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Relationship Between Value Added and Electricity Consumption in the Iranian Industries

S.F. Ghaderi, M.A. Azadeh and S. Mohammadzadeh
Department of Industrial Engineering, Faculty of Engineering,
Research Institute of Energy Management and Planning , University of Tehran, Iran

Abstract: Energy is a vital resource for economic development in each country; therefore, the determination of relationship between energy consumption and economic growth is one of the factors that decides the supportive energy policies, and is used to optimize allocation of available energy resources. One of the most important segments as economical point and view are industrial sectors. Electricity holds a large percentage of industrial energy consumption, in this study the relationship between value added (economics growth) and electricity consumption was studied. According to the results of casual test, electricity consumption does not add any value to most industries in Iran; hence, supportive policies to increase electricity consumption are inefficient in economic growth.

Key words: Value added, electricity consumption, Granger causality test, supportive policies

INTRODUCTION

Energy effectiveness and its importance today are entirely manifest for everybody. Different economic section necessities of a country to energy can put an irrecoverable shock on the trend of reclamation and development of a country if they are not paid much attention. Acceptance of energy sovereignty on the current and future economy of the country and the substantial need to currency incomes and its usage for interior consumption makes the necessity of immunization and economical exploitation of energy. The realization of a stable economic promotion needs the production and exploitation of energy to be programmed compatibly along the other associations such as human, resources, raw materials, financial sources and etc.

After the oil crisis in 1973 the relationship between the consumption of energy and economic growth were seriously considered and whatever which is yet doubtful and discussable in energy economy is the determination of the relationship between the consumption of energy and economic growth. The most noticeable questions in this regard are: Is the energy consumption a motivation for economic growth or vice versa? And if the energy consumption is the cause of economic growth changes, how much will the rate of economic growth change with 1% change in the energy consumption? Iran has rich and widespread oil resources, large oil depositories and potential energy; hence, it is necessary to consider this relationship for energy management in order to plan the exact energy consumption. Lack of such relationships can be a reason for wasting resources and lack of the efficient consumption of energy sources as a production factor.

In the eye of different economic schools, the most significant factors influences on economic growth are: investment and workforces such as specialists and unskilled people. In new growth theories, energy factor has been included as a model, but its importance in different models is not the same. By considering this point that industry is one of the main economic sections and electricity is one of the most consuming energies in industries, so in this research it has tried to consider the relationship between the value added and electrical energy consumption on the basis of econometrics models for the periods of 1980 to 2001.

Many researches have been conducted in the field of the determination of the relationship between economic growth and energy consumption in and out of Iran. Graft and Graft[1], Yu and Long [2]have investigated the relationship between gross domestic product and energy consumption. Abosadra and Baghestani[3] considered the causal relationship between energy consumption and the gross domestic product in America. Stern[4] and also utility estimate group of Indiana State of America considered the economic growth relationship and energy consumption. In Iran, Rahimee[5] considered the relationship between economic growth and energy demand[6-9] many researches investigated the causality between the consumption of energy carrier and economic growth in Iran. With regard to the existence of differences in estimate methods and causal tests, the results were not the same in some cases.

Corresponding Author: S.F. Ghaderi, Department of Industrial Engineering, Faculty of Engineering,
Research Institute of Energy Management and Planning , University of Tehran, Iran
Tel: 00982166461990/00982166461680

INDUSTRIES OF IRAN

Industry in Iran can be classified into big industry and small-scale industry. The industrial plants which employ more than 10 workers fall under the big industrial category. The latest statistics for 2002 show that the number of big industries has reached 16,305, petroleum, petrochemicals, textiles, cement and other construction materials, food processing (particularly sugar refining and vegetable oil production), metal fabrication being the largest branches. The large public enterprises account for approximately 70% of value added in manufacturing industries and have a relatively intensive production while the private sector has been characterized by more labor-intensive activities. 66.2% of the industrial enterprises are concentrated in large cities such as Tehran, Isfahan, Mashahad, Tabriz and Arak.

The small-scale industries are scattered throughout the cities and the rural areas. It is estimated that there are 1.2 million small rural workshops of which 81% are textile production. Their share of the value-added to the entire economy is negligible. Textiles with 35%, food products with 30%, machinery, tools, and metal-works with 14% account for the total value-added of the small-scale industry.

Figure 1 indicates the Development of GDP in the different economic Sector. The industrial Sector remains increasingly dependent on imported raw materials and parts of its growth. This fact led to a considerable decline in 1979-1989 due to the foreign currnacy crisis arising from the oil pricing reduction. Afterwards with the end of Iran /Iraq war and the growth of the oil prices, the share of the industry in the economy increased to 37% of GDP in 1996. Apart from the oil sector, the economy in 1995-96 had a growth of 19.5% in the food industries, 17.1% in paper production 22.5% in chemical production and 11.4% in non metallic mineral production.

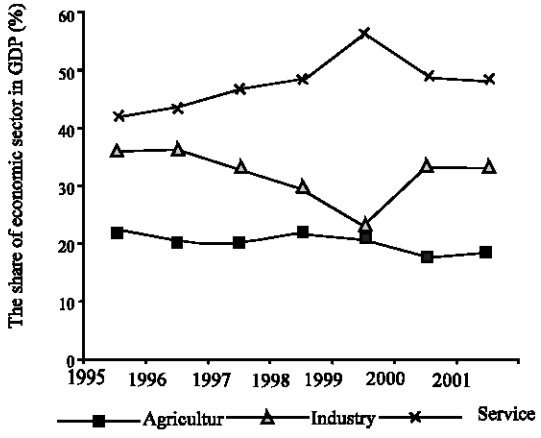

Fig. 1: The Development of GDP in different economic sectors

THE CAUSAL TEST

Regression and its analysis, shows the dependence of a variable with the other variables, but the meaning of causality necessarily is not resulted by sadeghi[10]. Causality Test discusses the relationship between two variables. The above-mentioned test answer the following questions: Are these variable independent from each other? If no: which variable changes have caused changes in the other one? For example, in the following model, the variable of value added (VA) is a function of electricity consumption variable (EC) (Eq.1) or the electricity consumption variable is a function of value added (Eq. 2).

$$EC_t = \sum_{i=1}^{n} \alpha_i VA_{t-i} + \sum_{j=1}^{n} B_j EC_{t-j} + U_{2t} \quad (1)$$

$$VA_t = \sum_{i=1}^{n} \lambda_i VA_{t-i} + \sum_{j=1}^{n} \delta_j EC_{t-j} + U_{1t} \quad (2)$$

Casual test by using Granger Test devised in the Eviews software package is discussable. The results of this test will be analyzed in four states:

- Sideway causality from EC to VA: It means that changes of EC variable will result in changes in VA variable.
- Sideway causality from VA to EC:
- It means that changes in VA variable can cause changes in EC variable.
- Bilateral causality:
- There is a feedback flow and changes in two variables result in changes in both of them.
- Meaningless causality from two sides:
- Two variables will be independent and will have no effect on each other.

RESULTS AND DISCUSSION

Results showed the relationship between the value added and electricity consumption in Iran industries. So, the statistical data, being used here, will firstly be described, then the causal relationship between two variables, value added variable and electricity consumption variable, in different industries will be studied.

Statistical data: Statistical sources and the data related to the model variables is from a statistical leaflet from industrial workshops of the country (compiled annually by the statistic center of Iran). In this list if new divisions of industries are put in the form of the third edition of the

international classification of the economical classifications, the data will be just limited to the years from 1994 to 2001 and this amount of information, because of its lack, can make great errors in the results. Now, if we use the data before the year of 1994, in this research, then, the problem of the comparison of new statistics and the data with old ones can be presented and the modification and transformation of data, compatible with many new international definitions is difficult or even unlikely, for this reason , the classification of industries on the basis of the second edition have considered the international classification and with three mantissa as a criterion to make the changing of third edition into the second one to provide a suitable statistic community. So the essential data (on the basis of international classification and the second edition) from 1980 to 2001 are available and 21 series of statistical data are suitable for estimations. Of course the above mentioned data is related to the great industrial workshops of the country (which has 10 or more employees). Because the data related to the small workshops have not yet been compiled and is unavailable [11].

Causality Tests: Causality test, by the use of Granger Test (devised in the Eviews software package) and the number of 1 and 2 lags (it is supposed that electricity consumption changes in a short time period can influence on the value added) and at the confidence level of 95% has been fulfilled.

Table 1: The results of the causality test on the basis of classification of industries in 24 groups

		Causality from electricity consumption to value added	
Row	Industries	1 lag	2 lag
1	Foods products	Rejected	Rejected
2	Beverage	Rejected	Rejected
3	Tobacco	Rejected	Rejected
4	Textile	Rejected	Rejected
5	Clothes except shoes	Rejected	Rejected
6	leathern products	Rejected	Rejected
7	producing shoes	Rejected	Rejected
8	Wood products	Rejected	Rejected
9	Furniture	Rejected	Rejected
10	Paper and paperboard	Rejected	Rejected
11	Print and publication	Rejected	Rejected
12	Industrial chemical products	Accepted	Rejected
13	Other chemical products	Rejected	Rejected
14	Refineries and petroleum	Rejected	Accepted
15	Rubber products	Rejected	Rejected
16	Plastic products	Rejected	Rejected
17	Glass, china and tegular	Rejected	Rejected
18	Other mineral	Rejected	Rejected
19	Metal products	Accepted	Rejected
20	Nonmetal products	Accepted	Rejected
21	Fabric metal products	Rejected	Rejected
22	Other machinery	Rejected	Rejected
23	Transportation machinery	Rejected	Accepted
24	Measurement machinery	Accepted	Rejected

*Statistically significant at the 5% level

Table 2: The results of the causality test on the basis of classification of industries in 9 groups

		Causality from Electricity consumption to value added	
Row	Industries	1 lag	2 lags
1	Foods, Beverage and Tobacco products	Rejected	Rejected
2	Textile, clothes and leathern products	Rejected	Rejected
3	Furniture and Wood products	Rejected	Rejected
4	Paper, paperboard, Print and publication	Rejected	Rejected
5	Industrial chemical products	*Accepted	Accepted
6	Nonmetal products	Rejected	Rejected
7	Basic metal production	Accepted	Accepted
8	Equipment and machinery	Rejected	Rejected
9	Miscellaneous	Rejected	Rejected

*Statistically significant at the 5% level

The variables of this test consist of:

VA: is the amount of industrial value added in proportion to 1000 RLS and constant prices in 1997.

EC: is the amount of industrial electricity consumption in proportion to 1000 KW h.

According to the results of Table 1, the variable of electricity consumption is the cause of the change in value added only in the chemicals, petroleum, metal, nonmetal, transportation machineries and measurement machinery industries. In other industries, changes in electricity consumption do not have any effect on the value added of that industry.

As it is manifest according to the results the variable of electricity consumption is the cause of the change in value added only in the chemicals and basic metal industries and in other industries, changes in electricity consumption does not have any effect on the value added of that industry (Table 2).

CONCLUSIONS

On the basis of the conducted tests in the previous section, it is clear that in most of the industries causal relationship does not exists between the value added and electricity consumption it means, electricity consumption increase, necessarily in industries, can not cause much value added in Iran; so, supportive policies to increase electricity consumption is inefficient in economic growth. Some subjects that are suggested for further research are as follow:

- Study on relationship between energy demand, economic growth, and energy efficiency.
- Study on relationship between energy consumption and energy intensity in industries.

- Analyze the effects of environmental taxes on reducing energy consumption.
- Development of Energy Control Strategies for Iran.
- Electricity consumption and economic growth in Iran.

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