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The Inflationary Impact of Energy Subsidy Reform in Iran

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Abstract

Iran has suffered ever-increasing domestic energy consumption, mostly because of its long-standing price control policy. To decelerate this trend, Iran began a reform on its energy subsidy system in December 2010. This paper examines the inflationary impact of the energy subsidy reform on different Iranian non-energy sectors and urban and rural households by making an updated input–output price model and deriving the energy price elasticities (the percentage change in price of non-energy sectors in response to a one percent change in price of energy carriers). The results show that full reform (increasing the domestic energy prices immediately to average regional market prices) would increase consumption prices by 54.1% that impresses the expenditures of urban households more. In addition, the manufacture of non-metallic mineral products, basic metal industries, and transport, storage and communication sectors would experience the largest increase in production prices. Finally, electricity, natural gas and gasoline have the largest impact on production prices.

Keywords: *Energy subsidy reform, Input–output price model, Iran, Production and consumption prices*

JEL Classification: *A11, H70, H71*

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1. Introduction

Despite some limited and specific benefits, energy subsidies have imposed vast expenses on societies. Several literatures overviewed the economic, environmental, and social impacts (UNEP, 2003, 2008; Ellis, 2010). Among the developing countries, Gupta et al. (2002) found oil-exporting countries as the main net subsidizers of energy. Their study demonstrates that implicit subsidies in major oil-exporting countries were averagely equal to 3.0 percent of GDP and 15.2 percent of explicit government expenditures in 1999. In addition, IEA (2007) reveals that major energy subsidizers are oil-exporters. Russia had the largest subsidies in dollar terms in 2005, amounting to about 40 billion USD, most of which went to natural gas. Iran was second while it subsidized mostly oil products amounting 37 billion USD in the same year. China, Saudi Arabia, India, Indonesia, Ukraine, Egypt, Venezuela, and Kazakhstan are the next largest energy subsidizers which are mostly oil-producers.

As the third largest petroleum exporter in OPEC, Iran has suffered ever-increasing domestic energy consumption in recent decades, primarily because of its price control policy. For example, the respective final consumption of refined petroleum products, natural gas, and electricity was about 44.7, 0.7, and 1.9 MBOE [1] in 1967, increasing to 538.5, 519.7, and 100.8 MBOE in 2009. The growth rate of final energy consumption has generally exceeded Iran GDP and population growth rates. In general, this reflects the relatively low share of energy expenditure in total household spending and the high producer costs associated with low energy prices (MoE, 2010; SCI, 2010).

Different international organizations had encouraged Iran to start an energy subsidy reform. For instance, IMF reported that implementation of the reform has the following benefits (Guillaume and Zytek, 2010):

1. Million Barrel Oil Equivalent

- In the short-term, it strengthens Iran's current account and external reserve position and reduces the volatility in government capital spending. In the medium-term, energy allocation efficiency would improve significantly and energy intensity would decline, improving the overall competitiveness of the economy of Iran.
- Higher revenues resulting from the liberalization of energy prices would help generate the resources needed to maintain and expand energy production and support economic development and employment growth.
- Higher energy prices would support Iran's diversification of energy sources.
- Increased earnings from energy sales could allow the government to make the distribution of benefits from Iran's hydrocarbon resources more equitable.

After decades disputing the necessity of subsidy reform, the parliament of Iran approved the Reform Act on January 5, 2010. On December 19, 2010, Iran increased domestic and agricultural energy prices up to twentyfold, making it the first major oil-exporting country to reduce substantially its system of implicit energy subsidies (Guillaume et al., 2011). In the next phase, prices would increase progressively until the removal of all subsidies. Since the start of the first phase, the government has compensated for the burden of increased energy prices by transferring 450,000 IRR (nearly 45 USD in 2009) per person to Iranian household heads.

The reform has raised many policy questions among the policy makers and researchers. Some of the main questions can be listed as (i) the impact of the reform on producer cost and household expenditure; (ii) the welfare effects of reducing energy subsides; (iii) the relative policy and welfare implications of a gradual vs. one-time price increases; (iv) the impact on the social variables such as poverty, inequality, education, health, etc.; (v) the resource conservation and environmental improvement of the reform; and (vi) the impact of subsidy reform on energy intensity/productivity.

This paper studies the impact of the reform on the economy of Iran in terms of producer costs and household expenditures, using an input-output price model. Several studies have examined the economic effects of the reform using mostly general equilibrium models. Table 1 summarizes their aims and findings. This study provides two contributions to the studies in Iran. First, it uses an updated version of national input-output table of Iran, using a RAS method. Second, we derived the energy price elasticities of fuels to evaluate and compare the inflationary impact of each fuel on non-energy sectors. These elasticities can help the policy makers to adjust the reform in a more effective way.

Table 1: Some domestic and international studies about the impacts of Iran energy subsidy reform on domestic economic variables

Author	Aim	Key finding
Birol et al. (1995)	Quantifying the gains from removal of energy subsidies and an improvement in energy efficiency	Economic savings could be as high as 20%
Saboohi (2001)	The direct and indirect effects of eliminating energy subsidies on the living expenses	Living costs of an average urban and rural households increase by 28.7% and 33.7%, respectively
Jensen and Tarr (2003)	Quantifying the gains from energy pricing reform	The largest gain is 32% of consumption from energy pricing reform
Perme (2005)	The inflationary effects of energy subsidy reform	Total removal of all energy subsidies would increase the price index by 35.4%
Khiabani (2008)	The effects of an increase in the price of energy carriers on production costs, inflation, and economic welfare	The inflation rate increase by 35%, output and employment decreases by 4.5% and 6.8%, respectively and government revenue would increase by 40%

Author	Aim	Key finding
Sharifi et al. (2008)	Recognizing the most influenced sectors and influencing energy type	Sectors: mineral products, forestry, and refined petroleum products; Energy: Electricity
Shahmoradi et al. (2010)	The inflationary and social welfare effects of energy subsidy reform	Increasing consumer and producer price indices by 108% and 118%, respectively, and decreasing social welfare by 79%.
Heydari and Perme (2010)	The inflationary effect of energy subsidy reform	Increasing the urban and rural household expenditures by at least 33% and 40%, respectively
Manzoor et al. (2010)	The effects of implicit and explicit energy subsidy phase out	Increase the inflation rate by between 57.9% and 69.07%, reduce total output from 2.11% to 2.22%, and decrease household welfare between 11.80% and 12.62%
Sharifi and Shakeri (2011)	Dynamic analysis of the demand of energy input in manufacturing industries after applying the reform	Dramatic and moderate negative impacts on the industries' energy demand in the short and long terms, respectively
Mohammadi et al. (2011)	The impact of energy subsidy removal on GNP	If the reform reduces the consumption of gasoline and gas oil, the growth rate of GNP reduces. Otherwise, no change is observed.
Khalili and Barkhordari (2012)	Impact of rising energy prices on the household welfare	Regarding government transfers to household, household welfare will increase with a 100% or 200% rise in energy prices and decrease with a 400% and 500% rise in energy prices
Abbasian and Asadbeigi (2012)	The impact of energy subsidy reform on sector economic growth	No positive impact in agricultural and service sectors
Hazeri Nayyeri and Hosseini Nasab (2014)	Social welfare effects of the energy subsidy reform	Reduces the welfare of both rural and urban households, especially the people in the lowest income deciles

The remainder of the paper is organized as follows: Section 2 explains the methodology underpinning the input–output price model. Section 3 presents the results. Section 4 concludes the analysis and proposes a number of policy implications.

2. Methodology

2.1. Input–output price model

The input–output price model, or more typically, the Leontief price model, is an analytical framework used to examine the effects of energy price fluctuations in a static manner. The starting point in the derivation of the model is summing the jth column in a m×m standard input–output table:

$$X' = i'Z + V' \tag{1}$$

Where X, Z, and V are the total outlay, transaction, and value-added matrices and i indicates the unity vector. Substituting $Z = A\hat{X}$ and post multiplying by $\hat{X}^{-1}$ yields:

$$\begin{aligned} X'\hat{X}^{-1} &= i'AX\hat{X}^{-1} + V'\hat{X}^{-1} \\ i' &= i'A + V_c' \end{aligned} \tag{2}$$

Where $V_c' = V'\hat{X}^{-1}$. The right-hand side of Eq. (2) is the cost of inputs per unit of output.

Output prices are set equal to total cost of production (in the general case, this will include an allocation for profit and other primary inputs in V' and hence in V_c'), so each price is equal to 1. This illustrates the unique measurement units in the base year table – amounts that can be purchased for $1.00. If we denote these base-year index prices using the vector P, the input–output price model is as Eq. (3) (Miller and Blair, 2009, 41-53):

$$P' = P'A + V_c' \quad or \quad P = A'P + V_c \tag{3}$$

Following Suzuki and Uchiyama (2010), we make two modifications to Eq. (3). First, we externalize energy prices by decomposing Eq. (3) into energy (e) and non-energy sectors (n):

$$\begin{bmatrix} P_e \\ P_n \end{bmatrix} = \begin{bmatrix} A'_{ee} & A'_{ne} \\ A'_{en} & A'_{nn} \end{bmatrix} \begin{bmatrix} P_e \\ P_n \end{bmatrix} + \begin{bmatrix} V_{ce} \\ V_{cn} \end{bmatrix} \tag{4}$$

In Eq. (4), P_e and P_n are the respective index prices in energy and non-energy sectors, V_{ce} and V_{cn} are the value-added of the energy and non-energy sectors per unit of production, and as an example in the technical matrix (A), A_{en} provides the share of energy input transferred to non-energy sectors in the total outlays of the non-energy sector. In a country like Iran, where energy prices are set administratively, the price of energy is an exogenous variable. While the prices of energy carriers can influence the production costs of non-energy products, the only significant equation that can be derived from Eq. (4) is as follows:

$$\begin{aligned} P_n &= A'_{en} P_e + A'_{nn} P_n + V_{cn} \\ \left[I - A'_{nn}\right] P_n &= A'_{en} P_e + V_{cn} \\ P_n &= \left[I - A'_{nn}\right]^{-1} A'_{en} P_e + \left[I - A'_{nn}\right]^{-1} V_{cn} \end{aligned} \tag{5}$$

We can use Eq. (5) to examine the impact of an exogenously given change in energy prices. The assumption $\Delta V_{cn} = 0$ yields the general form of the price model[1]:

$$\Delta P_n = \left[I - A'_{nn}\right]^{-1} A'_{en} \Delta P_e \tag{6}$$

1. The model assumes that the structure of value-added part does not change through the reform. It may be unrealistic, but makes the model easier to be calculated and interpreted.

The second modification involves the extraction of imported non-energy commodities from the price model. This is because domestic energy prices do not determine the prices of imported non-energy products. For this purpose, we need to modify Eq. (6) using the import coefficient vector of non-energy products ($\hat{M}_n$), where the elements indicate the ratio of the imported non-energy products to the total demand of the respective sector:

$$\Delta P_n = \left[I - \left\{ (I - \hat{M}_n).A_{nn} \right\}' \right]^{-1} A'_{en} \Delta P_e \tag{7}$$

Where $B_{nn} = (I - \hat{M}_n).A_{nn}$. Eq. (7) can be rewritten as Eq. (8):

$$\Delta P_n = \left[I - B_{nn}{}' \right]^{-1} A'_{en} \Delta P_e \tag{8}$$

In addition to analyzing the effects on production prices, we can examine the impact of the reform of energy subsidies on consumption prices. Consumption prices are conventionally defined endogenously using a normalized basket of goods, which defines the weights of final prices (Llop and Pié, 2008):

$$P_C = \sum_{j=1}^{m} p_j . \frac{C_j}{C} \tag{9}$$

Where P_j are production prices and C_j/C represents the share of final consumption for each good with respect to all goods consumed. We can also obtain an approximation of the influence of the revised energy prices on consumer real income. In particular, the changes in private real income (ΔI) can be calculated using Eq. (10):

$$\Delta I = I - I^R = \sum_{j=1}^{m} P_j C_j - \sum_{j=1}^{m} P_j^R C_j = \sum_{j=1}^{m} (P_j - p_J^R) C_j \tag{10}$$

Where P_j and P^R_j indicate the consumption price of good j before and after the reform respectively. These results will assist us in estimating an approximation of the compensatory payments the government should transfer to consumers to cover any increased expenditure, at least in the short run.

2.2. Decomposition of the price model

While the Leontief price model assumes that the economic structure does not alter over time, Eq. (8) links the price change of non-energy products to the price change in energy carriers. If we decompose Eq. (8) into its constituent parts, we can individually track the impact of each part. Eq. (11) shows the decomposed equation.

$$\Delta P_n = (I - B'_{nn})^{-1} A'_{en} \left[\Delta P_{ELE} + \Delta P_{NG} + \Delta P_{GA} + \Delta P_{KE} + \Delta P_{GO} + \Delta P_{FO} + \Delta P_{LPG}\right] \quad (11)$$

Where ELE, NG, GA, KE, GO, FO, and LPG[1] denote electricity, natural gas, gasoline, kerosene, gas oil, fuel oil, and LPG, respectively. When all the diagonal elements in ΔP_e are set equal to one, ΔP_n represents the energy price elasticity in each non-energy sector.[2] We can then decompose the elasticities obtained from Eq. (11) into their direct and indirect impacts by substituting the Leontief inverse matrix with the equivalent power series. For instance, the first term in Eq. (12) ($A'_{en}\Delta P_{ELE}$) indicates the direct impact of any electricity price change, whereas the remaining terms [$(B_{nn} + B_{nn}^{\ 2} + \ldots)A'_{en}\Delta P_{ELE}$] reflect the indirect impacts (Suzuki and Uchiyama, 2010):

1. Liquid Pressured Gas
2. In economics, elasticity is the measurement of how responsive an economic variable is to a change in another. It is important to understand that the concept of energy price elasticity is different from the commonly used ones here. Usually, (demand/supply) price elasticity gives the percentage change in quantity (demanded/supplied) in response to a one percent change in price (ceteris paribus, i.e. holding constant all the other determinants of demand, such as income). Here, it gives the percentage change in price of a non-energy sector in response to a one percent change in price of a specific energy carrier.

$$\Delta P_{n.ELE} = (I - B'_{nn})^{-1} A'_{en} \Delta P_{ELE} = (I + B_{nn} + B_{nn}{}^{2} + \ldots) A'_{en} \Delta P_{ELE} \\ = A'_{en} \Delta P_{ELE} + (B_{nn} + B_{nn}{}^{2} + \ldots) A'_{en} \Delta P_{ELE} \quad (12)$$

3. Empirical Results

The last published survey-based input-output table is for 2001, issued by Statistical Center of Iran (SCI, 2005). We applied two modifications on the table 2001. First, to simplify the analysis, we aggregate the original table of 91 commodities into 32 sectors.[1] Table 2 depicts the structure of our aggregated input–output table comprising primary energy products (crude oil and natural gas), final energy products (Sectors 2–10), and non-energy products (Sectors 11–32). Given the focus of our analysis is energy subsidy reform, we assume the prices in sectors water (3) and other refined petroleum products (10) remain unchanged.

Second, we updated the original table to the values of 2009 by using a non-survey based approach, i.e. RAS method. The RAS method is the best-known and mostly used bi-proportional procedure introduced by Stone (1961). We collected and classified the required data of the target year from the national accounts of Iran (SCI, 2012).

3.1. Direct and indirect elasticities of fuels in non-energy sectors

Using the methodology introduced in Section 2.2, the energy price elasticities by fuel and sector are measured and shown in Table 3. As explained earlier, we calculate the elasticities by equalizing the rate of price increase of each fuel to unity. Therefore, we interpret the elasticities as indicating by how many percents the price of a specific non-energy sector would increase if the price of a specific fuel were to double. For instance, the results in Table 3 show that the price elasticity of electricity in the

1. For this, we used the manual explaining corresponding between CPC (Central Product Classification) and ISIC (International Standard Industrial Classification of All Economic Activities) (available at http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=66)

construction sector (23) is 1.45. This means that if the price of electricity per kWh is doubled, prices in the construction sector would increase by 1.45% per unit of output. Of this total elasticity measure, only 0.03% stems from the increase in electricity prices consumed directly in the construction sector with the remainder (1.42%) associated with the increasing prices of other inputs associated with the indirect impact of the same electricity price increase.

Table 2: Primary energy, final energy, and non-energy sectors in Iranian input–output

Sector No.	Energy sectors	Sector No.	Non-energy sectors	Sector No.	Non-energy sectors
1	Crude oil and natural gas (primary energy)	11	Agriculture, hunting and forestry	22	Other manufacturing industries
2	Electricity	12	Fishing	23	Construction
3	Water	13	Other mining	24	Wholesale and retail trade and maintenance
4	Natural gas	14	Food, beverages and tobacco	25	Restaurants and hotels
5	Gasoline	15	Textile, wearing apparel and leather industries	26	Transport, storage and communication
6	Kerosene	16	Wood and wood products	27	Financing and insurance
7	Gas oil	17	Paper and paper products, printing and publishing	28	Real estate and business services
8	Fuel oil	18	Chemicals and chemical products	29	Public administration, defense and social security
9	LPG	19	Manufacture of non-metallic mineral products, except products of petroleum and coal	30	Education
10	Other refined petroleum products	20	Basic metal industries	31	Health services
		21	Fabricated metal products, machinery and equipment	32	Other community, social and personal, and household services

Source: Authors' calculations

It is clear that electricity has the highest energy price elasticity in the most of non-energy sectors. In other words, an increase in the electricity price can increase production costs, and consequently, the total inflation rate, relatively more than any other fuel. The exceptions for this rule are gasoline in the sectors of fishing (12), transport, storage and communication (26), and public administration, defense and social security (29), and natural gas in the chemicals sectors and chemical products (18), restaurants and hotels (25), education (30), and other services (32).

The highest price elasticities of electricity are in basic metal industries (8.36%), manufacture of non-metallic mineral products (4.3%), and paper and paper products, printing and publishing (3.3%). Electricity is one of the main inputs of these industries and consequently, has a significant share in their total production costs. The results for natural gas are similar in that the total elasticities of natural gas are higher in the same sectors that are the largest consumers of electricity, i.e. basic metal industries (7.43%), manufacture of non-metallic mineral products (2.81%), and paper and paper products, printing and publishing (2.71%).

Since 99% of gasoline consumption occurs in the transportation sector, it is not surprising that an increase in the price of gasoline mainly affects prices in this sector. Put simply, if the price of gasoline were to double, the prices of transport services would increase by 3.58%. In sharp contrast, the price of kerosene has one of the lowest impacts on production prices, with the largest energy price elasticities in chemicals and chemical products (0.21%), other services (0.08%), and fishing (0.06%) sectors.

Table 3: Total, direct, and indirect energy price elasticities of fuels in non-energy sectors (%)

Sec. No.	Electricity			Natural gas			Gasoline			Kerosene			Gas oil			Fuel oil			LPG		
	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.
11	0.47	0.21	0.26	0.14	0.01	0.14	0.33	0.13	0.2	0.02	0.01	0.01	0.22	0.14	0.08	0.06	0	0.05	0.02	0	0.02
12	0.59	0.25	0.33	0.23	0.01	0.22	1.5	1.26	0.23	0.06	0.05	0.01	0.79	0.71	0.08	0.06	0	0.06	0.08	0.05	0.03
13	2.66	2.41	0.25	0.23	0.06	0.17	0.5	0.29	0.22	0.02	0.01	0.01	0.69	0.63	0.06	0.12	0.04	0.08	0.03	0.01	0.02
14	0.58	0.15	0.43	0.37	0.2	0.17	0.34	0.02	0.33	0.02	0.01	0.01	0.21	0.04	0.17	0.11	0.04	0.08	0.02	0	0.02
15	2.02	1.41	0.61	0.58	0.18	0.41	0.28	0.04	0.23	0.04	0.01	0.03	0.15	0.05	0.1	0.11	0.05	0.06	0.11	0	0.1
16	1.35	0.81	0.54	0.22	0.05	0.18	0.33	0.09	0.24	0.03	0.01	0.01	0.16	0.06	0.1	0.12	0.05	0.07	0.02	0	0.02
17	3.3	2.47	0.83	2.71	2.08	0.62	0.37	0.08	0.29	0.03	0.01	0.02	0.17	0.07	0.1	0.18	0.09	0.09	0.05	0	0.05
18	1.76	1.04	0.72	1.98	1.36	0.62	0.36	0.07	0.29	0.21	0.16	0.05	0.16	0.06	0.1	0.13	0.03	0.1	0.7	0.54	0.16
19	4.3	3.69	0.62	2.81	2.51	0.3	0.57	0.14	0.44	0.03	0.02	0.01	0.35	0.21	0.14	1.87	1.66	0.21	0.07	0.04	0.02
20	8.36	6.53	1.83	7.43	6.14	1.3	0.59	0.08	0.51	0.02	0.01	0.01	0.32	0.11	0.21	0.23	0.06	0.16	0.03	0.01	0.02
21	2.44	0.6	1.83	1.71	0.26	1.44	0.45	0.04	0.41	0.01	0	0.01	0.16	0.02	0.14	0.13	0	0.13	0.03	0	0.03
22	1.83	0.58	1.25	0.84	0.14	0.69	0.58	0.18	0.4	0.04	0.01	0.03	0.22	0.06	0.16	0.21	0.01	0.2	0.08	0.01	0.07
23	1.45	0.03	1.42	0.99	0	0.99	0.63	0.15	0.48	0.01	0	0.01	0.24	0.07	0.16	0.34	0.01	0.33	0.02	0	0.02
24	1.81	1.65	0.15	0.87	0.78	0.09	0.59	0.33	0.25	0.01	0.01	0	0.21	0.15	0.06	0.1	0.02	0.08	0.01	0	0.01
25	0.99	0.7	0.29	1.22	1.05	0.16	0.21	0.02	0.2	0.02	0.01	0.01	0.11	0.02	0.09	0.07	0	0.07	0.06	0.05	0.01
26	0.65	0.34	0.31	0.26	0.07	0.18	3.58	3.15	0.43	0.01	0	0.01	0.78	0.68	0.1	1.17	1.04	0.13	0.02	0	0.02
27	0.75	0.6	0.15	0.29	0.21	0.08	0.36	0.26	0.11	0	0	0	0.05	0.02	0.02	0.03	0	0.03	0.01	0	0
28	0.23	0.05	0.18	0.14	0.02	0.12	0.09	0.01	0.08	0	0	0	0.03	0	0.03	0.05	0	0.05	0	0	0
29	0.52	0.29	0.23	0.28	0.13	0.15	0.64	0.52	0.12	0.01	0	0	0.08	0.05	0.04	0.04	0	0.04	0.02	0.02	0.01
30	0.65	0.52	0.13	1.04	0.96	0.08	0.37	0.28	0.08	0.04	0.03	0	0.12	0.09	0.02	0.03	0	0.03	0.02	0.02	0.01
31	0.74	0.58	0.16	0.71	0.58	0.13	0.32	0.25	0.07	0.04	0.03	0.01	0.11	0.09	0.02	0.02	0	0.02	0.04	0.01	0.03
32	1.43	1.2	0.24	1.45	1.26	0.19	0.48	0.35	0.13	0.08	0.08	0.01	0.16	0.12	0.04	0.17	0.12	0.05	0.05	0.03	0.01

Source: Authors' findings

Because of their substantial direct consumption of gas oil, fishing, transport, storage and communication, and other mining have the largest energy price elasticities of 0.79%, 0.78%, and 0.69%, respectively. The highest energy price elasticities for fuel oil are manufacture of non-metallic mineral products (1.87%), and transport, storage and communication (1.17%), mainly because of its direct impact. Finally, doubling the price of LPG increases the prices of chemicals and chemical products and textile, wearing apparel and leather industries by 0.70% and 0.11%, respectively. This is mainly associated with the direct consumption of LPG in these sectors. The highest indirect impact of an increase in the price of LPG appears in chemicals and chemical products.

3.2. Price effects on producers and consumers

Estimation of the energy price elasticities of these several fuels paves the way to examine the impact of energy subsidy reform on production costs and household expenditures and real incomes in Iran. Table 4 provides information on domestic and regional energy prices before and after the reform. Clearly, the gap in prices between domestic and regional prices in Iran has been considerable for much of recent history. Before implementation of the reform, the ratios of international prices to domestic prices for electricity, natural gas, gasoline, kerosene, gas oil, fuel oil, and LPG were 4.68, 22.96, 5.36, 38.7, 37.81, 41.49, and 11.49, respectively. In the first phase of the reform from December 2010, the government increased the domestic prices of these same fuels by 172%, 569%, 300%, 506%, 809%, 201%, and 223%, respectively. Article 1 of the Subsidy Reform Law requires that the domestic sale prices of energy carriers should adjust gradually until the end of the Fifth Five-Year Development Plan (2010–15) to a level not less than 90% of Persian Gulf FOB[1] prices. However, it is not clear when and in how many steps the next phases of reform will proceed.

1. Freight on Board (FOB)

Table 4: Domestic and regional energy prices before and after the reform (IRR)

	Domestic energy prices in 2009/10 – before reform	**Average regional market prices in 2009/10**	**Domestic energy prices in 2010 – after reform**
Electricity	165	773[a]	450
Natural gas	104.5	2400[b]	700
Gasoline	1000	5362[c]	4000
Kerosene	165	6392[c]	1000
Gas oil	165	6239[c]	1500
Fuel oil	94.5	3921[c]	2000
LPG	309.1	3605[c]	1000

Source: MoE (2010) and MoP (2009).
[a] Export price (IRR/kWh), [b] Export price (IRR/m3), [c] FOB price of refined petroleum products in Persian Gulf (IRR/liter); Note: 1 USD = 9,917 IRR in 2009/10.

Because of some ambiguity about the phases of reform and the market prices of fuels in 2015, we examine the impact of the subsidy reform on production and consumption prices using two scenarios. The first scenario (phase 1) is where the price changes correspond to the first phase of reform in 2010. This is because analyzing the price impact of the first reform phase is essential from a policy viewpoint, particularly as we can compare the results with the real initial increase in prices as reported by Central Bank of Iran. The second scenario (full/complete reform) assumes that domestic energy prices increase immediately to average regional market prices in 2009/10. In practical terms, the results of this second scenario can improve our understanding about the overall inflationary impact of a full energy price adjustment in Iran.

Table 5 details the total, direct, and indirect impact of energy subsidy reform under two alternative scenarios. It is apparent that the removal of energy subsidies principally affects the manufacture of non-metallic mineral products (19), basic metal industries (20), and transport, storage and communication (26) sectors. While the first phase of reform respectively increased the production prices of these sectors by 66.03%, 65.87%, and 43.38%, the removal of energy subsidies would increase production prices in these same sectors by 170.71%, 218.64%, and 100.58%, respectively. Four sectors are affected less by the increase in energy prices, i.e. real estate and business services (28), financing and insurance (27), public administration, defense and social security (29), and agriculture, hunting and forestry (11). We expect that by removing all energy subsidies in Iran, the increase in production prices in these sectors would not exceed 7.71%, 13.7%, 15.95% and 17.44%, respectively.

As with the energy price elasticities, comparison of the total and direct effects for both scenarios reveals that the sectors experiencing the largest total impact are the main consumers of energy, mostly because of their large energy input shares. However, the picture for indirect effects differs. The main increase in the price of non-energy inputs resulting from the increase in energy prices occurs in the construction (23), basic metal industries (20), and fabricated metal products (21) sectors. Increasing energy prices in the first phase respectively increases production prices in these sectors by 17.60%, 17.11%, and 16.52% indirectly. These rates for the full reform are around 49.03%, 52.28%, and 51.47%, respectively.

To understand the impact of the reform on Iranian households, we estimate the changes in consumption prices and real incomes of urban and rural households. Table 6 shows that by removing all energy subsidies in Iran, cosumption prices would increase by 54.1%, representing a strong and highly destructive shock for most Iranian households. The results also reveal that rural families will suffer the burden of inflation more than urban families. For example, we expect consumption prices to increase by 51.49% in urban areas and 63.22% in rural areas. Comparison of the change in consumption prices across the first and the second scenarios reveals that the gradual phasing out of energy subsidies can control and reduce the impact of these potentially devastating shocks on households, especially poor households. Overall, the results from the first scenario show that the first phase of reform will increase consumption prices by 18.86% nationwide. In the second scenario, inflation would hit rural households particularly hard relative to their urban counterparts, i.e. 19.71% vs. 18.61%.

Table 5: Effects of energy subsidy reform on producer prices (%)

Sector number	Scenario 1: First phase			Scenario 2: Complete reform		
	Total	Direct	Indirect	Total	Direct	Indirect
11	5.62	1.99	3.63	17.44	6.99	10.45
12	14.80	10.34	4.46	48.16	34.96	13.20
13	15.59	11.38	4.22	48.41	36.88	11.53
14	8.29	2.58	5.71	25.07	8.29	16.78
15	11.53	4.98	6.55	34.32	13.53	20.80
16	8.43	3.42	5.00	23.16	9.01	14.15
17	27.58	18.78	8.80	88.62	61.76	26.86
18	21.87	12.82	9.05	77.79	49.02	28.78
19	66.03	56.51	9.52	170.71	145.62	25.09
20	65.87	48.76	17.11	218.64	166.35	52.28
21	19.45	2.93	16.52	60.72	9.25	51.47
22	16.10	3.16	12.94	46.54	9.16	37.38
23	18.90	1.29	17.60	53.01	3.98	49.03
24	13.61	9.88	3.73	40.60	31.18	9.42
25	11.74	7.62	4.13	39.47	27.61	11.86
26	43.38	36.86	6.51	100.58	83.70	16.88
27	4.98	3.22	1.77	13.70	8.94	4.75
28	2.79	0.27	2.52	7.71	0.85	6.86
29	5.93	3.23	2.70	15.95	8.23	7.72
30	9.97	8.19	1.79	34.09	29.12	4.97
31	7.90	5.93	1.97	26.45	20.30	6.15
32	17.46	14.18	3.28	55.78	46.21	9.57

Source: Authors' findings

The loss in household annual real income under the two scenarios would be in the order of more than 274,500 billion IRR (about 27.6 billion USD, considering the exchange rate of 2009/10) in the first scenario and 787,600 billion IRR in the second scenario (some 79.4 billion USD in 2009/10). Because of the relatively greater expenditures of urban households, urban households stand to lose between 1.5 and 1.29 times more under the reform scenarios than would rural households. Since the Reform Law requires the government to compensate for the increased burden of charges, we calculate the compensatory payments per person in Table 6. As shown, if the government were to remove all energy subsidies, it would need to transfer 11.25 million IRR to each person annually, whereas the required amount is close to 3.92 million IRR in the first phase of the reform only.

We can see a sizeable difference between what has been already transferred to households and that inferred by our model. At present, the government pays 450,000 IRR to each registered person per month, while the model instead proposes 327,000 IRR. In addition, the model suggests that the payments to urban residents per month should exceed those for rural residents, 365,000 IRR vs. 242,000 IRR. This lies counter to the currently equal compensatory payment to all Iranians, regardless of income or residence.

The main reason for the current overpayment can root in controlling the expected inflation among the inhabitants. The government has tried to send this message to the people that the energy subsidies reform never worsens their living conditions, but the reform improves it by increasing their income. However, when the payment is constant in the following years of starting the reform, the government knows that the real compensatory receipts reduce dramatically by increasing the inflation rate.

Table 6: Effects on consumption prices and real incomes

	National	Urban	Rural
Household consumption price changes: Scenario 1 (%)	18.86	18.61	19.71
Household consumption price changes: Scenario 2 (%)	54.10	51.49	63.22
Change in household annual real income at 2010 prices: Scenario 1 (IRR millions)	-274,513,902	-210,492,109	-64,021,793
Change in household annual real income at 2010 prices: Scenario 2 (IRR millions)	-787,633,782	-582,303,183	-205,330,600
Compensatory payment per year per person at 2010 prices: Scenario 1(IRR millions)	3.92	4.38	2.91
Compensatory payment per year per person at 2010 prices: Scenario 2(IRR millions)	11.25	12.13	9.33

Source: Authors' findings

4. Conclusion

The study examined the impact of energy subsidy reform in Iran under two alternate reform scenarios. Our analysis revealed the tremendous inflationary impact of a complete energy subsidy reform on the production and consumption prices. The results showed that full reform would increase consumption prices by 54.1%. Further, although the increase in consumption prices affected rural households more, families in urban areas potentially lose greater real income because of their higher level of expenditure. In the reform procedure, the manufacture of non-metallic mineral products, basic metal industries, and transport, storage and communication sectors would experience the largest increase in production prices. Consideration of the sector energy price elasticities confirms that all of the fuels, electricity, natural gas and gasoline have the largest impact on production prices.

We now propose some policy implications: First, a gradual and phased reform process imposes lower inflation on producers and households and provides sufficient room for policy makers to modify any succeeding phases to help alleviate any negative effects. Second, given that the real income losses of households differ according to income and geographic location, the government of Iran should compensate for losses in a discriminatory manner with some households receiving relatively more (less) compensation for the increase in consumption prices. Finally, since the increases in the prices of some fuels, such as electricity and gasoline, have a potentially greater inflationary impact, the pace of the reform for these fuels should be more gradual.

However, it is of course essential to note that we should interpret the results of this analysis with some caution. First, although we used an updated input–output table, the non-survey based updating approaches (such as RAS) enter some uncertainties to the study. Second, the Leontief price model has some deficiencies because of its relatively restrictive assumptions concerning the lack of substitution between factors and the null role of final demand in the economy price setting.

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