

Input-Output Analysis for Price Targeting Effects of Energy Carriers on The Agricultural Production of Iran

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Abstract:

In this research, the effect of changes in energy prices on output of different sectors by using of regional input output of Hormozgan province is investigated. The AFLQ method is used for regionalization of national I_O table. Three scenarios for the increase in energy prices have been considered. The results showed that except of -water, electricity and gas/ sector, the output of other sectors has decreased. In the first scenario, the increase in the output of Water, Electricity and Gas/ sector was equal to 38574.52 million Rials whereas the output of transportation sector had the largest decrease in production. Industry and agriculture sectors are the other sectors that have the largest decrease in output after transportation. Total decrease of regional output in first scenario was 1896633.17 million Rials. As a result of the research, 20% increase in the price of energy carriers, about 0.28% of the total production of the province has decreased. In the second and third scenario total decrement of regional output was 512973.80 and 3048927.86 million Rials, respectively. Decrement of agriculture output in these two scenarios was 362099.15 and 512973.80 million Rials. Considering the importance of the agricultural sector in food production, supporting the production of this sector is necessary using appropriate policies such as guaranteed purchase or decrease of tax rate and technology subsidies in different sectors. These policies can provide the necessary incentives to adjust towards more efficient energy technologies, in order to ultimately reduce the negative effects of the increase in the price of energy.

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1. Introduction

The rapid increase in demand for energy and the dependence of countries on its use show that energy will be one of the most important issues in the future. Because for countries like Iran, whose main income is through the export of energy carriers, unlimited energy consumption means increased production for domestic consumption, not more exports, and less exports will cause a decrease in foreign earnings. (Mehrara et al. 2015)

In the world, different countries support the agricultural sector by using different tools and methods. This is done generally to support domestic producers, increase per capita income of farmers and reduce poverty.

According to the literature of development and economic growth, the development of the agricultural sector can be an effective factor in increasing industrial production. In this literature, the agricultural sector provides labor, capital and inputs needed by the industrial sector, and on the other hand, the industrial sector looks at the agricultural sector as a potential market for its products. Also, the difference in the productivity of the economic sectors and the existing flows between these two sectors have created a complementary relationship and mutual dependence between the industry and agriculture sectors (Hashemi Tabar et al. 2013). Therefore, in recent years, support for this sector has been emphasized in various ways with the aim of supporting the producers of the sector, reducing dependency, poverty and creating food security.

Today, economists believe that the government's support policies cause market prices and production to be distorted, and in the long term, the non-optimal allocation of inputs causes a decrease in social welfare. Therefore, with the aim of removing these obstacles and also using from the benefits of removing subsidies; the plan to target subsidies in the agricultural sector in Iran was proposed and implemented. It is obvious that the production sectors of the country will be affected by the implementation of this plan and the increase in the price of energy carriers and will apply the effects of this price increase in their production. The agricultural sector, as one of the country's productive sectors, which has a major share in the country's GDP, will not be an exception to this rule, and the increase in the price of energy carriers will definitely affect the production of this sector. The analysis of the stages of energy consumption in the agricultural sector shows that oil and gas are the main energy carriers that are used in the agricultural sector in the last forty years, but with the passage of time, their share has gradually decreased with the use of electrical energy. The statistics provided by the Deputy of Electricity and Energy Affairs of the Ministry of Energy of Iran in 2018 show that 65% of the energy consumed in the agricultural sector is related to petroleum products, while the energy consumed is related to natural gas 5% and electricity 30%. Therefore, oil, natural gas and electricity are the determining parameters in the growth and development of the agricultural sector. (Bakhayesh and Yazdani. 2012).

The agricultural sector is highly dependent on energy carriers such as irrigation pumps that depend on electricity. Therefore, any deficiency in energy supply or change in its price can have a great impact on the production of agricultural products. Different types of energy carriers in the agricultural sector are consumed due to the different nature of activities and the consumption of different types of fuel in the engines of agricultural machines and the driving force for pumping water from electric wells. In addition, part of the consumed energy is used to heat greenhouses, livestock farms and poultry farms. Among the types of energy carriers, diesel and electricity are the most important energy sources used in the agricultural sector, and the share of these two energy carriers is about 98% of the total energy consumed in this sector in Iran. (Abbasi 2014)

At the same time as the targeting of subsidies, the increase in the energy carriers' price in recent years, as well as the increase in population and the price of food items in the world markets, it seems inevitable to investigate and analyze the relationship between the increase in the energy carriers' price and the prices of agricultural products. Therefore, considering the importance of Hormozgan province in terms of agriculture in Iran; in this research, an attempt has been made to analyze these works in the agricultural sector of this province - which is followed by a brief review of the agricultural characteristics of this province - because this research can provide appropriate policies and solutions to improve productivity and reduce production costs and correct use of energy resources.

Hormozgan province is one of the southern provinces of Iran, which is bordered by the Oman Sea and the Persian Gulf from the south. This province is bordered by Sistan and Baluchestan from the east, Kerman province from the north, and Fars and Bushehr provinces from the west. It is also considered as a tourism and economic hub of Iran. The presence of Kish and Qeshm islands as well as very large ports, especially in Bandar Abbas city, has made this province one of the strategic and important areas for Iran. This province is the largest producer of agricultural products, especially vegetables and summer vegetables out of season in Iran. Every year, about one million and 600 thousand tons of agricultural products are produced out of season in this province and are exported to the whole country as well as neighboring countries. From about 170 thousand hectares of cultivated land, more than 3 million tons of agricultural products are obtained annually. In recent years, new agricultural systems, irrigation systems under pressure, as well as the selection of suitable cultivars for cultivation in the region have improved the efficiency of agricultural production and various agricultural products can be cultivated in Hormozgan province. Optimizing the water conditions and making different water sources available has made it possible to grow crops with high water requirements such as summer crops in this province. (Ali Roshan section 2020)

Off-season planting possibility of many crops and even garden products has turned this province into a very large greenhouse that can meet many of the country's food needs and cause price adjustment in the market, especially in the winter season. Also, due to having a sea border, it is possible to export agricultural products to other countries specially into Persian Gulf countries. This province is the leader in the production of summer fruits off- season, also citrus groves such as limes or palm trees are found in abundance in this province. (Ali Roshan Bakhsh 2020, Babazadeh 2011)

Since Iran's economy is moving from a centralized planning to a decentralized planning, energy degradation is one of the main debates in this transition. It seems that the income we get from the sale of oil and various petroleum products (as a part of energy carriers) constitutes more than 90% of the country's foreign currency income, so by paying subsidies to various energy carriers every year, a huge amount of foreign income is allocated to this issue. (Emami Meybodi, 2000). Therefore, the removal of energy carriers is highly sensitive, and it is clear that the discussion of the consequences of the increase in the cost of goods and services in various economic sectors and its effects and also the distribution of income resulting from the removal of energy subsidies, is one of the most important discussions that can be investigated (Emami Meybodi, 2016).

The results of studies conducted on the energy carriers' price show that the increase in the price of electricity has more effects than other energy carriers (Sabir et al. 2013, Azrem and Bakhshude 2016, Bhattachary and Ganguly 2017, Gelan 2018). But the effects of other energy carriers such as oil should not be ignored because it is traded in dollars in the global market and can have direct and indirect effects on the value of the national currency and the price of products. Given the roles of energy carriers in the production and transportation of agricultural products, such as providing fuel for water pump engines, transportation fuel and greenhouse heating systems, etc., it can lead to harmful effects in the short and long term, if the increase in the energy carriers' price is not accompanied by proper planning. The increase in the energy carriers' price will naturally lead to an increase in production costs, and in order to reduce this cost, they are forced to reduce the area under cultivation. This decrease in the cultivation area will have consequences such as a decrease in labor employment, a decrease in production, and eventually a shortage of products and an increase in their prices. (although reduction in the cultivation area in a country such as Iran that faces water restrictions is somewhat normal, but the increase in the price of energy carriers can be considered as one of the effective factors.) Therefore, the government can adopt efficient policies and suitable support programs for farmers to reduce and minimize the effects of this increase in the price of energy carriers.

Analysis of the effects of the increase in energy prices shows that it has direct and indirect effects on the value of agricultural products. Globalization of the

energy carriers' price in Iran's agricultural sector will reduce energy demand in the agricultural sector. (Alipour et al. 2013) and with the increase in the energy carriers' price, production and investment will decrease and the price of products will increase. (Nemat Elahi et al. 2014) While the results of some studies show that in the agriculture and horticulture sector, the change in the composition of input costs and the relatively high share of energy carriers in it causes the production value of the agricultural sector to decrease. (Ahmadi and Mirzaei Khalilabadi, 2013).

Although some believe that the removal of subsidies for energy carriers will increase the price of the products of this sector and reduce the demand for agricultural products, but considering the limitation of the cost share of energy carriers in the composition of inputs and their effectiveness from the sectors that the least effect from the increase in the price of energy carriers have accepted and as a result have minimum inflation in their price levels. (Ahmadi and Mirzaei Khalilabadi 2013) Therefore, the relative decrease in the price of products in the agriculture and horticulture sector compared to the products of other sectors causes the demand to buy these products to increase, and as a result of this increase in demand, the production of this sector can also increase (Eskandari et al., 2014).

Sroudi and Mirzaei Khalilabadi (2012) stated in their study that the increase of the energy carrier's price, the overall decrease in employment. So that in the agriculture sector, we face a 10.8% decrease in employment and this decrease will cause a decrease in production in the agriculture sector, while considering the possible changes made in the composition of inputs due to the change in energy prices, with the increase in the price of energy carriers; the demand for production factors such as land, labor and the area under cultivation will face an increase. Therefore, this policy of releasing energy carriers can be called as an important and strategic policy. (Alipour et al. 2013)

On the other hand, studies show that because the most fuel and energy is used to get water from the well; the increase in energy prices can reduce water consumption and of course reduce the cultivation area of most agricultural products. Although this decrease in cultivated area is not significant, it can lead to a decrease in production and purchasing power of farmers. (Mousavi and Bahmanpour, 2014). The results of other studies that have investigated the effects of the increase in the price of energy carriers on the production of agricultural products they confirm this and also show that the increase in the price of electricity compared to the price of diesel has significant effects (Sabir et al. 2013).

Some studies have investigated the multiple effects of adjusting the price of energy carriers on major economic-environmental indicators. For example, the results of the study by Jiang and Tan (2013) in China showed that petroleum

products have the greatest impact on the general price level and this impact goes back to the producer price index and will generally have a significant impact on the energy industry and there will be a lot of pressure on the general level of prices.

Also, the study by Semiromi and colleagues (2020) in Iran shows that by removing the energy subsidy; the consumption of electricity and diesel in the agricultural sector is reduced, although it has significant environmental effects and saves on the consumption of energy carriers, but it has significant effects on consumer prices and agricultural products, so that the demand for investment in The agricultural sector is facing a 41.13% decrease and a 12.46% increase in the consumer price index. A group of studies have analyzed the effects of oil shocks in global markets on the agricultural sector, because the price of oil can have a direct and indirect effect through the exchange rate on the price of agricultural products. Given that oil is often traded in US dollars.; It can affect the value of countries' currencies through exchange rates and have indirect effects on the export, import and the local price of agricultural products (Haghighat and Pasbani Mirek 2015, Chitiga et al. 2010, Kaltalioglu and Suistas 2009, and, Emami Meybodi, 2000)

For example, Chitiga et al., 2010, investigated the policies of the South African government regarding the increase in global oil prices, their results showed that the agricultural sector and small industries faced a decrease in public demand due to the increase in product prices. . This increase is not the same in different sectors, but sectors will suffer significantly.

Material and Methods:

In this study, the input-output model is used to investigate the effect of the increase of energy carriers on the production of the agricultural sector in Hormozgan province. First developed by the Russian-born economist Wassily Leontief for the US economy in 1919 and 1929, Input-output tables developed as both a theoretical framework and a practical economic tool from François Quesnay's table. An economic table that was only a descriptive tool to show the relationship between buying and selling between different producers and consumers in the economy and made economic analysis and forecasts easier. The Input-output table is prepared in two ways, one is the method of collecting statistics and information through extensive statistical plans, which requires a large amount of detailed and executive work and high cost. In the second method, the RAS method is used to prepare the statistics and information of the required sections from the previous tables. In this way, in the RAS method, if the data-output tables are available for a specific year and the additional information required for the new year is available, the Input-output table can be calculated.

This table is actually a broader form of national accounts that shows the flow of exchange between economic activities. Therefore, at first glance, it gives a statistical picture of the state of the economy in a given year. It should be noted

that due to the impossibility of using physical figures, all the figures in this table are expressed in monetary units. In the Input-Output table, the various elements of net final demand, which include household final consumption, government final consumption, non-profit institutions serving households, gross capital formation and export minus import, instead of being shown in multiple vectors, are collectively represented in a column vector. Also, all consumer activities are shown in one column and all producer activities are shown in one row. The added value elements of this table, which are known as primary data in economic literature, are shown as a line vector. The input-output table shows the mutual relations between the economic activities of a society in relation to the production and consumption of their products and products imported from abroad.

Total demand is the sum of intermediate demand and final demand of different sectors:

$$W_i + F_i = Z_i \quad (1)$$

And the total demand is equal to the total supply, which is obtained from two important components, the total of domestic production and imports.

$$X_i + M_j = Z_j \quad (2)$$

In the above equation, M is the import of different sectors. Therefore, domestic production is in the form of the following equation.

$$Z_i = X_i + M_i = \sum_j x_{ij} + F_i = W_i + F_i \quad (3)$$

Based on the above equation, the following equation can be written.

$$\sum_i X_i = \sum_i \sum_j X_{ij} + \sum_i F_i - \sum_i M_i \quad (4)$$

$$X_i = \sum_j x_{ij} + F_i - M_i$$

The matrix form of the above relationship can be written as follows.

$$X = (I - M - A)^{-1}f \quad (5)$$

Based on the above relationship and with the price elasticity of energy carriers, it is possible to examine the effect of the price change of each of the energy carriers on the production of different sectors, including the agricultural sector.

In order to obtain the final demand of energy carriers at different prices, the price elasticities of these carriers are needed. Based on this, using previous studies on the demand of energy carriers, the price elasticity of energy carriers is considered in the following table.

Table 1. Price elasticity of demand for energy carriers

Electricity	Petrol	Fuel oil	kerosene	natural gas	Gasoline
-0/16	-0/12	-0/04	-0/12	-0/15	-0/29

Source: Ahmadi.Z., Mirzaei Khalilabadi.H (2012).

By having the price elasticities of energy carriers, the change in the final demand of energy carriers is obtained and then it is placed in relation (5) to obtain the effect of this price change on the production of different economic sectors.

Results and Discussions

In order to investigate the effect of the change in the price of energy carriers on the production of different sectors, including agriculture, it is necessary to obtain the effect of the change in the price of energy carriers on the final demand of each of these carriers in different scenarios. Then the effect of this change in the final demand of the carriers on the production of sectors should be calculated. Based on the values of table (1) and using equation (5), the effect (direct and indirect) of the change in the price of energy carriers on the production of different sectors is obtained. The effect of the change in the final demand of energy carriers (as a result of their price change) on the production of different sectors of the economy is shown in table (2).

According to the information in the table, as a result of a 20% increase in the price of energy carriers, the total production of the province (the total change in the total production of the sectors) has decreased by 1896633.17 million rials. This amount of reduction is about 0.28% of the total production of the province. In other words, with the increase in the price of energy carriers, the total production of the province has decreased by 0.28 percent.

Of the twelve sectors considered in this study, only the production of water, electricity and gas has increased due to the increase in the price of energy carriers, and the production of other sectors has decreased. The increase in the production of water, electricity and gas sector due to the price change in the first scenario was equal to 38574.52 million Rials. This amount is about 0.1% of the water, electricity and gas production of the province. The reason for the decrease in the production of different sectors due to the increase in the price of energy carriers is that the increase in the price of energy carriers causes an increase in production costs and, as a result, a decrease in production. Therefore, the amount of production of the sectors is directly reduced.

The degree of effectiveness (direct and indirect) of the production of sectors depends on the share of energy carriers in the inputs of these sectors, as well as the degree of connection between the progresses of different sectors. The higher the share of energy carriers in the production of a sector, the more the decrease in production in these sectors will be due to the increase in the price of energy carriers.

Table (2). The effects of the increase in the price of energy carriers on the production of different economic sectors (million Rials)

Secors	First Scenario	Second Scenario	Third Scenario
Agriculture	-301749.29	-362099.15	-512973.80
Mining	-11721.48	-15772.42	-21633.16
Industry	-471989.52	-572806.49	-808801.25
Water, electricity and gas	38574.52	50625.20	69912.46
Building	-25185.74	-28769.67	-41362.53
Wholesale and retail sale	-121463.07	-21848.30	-82579.83
Transportation and communication	-761258.21	-855334.50	-1235963.61
Hotels, hostels and restaurants	-11718.60	-15530.19	-21389.49
Post and telecommunications	-6878.86	-11778.67	-15218.10
Business activities	-79177.14	-103809.14	-143397.71
Education and Health	-121267.69	-133394.46	-194028.30
Other Services	-22798.10	-30093.49	-41492.54
Total	-1896633.17	-512973.80	-3048927.86

Diagram (1) shows the change in the production of different parts of the province due to the change in the price of energy carriers in the first scenario. As shown in the graph, the transportation sector has had the biggest decrease in production due to the increase in the price of energy carriers. The decrease in the production of this sector was equal to 121463.07 million Rials. After this sector, the industrial sector and the agricultural sector respectively have had the biggest decrease in production due to price changes. The decrease in the production of these two sectors was equal to 471989.52 million Rials and 301749.29 million Rials, respectively.

The reason for the sharp decrease in the production of these sectors compared to other economic sectors of the province can be two important factors. The first factor is the dependence of these sectors on the consumption of energy carriers. In other words, these sectors have higher energy intensity than other sectors and require more energy consumption for each production unit. Therefore, with an increase in the price of energy carriers and a decrease in their consumption in these sectors, the production of these sectors will decrease more strongly.

The second reason for the sharp decrease in the production of these sectors is due to the existence of higher backward linkages of these sectors with other economic sectors of the province. The high backwardness of these sectors means that other economic sectors are more dependent on the products of these three sectors to produce their products. As a result, as a result of the decrease in the production of other sectors, these sectors will have less demand for the products of the three sectors and the production of these three sectors will decrease more intensively.

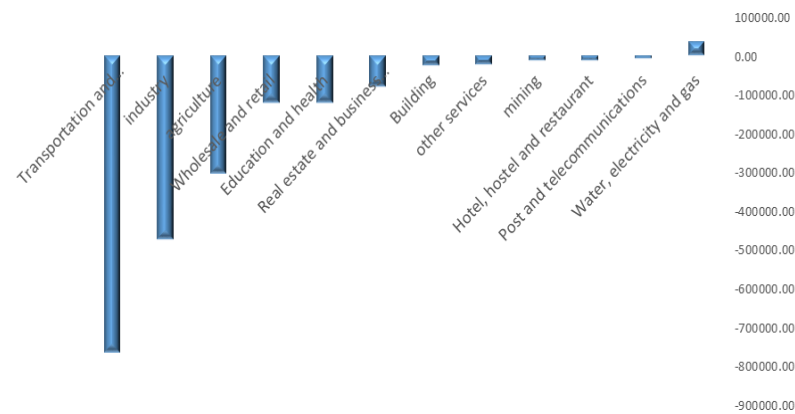


Chart (1). The effect of the increase in the price of energy carriers on the production of different sectors in the first scenario (million Rials)

The mining, hotel and restaurant sectors and the post and communication sector had the least decrease due to the change in the price of energy carriers. The decrease in production of the mining sector in the first scenario was equal to 11721.48 million Rials. The decrease in the production of hotel and restaurant and post and communication sectors was equal to 11718.60 million Rials and 6878.86 million Rials, respectively. One of the main reasons for the low production changes of these sectors due to the change in the price of energy carriers is the low level of backward communication of these sectors in the economy of the province.

Conclusion

Based on the subsidy targeting plan, reforming the price structure of all energy carriers is part of the government's policies. Therefore, it is very important to study the effects of the increase in the price of energy carriers in economic and social variables. Therefore, in this study, the effects of the increase in the price of energy carriers on the production of different sectors of the economy of Hormozgan province were investigated using the regional Input-Output table of the province.

One of the basic advantages of the Input-output model is to investigate the indirect effects of the increase in the price of energy carriers in different economic sectors. The price increase of energy carriers was investigated in three different scenarios of 20%, 60% and 100% increase. The results of the research showed that the increase in the price of energy carriers has caused a decrease in production in all economic sectors of the province except for water, electricity and gas sectors. The reason for this is the increase in the price of the products produced by this sector and the increase in production and supply by this sector. The transportation, industry and agriculture sectors have had the biggest decrease

in production due to the increase in the price of energy carriers. Therefore, it is suggested that support policies be implemented by the government after the liberalization and increase in the price of energy carriers.

Considering the importance of the issue of food security and the role of the agricultural sector in food production, in order to prevent the reduction of food production, we must continue to support the production of this sector with mechanisms such as guaranteed purchase and no pricing tools for example import tariffs can be used to prevent excessive imports and support production. One of the other policy recommendations of this study is that departments plan to improve technology and increase energy efficiency. For this purpose, by using support measures such as tax rebates, cash support and technology subsidies to increase energy efficiency in different sectors, the necessary incentives to adjust towards more efficient energy technologies can be provided to ultimately reduce the negative effects of the increase in the energy carriers' price.

But policymakers should pay attention to some points in this regard. For example, the policy of freeing the price of energy carriers as well as other inputs in the agricultural sector should be done step by step so that farmers have enough awareness and opportunity to adapt to the new conditions, and as a result, damages to the agricultural sector will be reduced.

In the meantime, small-scale farmers, whose income levels are low, will be more vulnerable and therefore should be supported with additional policies such as paying cheap loans. Another issue is about the resources released from the implementation of the liberalization plan and the increase in the price of energy carriers. In order to achieve the goals of this plan and the economic growth and development of the country; It is necessary to plan for the promotion of technical knowledge and the expansion of technology in the agricultural sector from these freed resources. The increase in energy prices requires more investment to maintain the current situation, since capital input plays a very effective role in production, therefore, providing credits to producers can be increased as another key proposal for policy to deal with the negative effects. Know the price of energy.

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تحلیل داده- ستانده ی اثرات هدفمندی قیمت حامل های انرژی بر تولید کشاورزی ایران

چکیده:

در این تحقیق تأثیر تغییرات قیمت انرژی بر تولید بخش های مختلف با استفاده از جدول داده-ستانده منطقه ای استان هرمزگان مورد بررسی قرار گرفته است. برای منطقه ای کردن جدول ملی داده-ستانده (I-O) تحت سه سناریو افزایش قیمت انرژی، از روش AFLQ استفاده شده است. نتایج نشان می دهد که به جز برای بخش های آب، برق و گاز، تولید سایر بخش ها کاهش داشته است. در سناریوی اول، افزایش در تولید بخش آب، برق و گاز معادل 38574.52 میلیون ریال بوده است. در حالی که در بخش حمل و نقل بیشترین میزان کاهش تولید را شاهد بوده ایم؛ بخش های صنعت و کشاورزی دو بخش دیگر هستند که پس از حمل و نقل بیشترین کاهش تولید را تجربه خواهند کرد. همچنین در سناریوی اول کاهش کل تولید منطقه ای معادل 1896633.17 میلیون ریال بوده است. براساس نتایج تحقیق 20 درصد افزایش در قیمت حامل های انرژی حدود 0.28 درصد از کل تولید استان را کاهش خواهد داد. در سناریوی دوم و سوم نیز مجموع کاهش تولید منطقه ای بترتیب معادل 512973.80 و 3048927.86 میلیون ریال خواهد بود. همچنین کاهش تولید کشاورزی در این دو سناریو معادل 362099.15 و 512973.80 میلیون ریال بوده که با توجه به اهمیت بخش کشاورزی در مواد غذایی تولید، حمایت از تولید این بخش با استفاده از سیاست های مناسب مانند خرید تضمینی یا کاهش نرخ مالیات و یارانه فناوری در بخش های مختلف ضروری است. چرا که این سیاست ها می توانند انگیزه های لازم را برای تطبیق با فن آوری های انرژی کارآمدتر را به منظور کاهش اثرات منفی افزایش قیمت انرژی فراهم نمایند.

کلمات کلیدی: رسانه های اجتماعی، نوسانات، عملکرد مالی، بازار سهام.