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# THE EFFECTS OF OIL PRICES ON INFLATION AND GROWTH: TIME SERIES ANALYSIS IN TURKISH ECONOMY FOR 1988:01- 2013:04 PERIOD

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## Abstract

In this study, the analysis was that the capacity of creating inflation depends on oil prices as the one of energy types that is a major input of aggregate output which becomes a source of economic growth with increasing in costs. The aggregate output is also a function of energy that is the one of production inputs. Moreover, energy is an imported by several countries because it is acquired from the limited sources around the world. It causes inflation of importing countries to exporting countries through oil prices. At the same time, the rises of oil prices causes inflation because it increases the product costs. The second argument is that the increasing of aggregate output is generally affected by energy use, and is privately affected by oil use. In that case, oil import is both efficient on inflation and on growth. Tested hypothesis in the study is that oil prices have an inflationary effect because of its effect on costs, and is that this activity will negatively affect the growth because of its effect on expectations. In this study, the effects of the crude oil import of Turkey for inflation and growth are analysed over the long term. The committed analyses show that GDP was affected by oil imports, and it also caused inflation in the Turkish economy.

**Keywords:** Oil Import, Inflation, Economic Growth

**JEL:** C32, E31, E52

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## 1. Introduction

The relation between inflation and growth is traditionally discussed. Keynesian aggregate demand increase policies have had an upside effect on inflation, and it can be said that inflation also had positive effects on growth after World War 2. Especially, it was thought that hyperinflation positively affect growth depending on that it keeps down unemployment in the analysis of Phillips Curve (Grimes, 1991). With 1970s, this thought has ended with the build-up of opinions about the negative effects of volatility in the inflation rates. In particular, inflation fluctuations turn up pressure on the long term decisions of firms and individuals because of their destruction on expectations, and it negatively affects the growth (Mankiw, 2009; Andres & Hernando 1997).

On the other hand, aggregate output is a function of inputs, and the one of most efficient variables is energy between inputs. Particularly, growth is also greatly affected by energy costs in the economies that have to import a lot energy. Imported energy that has such an effect on aggregate

output is also the one of the main causes of inflation. Consequently, it has the ability that simultaneously supports both inflation and growth.

Turkey exports energy in the form of oil exporter and imports most of the aggregate oil consumption. It has imported 18,55 million tons oil since end of 2013. The Turkish economy is dependent on outside energy. When the energy costs increase on a global scale, production costs noticeably increase, and causes the inflation. At the same time, its growth with its annual average growth rate 4,63% is higher than the average growth rate (3,45%) of the world economy. Moreover, with its situation, it has a higher growth rate than the average growth rate (3,13) of OECD countries. Therefore, the dependence continues for energy import in order to continue this high growth rate.

In this study, the hypothesis is analysed that the oil quantity that is imported by the Turkish economy, is effective on the growth rate but it is also affects inflation. Several empirical studies have been done for the similar hypotheses.

## 2. Literature

There are several studies that analyse the effects of oil costs on the growth and inflation. Gomez-Loscos et al. (2012) remarked that the oil costs were quite effective on inflation in the 1970s, and this effect that continued to decrease until the 1990s, and increased again since the 2000s. At the same time, they state that oil costs lost their explanatory date for the growth in terms of G7 country datas. Lu et al. (2010) have concluded that oil costs have a nonlinear effect on the inflation by using GARCH method, and remark that there is a nonlinear Granger causality from the oil costs to the inflation. Killian & Vigfusson (2013) have determined a nonlinear relation between oil costs and GDP in their analyses for the USA. They have concluded that the fall of prices doesn't have a distinct effect on the growth while the increase of prices has a negative effect on the growth. Estrada & Cos (2012) have acquired the results about the detractive effect of non-transitory cost increases for GDP except the fluctuations on the oil costs. Also, the oil costs can be efficient on other macroeconomic variables. For example, Bleich et al. (2012) has concluded that 11 basic increases in the oil costs caused a change of 1% in Canada, UK and European Central Banks Interests. The developed economies continue to develop even if the oil costs increase. This situation had the opposite effects on growth because of the oil shocks in the 1970s and the 1980s. However, even if the oil shocks have an effective strength on the cyclical fluctuations (Schmidt & Zimmermann 2011; Jacoby & Paddock, 1983), the effect can increase the inflation risk even if the effect isn't immediately

seen on the inflation. For example, Rooger (2005) determine that the oil costs have the negative effects on the growth and the inflation for OECD and EU, and it increase the inflation risk for EU. Also, there are empirical proofs about the dependence of the developed countries for oil. For Brazil and the USA, Cavalcanti & Jalles (2013) have concluded that the dependence of Brazil for oil is lower than USA, and the growth and inflation rate of Brazil aren't affected by the oil cost shocks. The output growth rate of the USA is dependent on the oil.

There are also studies for the oil producer / exporter countries. It has concluded that the rise 1% of the oil costs cause the developing 0,44% of GDP in the analysis for Russia that has become the second largest oil exporter in the world (Ito, 2012). Hamdi & Sbia (2013) have concluded that oil incomes are long term cointegrated with the growth and the public expenditures in Kingdom of Bahrain.. Alkhathlan (2013) remark that there is a long term growth between increase of oil costs and growth in oil producer Saudi Arabia.

In some special cases, it can be seen that natural sources such as oil don't give the expected result for the producer /exporter countries. The special cases are also in question that called "Dutch Disease", and when the new natural source is found, the fall of export and the growth is negatively affected after the appreciation of the domestic currency (Jbir, 2013).

The remarkable studies in the last period and the acquired results are shown in Table-1 about the inflation-growth-oil costs relations that have a wide literature

**Table-1.** Chosen country and chosen literature (the effect of oil cost) for the country groups

| Authors                      | Period    | Country/ Countries                          | Findings  |
|------------------------------|-----------|---|---|
| Cunado & Gracia (2005)       | 1975-2002 | 6 Developing Asian countries                | Significantly negative effective on the growth  |
| Chen (2009)                  | 1957-2006 | 19 Developed Countries                      | Decrease its effect on the inflation.   |
| Li (2010)                    | 2000-2009 | China                                       | Positively effective on the inflation but dependence increases.                                 |
| Schubert & Turnovsky (2011)  | 1990-2010 | Developing Countries                        | Negatively affects growth.  |
| Segal (2011)                 | 2008-2009 | World Economy                               | Its effect was less on the growth until 2008.   |
| Barrell et al. (2011)        | 1975-2012 | OECD  | Affects both inflation and the growth. The growth is based on the oil-intensive production.     |
| Alvarez et al. (2011)        | 1996-2008 | Countries that spoken Spanish and Euro zone | Effective on inflation but this effect is limited   |
| Bencivenga et al. (2012)     | 1993-2009 | USA   | Cointegrated with growth and inflation in long term   |
| Saxena & Bhadauriya (2012)   | 2000-2010 | India                                       | Long term cointegrated with growth  |
| Cavalcanti & Jalles (2013)   | 1980-2010 | USA, Brazil                                 | The dependence for oil is higher in the USA.  |
| Valcarcel & Wohar (2013)     | 1948-2011 | USA   | Only effective for the aggregate output in 1970-1980.   |
| Dieck-Assad & Peralta (2013) | 1965-2004 | Mexico                                      | The output for per employee is based on the energy for per employee.                            |
| Bhar & Malik (2013)          | 1957-2009 | UK  | Increase the inflation and negatively affects growth because of the uncertainty.                |
| Papapetrou (2013)            | 1982-2008 | Greece                                      | Negatively effective on growth.   |
| Narayan et al. (2014)        | 1983-2010 | 28 Developed, Developing Counties           | The effect cannot be provided for growth. This uncertainty is less for the developed countries. |
| Pereira & Pereira (2014)     | 1990-2008 | Portoguese                                  | More effective for the growth in small economies.   |
| Dreger & Zhang (2014)        | 1979-2009 | China, Japan, US, EU                        | Its effect is wider in Japan than US and EU for the growth.                                     |

### 3. Data and Method

Analysis use quarter datas related to 1998:01-2013:04 period in the Turkish economy. These datas have been acquired by TCMB-EVDS. GDP variables are the seasonality purged growth rates. Inflation (INF) variable is the relative change in TUF. Oil data (OIL) is a value in terms of tone of importee crude oil by Turkey. OILP consist of the change rates in the barrel costs of the US oil in international markets. Therefore, two different unit roots tests have been primarily made for the series (Dickey and Fuller, 1979; Phillips and Perron, 1988), and then two-stage

Engle-Granger (1987) cointegration test and Johansen-Juselius (1990) cointegration tests have been applied. In addition, Granger (1969) causality test has been made.

### 4. Results

As the first stage of analysis, the unit root tests have been made for all series. Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test results are shown in Table-2.

**Table 2.** ADF, PP and KPSS Unit Root Tests.

|      | ADF                      | Entegre | PP                       | Integre |
|------|--------------------------|---------|--------------------------|---------|
| GDP  | -3,753058<br>(-2,909206) | I(0)    | -2,997896<br>(-2,908420) | I(0)    |
| INF  | -2,987019<br>(-2,909206) | I(0)    | -3,522969<br>(-2,908420) | I(0)    |
| OIL  | -3,601702<br>(-2,908420) | I(0)    | -3,443845<br>(-2,908420) | I(0)    |
| OILP | -7,431240<br>(-2,909206) | I(0)    | -7,792567<br>(-2,908420) | I(0)    |

**Note:** The values in brackets are the critical values for 5% meaning level.

As the seen in Table-2, all variables don't include the unit root according to the committed unit root tests. So, according to the level values of series, it has been concluded that they are constant.

In this situation, constant series are available for the future tests in long term analysis. First test is Engle-Granger test for long term analysis. The calculated values are shown in Table-3 for this test.

**Table 3.** Engle- Granger Cointegration Test

| Equation    | Coefficient             | t-Stat.   | u → ADF                  | u → PP                   | Integre |
|-------------|-------------------------|-----------|--------------------------|--------------------------|---------|
| GDP=f(INF)  | -3,362705<br>(0,138447) | -2,619813 | -3,999708<br>(-2,909206) | -3,093915<br>(-2,908420) | I(0)    |
| GDP=f(OIL)  | 4,85<br>(8,11)          | 0,598772  | -3,776940<br>(-2,909206) | -3,776940<br>(-2,909206) | I(0)    |
| GDP=f(OILP) | 0,173795<br>(0,068566)  | 2,534693  | -3,273846<br>(-2,908420) | -3,273846<br>(-2,908420) | I(0)    |
| INF=f(OIL)  | 1,22<br>(6,90)          | 1,770564  | -3,981709<br>(-2,908420) | -3,870341<br>(-2,908420) | I(0)    |
| INF=f(OILP) | 0,026887<br>(0,062604)  | 0,429485  | -2,652468<br>(-2,909206) | -3,509314<br>(-2,908420) | I(0)    |

**Note:** The values in brackets and under the coefficients are Standard Deviation Values. The values in brackets and under ADF and PP test statistics are the critical values for 5% meaning level.

EG Test and long term analysis consists of two stages. In the first stage, regression equation will be acquired that is established between two variables, and error term series will be constituted. According to the level values of the acquired error terms, it is expected that it is constant. According to the level values, if error terms are constant, it will be concluded that there is long term relation between variables that create the

regression. It has been acquired that the variables are cointegrated for long term in Table-3. It may be said that the error terms are cointegrated in long term because of their constance through PP test even if they aren't constant through ADF test in INF=f(OILP) equation.

Johansen-Juselius test has been made for cointegration research between the more than two variables, and the results have been given in Table-4.

**Table-4.** Johansen- Juselius Cointegration Test

| H <sub>0</sub> | H <sub>1</sub> | Eigenvalue | Trace Stat. | 0,05     | Max-Eigen Stat. | 0,05     |
|----------------|----------------|------------|-------------|----------|-----------------|----------|
| r = 0          | r ≥ 1          | 0,445250   | 71,07502    | 54,07904 | 35,94353        | 28,58808 |
| r = 1          | r ≥ 2          | 0,294395   | 35,13150    | 35,19275 | 21,27064        | 22,29962 |
| r = 2          | r ≥ 3          | 0,136683   | 13,86086    | 20,26184 | 8,965353        | 15,88920 |

“Constant” and “non-trend” model have been detected as the best model according to Akaike (47,97071) and Schwarz (49,42583) information criterions. Model 2 have been created for the late value. Accordingly, “Trace Stat. > 0,05 meaning critical value” and “Max-Eigen Stat. > 0,05 meaning for critical value” as long as H<sub>0</sub> hypothesis will be rejected, and H<sub>1</sub> hypothesis will be accepted. When Table-4 is analysed, there is only a long term cointegration vector because while H<sub>0</sub>: r=

0, Trace Stat. (71,07502) > 0,05 meaning for the critical value (54,07904)” and “Max-Eigen Stat. (35,94353) > 0,05 meaning for the critical value (25,58808)” these hypotheses are valid.

Granger causality test has been applied to determine the causality and the way of this causality between the cointegrated variables in long term, and the acquired results have been shown in Table-5.

**Table 5.**Granger Causality Test

| Hypotheses                   | Chi-sq   | Prob.  | Result            |
|------------------------------|----------|--------|-------------------|
| OIL is Granger Cause of GDP  | 8,306809 | 0,0157 | Hypothesis accept |
| GDP is Granger Cause of OIL  | 11,58191 | 0,0031 | Hypothesis accept |
| INF is Granger Cause of OIL  | 9,507995 | 0,0086 | Hypothesis accept |
| OILP is Granger Cause of OIL | 15,18046 | 0,0005 | Hypothesis accept |

According to the acquired results in Table-5, 4 causality relations have been detected. Especially, it is the Granger cause on oil import quantity (OIL) of GDP and INF variables. In that case, the growth is based on oil imports, and at the same time, this causes the inflation.

## 5. Conclusion

The hypothesis about “oil costs” have been tested and have found that the inflation have a particular affect on costs, and this activity negatively affect growth because of its effects on expectations in the inflation” by using GDP, INF, OIL and OILP variables that involve 1998:01-2013:04 period in this study. According to the acquired results, growth, inflation and oil import are the long term cointegrated variables in the Turkish economy.

Particularly, the result of the growth that is based upon oil imports has been detected with the Granger causality test. In addition, oil imports causes inflation in the Turkish economy. In short, the hypothesis that has been tested by the study, has been confirmed with the acquired findings.

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