

Relationship Between Natural Gas Consumption And Economic Growth In Turkey

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Abstract

Natural gas is an important source of renewable energy. It has many advantages such as being easy to store and transport and most importantly it is a friend of environment. Due to this, by the increase of Turkey's GDP the natural gas demand especially increases in recent years. In this study, the relationship between natural gas consumption and economic growth of Turkey was examined using annual data between 1986 and 2015. Firstly ADF unit root test is conducted in order to determine whether the variables are stable. After this, the long-run relationship between natural gas consumption and economic growth has been examined by Engle-Granger co-integration test. Co-integrated relationships are short-term relationships and dealt with within the error correction model, and finally, causal relationships between variables are tested with the Granger Causality Test. Although it is determined that there is a long-run relationship between the variables according to the econometric results, it is revealed that there is no mutual causality.

Keywords: Natural Gas Consumption, Economic Growth, Renewable Energy Resources

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1. Introduction

Energy, which is one of the needs of human beings and increases its significance from day to day, has the biggest share in the development of a nation as Mustafa Kemal Atatürk said. Energy sources vary widely depending on the natural resources of the countries they are subject to in many ways. The most common primary and secondary sources of energy in these divisions are the distinction. Primary energy sources are energy sources that are produced from primary energy sources, while primary sources are those that are used once and exhausted and are not renewable. Primary energy sources are divided into two categories: non-renewable energy sources such as oil, natural gas, coal, and renewable energy sources such as hydraulic energy, wind energy and solar energy (Güvenek, 2009: 59). Natural gas, which is regarded as one of the non-renewable energy sources, started commercial use in the world for the first time in 1985 and became a rapid trend after the 1973 oil crisis (Güvenek, 2009: 62). In our country, natural gas was first discovered in 1970; The first use of natural gas occurred in 1976. In the 1980s, the use of natural gas became widespread in our major cities, especially in Ankara. In 1986, the first natural gas purchase contract between BOTAS and USSR Soyuzgazexport Company was signed and started to be used in 1987 (Celepçi: 2002). The positive effect of environmental awareness, which has developed significantly in recent years, is the share of natural gas, which is a clean fuel as a result, in the World Primary Energy Market. For this reason, importance has been given to the study of finding new natural gas reserves (Dünya Enerji Konseyi, 1994: 3). However, there are considerable problems in terms of external dependence in terms of countries that do not have natural gas reserves like our country, or are unable to meet the demand of the country. The relationship between this energy source and economic growth, which is highly dependent on external sources in terms of our country, seems to be economically investigated in this sense. In this study, the relationship between natural gas consumption and economic growth using data from 1980-2015 Turkish economy is tested using Johansen Cointegration Test and Granger Causality Test.

2. Natural Gas

Natural gas, like oil, is an important source of energy, which is millions of years old, but is closer to the surface than oil in terms of its extraction and use. The dates on which natural gas is being used are not fully understood by people. Although natural gas was first understood by people as a self-burning fire because of lightning, this fire surprised people and caused many superstitious incidents among people. During these periods when natural gas was not understood, while they were being experienced, during the periods when they were fully

understood, Britain became the first country to have a natural gas business. The first well for the production of natural gas was excavated in 1821 by William Hart in New York. In the 19th century, natural gas was used only for lighting purposes, and there was no use at home due to the lack of pipelines for natural gas transportation. When it came to 1885, Robert Bunsen made use of a machine that could burn natural gas safely, increasing its use all over the world, especially in America (Acar vd, 2011: 36-37).

Natural gas is a kind of combustible gas mixture of fossil origin in the ground shell. Natural gas is generally regarded as fossil fuel because of the remnants of small marine animals and plants that died 300-400 million years ago (NEED,2016: 27). Natural gas is also a colorless, odorless energy source consisting mostly of methane consisting of 1 carbon to 4 hydrogen atoms and a small amount of ethane, propane, butane and carbon dioxide. Combustion is easy because of its simple chemical structure. Therefore, combustion is the most easily adjustable fuel with the highest combustion efficiency. This makes it easy to use and economic (NükTe, 2007). Known fossil fuels are the clearest as natural gas (Erdoğan,2008: 15). At this point, other advantages of natural gas can be listed as follows;

- The use of natural gas is easy.
- It is an energy source that can be found easily in almost the whole world.
- It is cheaper than electricity when natural gas is used compared to other fossil fuels.
- It does not pollute natural gas environment or groundwater. Another important fact is that natural gas emits around 45% less carbon dioxide than coal.
- The transportation of natural gas is done through sea tankers and pipelines and small tanks in the field. This ensures that the actual gas can be easily transferred from the power plants to the residential areas.
- Natural gas is a multipurpose energy source. Cooking, heating, drying, etc. Used in the house for. It can be used for generating electricity, for supplying power to vehicles (substituting diesel and gas), plastic, paint, fertilizer and many other uses.

Natural gas has some disadvantages besides the advantages mentioned above. These;

- The leakage of natural gas is extremely dangerous. These leaks may cause excessive toxicity when inhaled, as may be the cause of a fire or explosion. Natural gas is not understood because it is odorless, which is the most important reason to carry this risk.
- When natural gas is burned, carbon dioxide and other carbon components are spread to the atmosphere by the greenhouse effect. Despite being cleaner, natural gas leaks can be more dangerous because methane in natural gas is 21 times more dangerous than carbon dioxide.

- The installation can be very expensive because it is built with natural gas piping, long pipes, special tanks.
- When natural gas is used as a fuel in cars, the mileage is lower than gasoline (Karanasiou, 2014).

As a result, despite the above-mentioned disadvantages of natural gas, the advantages of storage and transportation and environmental friendliness make natural gas an important energy today. Today's developing industry and increasing population continue to be used increasingly as a result (Gültekin ve Ergün, 1993: 41). In order to reduce foreign dependency in terms of countries, the use of natural gas is still important in terms of economic growth, although it is directed towards alternative energy sources.

3.Natural Gas Consumption Economic Growth Relationship

Energy has been remarkable in terms of economic growth, especially after the rise in oil prices in 1973-97 and 1978-1979 (Reddy: 1998, 82). Along with these oil shocks, energy dependency has been recognized all over the world, where energy and energy-based inputs play an important role in the production process. When it comes to exiting this crisis, the energy consumption of developed and developing countries has become an indisputable element of the growth relationship. As a result of this process, countries have now obliged to search for alternative energy sources to oil (Güvenek ve Alptekin, 2010: 175).

The adverse effects of the ongoing economic crisis in the oil crises of the past have led to an increase in academic work on energy consumption and economic growth. There are two views in the literature between energy consumption and growth. These are opinions that Neoclassicals and Energy economists put forward. Neoclassicalists say energy is unbiased for growth, while energy economists claim that energy is one of the production factors and that it is impossible for labor and capital to function without energy.

When the present researches are examined, the causality relation between energy consumption and economic growth has been examined in general. Some studies have found that there is no causality towards growing energy consumption, some have one-sided causality and others have two-way relationship. For example, if the economy from energy consumption has a one-way causality, the finding that is generally achieved is that in the presence of two-way causality that limiting growth of energy consumption prevents growth, the general finding is that energy and the economy are in mutual solidarity. However, in the absence of causality between energy consumption and growth, the finding that is generally achieved does not affect the growth of energy use (Aydın,2010: 320).

Işık (2010) study, Turkey's 1977-2008 period was examined by ARDL boundary test. The study found that natural gas consumption positively affects Turkey's economic growth in the short term and that there is a negative relationship between the variables in the long run. Khoshnevis and Mastorakis (2014) study in Iran for the period 1975-1911 by the analysis of causality. The study revealed that gas consumption, capital formation, employment, financial development, exports, domestic production and therefore the contribution to economic growth in Iran are also linked to capital formation and economic growth and exports. Solarin and Shahbaz (2014) studied the relationship between natural gas consumption and economic growth in Malaysia by examining various factors together. Unit root test and cointegration test. The study concluded that natural gas consumption, foreign direct investment, capital formation and foreign trade positively affected economic growth in Malaysia.

Farhani, Shahbaz and Rahman (2014) conducted a study of VECM Granger causality analysis in order to determine the relationship between France's 1970-2010 period unit root test, cointegration test and variables. As a result of the study, it has been revealed that the exports of the economy, the increase of the labor and capital factor, cause the consumption of natural gas to grow. In the study of Öztürk and Al-Mulali (2015), panel data analysis for the 1980-2012 period in the Gulf Arab States and the causality test were used to determine the relationship between the variables. The study concluded that the consumption of natural gas affects the growth of the Gulf countries and is supported by a number of policies. Solarin and Öztürk (2015) study examined the relationship between natural gas consumption and economic growth in 12 OPEC member countries. Using the conservation hypothesis and the Granger causality analysis, it has been shown that the provision of evidence for the growth hypothesis in Iraq, Kuwait, Libya, Nigeria and Saudi Arabia as a result of the study for the period 1980-2012 provides protection hypotheses in Algeria, Iran, United Arab Emirates and Venezuela. In the Support (2016) study, the relationship between natural gas consumption and economic growth in OECD countries was analyzed using panel data analysis of 26 OECD countries and VECM Granger causality analysis to determine the relationship between variables. As a result of studying the period between 1991 and 2013, long-term results in the OECD countries have shown that consumption of natural gas affects economic growth positively.

In the study of Chang, Gupta, Inglesi-Lotz, Masabala, Simo-Kengne and Weideman (2016), we examined the relationship between natural gas consumption and economic growth given in the G7 countries for 1965-2011 period using panel data analysis and causality analysis to determine the relationship between variables. As a result of the study, it is revealed that GDP

causes natural gas consumption in the country, and as a result, policies that encourage natural gas consumption should be produced in terms of effects on economic growth and development levels. In the study of Çılbant and Alma (2016), the relationship between natural gas consumption and growth in Turkey is given by Johansen Cointegration and Granger causality test for 1998-2015 period. As a result of the study, we have found that causality from natural gas consumption to growth and the relationship between them are long-term positive.

4. Data Set and Method

In this study, the relationship between economic growth and the amount of natural gas consumption was examined and annual data for the period 1986-2015 were used. Economic growth figures used in the study were generated from the 1998 prices and gross domestic product values in real terms and were procured from the TCMB. The other variable natural gas consumption rate is compiled from BP Statistical Review of World Energy.

5. Econometric Analysis and Findings

In this study, short - term and long - term relationships between natural gas consumption (DG) and economic growth (EB) between 1986 and 2015 are discussed. First of all, whether the variables included in the scope of the study are stationary or not is investigated by ADF unit root test. After determining the order of integration of the series, the long-run relationship between natural gas consumption and economic growth was examined by Engle-Granger cointegration analysis. If there is a cointegrated relationship, short-term relationships are dealt with within the error correction model, and finally, causal relationships between variables are tested with the help of the Granger Causality Test.

First, it must be tested whether the time series data contains unit root. The results of the extended Dickey Fuller unit root test are given in the table below. Accordingly, both series were found to contain unit roots in a purely stationary state. For this reason, differences from the first degree of the series were taken. Both series were found to be stationary at 5% significance level in first degree differences.

Table 1. ADF Unit Root Test Results for Variables

	Eligible Delay	ADF Value	Mackinnon Critical Value (1%)	Mackinnon Critical Value (5%)
DG	1	-0,644940	-3,689194	-2,971853
EB	0	-0,461558	-3,679322	-2,967767
Δ DG	0	-3,282436	-3,689194	-2,971853
Δ EB	0	-6,288141	-3,689194	-2,971853

In order to test Engle - Granger (1987) cointegration between variables, variables must be stable at the same level. In this study, it is determined that the two series are stable in their first degree differences in the ADF unit root test results, in other words, they are $I(1)$. In the cointegration test to be performed using the Engle-Granger method for these series, which are stationary at the same level, the parameter values of the following expressions were first estimated by least squares method.

$$DG = \alpha_0 + \alpha_1 EB + \varepsilon_t \quad (1)$$

The prediction results of the above regression equation are given in the following table.

Table 2. Regression Results

Number (1) model ($DG = \alpha_0 + \alpha_1 EB + \varepsilon_t$)		
	α_0	α_1
1986-2015 period	-28,05875	0,221478
Probability value	0,0000	0,0000

According to the above table, a 1% increase in the economic growth rate increases the natural gas consumption by 0.22%. In other words, the relationship between economic growth and natural gas consumption is positive and meaningful. The estimated error values (ε_t) of this model refer to the corrupted term of the long-term relationship. If it turns out that this long-run equilibrium is stationary, it is understood that there is a cointegration between the variables. Accordingly, it is evident that the error term (residuals) estimated from equation (1) above must be stable and exhibit a normal distribution. According to this, it was found that the residues of model 1 were stable at the level of 5% significance level in the test result and that the residues exhibited a normal distribution according to the Jarque-Bera test results. Since it is understood that the error term is stationary, it is assumed that the regression relation expressed by equation 1 is cointegrated. A co-integration between variables indicates a long-term relationship. The error in modeling plays a bridge between short term values and long term values in the dependent dependent variable in the model. The error correction model has been developed for this purpose. The simplest error correction model is given below.

$$\Delta DG = \alpha_0 + \alpha_1 \Delta EB + \alpha_2 \varepsilon_{DG(t-1)} \quad (2)$$

The results obtained from this model are given in the table below.

Table 3. Results of Regression Analysis of Error Correction Model

Number (2) model ($\Delta DG = \alpha_0 + \alpha_1 \Delta EB + \alpha_2 \varepsilon_{DG(t-1)}$)			
	α_0	α_1	α_2
1986-2015 period	0,157	0,737	-0,4627
Probability value	0,0093	0,4400	0,0001

Although the error correction model for the period 1986 - 2015 is taken into consideration, it is seen that the economic growth coefficient in the error correction model between 1986 and 2015 shows that there is no statistical effect on the natural gas consumption in the short term. Because the coefficients of this variable are not statistically different from zero even at the level of 10% significance. On the other hand, the parameter of the error correction term is calculated as -0,46 and it is statistically different from zero according to the level of 1% significance. In that case, 46.2% of the imbalances in the economy due to external shocks and natural gas consumption are lifted in the 1-year period, and the system resumes its balance almost 2.2 years later.

Before going to the Granger causality test, the delay of the autoregressive model needs to be determined. The most important method used in determining the delay values is the comparison of the Akaiki Kriteri values in the VAR Analysis. The appropriate delay structure for the VAR model was determined according to the Akaiki Information Criteria and the most appropriate number of delays was tested as two. The results of the dual Granger causality test performed under the VAR model with the specified delay lengths are given in the following table.

Table 4. Granger Causality Test Results Between Variables

	F- value	p value	Result**
Δ Natural gas consumption is the reason for Δ Economy growth	0,16326	0,8504	Refuse
Δ Economic growth is the cause of Δ Natural Gas Consumption	0,09862	0,9065	Refuse

* At a level of significance of 5%

** Results (H1): Made according to Alternative Hypothesis.

In the analysis of causality made during the period, between 1986 and 2015, there was no mutual causality relation between economic growth and natural gas consumption amount.

Result

It is a fact that countries will not be able to grow up without consumption of natural gas, ie energy consumption. In this study, the relationship between Turkey's natural gas consumption and growth was analyzed by considering the periods between 1986-2015. For this purpose, we found that the 1% increase in economic growth compared to the regression test, after determining that the variables were stationary according to the ADF unit root test results, increased the natural gas consumption by 0.22%. According to the results of error correction model between 1986-2015, economic growth coefficient has not been statistically effected on natural gas consumption in the short term. Granger causality analysis has also shown that economic growth does not cause consumption of natural gas, either because natural gas consumption does not cause economic growth.

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