	3.46 (0.00)	6.67 (0.00)	1.645	There is co-integration.

Above Table 3-A shows us, GDP, CPI and UR are dependent variables respectively and OIL is independent variable in each of the single regression. We conclude that, there are co-integration relations between GDP and OIL, CPI and OIL, UR and OIL both in Durbin-H group statistics and Durbin-H panel statistics. H_0 is rejected in all cases, because both computed values of group and panel statistics are greater than

1.645 (%5 significance level), so, there is co-integration between each dependent variable and independent variable.

After that, double regression model has been done with six different models and analyse the co-integration relations.

Table 3-B: Double Regression: Results of Durbin-H Panel Co-integration Test

	Durbin-H Group Stats. & Prob. Values	**Durbin-H Panel Stats. & Prob. Values**	**Critical Value (5% significance level)**	**Decision**
Model 1 GDP=f(CPI, OIL)	2.13 (0.016)	4.67 (0.00)	1.645	There is co-integration.
Model 2 GDP=f(UR, OIL)	0.41 (0.338)	2.62 (0.004)	1.645	There is no co-integration in group and there is co-integration in panel.
Model 3 CPI=f(UR, OIL)	4.61 (0.00)	11.63 (0.00)	1.645	There is co-integration.
Model 4 CPI=f(GDP, OIL)	11.24 (0.00)	19.16 (0.00)	1.645	There is co-integration.
Model 5 UR=f(GDP, OIL)	0.78 (0.215)	2.83 (0.002)	1.645	There is no co-integration in group and there is co-integration in panel.
Model 6 UR=f(CPI, OIL)	-0.86 (0.805)	0.59 (0.275)	1.645	There is no co-integration both in group and panel.

In this part of the study, double regression analyses have been done and see the co-integration relations in Table 3-B. First of all, GDP is used as a dependent variable in two models. CPI and OIL are independent variables in first model and computed values are greater than the 1.645, so H_0 is rejected in first model both in group and panel. We conclude that, there is co-integration between GDP, CPI and OIL. In second model, there is no co-integration in group statistic and there is co-integration

in panel statistic, because computed value is not greater than 1.645 in group and it is greater than 1.645 in panel. H_0 is rejected in panel and not rejected in group statistics. The conclusion is that, there is co-integration between GDP, UR and OIL in panel and not in group. In third and fourth model, co-integration relations are found between CPI, UR, OIL, and CPI, GDP and OIL. Moreover, in model five, there is no co-integration in group statistics and there is co-integration in panel statistics, because computed value is not greater than 1.645 in group and it is greater than 1.645 in panel. It is the same as model two and we conclude that, there is co-integration between UR, GDP and OIL in panel and not in group. In the last model which is model six, co-integration relations are not found between UR, CPI and OIL both in group and panel statistics.

Finally, multiple regression models have been tested in order to see whether there is co-integration between variables or not.

Table 3-C: Multiple Regression: Results of Durbin-H Panel Co-integration Test

	Durbin-H Group Stats. & Prob. Values	**Durbin-H Panel Stats. & Prob. Values**	**Critical Value (5% significance level)**	**Decision**
Model 1 **GDP=f(UR, CPI, OIL)**	1.35 (0.08)	0.60 (0.27)	1.645	There is no co-integration.
Model 2 **CPI=f(GDP, UR, OIL)**	6.36 (0.00)	15.06 (0.00)	1.645	There is co-integration.
Model 3 **UR=f(CPI, GDP, OIL)**	-1.82 (0.96)	-0.56 (0.71)	1.645	There is no co-integration both in group and panel.

In Table 3-C shows that, both in group and panel, there is no co-integration in the first model if the GDP is dependent variable and UR, CPI and OIL are independent variable. On the other hand, in model three, it is same as model one. There is only co-integration relation between variables, if the CPI is dependent and the GDP, UR and OIL are independent.

In addition to above tests, the final test is Augmented Mean Group Estimator (AUG Full) that is developed by Bond and Eberhardt (2009) and Eberhardt and Teal (2010). The aim of this test is to see whether or not if there is any relationship between variables in the long run. Moreover, Common Correlated Effects Mean Group Estimator (CCE Full Robust) test that is developed by Pesaran (2006) is estimated too. However, we use AUG Full test, because the variables are more significant in this test. So, the estimation results are according to this test. Also, these results are for the twenty-six OECD countries in panel not for the each country. The test results are separated into three parts which are single regression, double regression and multiple regression and estimation results are below;

Table 4-A: Single Regressions: Results of Long Term Coefficients (AUG Full)

	Coefficients &computed t- stat.
	OIL
Model 1	-0.0088
GDP=f(OIL)	(-1.36***)
Model 2	-4.4524
CPI=f(OIL)	(-3.21*)
Model 3	-0.1623
UR=f(OIL)	(-0.42)

Note: *, ** and * respectively 1%, 5% and 10% significance level.**
The computed t-statistics are in the parenthesis.

According to estimation result, in order to decide whether if the model is significant or not, decision should be according to significance level which are 1% (if the computed t- stat is greater than 2.3), 5% (if the computed t- stat is greater than 1.645) and 10% (if the computed t- stat is greater than 1.28). If the computed values are greater than the critical values, variable will be significant.

On the other hand, above table shows that, there are three single regression models and GDP, CPI and UR are used as a dependent variable respectively in each three model and oil is used as an independent variable. Oil is significant in the first two models, but it is not significant in the third model. It is significant at 10% in model one and 1% in model two. In model one; we conclude that, if oil increases by one unit of US dollar, then GDP will decrease by 0.88%. In model two; we conclude that, if oil increases by one unit of US dollar, then CPI will decrease by 4.45 $ US. So, in both models, oil price has negative impact on GDP and CPI, but in model three; oil is not significant, so oil price does not have any impact on unemployment rate in long term on these countries. These are all for the result of single regression models.

Table 4-B: Double Regressions: Results of Long Term Coefficients (AUG Full)

	Coefficients & computed t-stat.			
	GDP	**CPI**	**UR**	**OIL**
Model 1 **GDP=f(CPI, OIL)**	-	-0.0001 (-0.39)	-	-0.009 (-1.52***)
Model 2 **GDP=f(UR, OIL)**	-	-	-0.006 (-6.15*)	-0.008 (-1.71**)
Model 3 **CPI=f(UR, OIL)**	-	-	0.91 (2.10**)	-3.99 (-3.22*)
Model 4 **CPI=f(GDP, OIL)**	-4.53 (-0.21)	-	-	-4.17 (-3.43*)
Model 5 **UR=f(GDP, OIL)**	-51.12 (-7.41*)	-	-	-0.19 (-0.47)
Model 6 **UR=f(CPI, OIL)**	-	0.03 (3.53*)	-	0.24 (0.61)

Note: *, ** and * respectively 1%, 5% and 10% significance level. The computed t-statistics are in the parenthesis.**

In this table, double regression models are tested in order to see the long term impacts of oil and other variables. In first two models, GDP is dependent variable. In the first model, CPI is not significant, but oil price is significant at 10%. So, this means that, CPI does not have any impact on GDP in long term. However, if oil price increases by one unit of US dollar, then GDP will decrease by 0.9% in long term. On the other hand, in model two, UR (at 1%) and oil price (at 5%) are significant, so both of them have impact on GDP. If oil price increases by one unit of US dollar, then GDP will decrease by 0.8% and if UR increases by 1%, then GDP will decrease by 0.6% in long term. Moreover, in model three and four, CPI is used as a dependent variable. In model three, UR is significant at 5% and oil price is significant at 1%. So, both of them have impact on CPI. For instance, If UR increases by 1%, and then CPI will increase by 0.91 units of US dollar and if oil price increases by one unit of US dollar, then CPI will decrease by 3.99 units of US dollar. In model four, GDP is not significant, but oil price is significant at 1%. If oil price increases by one unit of

US dollar, then CPI will decrease by 4.17 units of US dollar. In addition, in model five and six, UR is used as a dependent variable. In model five, oil price is not significant, but GDP is significant at 1% and has impact on UR in long term. For example, if GDP increases by 1%, then UR will decrease by 51.12%. In last model which is model 6, CPI is significant, but oil price is not significant. So, if CPI increases by one unit of US dollar, then UR will increase by 0.03%. These are all for the result of double regression models.

Table 4-C: Multiple Regressions: Results of Long Term Coefficients (AUG Full)

	Coefficients & computed t- stat.			
	GDP	**CPI**	**UR**	**OIL**
Model 1		-0.00004	-0.0068	-0.0088
GDP=f(UR, CPI, OIL)	-	(-0.15)	(-6.47*)	(-1.70**)
Model 2	17.38		0.97	-3.71
CPI=f(GDP, UR, OIL)	(0.53)	-	(1.81**)	(-2.96*)
Model 3	-54.31	0.053		-0.058
UR=f(CPI, GDP, OIL)	(-7.61*)	(2.52*)	-	(-1.52***)

Note: *, ** and * respectively 1%, 5% and 10% significance level. The computed t-statistics are in the parenthesis.**

In this section of the study, multiple regression models are tested in three ways. In first model, GDP is used as dependent variable and UR, CPI and OIL (oil price) are used as independent variables and measure the impact on GDP. CPI is not significant, but UR is significant at 1% and oil price is significant at 5%. We conclude that, if UR increases by 1%, then GDP will decrease by 0.68% and if oil price increases by one unit of US dollar, then GDP will decrease by 0.88% in long term. On the other hand, in model two, CPI is used as a dependent variable and GDP, UR and oil price are used as independent variables. GDP is not significant, in other words it does not have any impact on CPI in long term. On the other hand, UR is significant at 5% and oil price is significant at 1%. We conclude that, if UR increases

by 1%, then CPI will increase by 0.97 units of US dollar and if oil price increases by one unit of US dollar, then CPI will decrease by 3.71 units of US dollar. The last model is model three, UR is used as dependent variable and CPI, GDP and oil price are used as independent variables. All of them are significant, this is the only multiple regression model that, all the macroeconomic variables has impact on dependent variable which is unemployment rate. GDP and CPI are at 1%, oil price is at 10% significant. The conclusions of the variables are; if GDP increases by 1%, then UR will decrease by 54.31% in long term. On the other hand, if CPI increases by one unit of US dollar, then UR will increase by 0.053% and if oil price increases by one unit of US dollar, then UR will decrease by 0.058%. These are the general interpretations about the regression models.

After analysing the long term coefficients and t-statistics in general of twenty-six OECD countries in panel, then the following table shows the impact of oil price movements on macroeconomic variables by using three parts which are single regression, double regression and multiple regression for each of the countries. The estimation results are as follows;

Table 5-A: Single Regressions: Results of Long Term Coefficients (AUG Full)

	Model 1 GDP=f(OIL)	Model 2 CPI=f(OIL)	Model 3 UR=f(OIL)
	Coefficients & Computed t-stats		
Australia	0.018 (4.32*)	-4.04 (-2.75*)	-1.86 (-1.67**)
Austria	0.002 (0.51)	-1.30 (-1.63***)	0.51 (0.92)
Belgium	-0.007 (-2.05**)	-2.27 (-1.72**)	-0.52 (-0.38)
Canada	0.014 (1.91**)	-6.52 (-5.39*)	-0.95 (-0.83)
Denmark	-0.034 (-5.47*)	-5.80 (-5.39*)	-0.39 (-0.30)
Finland	0.037 (3.00*)	-13.91 (-8.45*)	- 3.30 (-1.55***)
France	-0.013 (-3.72*)	-11.71 (-7.25*)	-3.36 (-5.08*)
Greece	0.019 (6.16*)	0.87 (1.01)	-0.96 (-3.17*)
Hungary	0.017 (4.47*)	7.18 (11.05*)	-1.03 (-4.58*)
Iceland	0.003 (1.67**)	-0.15 (-0.21)	-0.03 (-0.23)
Ireland	0.004 (0.21)	-1.75 (-0.79)	1.26 (0.37)
Israel	0.00000036 (0.14)	0.007 (0.50)	-0.008 (-2.59*)
Italy	-0.044 (-8.44*)	-8.73 (-11.77*)	-3.01 (-3.91*)
Japan	-0.086 (-4.56*)	-17.23 (-8.92*)	1.64 (2.06**)
Korea Rep.	-0.088 (-4.23*)	5.65 (3.64*)	0.45 (0.59)
Luxembourg	-0.066 (-5.46*)	0.30 (0.22)	3.39 (3.78*)
Mexico	0.0002 (5.65*)	0.11 (6.18*)	-0.001 (-0.40)
Netherland	0.003 (0.46)	5.39 (3.39*)	-2.56 (-1.22)
New Zealand	0.021 (2.37*)	-12.90 (-6.22*)	-1.55 (-1.56***)
Norway	-0.029 (-3.71*)	-11.29 (-10.75*)	-1.86 (-2.76*)
Portugal	-0.015 (-2.45*)	-5.21 (-4.94*)	1.46 (2.85*)
Spain	-0.013 (-2.67*)	-3.60 (-6.14*)	1.75 (1.03)
Sweden	0.036 (4.44*)	-18.36 (-8.11*)	0.79 (0.51)
Switzerland	0.014 (1.87**)	-13.00 (-7.16*)	1.02 (0.97)
Turkey	0.00000013 (-0.88)	0.006 (4.62*)	-0.0001 (-1.77**)
US	-0.023 (-5.57*)	2.55 (4.83*)	4.93 (4.77*)

Note: *, ** and * respectively 1%, 5% and 10% significance level. The computed t-statistics are in the parenthesis.**

Above the table shows that, what does the impact of increase in oil price on macroeconomic variables which are GDP, CPI and UR. In first model, it shows the impact of oil prices on GDP. The increase in oil prices does not have any significant impact on GDP in Austria, Ireland, Israel, Netherland and Turkey. Oil price movements have impact on GDP in remaining twenty-one OECD countries. Ten of them are affected positively which means increases in oil price by one unit of US $ cause an increase in GDP in following countries; Austria, Canada, Finland, Greece,

Hungary, Iceland, Mexico, New Zealand, Sweden and Switzerland and eleven of them which are Belgium, Denmark, France, Italy, Japan, Korea Republic, Luxembourg, Norway, Portugal, Spain, and US. For these countries, increases in oil prices cause the decrease in GDP in long term. The impact is not too much on GDP in these countries. On the other hand, in second model, the impact of oil prices on CPI is investigated and found both positive and negative impacts in long term. Also, oil price movement does not have any impact on CPI in Greece, Iceland, Ireland, Israel and Luxembourg. Moreover, there is negative impact on CPI in Australia, Austria, Belgium, Canada, Denmark, Finland, France, Italy, Japan, New Zealand, Norway, Portugal, Spain, Sweden and Switzerland and positive impact in Hungary, Korea Republic, Mexico, Netherland, Turkey, and US. The increase in oil price cause an increase and decrease in CPI in long term and also the impact is higher on CPI than on GDP. In last model, unemployment rate is used as a dependent variable and measured the impact of oil price movements on UR. The results shows that, there is no significant effect on UR in Austria, Belgium, Canada, Denmark, Iceland, Ireland, Korea Republic, Mexico, Netherland, Spain, Sweden, and Switzerland. In addition, there is positive effect on UR in Japan, Luxembourg, Portugal and US and negative effect in Australia, Finland, France, Greece, Hungary, Israel, Italy, New Zealand, Norway and Turkey in long term.

The important thing is that, the impact of oil price movement is negative on GDP and CPI, in contrast there is no significant effect on UR in general of the twenty-six OECD countries. (Please check Table 4-A).

Below the Table 5-B shows the double regressions and the long term coefficients of macroeconomic variables.

Table 5-B: Double Regressions: Results of Long Term Coefficients (AUG Full)

	Model 1 GDP=f(CPI , OIL)	**Model 2 GDP=f(UR, OIL)**	**Model 3 CPI=f(UR , OIL)**	**Model 4 CPI=f(GDP , OIL)**	**Model 5 UR=f(GDP, OIL)**	**Model 6 UR=f(CPI , OIL)**
	Coefficients & Computed t-stats of Oil Price					
	OIL	**OIL**	**OIL**	**OIL**	**OIL**	**OIL**
Australia	0.01 (4.31*)	0.008 (2.09**)	-3.41 (-1.79**)	-3.20 (-2.32*)	-0.81 (-1.76**)	-1.91 (-3.29*)
Austria	-0.0008 (-0.20)	0.007 (1.86**)	-1.12 (-1.28)	-1.86 (-2.36*)	0.06 (0.17)	-0.32 (-0.75)
Belgium	-0.008 (-2.24**)	-0.0004 (-0.15)	-2.75 (-2.15**)	-4.33 (-3.92*)	0.87 (0.97)	1.35 (1.23)
Canada	0.009 (1.33***)	0.008 (1.25)	-6.02 (-5.01*)	-6.24 (-5.42*)	0.23 (0.40)	0.45 (0.72)
Denmark	-0.03 (-5.69*)	-0.034 (-7.05*)	-5.62 (-5.53*)	-6.78 (-4.94*)	-2.42 (-4.31*)	1.10 (1.26)
Finland	0.01 (1.26)	0.003 (0.67)	-13.09 (-6.68*)	-12.96 (-7.96*)	-1.12 (-0.80)	-2.84 (-1.30***)
France	-0.01 (-4.06*)	-0.023 (-4.43*)	-8.37 (-3.77*)	-13.44 (-7.66*)	-4.27 (-7.02*)	-3.01 (-4.21*)
Greece	0.02 (8.23*)	0.017 (6.03*)	0.92 (0.99)	1.99 (1.89**)	0.57 (1.74**)	-0.24 (-0.86)
Hungary	0.01 (2.76*)	0.012 (4.34*)	6.48 (10.50*)	6.84 (8.89*)	0.87 (4.18*)	-0.68 (-2.95*)
Iceland	0.002 (1.52***)	0.003 (2.28**)	-0.09 (-0.17)	0.26 (0.36)	0.32 (3.41*)	0.30 (6.36*)
Ireland	0.008 (0.57)	-0.005 (-0.80)	-1.60 (-0.72)	-1.85 (-0.83)	0.96 (1.07)	2.90 (1.25)
Israel	0.0000004 (0.20)	0.0000006 (0.35)	0.01 (1.28)	-0.0004 (-0.04)	0.001 (0.53)	-0.004 (-1.51***)
Italy	-0.05 (-8.44*)	-0.04 (-3.87*)	-7.07 (-6.27*)	-6.86 (-6.98*)	-4.52 (-6.75*)	-3.36 (-5.24*)
Japan	0.001 (0.10)	-0.09 (-11.28*)	-18.60 (-10.91*)	-8.93 (-3.78*)	-1.73 (-3.23*)	0.54 (0.93)
Korea Rep.	-0.12 (-6.82*)	-0.05 (-4.56*)	4.06 (3.36*)	3.36 (1.16)	0.75 (1.00)	0.62 (0.80)
Luxembourg	-0.06 (-5.48*)	-0.03 (-3.05*)	-2.10 (-1.78**)	-3.50 (-2.13**)	1.81 (3.61*)	1.95 (3.31*)
Mexico	0.0001 (2.77*)	0.0002 (5.47*)	0.11 (5.61*)	0.06 (2.67*)	-0.003 (-0.59)	-0.001 (-0.71)

Table 5-B: Double Regressions: Results of Long Term Coefficients (AUG Full)

Continued;

	Model 1 GDP=f(CPI , OIL)	Model 2 GDP=f(UR, OIL)	Model 3 CPI=f(UR, OIL)	Model 4 CPI=f(GDP , OIL)	Model 5 UR=f(GDP, OIL)	Model 6 UR=f(CPI, OIL)
	Coefficients & Computed t-stats of Oil Price					
	OIL	**OIL**	**OIL**	**OIL**	**OIL**	**OIL**
Netherland	0.004 (0.54)	0.006 (1.50***)	5.20 (3.25*)	5.48 (3.32*)	-1.19 (1.06)	1.80 (1.20)
New Zealand	0.006 (0.68)	-0.0003 (-0.07)	-10.42 (-4.73*)	-11.14 (-6.07*)	-0.40 (-0.73)	-1.19 (-1.16)
Norway	-0.039 (-4.45*)	-0.041 (-5.37*)	-9.53 (-8.20*)	-13.56 (-13.64*)	-2.46 (-4.68*)	-1.63 (-2.33*)
Portugal	-0.007 (-1.11)	0.002 (0.83)	-3.77 (-3.79*)	-3.43 (-4.31*)	-1.60 (8.09*)	-2.28 (3.84*)
Spain	-0.01 (-3.36*)	-0.018 (-4.42*)	-3.66) (-5.71*)	-3.44 (-5.52*)	-3.24 (-3.52*)	-0.82 (0.68)
Sweden	0.01 (1.64***)	0.033 (7.19*)	-16.56 (-8.32*)	-14.96 (-8.14*)	-3.21 (3.75*)	-1.93 (1.63***)
Switzerland	0.01 (1.35***)	0.007 (1.00)	-9.34 (-5.42*)	-12.53 (-6.97*)	-0.38 (-0.80)	-0.35 (-0.71)
Turkey	0.0000003 (-2.14**)	0.000000001 (0.01)	0.005 (5.39*)	0.006 (4.55*)	-0.0001 (0.89)	-0.000024 (-0.38)
US	-0.01 (-4.23*)	0.0007 (0.18)	2.59 (3.95*)	2.45 (3.97*)	-4.00 (6.00*)	-5.62 (6.46*)

Note: *, ** and * respectively 1%, 5% and 10% significance level. The computed t-statistics are in the parenthesis.**

The results tell us, in model one and two, GDP is used as a dependent variable.

In model one; oil price does not have any impact on GDP in Austria, Finland, Ireland, Israel, Japan, Netherland, New Zealand and Portugal. In model two; oil price movements do not have any impact on GDP in Belgium, Canada, Finland, Ireland, Israel, US, Turkey, Switzerland, New Zealand and Portugal. For instance, in both of the model, it has positive effect on GDP in Austria, Greece, Hungary, Iceland, Mexico and Sweden. In other words, the increases in one unit of US $ cause an increase in GDP in long term. On the other hand, there is negative impact on GDP in Denmark, France, Italy, Korea Republic, Luxembourg, Norway and Spain in both of

the models. Negative impact on GDP means the increases in one unit of US dollar cause decreases in GDP.

The difference is that, in model one, there is positive effect on GDP in Canada, Switzerland and Turkey and negative in Belgium and US. Whereas, oil price movement affects GDP positively in Netherland and Austria and negative in Japan.
In model three, oil price is not significant in other words it does not have any impact on CPI in Austria, Greece, Iceland, Ireland and Israel in long term and in model four, it is not significant in Iceland, Ireland, Israel and Korea Republic. On the other hand, in both of the model the remaining results are almost similar, for instance, the impact of oil is negative in Australia, Belgium, Canada, Denmark, Finland, France, Italy, Japan, Luxembourg, New Zealand, Norway, Portugal, Spain, Sweden and Switzerland in long term in both of the models. Also, the impact is positive in Hungary, Mexico, Netherland, Turkey and US in both of the models. The difference is that, in model three, the effect of increases in oil price is positive on CPI in Hungary and in model four, the effect is negative in Australia and positive in Greece on CPI.

Moreover, the common results for model five and six are; oil price movement does not have any effect on unemployment rate, in other words oil price is not significant in Austria, Belgium, Canada, Ireland, Korea Republic, Mexico, Netherland, New Zealand, Switzerland and Turkey. On the other hand, the impact on UR is positive in Iceland and Luxembourg in both of the models and negative in Australia, France, Italy, Norway, Portugal, Sweden and US. The difference is the impact of oil price movements on UR is negative in Denmark, Japan and Spain, positive in Greece, Hungary and no effect (not significant) in Finland and Israel in model five.

In contrast, the impact is negative in Finland, Hungary and Israel and there in no impact on UR in Denmark, Greece, Japan and Spain in model six.

Another important point is that, the impact of oil price movement is negative on GDP and CPI, in contrast there is no significant effect on UR in general of the twenty six OECD countries. (Please check Table 4-B). Whereas, when we focus on countries separately, we see that, the effect of oil is both positive and negative on macroeconomic variables.

Table 5-C below shows the multiple regressions and the long term coefficients of macroeconomic variables.

Table 5-C: Multiple Regressions: Results of Long Term Coefficients (AUG Full)

	Model 1 GDP=f(UR, CPI, OIL)	**Model 2 CPI=f(GDP, UR, OIL)**	**Model 3 UR=f(CPI, GDP, OIL)**
	Coefficients & Computed t-stats of Oil Price		
	OIL	**OIL**	**OIL**
Australia	0.007 (1.75**)	-9.89 (-5.81*)	-0.52 (-1.03)
Austria	0.007 (1.61***)	-1.95 (-2.16**)	0.58 (0.75)
Belgium	0.002 (1.18)	-4.70 (-4.01*)	0.54 (0.39)
Canada	0.008 (1.26)	-6.22 (-4.87*)	0.29 (0.46)
Denmark	-0.034 (-6.98*)	-3.73 (-1.98**)	-2.46 (-3.64*)
Finland	-0.004 (-0.93)	-14.70 (-7.48*)	-1.26 (-0.83)
France	-0.024 (-4.86*)	-10.75 (-3.54*)	-4.06 (-6.81*)
Greece	0.024 (8.95*)	2.10 (1.93**)	0.51 (1.11)
Hungary	0.009 (1.47***)	7.82 (12.76*)	1.19 (3.42*)
Iceland	0.003 (2.51*)	-0.55 (-1.02)	0.17 (2.80*)
Ireland	-0.006 (-0.85)	1.88 (0.48)	-0.25 (-0.32)
Israel	-0.00001 (-1.04)	0.014 (1.70**)	-0.003 (-1.08)
Italy	-0.040 (-4.54*)	-4.59 (-3.65*)	-4.43 (-4.34*)
Japan	-0.048 (-4.42*)	-5.88 (-1.12)	-1.64 (-2.02**)
Korea Rep.	-0.090 (-7.53*)	6.22 (2.68*)	-4.05 (-4.00*)
Luxembourg	-0.034 (-2.95*)	-3.61 (-2.50*)	0.56 (0.63)
Mexico	0.00009 (1.31***)	0.066 (2.67*)	-0.003 (-0.64)
Netherland	0.013 (2.14**)	4.92 (2.81*)	1.37 (0.79)
New Zealand	-0.0019 (-0.33)	-12.75 (-5.70*)	-0.20 (-0.36)
Norway	-0.047 (-7.54*)	-12.78 (-8.70*)	-2.26 (-4.20*)
Portugal	0.009 (3.48*)	-3.94 (-5.15*)	1.61 (6.43*)
Spain	-0.019 (-3.23*)	-1.39 (-1.25)	-4.00 (-2.56*)
Sweden	0.020 (4.03*)	-15.32 (-8.19*)	3.33 (3.58*)
Switzerland	0.009 (1.18)	-9.18 (-5.15*)	0.20 (0.42)
Turkey	-0.0000003 (-2.35*)	0.006 (5.86*)	-0.0002 (-2.31*)
US	0.008 (1.81**)	2.47 (4.64*)	-0.30 (-0.21)

Note: *, ** and * respectively 1%, 5% and 10% significance level. The computed t-statistics are in the parenthesis.**

In above the table, the results show that, in three models there is positive, negative and insignificant impacts on macroeconomic variables of oil price movements. In first model, the impact of oil price movement on GDP is not significant in Belgium,

Canada, Finland, Ireland, Israel, New Zealand and Switzerland. Also, negative impacts on GDP in Denmark, France, Italy, Japan, Korea Republic, Luxembourg, Norway, Spain and Turkey, positive effects in Australia, Austria, Greece, Hungary, Iceland, Mexico, Netherland, Portugal, Sweden and US. In model two, the impact of oil price movements on CPI is not significant in Iceland, Ireland, Japan and Spain. In addition, the effect is positive on CPI in Greece, Hungary, Israel, Korea Republic, Mexico, Netherland, Turkey and US, negative in Australia, Austria, Belgium, Canada, Denmark, Finland, France, Italy, Luxembourg, New Zealand, Norway, Portugal, Sweden and Switzerland. On the other hand, in the last model which is model three, the effect of oil price movements on unemployment rate is tested and found that, there is no effect on UR in Australia, Austria, Belgium, Canada, Finland, Greece, Ireland, Israel, Luxembourg, Mexico, Netherland, New Zealand, Switzerland and US. Moreover, the effect is positive in Hungary, Iceland, Portugal and Sweden, negative in Denmark, France, Italy, Japan, Korea Republic, Norway, Spain and Turkey. These are the all interpretations of the estimated long term coefficients.

In general, the impact of oil price movement on GDP, CPI and UR was negative in multiple regressions. (Please check Table 4-C). However, here in this case, when the estimations are done for each country separately, the effect can be positive, negative or insignificant.

Chapter 6

CONCLUSION AND POLICY IMPLICATIONS

6.1 Summary of the Findings

The aim of this thesis was to see the impact of oil price movements on macroeconomic variables. In this thesis, we focused on twenty-six OECD countries by using panel tests in both Gauss and Stata package programs between 1980– 2011. We analysed twenty-six OECD countries as general not each of them separately and found the impacts of oil prices on macroeconomic variables which are GDP, CPI and UR. We did cross section dependency test, CADF panel unit root test in order measure stationary, Durbin-H panel co-integration test in order to measure if there will be any relation between variables in long term and finally estimated the long term co-integration coefficient. These tests are all second generation methods and because of this reason giving the more robust estimation results. When we looked at the long term coefficients, oil price has statistically significant impact in all of the regressions except on unemployment rate in single and double regression models in Table 4-A and 4-B. So, this means that, increase in oil price affects macroeconomic variables negatively, but it has low impact on UR and GDP and more on CPI in long term as general on twenty-six OECD countries.

Moreover, as mentioned above, the impact of oil price on unemployment rate is low in the long term, because the unemployment rate of the country may increase in short term, but in long term it reaches back to full employment level. Therefore, the

relationship between unemployment rate and oil price may not be quite visible in the long run but in some other studies in the future, the relationship between oil prices and unemployment rate in the short term would be observed more significantly.

Also, when we compare the results with other studies which are done for the other countries, they confirm our estimation results. In most of the study, oil price movements affect macroeconomic variables both positive and negative such as unemployment rate, inflation, GDP, economic growth, investment, stock exchange prices and etc. For instance, in some studies, the finding was, the increase in oil prices cause inflation and affect unemployment rate in long term. So, our findings are parallel with other researches. Also, when we focus on the long term coefficients of the countries one by one, we analyse that, oil price movements have impact on macroeconomic variables either positive or negative in long term. In general, we found negative impact of oil price movements on GDP, CPI and UR.

6.2 Policy Implications

In this thesis, in general, results show that, the impact of oil prices is negative and does exert statistically significant impact on macroeconomic variables. It means that, the increase in oil price generally cause a decrease in GDP, CPI and unemployment rate. However, in some cases, it does not have any impact on unemployment rate. Also, the impact is low on GDP and unemployment rate, but it is more on CPI. This is for all of twenty-six OECD countries. On the other hand, the other findings which focus on individual countries, oil price movement exerts mixed impact in the long term. The expected impact was negative in general and the finding was proving itself, but for country specific analysis, both negative and positive impact was not expected. The main point is that, the impact of oil price movement on

macroeconomics is actually depends on the country's oil dependency. If oil is used as a main source of industry, it affects everything in the country, but if this is not the case, it does not have too much impact on the macroeconomic variables of country. Also, nowadays, people start to use more fuel efficient vehicles and transportation services. In addition to these, renewable energy resources like biofuels can be used as an alternative to oil and by this way, the demand for oil will decrease and the dependency to oil in countries will reduce and this will decrease the impact of oil price movement on macroeconomic variables. For instance, if the country reduce the use of oil and instead usage of other energy sources like biofuels, solar energy, wind energy are increased, then the GDP, inflation, unemployment rate, economic growth and other economic variables will be affected less when oil prices increase, because countries will not largely be dependent to oil. On the other hand, we saw the impact of oil price movement both negative and positive while estimating the impacts on each of the countries and as mentioned above, the impact can be positive if the oil is not a main source of the country, but if it is used as a main source, then it will affect GDP, CPI and unemployment rate negatively.

For instance, in OECD countries, because of increases in oil prices in the world, the demand for oil consumption decreased between 2000 – 2010 periods while it was increasing in non-OECD countries. Also, in most of the OECD countries, they increased the taxes on fuel and try to encourage the use of biofuels and more efficient vehicles and increase the usage of optimized transportation. If the price of oil remains high, the people will consume less oil and will try to consume renewable energy resources more, so that means, the dependency to oil will be reduced.

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