

## Relationship of energy needs and external deficit in the context of helical of 21. Century energy problems<sup>1</sup>

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**Abstract:** The increasing of demand for energy, has led to a much more comprehensive and cost issues for the countries, especially it has been a complicated problems for the countries' which ones are couldn't use their money. Because rapid industrialization urbanization and the population growth that seen in developing countries, are directly affecting to the energy consumption. Outward countries and particularly dependent on foreign countries for energy like Turkey, may experience more problems in this process. The result of energy dependency for these countries is the current account deficit. The most important problem is the current account deficit for the dependent on outside countries. Scope of the study we will test VAR analysis, co integration, error correction model and the Granger causality test. We would like to analyze relationship between industrial production, energy imports and current account deficit and we will analysis the direction of relationship. The data set will be used data obtained from TUIK. The data set will be used as the period between the years 2005-2014. According to the obtained data we will analyze the direction of causality in Turkey.

**Keywords:** Current Account Deficit, Energy, Granger Causality Relationship

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### I. Introduction

After the industrial revolution; energy demand has increased along with growing production systems, and energy focused consumption growing population. These economic growth and requirements have also started to influence developing countries directly especially after the 20th Century. Because these countries have become production centre for developed countries. The increase in energy demand led to a much more comprehensive issues and cost especially for the countries which do not use their own money on the international markets. Because rapid industrialization, urbanization and population growth seen in developing countries affects energy consumption, directly. Countries such as Turkey that outward oriented and also dependent on foreign countries in terms of energy may experience more problems in the process. The most important problem for the countries which dependent on foreign countries in terms of energy is the current account deficit.

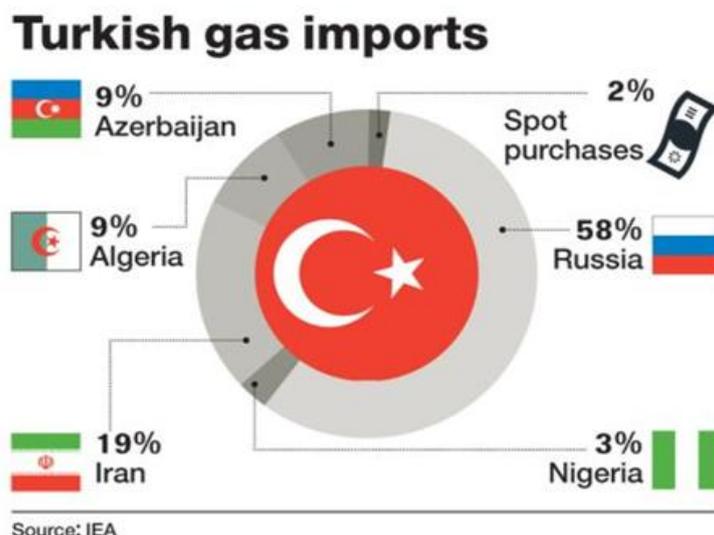
Although the Black Sea region is one of the main victims of environmental degradation in particular in Turkey, environmental concerns are left aside. The negative effects of pollution and reduction of biodiversity in the Black Sea has affected Turkey both economically and socially. More importantly, tanker traffic which has reached 2.9 million barrels per day as of 2009 in the Marmara and the Dardanelles constitute a high risk for other industrial cities and areas in Istanbul. In this context, Ankara energy producer has started to look for alternative ways for transference of oil and natural gas from the regional countries to Europe (especially Mediterranean). At this point, new and profitable opportunities have opened up for Turkey for supporting the increase economic growth in energy imports to EU countries. Turkey which is in a correct position in the middle of the energy producers and consumers countries has been perceived this geopolitical position as a window of opportunity and has focused on developing energy policies on the basis of reliability, diversity and productivity by aiming to create a more liberal energy market [1].

One of the issues discussed in the context of dependence on energy-producing countries is the nuclear energy. The growing population, booming economy and rising energy needs canalizes countries to efficient energy sources. In this framework, Turkey began to evaluate the nuclear power plants in order to reduce dependence on energy producer countries such like other countries. Ankara preferred the way of producing energy from nuclear as well as the development of renewable energy resources within the country [2]. Moscow intends to make a trade for their own a significant portion of the gas source in Astana, Ashgabat and Tashkent via long-term agreements channels. The Central Asian countries, particularly Ashgabat, want from Moscow to make the price increase. As long as this increases met by, Russia has maintained its influence in Central Asia. The finalization of natural gas pipeline starting from Turkmenistan to China through Uzbekistan and

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Kazakhstan strengthened the hands of Central Asian gas producers not only against Moscow but also Ankara. Turkey is a country dependent on outside in terms of energy. Dependence on natural gas was 30% in particular and 98% of this is met from the outside. In case of a shortage of natural gas purchases, Turkey may be face to face with serious problems in the energy context [2]. In this regard, it would be appropriate to look at the situation of Turkey's gas imports. Turkey's natural gas trade with countries that we import gas are as follows.



Source: [http://www.haaretz.com/polopoly\\_fs/1.503529.1360838237!/image/2727568444.jpg\\_gen/derivatives/landscape\\_640/2727568444.jpg](http://www.haaretz.com/polopoly_fs/1.503529.1360838237!/image/2727568444.jpg_gen/derivatives/landscape_640/2727568444.jpg)

Energy issue is one of the most important areas of investigation in different disciplines such as political science, finance, law and especially in economy literature with its economic, financial and political aspects in almost every period. When energy taken in economic basic, it is extremely important to meet the energy that urbanization need with rapid growth and development at affordable price, uninterrupted and in sufficient quantity. Rapid growth and urbanization seen in developed countries makes the issue much more sensitive for the related countries. Increasing energy demand, dependence on foreign in energy for a substantial portion of said countries and significant balance of payments problems has consistently keeps the economic and financial stability of these countries at fragile state. Increasing of exports could be an alternative for in controlling the current account deficit caused by the high-energy imports. However, energy demand will increase and the current account deficit will gradually grow as the economic growth and exports increase along with the current account deficit struggles since significant additional energy use will be occurred by increase in exports. Turkey having important goals for economic growth and development provide about  $\frac{3}{4}$  of its energy requirements as externally [3]. In this study, values of Gross Domestic Product, Current Account (CA) and Total Number of Employees, Total Coal Consumption, Total Electricity Consumption, Total Natural Gas Consumption and Total Oil and Derivative Consumption annually in 1998-2013 period were used and the relationships between variables were studied.

Literature review is given in terms of shedding light to work to be performed as follows. Since there is no direct study related to Current Account, Gross Domestic Product and energy consumption, causal relationships with the relevant variable and related literature was reviewed in the scope of work. Related studies were taken into account in terms of econometric modelling in our study.

## II. Literature Review

[4] measured the effect of many variables in stock returns in the US and Japan. As a result, the amount of increase of industrial production has positive effect on US stock and also effects Japanese stock returns less compared to the volume of trade in oil prices. [5] used quarterly data for 1989:1-1999:4 periods and examined the relationship between economic growth and various items of capital flows. He concluded that short-term capital hasn't been significant in explaining economic growth.

[6] examined the relationship between the crude oil prices in January 1, 1989-June 30, 2001 period and stock returns of companies in the oil and gas sector traded in the UK. As a result, it was detected that changes in oil prices affect the stock returns of oil and gas in the UK, positively. [7] analysed the interaction between the short-term capital movements between 1992-2005 and macro-economic variables. According to the results,

Turkey's economy has recorded growth based on short-term capital movements in the specified years and has shrunk when the short-term capital movements break out as exactly the opposite.

[8] used monthly data for the period of January 1996-December 2007 and examined the interaction between oil price shocks and the China's stock market .As a result of the study, it was determined that oil price shocks have no significant effect on most of the Chinese stock index, except manufacturing index and some oil companies. [9] has studied the effect of short-term capital movements on exchange rate, interest rate and current account balance between 1992:1-2007:7 by using monthly data. At the end of the study, it was concluded that short-term capital movements affects the current account balance negatively by leading for the national currency to appreciation of currency in long-term.

[10] examined the effects of oil price oil change on the stock price of energy sector traded in Istanbul stock exchange by using 2274 daily price data within July 10, 2000 – August 10, 2009. It was found that Brent oil price is an important indicator in stock price and electricity index prices. Consequently, it was found that there is an accurate and one-way and significant causal relationship from Brent oil to electricity index in Istanbul Stock Exchange (IMKB). [11] has studied the long-term relationship between oil prices and stock prices with daily data of Istanbul Stock Exchange (IMKB). Daily IMKB100 (Istanbul Stock Exchange) index between December 3, 2001-31 December, 2009 and Brent oil prices were used during analysis. As as results of the study, there is no relationship between oil prices and stock prices.

[12] conducted a study analysing whether there is a long-term relationship between the current deficit, short-term capital flows and economic growth in 1990:1 – 2010:4 years. As a result of studies, they have found a significant relationship between these three variables in the long term. [13] have examined how and to what extent the changes occurred in the price of imported crude oil affect macroeconomic activities. Therefore, they used quarterly data covering the period 1986Q2-2010Q2 and VAR analysis. At the end of analysis, imported crude oil prices has been found to be more effective on Turkey's monetary policy, especially on money supply.

[14] studied the relation between change in the oil prices and IMKB 100 (Istanbul Stock Exchange), İMKB industrial and İMKB Chemistry, Oil and Plastic indexes. Accordingly, they used weekly closing prices within 02/03/1997 – 11/30/2012 of İMKB indexes and the oil prices from the same period. As a result of this study, granger did not support causality and rejects statistically significant short-term causal relationship. [15] examined the relation between oil prices and BIST 100 index closing prices in January 2003 - February 2014 daily data by using Granger co-integration and Granger causality test. At the end of Gragner co-integration test, it was found that there is long-term relationship between oil prices and BIST 100 index closing prices. As a consequence, a one-way causal relationship was detected from BIST 100 index closing price to oil prices.

[16] examined the effect of the international crude oil and natural gas prices on stock prices of industrial companies traded in Istanbul Stock market in 1991: 01-2013: 11 periods with monthly data. Consequently, a long-term relationship has been found between international crude oil and natural gas price indices and Istanbul Stock Exchange industrial index. At the end of Granger causality test, it was found that there is a one-way causal relationship from crude oil prices index to industrial index and one-way causal relationship from industrial index to natural gas price index.

### III. Data Set

The annual value of those mentioned in the 1998- 2013 period used in our study were obtained by using Thomson Reuter Datastream database. . Due to the nature of the study, data were included in the analysis by converting into logarithmic form. Since industry data cannot be obtained in terms of periods to be included into the analysis, it has attempted to analyse with the following data. In case of obtaining the industrial data, study can be performed again and new results can be obtained. Variables to be searched causal connection between are presented in Table 1. GDP, current deficit and İS variables and correlation between energy consumption of other indicators were examined.

**Table 1: The Variables Used in the research**

Gross domestic product	GSYH
Current Account Deficit	CA
Total number of employees in the country	İS
Total Coal Consumption	KR
Total Electricity Consumption	EK
Total Natural Gas Consumption	DZ
Total consumption of oil and Type	PL

Descriptive statistics information such as average, standard deviation and normal distribution of the variables used in our study were presented in Table 2.

**Table 2: Descriptive Statistics**

	<u>CA</u>	<u>GSYH</u>	<u>İS</u>	<u>KR</u>	<u>EK</u>	<u>DZ</u>	<u>PL</u>
<b>Mean</b>	-25265.19	91237028	21864.96	93662.74	1.46E+11	1005.363	660.0444
<b>Medyan</b>	-17823.5	93619026	21438.85	90647.47	1.43E+11	1033.99	658.54
<b>Max.</b>	3760	1.23E+08	25538.41	113396.4	2.09E+11	1611.78	719.27
<b>Min.</b>	-75008	67840570	19631.86	71060.5	9.32E+10	365.55	618.62
<b>Std.Dev.</b>	24548.44	18698936	1658.691	15559.43	4.02E+10	432.6622	24.88861
<b>Skw.</b>	-0.574465	0.183218	0.981069	-0.114638	0.22444	-0.001262	0.456846
<b>Kurt.</b>	2.201538	1.697772	3.077034	1.482639	1.678242	1.592892	3.394039
<b>Jarque-Bera</b>	1.305053	1.220049	2.570613	1.569967	1.299025	1.319973	0.660066
<b>Obs.</b>	16	16	16	16	16	16	16

Correlation matrix of variables used in our studies is given in Table 3. As it can be understood from table, positive and high directional correlation is seen between the energy consumption variables and GDP. Naturally, negative relationship with nature is revealed between all variables and current deficit.

	<u>CA</u>	<u>GSYH</u>	<u>İS</u>	<u>KR</u>	<u>EK</u>	<u>DZ</u>	<u>PL</u>
<u>CA</u>	1						
<u>GSYH</u>	-0.94218	1					
<u>İS</u>	-0.62764	0.596797437	1				
<u>KR</u>	-0.79665	0.847744966	0.588001	1			
<u>EK</u>	-0.92624	0.992589167	0.622382	0.85215	1		
<u>DZ</u>	-0.91849	0.986439564	0.547579	0.839562	0.993039	1	
<u>PL</u>	-0.60783	0.733204555	0.41576	0.548466	0.707385	0.696976	1

#### IV. Econometric Methodology And Analysis

Because of its easy applicability, Granger causality test was used to reveal the existence of the causality relationship between the two (or more) variables as a general approach. Granger causality test applied for two variables is as follows:

$$Y_t = \alpha_{10} + \sum_{i=1}^{L_{11}} \alpha_{11i} Y_{t-i} + \sum_{j=1}^{L_{12}} \alpha_{12j} X_{t-j} + u_{1t} \tag{1}$$

$$X_t = \alpha_{20} + \sum_{i=1}^{L_{21}} \alpha_{21i} Y_{t-i} + \sum_{j=1}^{L_{22}} \alpha_{22j} X_{t-j} + u_{2t} \tag{2}$$

$$H_0: \alpha_{12j} = 0 \quad j=1, \dots, L_{12} \quad \text{için}$$

$$H_1: \alpha_{12j} \neq 0 \quad \text{en az bir } j \text{ için}$$

As per (1) equation;  $\alpha_{10}$  is constant term,  $u_{1t}$  is error term and has 0 average and constant variance [ $u_{1t} \sim N(0, \sigma^2)$ ] and whitenoise is process.  $L_{11}$  and  $L_{12}$  represent the set optimal length of the delay. If the basic hypothesis where the vector of coefficients of delayed values of X variable ( $\alpha_{12}$ ) equals to zero is rejected, X variable is Granger causes of Y variable.

As per (1) equation, a similar process operates. If the basic hypothesis is rejected for both. It is possible to talk about the two-way causality.

Basic hypotheses formed to examine the Granger causal relationship is as follows:

- Hypothesis 1:  $H_0$  = The change in KR is not the Granger cause of changes in CA.  
 $H_1$  = The change in CA is the Granger cause of changes in KR.
- Hypothesis 2:  $H_0$  = The change in EK is not the Granger cause of changes in CA.  
 $H_1$  = The change in CA is the Granger cause of changes in EK.
- Hypothesis 3:  $H_0$  = The change in DZ is not the Granger cause of changes in CA.  
 $H_1$  = The change in CA is the Granger cause of changes in DZ.
- Hypothesis 4:  $H_0$  = The change in PL is not the Granger cause of changes in CA.  
 $H_1$  = The change in CA is the Granger cause of changes in PL.
- Hypothesis 5:  $H_0$  = The change in KR is not the Granger cause of changes in GSYH.  
 $H_1$  = The change in GSYH is the Granger cause of changes in KR.
- Hypothesis 6:  $H_0$  = The change in EK is not the Granger cause of changes in GSYH.

- Hypothesis 7: H1= The change in GSYH is the Granger cause of changes in EK.  
H0 = The change in DZ is not the Granger cause of changes in GSYH.
- Hypothesis 8: H1= The change in GSYH is the Granger cause of changes in DZ.  
H0 = The change in PL is not the Granger cause of changes in GSYH.
- Hypothesis 9: H1= The change in GSYH is the Granger cause of changes in PL.  
H0 = The change in KR is not the Granger cause of changes in IS.
- Hypothesis 10: H1= The change in IS is the Granger cause of changes in KR.  
H0 = The change in EK is not the Granger cause of changes in IS.
- Hypothesis 11: H1= The change in IS is the Granger cause of changes in EK.  
H0 = The change in DZ is not the Granger cause of changes in IS.
- Hypothesis 12: H1= The change in IS is the Granger cause of changes in DZ.  
H0 = The change in PL is not the Granger cause of changes in IS.
- H1= The change in IS is the Granger cause of changes in PL.

Since the variables are based on time-series, the series is tested if they are stable, firstly. Series which are not stable has become stable. Otherwise, the explanatory power of the model can be high because of "spurious regression". Augmented Dickey Fuller-ADF unit root test was applied to series. The results of the ADF test are presented in Table 4. It can be seen from the table what level of the delay or the stages where they stationarization with primary / secondary differences. For example, "IS" variables can be stationarized with secondary difference, but "KR" variable could be purified from unit root with 2 delays.

**Table 4: ADF Test Outcomes**

	ADF Val.	Prob (F-Statistic)	Lags	MC Kinnon Val.		
				1%	5%	10%
<b>CA</b>						
Level	-3.587991	0.0687	1	-4.80008	-3.79	-3.34225
<b>GSYH</b>						
First Difference	-3.528579	0.0754	0	-4.80008	-3.79	-3.34225
<b>IS</b>						
Second Difference	-5.044232	0.0079	0	-4.88643	-3.83	-3.36298
<b>KR</b>						
Level	-5.062005	0.0077	2	-4.88643	-3.83	-3.36298
<b>EK</b>						
First Difference	-3.619715	0.0686	1	-4.88643	-3.83	-3.36298
<b>DZ</b>						
First Difference	-3.551294	0.076	1	-4.88643	-3.83	-3.36298
<b>PL</b>						
Level	-3.673181	0.0576	0	-4.88643	-3.83	-3.36298

Determining the variables of delay values before starting the Granger Causality Analysis is required. 1 delay approach which is applied to the overall in the 1-year data is preferred for our model. The results of Granger Causality Test, significance levels and the direction of the relationship can be seen from Table-5. According to the findings, there is a one-way significance relation between GDP and EK, DZ and PL is 1%, 5% and 10%, respectively. (GDP is the Granger cause of EK). There is no significant causal relationship between energy consumption variables with IS. Additionally, it was observed that the increase in electricity consumption has an effect on the current account deficit (5% level). As it can be seen from Table-5, the level of significance of Hypothesis 3, Hypothesis 8, Hypothesis 12 and Hypothesis 14 are associated with each other at the 5% significance level. More specifically, issue expressed in Hypothesis 3, the current deficit is associated with the use of electricity. Issue expressed in Hypothesis 8, the current deficit is associated with Oil and Derivatives. Issue expressed in Hypothesis 12, the GSYH is associated with electricity consumption. Issue expressed in Hypothesis 14, the GSYH is associated with Natural gas consumption. In other hypothesis, a relationship between variables has not been established.

**Table 5: Granger Causality Test Results**

<b>Hypothesis</b>	<b>Obs.</b>	<b>F-Stat</b>	<b>Prob.</b>
KR is not the Granger cause of changes in CA	12	0.35737	0.7116
CA is the Granger cause of changes in KR	12	3.98929	0.0698*
EK is not the Granger cause of changes in CA	12	7.89038	0.0161**
CA is the Granger cause of changes in EK	12	1.33514	0.3227
DZ is not the Granger cause of changes in CA	12	3.7426	0.0785*
CA is the Granger cause of changes in DZ	12	0.56216	0.5937
PL is not the Granger cause of changes in CA	13	0.19256	0.8286
CA is the Granger cause of changes in PL	13	4.99381	0.0391**
KR is not the Granger cause of changes in GSYH	12	0.7191	0.52
GSYH is the Granger cause of changes in KR	12	1.07783	0.3908
EK is not the Granger cause of changes in GSYH	12	1.76214	0.24
GSYH is the Granger cause of changes in EK	12	23.4841	0.000***
DZ is not the Granger cause of changes in GSYH	12	1.82028	0.2309
GSYH is the Granger cause of changes in DZ	12	7.42094	0.0186**
PL is not the Granger cause of changes in GSYH	13	0.15407	0.8597
GSYH is the Granger cause of changes in PL	13	3.94087	0.0644*
KR is not the Granger cause of changes in IS	12	0.42288	0.6708
IS is the Granger cause of changes in KR	12	0.15811	0.8567
EK is not the Granger cause of changes in IS	12	0.92472	0.4402
IS is the Granger cause of changes in EK	12	0.95125	0.4311
DZ is not the Granger cause of changes in IS	12	0.85351	0.4659
IS is the Granger cause of changes in DZ	12	1.54768	0.2776
PL is not the Granger cause of changes in IS	12	0.448	0.656
IS is the Granger cause of changes in PL	12	0.01247	0.9876

## V. Conclusion And Evaluation

In this study, a significant relationship between energy factors, GDP, current deficit have been identified. In this context, the highest relation is found between GDP and Electricity Usage. In this regard, Turkey need to use electrical energy in any case and is required to supply it in some way. Turkey has a policy for diversification of sources for obtaining energy since it is in a foreign-dependent condition for Natural gas in the high proportion. Although this policy, it should be questioned that Ankara allows for a country that dependent on imported natural gas by 60 present to build the first nuclear power plant against the country's interests.

Allowing the transition of South Stream from their exclusive economic zone shows compatibility with Turkey politics being an energy corridor. (Kısacık, 2015). Within this regard, the main activities for Turkey are to perform energy diversification, absolutely. More importantly, Turkey should give priority to the supply of energy from renewable energy sources, especially from their own internal resources. Based on the results obtained from the study, the other issue to be expressed is that the energy consumption has to be used in industrial production, generally. Increasing industrial production will both increase the added value to be created and will make a positive contribution to export.

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