

The causality between energy consumption and economic growth in Turkey

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ABSTRACT

This paper applies the causality test to examine the causal relationship between primary energy consumption (EC) and real Gross National Product (GNP) for Turkey during 1970–2006. We employ unit root tests, the augmented Dickey–Fuller (ADF) and the Philips–Perron (PP), Johansen cointegration test, and Pair-wise Granger causality test to examine relation between EC and GNP. Our empirical results indicate that the two series are found to be non-stationary. However, first differences of these series lead to stationarity. Further, the results indicate that EC and GNP are cointegrated and there is bidirectional causality running from EC to GNP and vice versa. This means that an increase in EC directly affects economic growth and that economic growth also stimulates further EC. This bidirectional causality relationship between EC and GNP determined for Turkey at 1970–2006 period is in accordance with the ones in literature reported for similar countries. Consequently, we conclude that energy is a limiting factor to economic growth in Turkey and, hence, shocks to energy supply will have a negative impact on economic growth.

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1. Introduction

Turkey is a country in the process of development and its economy has undergone structural reforms since the beginning of the millennium in order to realize a sustainable development. Turkey is led by a strong political leadership in the last 5 years, which is not typical for the country. As a result of this political stability, Turkey has been ranked 20th in 2006 by its 378.4 billion dollars of Gross Domestic Product based on IMF's world's economic outlook.

Turkey has an important geopolitical status in the world. Indeed, it has been estimated that a great part of the world energy consumption (EC), which is expected to increase by 60% in the next 25 years, will be met from the region, which also includes Turkey. About 75% of world's oil and natural gas reserves are in Middle-East, Europe, Russia and Central-Asia. Reserves in Central-Asia come to the fore as an alternative source for meeting the world's energy demand. Turkey is both in a bridge and an outlet position for transporting the production in Central-Asia to world markets because of its geographical and geopolitical location.

Turkey, being in the process of economical growth and development, has an increasing energy need. Being the basic input that facilitates economical growth and development, energy has a strategic role in Turkey. Nevertheless, Turkey has to meet a

great part of its energy need from abroad. Naturally, increases in energy costs result in significant cost increases for Turkey.

Total primary EC in Turkey and data from economical development over the years are given in Fig. 1. In both drawings of Fig. 1, similar up and downs are remarkable. Here, it would not be wrong to reach the conclusion that increases or decreases in Turkey's economical figures are related to increases or decreases in EC.

Of Turkey's primary energy supply of 92,392 mtoe in 2006, share of domestic energy sources is 28.83%, while that of imports is 71.17%.

In addition, the biggest share in energy supply belongs to oil (35.62%) followed by natural gas (27.55%), hard coal (13.65%) and lignite (11.98%) (Table 1). Foreign currency spent on energy import by Turkey has been growing. Turkey spent 5.9 billions US dollars annually for energy import in 1996–2006 period, and this figure has reached to 28.6 billions US dollars in 2006, increasing about five-fold (Türkyılmaz, 2007).

On the other hand, Turkey's population has increased two-fold and EC has increased four-fold while EC per capita has increased two-fold. Rate of EC increase is higher than the population increase rate in both Turkey and the world. However, increase in EC per capita in Turkey is higher than the world average (ITU, 2007).

Increase in EC as a result of the population growth, urbanization and industrialization results in major environmental problems as in many other countries. Furthermore, Turkey has announced that she will sign the Kyoto Protocol. Therefore, Turkey

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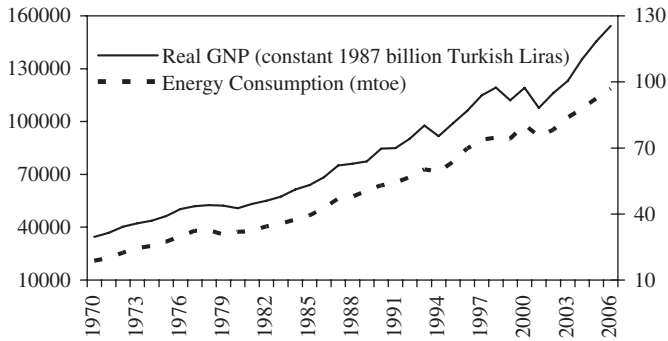


Fig. 1. The plots of the total primary energy consumption and real GNP in Turkey.

Table 1
Primary energy balance in Turkey in 2006 (mtoe) (MENR, 2007)

	Production	Import	Total primary energy supply	Total energy supply
Oil	2504	30,406	32,910	35.62
Natural gas	743	24,714	25,457	27.55
Hard coal	1973	10,637	12,610	13.65
Lignite	11,065		11,065	11.98
Animal and vegetable wastes	5127		5127	5.55
Hydroelectric	3745		3745	4.05
Geothermal electric	92		92	0.10
Wind	7		7	0.01
Thermal	976		976	1.06
Solar	403		403	0.44
Total	26,635	65,757	92,392	100.00

has to develop policies toward replacing fossil fuels with renewable energy sources for a sustainable development in the long run. Studies have been conducted into the energy supply security from a sustainability, economical efficiency and environmental point of view. A new institution called Energy Market Regulatory Authority (EMRA) has recently been established. Some important oil and natural gas pipelines are being installed and they will improve Turkey's energy supply security and will make Turkey an energy corridor between East and West.

While maintaining its fast economical growth and development process, Turkey aims to fully exploit its domestic hard coal and lignite reserves, hydro and other renewable resources such as wind and solar energy. Besides, Turkey is planning to build nuclear power plants in order to meet its future energy demands. Nuclear power plants of 4500 MW capacity are being planned in order to close the energy gap in 2020.

In addition to all these, considering the dynamic growth process in Turkish economy, there is a need for investigations that study the relationship between economical growth and EC for guiding the long-term energy policies to be developed by Turkey. On the other hand, in order to determine the changes in the direction of the relationship between economical growth and EC that occur in the process, current studies that comprise of timely data are necessary.

There are some studies that deal with the relationship between economical growth and EC for Turkey. Soytaş et al. (2001) found unidirectional causality relationship from EC to GDP at 1960–1995 period. Soytaş and Sarı (2003) reported a similar result for 1950–1992 period. In their studies, Soytaş et al. (2001) used cointegration analysis method, while Soytaş and Sarı (2003) used VECM method. On the other hand, time periods studied in both

studies are alike. In the starting years of both studies (1950–1960) there were not drastic changes in major economical aspects of Turkey. Therefore, it is not surprising that both studies found similar causality relationships between EC and economical growth.

Lise and Montfort (2007) found a unidirectional relationship from economical growth to EC at 1970–2003 period. OLS and ECM methods were used. The period studied in this study is especially important, because Turkey followed an economical policy open to the world after 1980. Economical growth was more prominent at the period studied by Lise and Montfort (2007). The finding that economical growth increases EC reflects the characteristic of the period studied.

Studies conducted for 1950–2000 period by Altınay and Karagöl (2004) and for 1960–2003 period by Jobert and Karanfil (2007) indicated that there were no relationships between economical growth and EC in Turkey.

Altınay and Karagöl (2004) employed unit root and causality test in their studies. They reported that there was a structural breaking in data from pre-1970 period, and these breaking results in some problems in the analyses. Jobert and Karanfil (2007) employed cointegration and Granger causality methods in their studies. They used the logarithmic form of the variables they studied. Lack of a causality relationship between economical growth and EC in those two studies is due to the fact that they disregarded the structural breakings in Turkish economy in the studied periods, because these results were not expected for Turkish economy, which was in the process of development.

Thus, it can be said that different results from the studies that deal with economical growth and EC in Turkey could be due to the transformations experienced in development process of Turkish economy during the periods studied.

Aim of the present investigation was to study the effect of the economical reforms in Turkish economy implemented in 2001 on the causality relationship between economical growth and EC through considering the 1970–2006 period for Turkey. The studied period is important in that it can show that effects of the economical reforms on the causality relationship and that it can yield beneficial data that can be used to form the new energy policies of Turkey. No doubt that there is a need for other studies to be carried out with new data in the future.

2. Literature

There are numerous studies that deal with the causality relationship between economical growth and EC. We tried to focus on studies conducted in the year 2000 and afterwards especially about countries with developing economies such as Turkey. Thus, we had an opportunity to compare the results from Turkey and similar countries. Summary information about these studies is given in Table 2.

Different unidirectional or bidirectional causality relationships between economical growth and EC obtained from different studies in some countries over some periods are given Table 2.

Besides, there are studies in the literature, which indicate that a causality relationship does not exist between economical growth and EC. Considering Table 2, it can be seen that a bidirectional causality relationship between economical growth and EC is more prominent in studies conducted in countries other than Turkey. This means that a mutual causality between economical growth and EC is common in especially developing countries.

On the other hand, economical conjuncture of these countries, time period studies and methodology used to investigate the causality relations are the factors that affect the direction of the

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