Determinants of Fossil Energy Demand in Iran's Manufacturing Sector

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Abstract

Fossil energy is one of the most important inputs in the production process of manufacturing enterprises. Industrial enterprises manufacture their products with the mixture of energy and the other inputs and sell them in markets. Hence, understanding the fossil energy demand and its determinants along with the other policies on energy demand can play an effective role in economic decision process. The industrial, agricultural and transportation sectors are the major energy consumers in Iran. Energy can be divided by fossil energy (such as kerosene, gasoline, natural gas and the other petroleum products) and non-fossil energy (such as electricity, sun and wind energy).Nowadays, most of industrial firms use fossil energy as well as electricity for light and production process. The policy of each firm is also to use optimal energy in its production process. The main purpose of this research is the study of kinds of fossil energy on demand of manufacturing sector of Iran over the period 1982-2015. The most important variables which affect the demand for fossil energy in the industrial enterprises are fossil prices, electricity price, the value-added of production and the physical capital. In Iran, the manufacturing sector is the third sector of house-made, commercial and transportation, sectors, and the natural gas consumption is increasing instead of oil products and electricity. The estimation technique of this paper is Auto-Regressive Distributed Lag (ARDL). Thus, the impacts of capital stock, the real price of electricity, and the real prices of various fossil energy in industrial sector in short-run and long–run. The result of this research show that fossil energy price elasticity in the long and short run is elastic in the manufacturing sector of Iran. Thus, the price policies are effective in industrial enterprises demand and they can lead the consumers to use the optimal energy in the production process.

Keywords: Electricity, Fossil energy, Long and Short Elasticity, Manufacturing Sector.

JEL Classification: Q41, C52, C22.

1. Introduction
Fossil energy is one of the most important inputs in the production process of manufacturing enterprises. Industrial enterprises manufacture their products with

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a mixture of energy and other inputs and sell them in markets. Hence, understanding the fossil energy demand and its determinants along with other policies on energy demand can play an effective role in the economic decision making process. The industrial, agricultural, and transportation sectors are the major energy consumers in Iran. Energy can be divided into fossil energy (such as kerosene, gasoline, natural gas, and the other petroleum products) and non-fossil energy (such as electricity, sun and wind energy). Nowadays, most of the industrial firms use fossil energy as well as electricity for light and production. The policy of each firm is also directed at optimal use of energy in its production process. The greatest portion of energy sources in Iran (i.e., 98.5 percent) comes from fossil fuel; unfortunately, the largest subsidy was allocated to these resources in recent decades. The main purpose of the present study is to study determinants of fossil energy demand in the manufacturing sector of Iran over the period 1982-2015.

2. Background
Many studies have been carried out on the determinants of energy consumption in developed and developing countries over different periods. However, the results obtained after the usage of an econometric tool show diverse views on the direction of causation between energy consumption and the studied variables. This discrepancy in results is largely due to the use of different econometric methods, and periods, besides country-specific heterogeneity in climatic conditions, developmental policies, energy production and consumption levels. Some of the related studies are as follows: Dilaver and Hunt (2011) carried out a study on demand for industrial electricity in Turkey over the period 1960-2008. Their empirical results revealed that the real price of energy and value added of the industry are the important factors affecting demand for industrial electricity. Hu et al. (2015) examined the relationship between energy consumption and economic growth in China, using a panel data model over the period 1998-2010. This study concluded that there is a bi-directional casual relationship between energy consumption and economic growth in the long run, but in the short run, there is a uni-directional casual between them. Bernard and Oludare (2016) investigated the relationship between various fossil energies and electricity in industrial firms in Nigeria over the period 1980-2013. They concluded that fossil energies and electricity have positive effects on industrial productions in Nigeria.

3. Methodology
The most important variables affecting the demand for fossil energy in the industrial enterprises are fossil fuels prices, electricity price, the value added of production and the physical capital. In Iran, the manufacturing sector is the third consumer of energy carriers after household, commercial and transportation sectors. The consumption of natural gas is also increasing instead of oil products

and electricity. In this paper, to study the long-run and short-run relationship between dependent and independent variables of the model, the Auto-Regressive–Distributed Lag (ARDL) approach was employed. In this method, the equality of variables cumulative degree is not essential, while in Engel-Granger method, it is necessary. Another advantage of ARDL is the simultaneous estimation of long-run and short-run patterns without facing theproblems of variables elimination and autocorrelation.

The final model for estimation of fossil energy demand for Iranian industries is as follows:

$$L_{F=INPT} + \beta 1 \, LP_F + \beta 2 \, LP_E + \beta 3 \, LV + \beta 4 \, LCLR$$

In the above model, L_F represents demand for fossil energies in industry sector (million barrel crude oil), INPT is intercept, LP_F is the logarithm of fossil energy real price (kilo watt hours), LP_E denotes the logarithm of electricity in real price (per cubic meter, Rial), LV indicates the logarithm of real value-added in the industry sector (Billion, Rial), and LCLR shows the logarithm of physical capital to the labor industry.

4. Empirical Results

All of the parameter estimates are statistically significant, and the coefficient generally displays the expected signs. The results of this study show that fossil energy price elasticity in the long and short run is elastic in the manufacturing sector of Iran. Thus, the price policies are effective in industrial enterprises demand, and they can lead the consumers to use the optimal energy in the production process. The cross elasticity of demand is negative, which shows that electricity is a good substitution for fossil energy. The long- and short-run income elasticity of demand has a direct effect on the optimal consumption of fossil energy, so that when the industrial products grow, their value added increases and the demand for fossil energy increases too. Finally, the elasticity of physical capital is not significant in the short run. However, it has a negative effect on demand for fossil energy in the long run.

5. Conclusion

The results of this study show that fossil energy price elasticity in the long and short run is elastic in the manufacturing sector of Iran. Thus, the price policies are effective in industrial enterprises demand, and they can lead the consumers to use the optimal energy in the production process. The cross elasticity of demand is negative, and it is a good substitution for fossil energy. The long and short run income elasticity of demand has a direct effect on the optimal consumption of fossil energy, so that when the industrial products increase, their value added increases and the demand for fossil energy increases too. Finally, the elasticity of physical capital is not significant in the short run; nevertheless, it

has a negative effect on demand for fossil energy in the long run. Thus, using modern machinery can decrease the demand for fossil energy. Nowadays, in Iran, the price of various kinds of energy is relatively low. So, the energy consumption is very high. Since fossil energies are non-renewable, economizing on them is quite essential. The government can perform the following policies to prevent heavy energy consumption in industries. Installing Multi-tariff meters for pricing energy, determining the real price of different kinds of energy, and removing the energy subsidies are some government policies for controlling the energy consumption in the manufacturing sector.

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