

## Estimation of the Potential Inflationary Impact of Energy Carriers Subsidy Removal on Different Economic Sectors (Case Study: Kurdistan Province)

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**Abstract:** This paper is an applied research in terms of objective and a library research on the basis of processing statistical data and theories in terms of type. So the analysis is undertaken based on books, papers, statistics, and reports published in this regard, through using global information network (internet), etc., and national input- output table and statistics related to Kurdistan regional accounts (published by planning deputy of the governor general for different years). The statistical universe is comprised of statistics and information related to all different economic activities and sectors of Kurdistan Province in 2008 classified based on "international standard industrial classification of all economic activities" (ISIC). So this paper has used the last version published as ISIC Rev. 3 in 1993 which is also applied by Central Bank and Statistical Center of Iran. The main goal of this paper is to present inflationary impact of increase in the price of energy carriers on export sector, private consumption, capital formation, and government consumption in Kurdistan Province and industries dependent upon these energy carriers as well.

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### 1. Introduction

During last decades, payment of subsidies in various ways for different types of energy carriers has kept their consumer prices low so that it has caused overuse of these carriers on one hand and a great share of national budget has been annually allocated to the energy carriers' subsidy on the other hand. Iran economy is in transition from central planning towards decentralized planning, and energy subsidy is one of the main issues in this period. The importance of this point is revealed when we find out that proceeds from the sale of energy carriers constitute over 90 percent of national income, and on the other hand large sums of national budget is annually allocated to the subsidy of the energy carriers. The importance of energy input relative to other inputs (in terms of substitutability and complementarity) is such that particular detailed issues have been allocated to it in economic literature of 1970s and 80s afterwards, "Hudson and Jorgenson", "Burnt and Wood", "Huffman and Jorgenson", "Halurson", "Hogan and Mann", "Pindick and Rotenberg", etc. can be mentioned as examples (Quarterly Journal of Economic Research, 2008). Third five year plan of Iran socio- economic development in the form of articles 46 and 47 of subsidies issue was taken into account more openly, and murmurs were constantly heard regarding the manner of dealing with subsidies payment to the extent that the issue has been

commenced seriously in the ninth government by gasoline rationing and in the tenth government by targeted subsidy plan in the Assembly, and experts have examined the impacts of this plan enforcement on different economic sectors in national and regional levels according to their expertise and experience and through using different estimation and planning models; the present paper has been designed in this regard for Kurdistan Province. With respect to the importance of the mentioned matter as well as the fact that in the recent years, particularly the current year, removal or decrease of subsidies issue has been raised seriously in the decision- making and executive circles of the country, this paper aims at investigating the inflationary impacts of decrease or removal of subsidies during different stages through using regional input- output model.

### 2. Literature Review

#### 2.1 Theoretical Principles

Extant methods for preparing regional input- output are namely direct, indirect and non- statistical sampling, coefficients equipoise based on regional weights, location coefficients, inter- industrial location coefficient, semi- logarithm of inter- industrial location coefficient, balance of goods and equality of supply and demand, shortcut in estimation of output coefficients, semi statistical Ross method, GRIT, synthetic, Ross. In general, two kinds of

relations can be considered in input- output table, the relation governing rows and the relation governing columns of the table.

**- Row relations**

As mentioned earlier, input- output table depicts the interaction among different economic sectors in which rows represent destination of products and data of each sector and these products are applied either in the form of intermediate inputs in the same sector and other sectors to produce final product or as the final consumption in other sectors (including families, government, export, increase in gross capital stock, etc.). Now if we assume supply equal to domestic production ( $X_i$ ) and import ( $M_i$ ) and demand equaling intermediate demand ( $x_{ij}$ s) and final demand ( $F_i$ ), then we have,

$$X_i + M_i = \sum_{j=1}^n x_{ij} + F_i,$$

$$a_{ij} = \frac{X_{ij}}{x_j} \Rightarrow X_{ij} = a_{ij}x_j,$$

$$m_i = \frac{M_i}{x_i} \Rightarrow M_i = m_i x_i$$

$a_{ij}$ : technical coefficient that represents some of sector  $i$  production that is consumed to produce one unit of product in sector  $j$ .

$X_{ij}$ : an amount of sector  $i$  product that is used in sector  $j$  as an intermediate input.

$X_i$ : total production of sector  $i$ .

$x_j$ : total production of sector  $j$ .

$m_i$ : import coefficient.

By using the above relation we will have,

$$X_i + m_i x_i = \sum_{j=1}^n a_{ij} x_j + F_i$$

And for  $n$  sectors we will have,

$$x_1 = (a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n) - m_1x_1 + F_1$$

$$x_2 = (a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n) - m_2x_2 + F_2$$

$$x_n = (a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n) - m_nx_n + F_n$$

And matrix form of  $n$  sectors will be,

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} - \begin{bmatrix} m_1 & 0 & \dots & 0 \\ 0 & m_2 & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \dots & \vdots \\ 0 & 0 & \dots & m_n \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} + \begin{bmatrix} F_1 \\ F_2 \\ \vdots \\ F_n \end{bmatrix}$$

If in the form of  $n$  sectors we show technical coefficients with  $A$  and matrix of import coefficients with  $M$ , the general form will be as following.

$$X = AX - MX + F$$

$$X - AX + MX = F$$

$$(I - A + M) X = F \Rightarrow X = (I - A + M)^{-1} F$$

In the above relation,  $(I - A + M)$  is called Leontief Matrix. Components of this matrix are always positive on the main diameter and negative or zero outside that. Also values of Leontief Matrix demonstrate direct and indirect effects of change in the final demand on the production. It is worth mentioning that  $(I - A + M)^{-1}$  is in fact the inverse of Leontief Matrix.

**- Column relations**

With respect to the fact that each column of the input- output matrix with its first outputs constitutes total costs of one sector, the price of each product (sector  $j$  product,  $X_j$ ) can be obtained by combination of its outputs prices that are weighted through the related output coefficients. So the price of sector  $j$  production is as following,

Cost of primary factors + intermediate cost = total cost of sector  $j$

$$p_j = \sum_{i=1}^n p_{ij} + v_j, \quad a_{ij} = \frac{p_{ij}}{p_i} \Rightarrow p_{ij} = a_{ij} p_i$$

$v_j$ : coefficients of primary factors (value added) of sector  $j$

$p_j$ : total cost (price) of sector  $j$

$p_{ij}$ : price of purchasing each unit of sector  $i$  product by sector  $j$

$p_i$ : total cost of sector  $i$

$a_{ij}$ : technical coefficient

By using the above relation, we will have

$$p_j = \sum_{i=1}^n a_{ij} p_i + v_j$$

And for  $n$  sectors form we will have,

$$p_1 = a_{11}p_1 + a_{21}p_2 + \dots + a_{n1}p_n + v_1$$

$$p_2 = a_{12}p_1 + a_{22}p_2 + \dots + a_{n2}p_n + v_2$$

$$\vdots$$

$$p_n = a_{1n}p_1 + a_{2n}p_2 + \dots + a_{nn}p_n + v_n$$

And matrix form of  $n$  sectors will be,

$$\begin{bmatrix} p_1 \\ p_2 \\ \vdots \\ p_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{bmatrix}$$

$$\times \begin{bmatrix} p_1 \\ p_2 \\ \vdots \\ p_n \end{bmatrix} + \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix}$$

#### - Assumptions governing input- output table

Since input- output table is based on assumptions that have particular importance in input- output analyses, it is necessary to mention them. These assumptions can be divided into two specified groups namely main assumptions and implicit assumptions of input- output table.

##### a- Main Assumptions

✓ Assumption of being linear and constant: each column of input-output table depicts a production process that produces a specified product. This column represents the production function so it specifies changes in the produced output based on changes in the consumed inputs.

✓ Assumption of homogeneity: in input- output economy, production units must be homogeneous as much as possible so analytical studies particularly measurement of the general impacts of demand increase by using Leontief inverse matrix will be more accurate.

##### b- Implicit Assumptions

✓ All transactions of goods and services that constitute the main body of input- output table accounting system are based on complete competition and there is no limitation in supply and demand of different sectors in this regard (there is not any limitation in the production capacity).

✓ Assumption of being static disrupts the economic analyses of interaction of goods and services of last year to the current year and current year to the future.

✓ Any producer can only use one production method in its production process. Such a production method is associated with constant coefficients of production in all levels of production.

## 2.2 Research Background

Berument et al showed that the effect of oil price shocks on the general price level has been analyzed (Berument, H. et al., 2000). In so doing, it has been assumed that nominal wages, profit, interest and rental rate are constant. The results reveal that 20 percent increase in the crude oil price will increase general price level by 1.08 percent. (Ikhupupuleny, D., 2003) investigates the effect of subsidy payment for three carriers of power, kerosene, kerosene with wood fuel (as a supplement). (Fatini, H., et al., 1999) investigates the inflationary impacts of energy carriers' price increase up to border price level on the

price of other economic sectors through using input-output method. (Sabuhi, Y., 1998) evaluation of the effect of energy subsidies reduction on the families' living expenses; this paper has evaluated the manner of resources distribution as a result of energy subsidies reduction and estimated the direct and indirect effects of removal or reduction of energy subsidies on the families living expenses. The results indicate that the resources obtained from reduction or removal of energy subsidies can be allocated to the compensation of decline in the purchasing power of the families. Other papers and case studies are as following, (Mojarad, M.J. et al., 1996) targeting policy to control inflation in Iran; (Komeijani, A., et al., 1991) appropriate monetary and currency policies for economic stabilization in Iran, the first phase report with deputy of economic affairs; (Bidabad, Bijan, et al., 1989) Functional form for estimating Lorenz curve; (Kazushige, Sh., et al., 2006) input-output based on a review on the connection size of domestic industries; (Duchin, F., 2004) input- output economy and materials flow; (Giljum, S., et al., 2004) alternative physical approaches to the input- output analysis for primary estimation of production input materials and accepted activities; (Suh, S., et al., 2005) industrial ecology and input- output economy; (Sonis, M., 2001) feedbacks in input-output systems, facts, loops, and hierarchies.

## 3. Research Methodology

This paper is an applied research in terms of objective and a library research based on processing statistical data and theories in terms of type. So the analysis is undertaken based on books, papers, statistics, and reports published in this regard, through using global information network (internet), etc., and national input- output table and statistics related to Kurdistan regional accounts (published by planning deputy of the governor general for different years).

### 3.1 Statistical Universe, Sample and Sampling Method

The statistical universe is comprised of statistics and information related to all different economic activities and sectors of Kurdistan Province in 2008 classified based on "international standard industrial classification of all economic activities" (ISIC). So this paper has used the last version published as ISIC Rev. 3 in 1993 which is also applied by Central Bank and Statistical Center of Iran. The related universe is confined to Kurdistan Province in terms of location and to the year 2008 in terms of time.

### 3.2 Goals

✓ Determination of potential inflation in different economic sectors of Kurdistan Province.

✓ Recognition of sectors that will experience the maximum inflation level.

✓ Comparison of inflationary impacts of sudden removal and step-wise removal of energy carriers' subsidy.

### 3.3 Variables

The independent variable of this paper is removal of energy carriers' subsidy and the dependent variable is inflationary impacts of energy subsidies removal.

### 3.3 Questions

- ✓ How much will the potential inflation be in different economic sectors?
- ✓ What sectors will experience the maximum potential inflation level?

## 4. Findings

To formulate the provincial input- output table, a national input-output table is needed. So input-output of 2001 has been firstly updated for 2007 through available statistics and then provincial input-output table has been formulated. To update national input-output table for 2007 a table for base year and three vectors for total intermediate costs, output value, and total intermediate demand of 2007 is required. In the following, the required information collection has been explained.

$$Z_i = X_i - M_i \Rightarrow X_i + M_i = W_i + F_i \Rightarrow W_i = X_i + M_i - F_i$$

Vector of final demand  $F_i$  in this equation includes private consumption  $C_i$ , government consumption  $G_i$ , capital formation  $I_i$ , and export  $E_i$ . So,

$$W_i = X_i - (C_i + G_i + I_i + E_i - M_i)$$

Data has been generally obtained from Statistical Center of Iran or if the required data were not available in this center, the tables were filled in by statistical methods and through conversion of family values to provincial values.

### 4.1 Energy Prices

There has been always a deep gap between domestic prices and international average prices. To increase the price of energy different carriers, two

✓ Vector of total intermediate costs for 2007: the above information has been obtained from national accounts of Statistical Center of Iran for different economic sectors.

✓ Vector of output value for 2007: this information has been obtained from Statistical Center of Iran for the related sectors too.

✓ Vector of total intermediate demand for 2007: estimation of the above vector has phases and it is explained in the following.

Total demand in economy is comprised of intermediate and final demands and is as below formulation.

$$Z_i = W_i + F_i$$

$Z_i$ : total demand

$W_i$ : total intermediate demand

$F_i$ : total final demand

So, total intermediate demand is obtained from difference of total demand and final demand as per below.

$$W_i = Z_i - F_i$$

It is assumed that total supply and total demand are equal and total supply is obtained from sum of import and output value. So,

scenarios are often suggested; First, sudden increase of prices and second, gradual increase of prices.

This paper investigates the increase in energy carriers price from the price level before targeted subsidy plan up to the price level imposed in the targeted subsidy plan. As shown in the below table, all carriers of power, gasoline, kerosene, gas oil, and natural gas have experienced increases from 142 percent for power up to near 2021 percent for gas oil by the targeted subsidy plan. The average prices of different energy carriers before and after the enforcement of targeted subsidy plan have been shown in Table (1).

Table 1. The average prices of different energy carriers before and after the enforcement of targeted subsidies plan (Rial)

	Power	Gasoline	Kerosene	Gas oil	Natural gas
Price before subsidy enforcement	145	1000	165	165	102.9
Price after subsidy enforcement	350	7000	1000	3500	700
Growth percent	142	600	506	2021	580

Resource: energy balance sheet, 2008.

### 4.2 Calculation of Scenarios results

a. In the first stage, as per the relation  $P_n = [I - A'_{nn}]^{-1} \times A'_{ne} \times (P_e + \Delta P_e) + [I - A'_{nn}]^{-1} \times V_n$ , it has been assumed that  $P_e$ s equal to one and  $\Delta P_e$ s values equal to

zero and then  $P_n$  value has been calculated as a base; that is, in this stage the increase in energy carriers' price has been assumed zero. The results of calculations are presented in Table (2).

Table 2. Calculation of base values in the state of lack of increase in energy carriers' price

Sectors	$I_1=(I-A'_{nn})^{-1}*A'_{nc}*P_c$	$I_2=(I-A'_{nn})^{-1}*V_n$	$P_n=I_1+I_2$
Water	0.0028	0.78	0.78504
Agriculture and horticulture	0.0003	0.8	0.79567
Ranching, aviculture, sericulture, apiculture, and hunt	0.0001	0.63	0.62724
Forestry	0.0009	0.74	0.74392
Fishing	0.0016	0.73	0.72983
Other mines	0.001	0.94	0.94494
Manufacture of food products and beverages	0.0006	0.7	0.70305
Manufacture of textiles	0.0018	0.62	0.62156
Manufacture of clothing, processing and painting fur	0.0004	0.5	0.503
Tanning leather and other leather products	0.0017	0.65	0.65328
Manufacture of wood and wood products	0.0019	0.63	0.62806
Manufacture of paper and paper products and publication	0.0066	0.51	0.51959
Manufacture of chemicals and chemical products	0.0161	0.41	0.42295
Manufacture of rubber and plastic products	0.0038	0.45	0.45047
Manufacture of other non-metallic mineral products	0.005	0.67	0.67745
Manufacture of basic metals	0.0625	0.32	0.38305
Manufacture of Fabricated Metal Products except for machinery and equipment	0.0034	0.5	0.50539
Manufacture of machinery	0.0016	0.39	0.39611
Manufacture of motor vehicles, trailers and semi-trailers	0.001	0.61	0.61478
Manufacture of furniture and artifacts not classified elsewhere	0.0015	0.58	0.58003
Residential buildings	0.0011	0.55	0.54891
Other buildings	0.0009	0.51	0.5107
Wholesale, retail, repair of vehicles and goods	0.0016	0.89	0.8875
Hotel and accommodation	0.0162	0.77	0.79082
Restaurant	0.0015	0.67	0.67125
Road transportation	0.0011	0.77	0.76817
Other transportations	0.0119	0.48	0.49055
Logistic services and warehousing	0.0145	0.77	0.78625
Post and telecommunications	0.0062	0.69	0.69207
Bank and insurance	0.0031	0.84	0.84256
Residential units and brokerage services	0.0004	0.84	0.8432
Business services and rent	0.0027	0.82	0.81882
Public affairs administration and civil services	0.0005	0.84	0.84252
Education	0.0008	0.93	0.92882
Health	0.0007	0.9	0.89951
Other public, social, personal and indoor services	0.0026	0.81	0.81755

b. In this stage as per the above relation, increases by 142 percent, 580 percent, 600 percent, 506 percent, and 2021 percent have been created in the price of power, natural gas, gasoline, kerosene,

and gas oil carriers. Consumption of different oil products during 2001 to 2009 and share of each product in the Province total consumption are presented in Tables (3) and (4).

Table 3. Consumption of different oil products during 2006 to 2009

Aviation Fuel ATK	Other products	LPG	Fuel Oil	Gas Oil	Kerosene	Gasoline	Year
-	14	35964	31440	720290	409821	438140	1385
-	256	41992	42903	545759	438255	390363	1386
462	191	45129	44419	551568	413414	420827	1387
1147	-	52385	34000	619356	363780	378044	1388

Resource: statistical yearbook of Kurdistan Province, 2009.



Table 4. Consumption of different oil products during 2006 to 2009

Aviation Fuel ATK	Other products	LPG	Fuel Oil	Gas Oil	Kerosene	Gasoline	Year
0.	0	2.2	1.9	44	25.1	26.8	1385
0	0.02	2.9	2.9	37.4	30	26.7	1386
0.03	0.01	3.1	3	37.4	28	28.5	1387
0.08	0	3.6	2.3	42.8	25.1	26.1	1388

#### 4.3 Calculation of Impacts

a) Micro impact includes inflationary impact on the price of different economic sectors, impact on the cost of living in different income groups, impact on the wages, etc.

b) Macro impact consists of impact on commercial balance and export and import, impact on

prices general level, financial impacts like impact on GDP, government expenses, etc.

The main objective of this paper is to investigate some prospects of micro and macro impacts of increase in energy carriers' price. The results of calculations are presented in Tables (5) to (12).

Table 5. Inflationary impact of increase in power price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	9.17	Manufacture of machinery	0.26
Logistic services and warehousing	2.75	Tanning leather and other leather products	0.26
Hotel and accommodation	2.15	Fishing	0.22
Manufacture of chemicals and chemical products	1.74	Other mines	0.22
Other transportations	1.41	Restaurant	0.21
Post and telecommunication	1.35	Residential buildings	0.17
Manufacture of paper and paper products and publication	0.97	Manufacture of motor vehicles, trailer and semi trailer	0.16
Manufacture of other non metallic mineral products	0.76	Other buildings	0.14
Manufacture of rubber and plastic products	0.69	Forestry	0.13
Water	0.57	Road transportation	0.12
Bank and insurance	0.56	Health	0.11
Manufacture of fabricated metal products except for machinery and equipment	0.54	Education	0.11
Manufacture of wood and wood products	0.4	Manufacture of food products and beverages	0.09
Business services and rent	0.38	Manufacture of clothing, processing and painting fur	0.08
Other public, social, personal, and indoor services	0.37	Public affairs administration and civil services	0.08
Manufacture of textiles	0.36	Agriculture and horticulture	0.05
Wholesale, retail, repair of vehicles and goods	0.27	Residential units and brokerage services	0.05
Manufacture of furniture and artifacts not classified elsewhere	0.26	Ranching, aviculture, sericulture, apiculture, and hunt	0.02

Table 6. Inflationary impacts of increase in natural gas price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	2.15	Other mines	0.09
Manufacture of chemicals and chemical products	1.22	Manufacture of furniture and artifacts not classified elsewhere	0.09
Other transportations	1.1	Other public, social, personal, and indoor services	0.09
Logistic services and warehousing	0.99	Manufacture of machinery	0.08
Post and telecommunication	0.54	Wholesale, retail, repair of vehicles and	0.08

		goods	
Hotel and accommodation	0.39	Manufacture of motor vehicles, trailer and semi trailer	0.05
Manufacture of paper and paper products and publication	0.27	Restaurant	0.04
Manufacture of rubber and plastic products	0.25	Forestry	0.04
Water	0.23	Other buildings	0.04
Manufacture of other non metallic mineral products	0.22	Residential buildings	0.04
Bank and insurance	0.2	Public affairs administration and civil services	0.03
Business services and rent	0.16	Manufacture of clothing, processing and painting fur	0.03
Manufacture of wood and wood products	0.16	Manufacture of food products and beverages	0.03
Manufacture of fabricated metal products except for machinery and equipment	0.15	Health	0.03
Fishing	0.14	Agriculture and horticulture	0.02
Manufacture of textiles	0.14	Education	0.02
Tanning of leather and other leather products	0.14	Residential units and brokerage services	0.01
Road transportation	0.1	Ranching, aviculture, sericulture, apiculture, and hunt	0.01

Table 7. Inflationary impacts of increase in gasoline price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	6.39	Manufacture of textiles	0.19
Manufacture of chemicals and chemical products	3.54	Manufacture of machinery	0.18
Other transportations	2.8	Manufacture of furniture and artifacts not classified elsewhere	0.17
Hotel and accommodation	1.65	Wholesale, retail, repair of vehicles and goods	0.17
Logistic services and warehousing	1.59	Restaurant	0.16
Manufacture of paper and paper products and publication	0.74	Residential buildings	0.12
Post and telecommunication	0.65	Other mines	0.11
Manufacture of other non metallic mineral products	0.55	Manufacture of motor vehicles, trailer and semi trailer	0.11
Manufacture of rubber and plastic products	0.43	Other buildings	0.1
Business services and rent	0.4	Forestry	0.09
Manufacture of fabricated metal products except for machinery and equipment	0.36	Education	0.09
Bank and insurance	0.33	Health	0.08
Water	0.32	Manufacture of food products and beverages	0.07
Fishing	0.31	Public affairs administration and civil services	0.06
Tanning of leather and other leather products	0.29	Agriculture and horticulture	0.04
Other public, social, personal, and indoor services	0.28	Manufacture of clothing, processing and painting fur	0.04
Road transportation	0.25	Residential units and brokerage services	0.04
Manufacture of wood and wood products	0.2	Ranching, aviculture, sericulture, apiculture, and hunt	0.02

Table 8. Inflationary impacts of increase in kerosene price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	6.37	Manufacture of textiles	0.18
Manufacture of chemicals and chemical products	3.25	Manufacture of machinery	0.18
Other transportations	2.56	Manufacture of furniture and artifacts not classified elsewhere	0.17
Hotel and accommodation	1.64	Wholesale, retail, repair of vehicles and goods	0.17
Logistic services and warehousing	1.57	Restaurant	0.16
Manufacture of paper and paper products and publication	0.73	Residential buildings	0.12
Post and telecommunication	0.64	Other mines	0.11
Manufacture of other non metallic mineral products	0.55	Manufacture of motor vehicles, trailer and semi trailer	0.11
Manufacture of rubber and plastic products	0.42	Other buildings	0.1
Business services and rent	0.38	Forestry	0.09
Manufacture of fabricated metal products except for machinery and equipment	0.35	Education	0.09
Bank and insurance	0.33	Health	0.08
Water	0.31	Manufacture of food products and beverages	0.07
Fishing	0.29	Public affairs administration and civil services	0.06
Other public, social, personal, and indoor services	0.28	Manufacture of clothing, processing and painting fur	0.04
Tanning of leather and other leather products	0.27	Residential units and brokerage services	0.04
Road transportation	0.23	Agriculture and horticulture	0.03
Manufacture of wood and wood products	0.2	Ranching, aviculture, sericulture, apiculture, and hunt	0.01

Table 9. Inflationary impacts of increase in gas oil price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of chemicals and chemical products	11.4	Manufacture of furniture and artifacts not classified elsewhere	0.26
Other transportations	9.33	Manufacture of machinery	0.25
Manufacture of basic metals	6.98	Manufacture of textiles	0.23
Logistic services and warehousing	2.13	Wholesale, retail, repair of vehicles and goods	0.21
Hotel and accommodation	1.76	Other mines	0.18
Manufacture of paper and paper products and publication	1.08	Restaurant	0.18
Fishing	0.96	Residential buildings	0.16
Business services and rent	0.96	Other buildings	0.15
Road transportation	0.84	Manufacture of motor vehicles, trailer and semi trailer	0.13
Manufacture of other non metallic mineral products	0.8	Forestry	0.11
Tanning of leather and other leather products	0.79	Education	0.11
Post and telecommunication	0.78	Manufacture of food products and beverages	0.1
Manufacture of rubber and plastic products	0.61	Health	0.1
Water	0.49	Public affairs administration and civil services	0.09
Bank and insurance	0.43	Agriculture and horticulture	0.07
Manufacture of fabricated metal products except for machinery and equipment	0.41	Manufacture of clothing, processing and painting fur	0.05
Other public, social, personal, and indoor services	0.36	Residential units and brokerage services	0.05
Manufacture of wood and wood products	0.26	Ranching, aviculture, sericulture, apiculture, and hunt	0.03



Table 10. Inflationary impacts of 21300 percent increase in all carriers price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	81.2	Wholesale, retail, repair of vehicles and goods	2.05
Hotel and accommodation	21	Fishing	2.03
Manufacture of chemicals and chemical products	20.9	Restaurant	1.95
Logistic services and warehousing	18.9	Manufacture of furniture and artifacts not classified elsewhere	1.93
Other transportations	15.4	Residential buildings	1.43
Manufacture of paper and paper products and publication	8.58	Road transportation	1.37
Post and telecommunication	8.03	Manufacture of motor vehicles, trailer and semi trailer	1.32
Manufacture of other non metallic mineral products	6.44	Other mines	1.28
Manufacture of rubber and plastic products	4.95	Other buildings	1.19
Manufacture of fabricated metal products except for machinery and equipment	4.43	Forestry	1.12
Bank and insurance	3.98	Education	1.1
water	3.61	Health	0.96
Business services and rent	3.45	Manufacture of food products and beverages	0.81
Other public, social, personal, and indoor services	3.42	Public affairs administration and civil services	0.62
Manufacture of wood and wood products	2.43	Manufacture of clothing, processing and painting fur	0.55
Manufacture of textiles	2.28	Residential units and brokerage services	0.46
Tanning of leather and other leather products	2.16	Agriculture and horticulture	0.35
Manufacture of machinery	2.13	Ranching, aviculture, sericulture, apiculture, and hunt	0.15

Table 11. Inflationary impacts of 3550 percent increase in all carriers price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	34.4	Wholesale, retail, repair of vehicles and goods	0.87
Hotel and accommodation	8.89	Fishing	0.86
Manufacture of chemicals and chemical products	8.86	Restaurant	0.83
Logistic services and warehousing	8	Manufacture of furniture and artifacts not classified elsewhere	0.82
Other transportations	6.53	Residential buildings	0.61
Manufacture of paper and paper products and publication	3.63	Road transportation	0.58
Post and telecommunication	3.4	Manufacture of motor vehicles, trailer and semi trailer	0.56
Manufacture of other non metallic mineral products	2.72	Other mines	0.54
Manufacture of rubber and plastic products	2.1	Other buildings	0.5
Manufacture of fabricated metal products except for machinery and equipment	1.87	Forestry	0.47
Bank and insurance	1.68	Education	0.47
water	1.53	Health	0.4
Business services and rent	1.46	Manufacture of food products and beverages	0.34
Other public, social, personal, and indoor services	1.45	Public affairs administration and civil services	0.26
Manufacture of wood and wood products	1.03	Manufacture of clothing, processing and	0.23

		painting fur	
Manufacture of textiles	0.97	Residential units and brokerage services	0.2
Tanning of leather and other leather products	0.91	Agriculture and horticulture	0.15
Manufacture of machinery	0.9	Ranching, aviculture, sericulture, apiculture, and hunt	0.07

Table 12. Inflationary impacts of 3770 percent increase in all carriers price (percent)

Sector	Inflation	Sector	Inflation
Manufacture of basic metals	48.1	Wholesale, retail, repair of vehicles and goods	1.21
Hotel and accommodation	12.5	Fishing	1.2
Manufacture of chemicals and chemical products	12.4	Restaurant	1.16
Logistic services and warehousing	11.2	Manufacture of furniture and artifacts not classified elsewhere	1.14
Other transportations	9.14	Residential buildings	0.85
Manufacture of paper and paper products and publication	5.08	Road transportation	0.81
Post and telecommunication	4.75	Manufacture of motor vehicles, trailer and semi trailer	0.78
Manufacture of other non metallic mineral products	3.81	Other mines	0.76
Manufacture of rubber and plastic products	2.93	Other buildings	0.7
Manufacture of fabricated metal products except for machinery and equipment	2.62	Forestry	0.66
Bank and insurance	2.36	Education	0.65
water	2.14	Health	0.57
Business services and rent	2.04	Manufacture of food products and beverages	0.48
Other public, social, personal, and indoor services	2.02	Public affairs administration and civil services	0.37
Manufacture of wood and wood products	1.44	Manufacture of clothing, processing and painting fur	0.33
Manufacture of textiles	1.35	Residential units and brokerage services	0.27
Tanning of leather and other leather products	1.28	Agriculture and horticulture	0.21
Manufacture of machinery	1.26	Ranching, aviculture, sericulture, apiculture, and hunt	0.09

**c- Sectors that show the maximum impact**

The results obtained for seven sectors that show maximum and minimum impacts based on inflation

percent in three states are presented in Tables (13) and (14).

Table 13. Maximum inflation impacts (percent)

Sector	Weighted (1300%)	Mean	Geometric (550%)	Mean	Simple (770%)	Mean
Manufacture of basic metals	81.2		34.4		48.1	
Hotel and accommodation	21		8.89		12.5	
Manufacture of chemicals and chemical products	20.9		8.86		12.4	
Logistic services and warehousing	18.9		8		11.2	
Other transportations	15.4		6.53		9.14	
Manufacture of paper and paper products and publication	8.58		3.63		5.08	
Post and telecommunication	8.03		3.4		4.75	

Table 14. Simultaneous increase in price of all carriers in the minimum increase state (percent)

Sector	Weighted (1300%)	Mean	Geometric (550%)	Mean	Simple (770%)	Mean
Education	1.1		0.47		0.65	
Health	0.96		0.4		0.57	
Manufacture of food products and beverages	0.81		0.34		0.48	
Public affairs administration and civil services	0.62		0.26		0.37	
Manufacture of clothing, processing and painting fur	0.55		0.23		0.33	
Residential units and brokerage services	0.46		0.2		0.27	
Agriculture and horticulture	0.35		0.15		0.21	
Ranching, aviculture, sericulture, apiculture, and hunt	0.15		0.07		0.09	

**d- Macro Impact**

This section examines inflationary impacts of increase in the price of energy carriers on private consumption costs, government consumption costs,

gross fixed capital formation, and export. So fund share of each component of final demand has been calculated and the results are presented in Table (15).

Table 15. Cost share of each component of final demand in different economic sectors (percent)

Sector	Private consumption	Government consumption	Capital formation	export
Water	0/5626	0	0	0.3918
Agriculture and horticulture	4.2929	0	0.232264	16.778
Ranching, aviculture, sericulture, apiculture, and hunt	1.5646	0	0.086224	12.793
Forestry	0.0397	0	0	0.4092
Fishing	0.3234	0	0	0.2745
Other mines	0	0	0	1.3221
Manufacture of food products and beverages	18.438	0	0	5.7403
Manufacture of textiles	1.9257	0	0.028365	0.6583
Manufacture of clothing, processing and painting fur	1.7117	0	0	0.4821
Tanning leather and other leather products	1.0513	0	0	0.0095
Manufacture of wood and wood products	0.0092	0	0.000164	0.4889
Manufacture of paper and paper products and publication	0.2821	0	0.0045	0.0382
Manufacture of chemicals and chemical products	1.805	0	0	0.1498
Manufacture of rubber and plastic products	0.2286	0	0.036391	0.7182
Manufacture of other non metallic mineral products	0.2287	0	0.059694	3.2059
Manufacture of basic metals	0	0	0	1.9435
Manufacture of fabricated metal products except for machinery and equipment	0.1929	0	4.013025	0.7524
Manufacture of machinery	2.4635	0	18.75485	9.7701
Manufacture of motor vehicles, trailer and semi trailer	3.3805	0	11.73681	0.107
Manufacture of furniture and artifacts non classified elsewhere	1.8498	0	0.845322	0.6072
Residential buildings	0.7077	0	23.04115	2.253
Other buildings	0	0	39.38741	0.7526
Wholesale, retail, repair of vehicles and goods	23.733	0	1.073151	29.082
Hotel and accommodation	0.0899	-6.10E-08	0	0.3569

Sector	Private consumption	Government consumption	Capital formation	export
Restaurant	1.5126	1.757784	0	1.1167
Road transportation	5.053	0	0.107079	6.3372
Other transportations	0.2913	0	0.000197	0.0292
Logistic services and warehousing	0.0666	0.069652	0	0.268
Post and telecommunication	2.635	0.009036	0	0.4316
Bank and insurance	0.8107	0.027374	0	2.1143
Residential units and brokerage services	19.232	0	0.100595	0
Business services and rent	0.2488	1.99885	0.446962	0
Public affairs administration and civil services	0.0007	33.26665	0	0
Education	0.7741	30.98374	0	0
Health	0.9694	21.9853	0	0
Other public, social, personal, and indoor services	1.2313	9.901609	0.045836	0

To calculate the above mentioned inflationary impacts,  $C_i \times \Delta P = \sum \Delta P_i$  relation is applied.

$C_i$ : sector i share from total expenses of each component of final demand (based on percentage)

$\Delta P_i$ : changes in sector i price (inflation based on percentage)

$\Delta P$ : increase in all prices of each component of final demand (based on percentage)

Now if cost share of sectors is combined with increases in the price of those sectors created by increase in the price of energy carriers as per the

above relation, an estimation of increase in costs of each component of final demand is obtained whose results are presented in Table (16).

Table 16. Inflationary impacts on each component of final demand

Sector	Export	Capital formation	Government consumption	Private consumption
In the state of 142 percent increase in power price	39/5	18/9	13/4	22/9
In the state of 580 percent increase in natural gas price	12	5/41	3/44	9/17
In the state of 600 percent increase in gasoline price	28/12	13/5	10/36	20/5
In the state of 506 percent increase in kerosene price	27/7	13/3	10/2	19/6
In the state of 2021 percent increase in gas oil price	39/17	18/7	14/5	43/9
In the state of 1300 percent increase in all carriers price	330	159/5	121/5	191/2
In the state of 550 percent increase in all carriers price	139/6	67/5	51/4	80/9
In the state of 770 percent increase in all carriers price	195/48	94/5	71/9	113/28

## 5. Conclusions

The main goal of this paper is to investigate the inflationary impacts of increase in the price of energy carriers through using regional input-output model. Although there are restrictions and different assumptions in preparing and updating the regional input-output table and using it to calculate and analyze the effects and consequences of increase in the price of energy carriers in different economic sectors, the above mentioned model is one of the best available models in this regard. The main advantage of this model is that it depicts the direct and indirect

effects of different economic sectors on each other. So, inflationary impacts of increase in the price of each carrier have been calculated by keeping constant the price of other carriers and finally inflationary impact of simultaneous increase in the price all carriers. The main result of this paper is to present inflationary impact of increase in the price of energy carriers on export, private consumption, capital formation, government consumption in Kurdistan Province as well as industries dependent upon these energy carriers.

a) The results of calculations reveal that,

✓ By increase in the power price up to the level of proposed prices, activities related to manufacture of basic metals (9.17%), logistic services and warehousing (3.75%), hotel and accommodation (3.15%), manufacture of chemicals and chemical products (1.74%), other transportations (1.41%), and post and telecommunication (1.35%)

✓ By increase in the natural gas price, activities related to manufacture of basic metals (3.15%), manufacture of chemicals and chemical products (1.22%), other transportations (1.1%), and logistic services and warehousing (0.99%)

✓ By increase in the gasoline price, activities related to manufacture of basic metals (6.39%), manufacture of chemicals and chemical products (3.54%), other transportations (2.8 & ), hotel and accommodation (1.65%), and logistic services and warehousing (1.59%)

✓ By increase in the kerosene price, activities related to manufacture of basic metals (6.37%), manufacture of chemicals and chemical products (3.25%), other transportations (2.56%), hotel and accommodation (1.64%), and logistic services and warehousing (1.57%)

✓ By increase in gas oil price, activities related to manufacture of chemicals and chemical products (11.4%), other transportations (9.33%), manufacture of basic metals (6.98%), logistic services and warehousing (2.13%), and hotel and accommodation (1.76%)

✓ By simultaneous increase in all carriers prices, activities related to manufacture of basic metals, hotel and accommodation, manufacture of chemicals and chemical products, logistic services and warehousing, other transportations, manufacture of paper and paper products and publication, post and telecommunication show maximum amount of expected inflation, respectively.

b) On the other hand, increase in the price of energy carriers has made changes in the level of macro variables as well. The results have been obtained for different carriers separately and for all five carriers together. So,

✓ In the state of increase in power price, respectively export, private consumption, capital formation, and government consumption.

✓ In the state of increase in natural gas price, respectively export, private consumption, capital formation, and government consumption.

✓ In the state of increase in gasoline price, respectively export, private consumption, capital formation, and government consumption.

✓ In the state of increase in kerosene price, respectively export, private consumption, capital formation, and government consumption .

✓ In the state of price increase, respectively private consumption, export, capital formation, and government consumption.

✓ In the state of simultaneous increase in all carriers price, respectively export, private consumption, capital formation, and government consumption show maximum inflation.

The important point that is worth mentioning is that a significant part of inflation that occurs by increase in the price of energy carriers in different economic sectors stems from psychological effects of increase in the carriers price among people of the society so that besides actual increase in the carriers price, an inflation occurs further greater than what is calculated in the form of numbers and figures.

#### - Suggestion

Improvement of methods of using different energy carriers and making them consistent with accepted standards.

✓ With respect to the fact that energy issue ranging from production, distribution, and consumption is a systematic and cyclic process, monitoring and reviewing different processes related to energy ranging from production, pricing, distribution, etc. is an essential matter.

✓ Protecting sectors that have had high inflationary impacts through different methods including tax exemptions, loans and special facilities (to improve production methods and tools).

✓ Redistribution of a percentage of increased revenues of the government among different classes of the society to reduce psychological effects of inflation in general and reduce its impact on the vulnerable groups of people.

✓ Allocation of a part of increased revenues of the government to the optimization plans of different processes related to the energy.

✓ A static price model has been applied in this paper, it is suggested to use dynamic models in future researches.

#### References

1. Quarterly Journal of Economic Research, 2008, eighth year, No. 4, pp. 93-94.
2. Berument, H., Talpcy, H., 2000, Inflationary Effect of Crude Oil Prices in Turkey, Department of Economics Bilkent University, Ankara.
3. Ikhupupuleny, Dube, 2003, Impact of energy subsidies on energy consumption and Supply in Zimbabwe. Do the urban poor really benefit, Energy Policy, Vol 31, No.2, pp.1635-1645.
4. Fatini, Habib, Bacon, R., 1999, "Economic Aspects of Increasing Energy Price Level in the



- Islamic Republic of Iran", the World Bank, Middle East Department.
5. Sabuhi, Yadollah, 1998, "optimized allocation of energy subsidy resources", *Barnameh va Budjeh Magazine*, No. 34 and 35, Tehran.
  6. Mojarad, Mohammad Jafar, Bidabadi, Bijan, 1996, targeting policy to control inflation in Iran, presented in the 6<sup>th</sup> conference on monetary and currency policies, papers of the 6<sup>th</sup> conference on monetary and currency policies, Institute of monetary researches, No. 21.
  7. Komeijani, Akbar, Bijan Bidabad, Roya Tabatabae, Yusef Faraji, Firuzeh Shekarabi, Koroush Madelat, 1991, appropriate monetary and currency policies for stabilizing economic activities in Iran, first stage report with deputy of economic affairs, Ministry of Economic Affairs and Finance, republished by deputy of economic affairs, Ministry of Economic Affairs and Finance.
  8. Bidabad, Bijan, Bidabad, Behruz, 1989, Functional form for estimating Lorenz curve, presented to the Econometric Society meeting, Australia.
  9. Kazushige, Shimpo, Asako, Okamura, 2006, Input-Output Based World Model and its Database., paper presented to IIOA Intermediate Input-Output Meeting, July 2006, Sendai, Japan.
  10. Drejer, I., 2002, Input-Output Based Measures of Interindustry Linkages Revisited. A Survey and Discussion, Presented to the 14th International Conference on Input-Output Techniques, Université du Québec à Montréal, Canada, October 10-15, 2002.
  11. Duchin, F. 2004, Input-Output Economics and Material Flows, Rensselaer Working Papers in Economics No. 0424, New York: Rensselaer Polytechnic Institute.
  12. Giljum, S. Hubacek, K., 2004, Alternative Approaches of Physical Input-Output Analysis to Estimate Primary Material Inputs of Production and Consumption Activities, *Economic Systems Research*, Vol. 16 (3): 301-310.
  13. Suh, S., Kagawa, S., 2005, Industrial Ecology and Input-Output Economics: An Introduction, *Economic Systems Research* Vol. 17 (4): 349-364.
  14. Sonis, M., Hewings, G.J.D., 2001,. Feedbacks in Input-Output Systems: Impacts, Loops and Hierarchies, in: Lahr, M. and E. Dietzenbacher [eds.], *Input-Output Analysis: Frontiers and Extensions*, Basingstoke: Palgrave.

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