IDEC DP² Series Vol. 2 No. 8

Developmnet Discussion Policy Paper

A general equilibrium analysis of the inflationary impact of energy subsidies reform in Iran

Hossein Mirshojaeian Hosseini and Shinji Kaneko

February, 2012

Department of Development Policy
Division of Development Science
Graduate School for International Development and Cooperation (IDEC)
Hiroshima University
1-5-1 Kagamiyama, Higashi-Hiroshima
739-8529 JAPAN

A general equilibrium analysis of the inflationary impact of energy subsidies reform in Iran

Hossein Mirshojaeian Hosseini[1]

Shinji Kaneko

Graduate School for International Development and Cooperation, Hiroshima University, 1-5-1 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8529 Japan.

ABSTRACT

Iran has suffered ever-increasing domestic energy consumption mostly due to its price controlling policy. If the trend continues, it will become a pure importer in the following decades. To avoid that unlucky fate, Iran started the energy subsidies reform on December 2010. It increased domestic energy and agricultural prices up to 20 times, making it the first major oil-exporting country to reduce substantially implicit energy subsidies. The paper studies the inflationary impact of the energy subsidies reform on different non-energy sectors and urban and rural households in Iran. For this purpose, the input-output price model of Iran is made and energy cross-price elasticities of non-energy sectors are derived. The results evidence the tremendous effects of the complete reform on the production and consumption prices.

Keywords: Energy subsidies reform, production and consumption prices, Iran, Input-output price model, Decomposition

JEL Classification: C67, E31, Q48

[1] Corresponding author, E-mail: mirshojaeian@hiroshima-u.ac.jp, mirshojaeian@ut.ac.ir, Tel.:+81-8042650580.

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). From economic perspective, subsidies can increase energy consumption, reduce incentives for energy efficiency, decrease foreign exchange revenues, drain and divert public budgets, increase countries' dependence on imports, undermine investment in alternative energy sources and technologies, substitute energy with capital and labor, lead to shortages or costly rationing systems, and finally promote smuggling and corruption. While energy subsidies encourage consumption, they increase local and global emissions, water pollution, landscape destruction, and depletion of non-renewable fossil-fuel stocks. At last, energy subsidies are featured by grievous social impacts. Usually, subsidies benefit the rich more than the poor, do not target types of energy more beneficial to the poor, divert government money from social programs, and make the poor suffer local emissions and consequently diseases made by the rich.

Different studies attempted to estimate energy subsidies around the world or for specific countries (Larsen and Shah, 1992; Myers and Kent, 2001; EIA, 2007; Coady et al., 2006). What they found is subsidies are large and the developing countries account for the bulk of them. They also suggest that most of energy subsidies in developing countries benefit consumers by controlling energy prices, whereas they target producers in developed countries in the form of direct payments or support for research and development (UNEP, 2008). Larsen and Shah (1992) estimated fossil-fuel consumption subsidies from under-pricing alone at around 230 billion USD per year that two-third has been paid by Former Soviet Union. Myers and Kent (2001) approximated net global consumption subsidies at 235 billion USD per year. EIA (2007) discovers that energy subsidies in the twenty largest non-OECD countries amount to around 220 billion USD at 2005, of which subsidies to fossil fuels account for around 170 billion USD. Assuming that subsidies per unit of energy consumed are of the same magnitude in other non-OECD countries and that OECD consumption subsidies are minimal, around 300 billion USD or 0.7 percent of world GDP paid for energy subsidies in the respective year. Coady et al (2006) also study the magnitude and distribution of fuel subsidies in specific developing countries.

Aside from the considerable share of subsidies in their GDP (2% – 4.3%), Coady et al. (2006) found out that energy subsidies are badly targeted in all of the analyzed countries.

Among the developing countries, Gupta et al. (2002) found oil-exporting countries as the main net subsidizers of petroleum. 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, EIA (2007) reveals that major energy subsidizers are oil-exporters. Russia had the largest subsidies in dollar terms at 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 at the same year. China, Saudi Arabia, India, Indonesia, Ukraine, Egypt, Venezuela, and Kazakhstan are the next largest energy subsidizers which are mostly oil-producers.

Iran, as the third main petroleum exporter in OPEC, has suffered ever-increasing domestic energy consumption mostly due to its price controlling policy. While domestic final energy consumption devoured 5% of total energy production in 1967, the ratio increased to 42% in 2009 (MoE, 2010). If the trend continues, Iran will become undoubtedly a pure importer in the following decades. To avoid that unlucky fate, Iran started the energy subsidies reform on December 2010. It increased domestic energy and agricultural prices up to 20 times, making it the first major oil-exporting country to reduce substantially implicit energy subsidies (Guillaume et al., 2011). The paper studies the inflationary impact of the energy subsidies reform on different non-energy sectors and urban and rural households in Iran. For this purpose, the input-output price model of Iran is made and energy cross-price elasticities of non-energy sectors are derived. The results evidence the tremendous effects of the complete reform on the production and consumption prices.

The paper is organized as follows. The second section introduces the trends of some main energy indicators in Iran. The third section explains the energy pricing and energy subsidies reform in Iran. While the literature would be reviewed in section 4, section 5 explains the methodology of the input-output price model. Finally, the results would be presented in section 6. The last section will conclude and propose a number of policy implications.

2. Energy indicators in Iran

Iran is a country in Central Eurasia and Western Asia with a population of over 74 million (SCI, 2010). It is a country of particular geostrategic significance because of its location in the Middle East and Central Eurasia. In addition, it is the eighteenth largest country in the world, with an area of 1,648,000 km2 (SCI, 2010).

Although oil and gas production has accounted for an increasingly smaller share of real GDP, oil and gas revenues remain the main source of foreign exchange earnings and fiscal revenues. The share of oil in real GDP fell from an average of 40 percent of real GDP in the 1960s to about 10.5 percent in the last decade, reflecting average annual non-oil GDP growth rate of 5.7 percent compared to only 4.4 percent for oil and gas GDP. Oil and gas receipts accounted for about 72 percent of export revenues in the last decade, despite rapid non-oil export growth. Oil and gas revenues also account for 65 percent of fiscal revenues, and are likely to remain the main source of financing for development projects in the foreseeable future notwithstanding recent efforts to diversify fiscal revenues (Guillaume and Zytek, 2010; Guillaume et al., 2011; IMF, 2011)

Table 1 illustrates the energy balance of Iran in 2008. From the balance, Iran could produce 2428.4 MBOE of different types of energy, mainly petroleum and refined petroleum products (66%) and natural gas (33%). Near to 44% of total produced energy was exported, as the main source of fiscal revenue, and the remainder was consumed domestically. The main energy consumers in Iran were residential, public, and commercial sectors, transportation sector, and industrial sector that accounted for 37%, 25%, and 23% of total energy demand. Following the production pattern, the main consumed energy carriers were fossil fuels. Petroleum products and natural gas accounted for 47.9% and 42.6% of total energy consumption, respectively. The share of electricity consumption was only 8.6%.

Table 1

Energy balance of Iran in 2008 (Million Barrel Oil Equivalent)

Description	Petroleum and refined petroleum products	Natural gas	Coke	Renewable energies (solid biomass and biogas)	Hydro power	Solar and wind energies	Total electricity	Total energy
Production	1606.6	805.3	7.8	5.6	2.9	0.1	-	**2428.4**
Import	84.3	44.5	3.7	-	-	-	1.0	**133.5**
Export	-1029.8	-29.7	-0.2	-	-	-	-2.3	**-1062.0**
Energy consumption in energy sectors and energy losses	-127.7	-344.9	-8.4	0.0	-2.9	-0.1	97.9	**-386.2**
Total energy supply	**533.5**	**475.2**	**2.9**	**5.6**	**0**	**0**	**96.6**	**1113.8**
Residential, public and commercial sectors	82.8	277.1	0.1	5.6	-	-	49.4	**415.0**
Industrial sector	73.0	147.3	0.3	-	-	-	32.2	**252.8**
Transportation sector	269.8	11.6	-	-	-	-	0.1	**281.6**
Agricultural sector	27.9	1.5	-	-	-	-	12.5	**41.9**
Other sectors	-	-	-	-	-	-	2.4	**2.4**
Non-energy utilization	79.9	37.7	2.5	-	-	-	-	**120.1**
Total energy demand	**533.5**	**475.2**	**2.9**	**5.6**	**0**	**0**	**96.6**	**1113.8**

Fig. 1 and 2 show the trend of fossil fuels and electricity consumption in Iran over the period 1973–2008. Despite a temporary decline in consumption of gas oil, fuel oil, and kerosene at the end of 1990s, the consumption of all types of fuels have increased enormously over the last decades. In the years after the Revolution (1979), the consumption of gas oil, fuel oil, gasoline, kerosene, LPG, natural gas, and electricity have grown annually 4.17%, 5.07%, 5.48%, 1.06%, 3.48%, 9.24%, and 8.54%, respectively. Fig. 3 compares the growth rates of GDP, final energy consumption, and population in Iran over the period 1968–2008. Almost, the growth rate of final energy consumption has been greater than the growth rates of GDP and population. It reflects the low share of energy expenditure in total spending of households and cost of producers due to low energy prices.

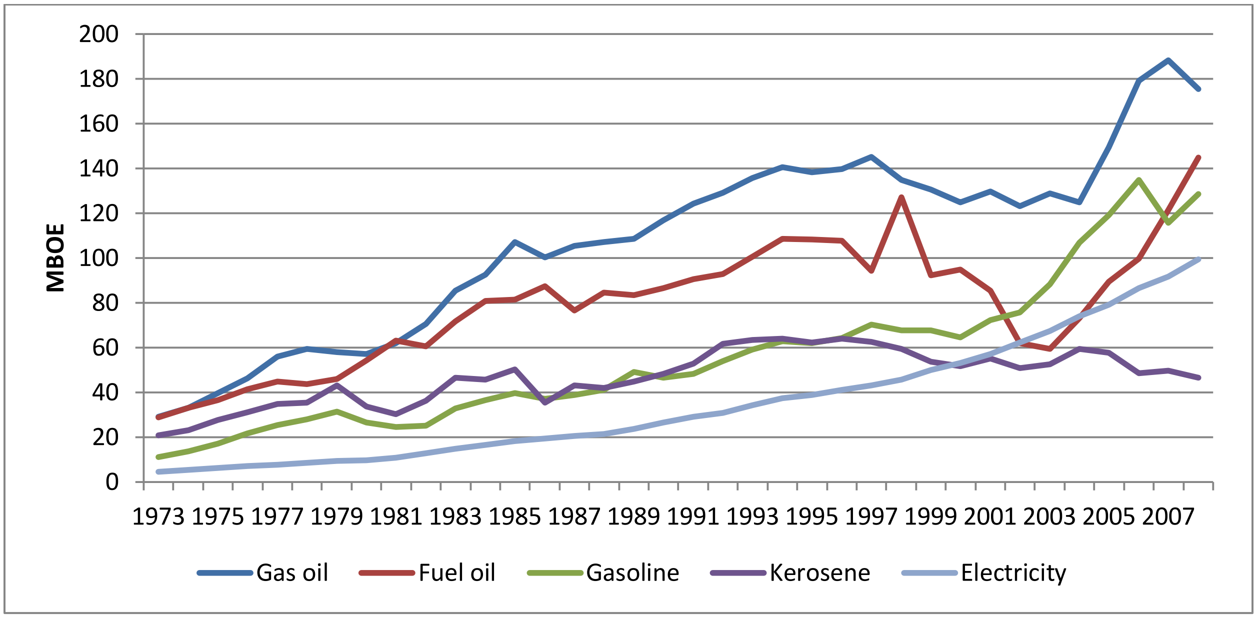


Fig. 1. Trend of total gas oil, fuel oil, gasoline, kerosene, and electricity consumption (1973-2008)

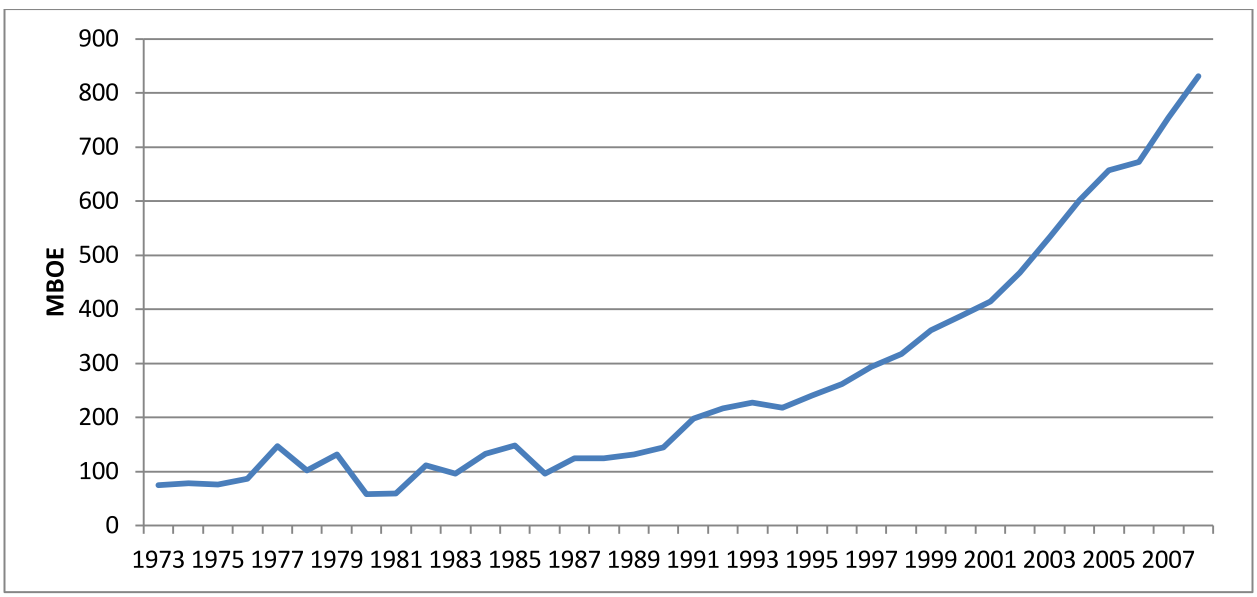


Fig. 2. Trend of total natural gas consumption (1973-2008)

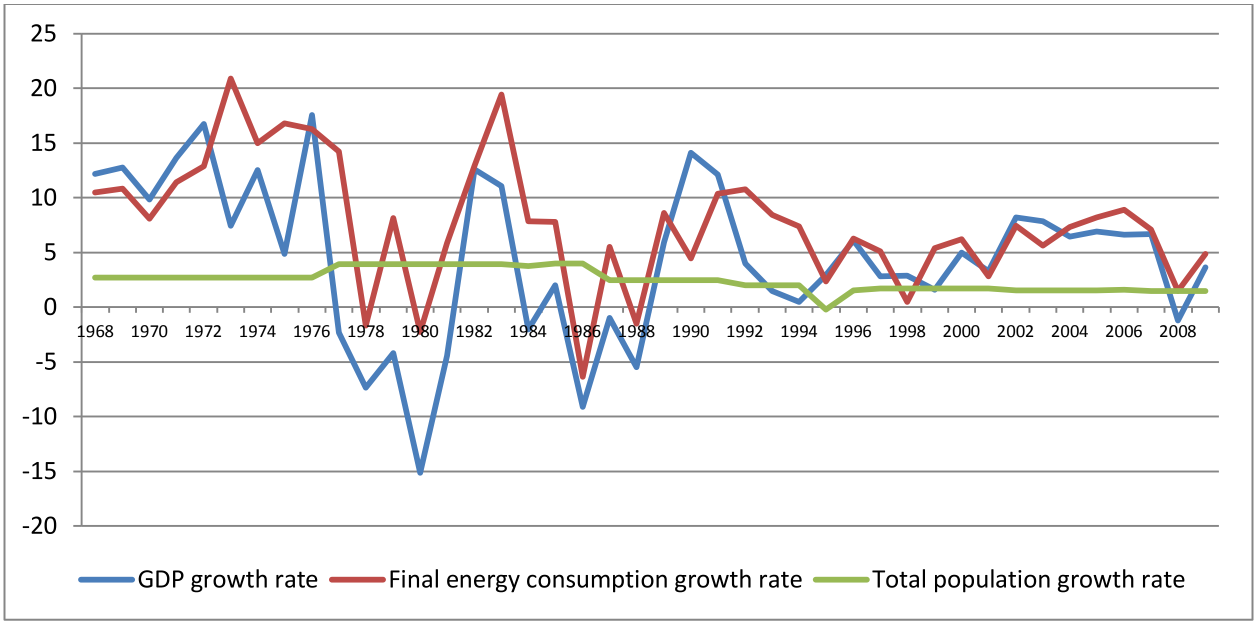


Fig. 3. Comparison of GDP, final energy consumption, and population growth rates in Iran (1968-2008)

As it is obvious in Fig. 4, the consumption pattern of some sectors has changed essentially since 1970. Although the predominant fuels in transportation sector are still refined petroleum products, electricity and natural gas have substituted with petroleum products in residential, public, and commercial sector, industrial sector, and agricultural sector. Iran has the second largest natural gas reservoirs in the world and invested hugely to increase its production. In addition, it followed an ambitious and prolonged plan to expand the domestic natural gas pipelines, especially because it is a clean fuel and substitutable to petroleum, which can be exported more easily. While the extraction of natural gas started in 1972, it accounted for 66.38%, 58.29%, 4.12% and 3.52% of total energy consumption in residential, public, and commercial sector, industrial sector, transportation sector, and agricultural sector respectively in 2008. As well, electricity accounted for 12.42%, 12.73%, 0.05% and 29.47% in the respective sectors.

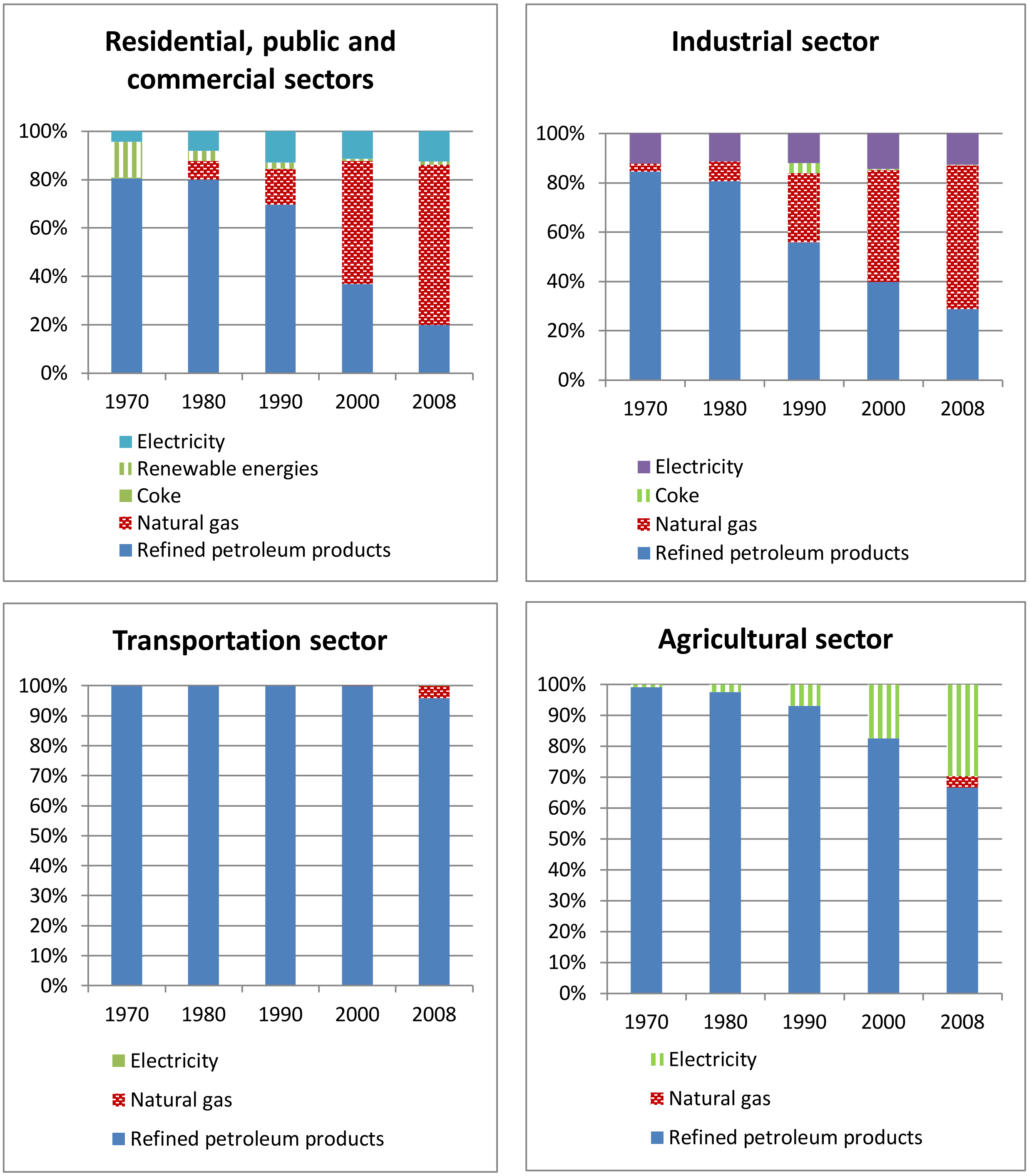


Fig. 4. Composition of sectoral energy consumption by fuel type in Iran at selected years

Fig. 5 shows the trend of energy intensity (energy consumption/GDP) in Iran as a whole and by fuel over the period 1973-2007. The graph illustrates when total energy intensity was 0.66 BOE/Million IR. Rials in 1973, it increased extremely to 2.18 after three decades. The main contributor is undoubtedly natural gas which accounted for 69% of total energy intensity in 2007. Due to the low price of natural gas (1.03 cents/m3), the energy intensity of natural gas increased from 0.42 BOE/Million IR in 1973 to 1.51 in 2007, that shows an averagely 6.23% growth rate per year.

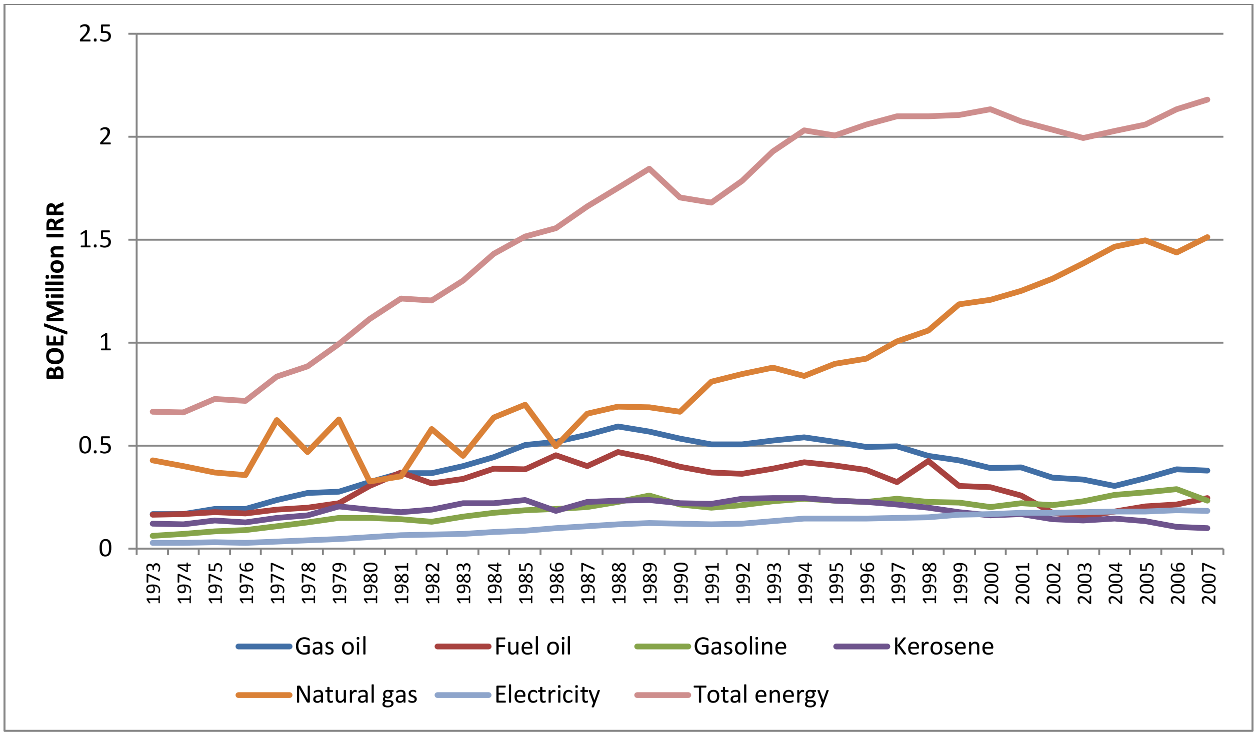
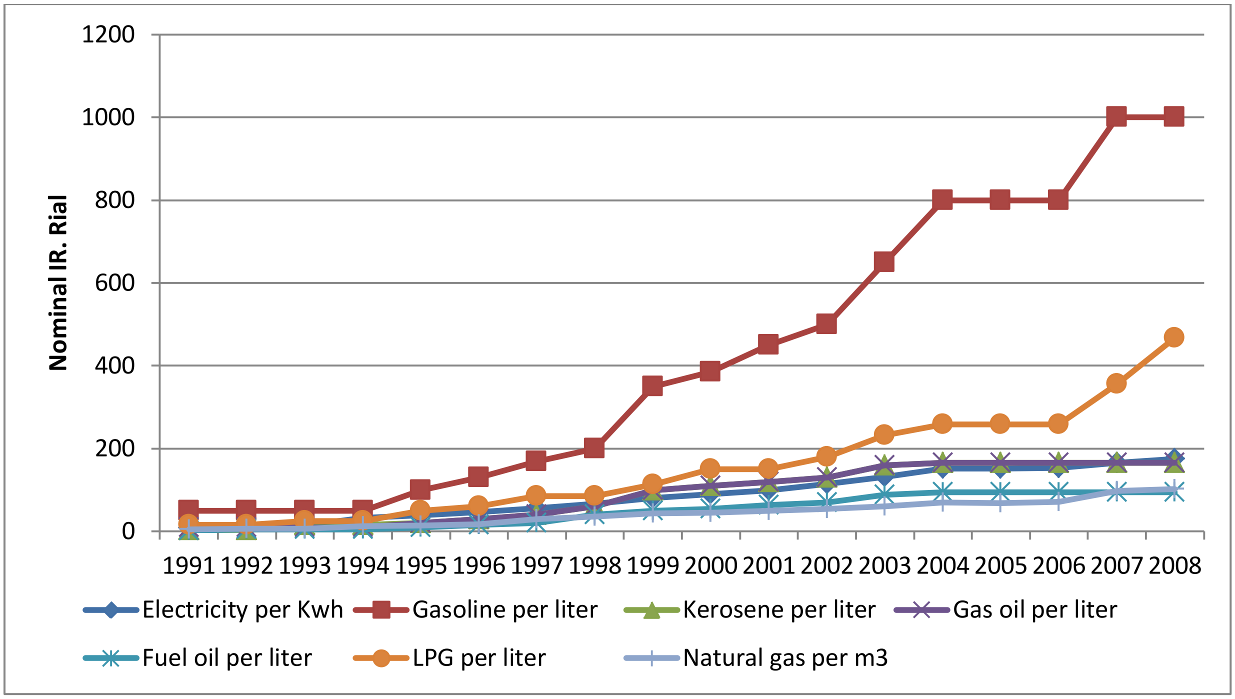


Fig. 5. Trend of energy intensity by fuel type in Iran (1973-2007)

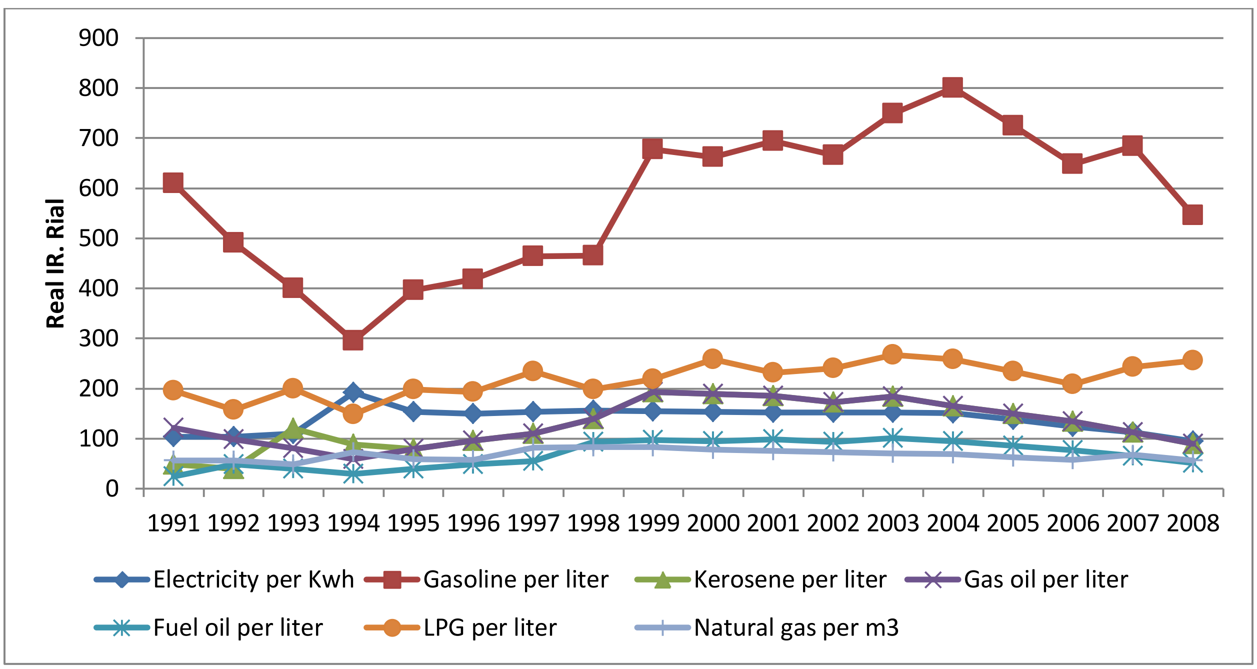
3. Energy pricing and energy subsidies reform

Domestic energy prices have historically been set administratively in Iran. Fig. 6 and 7 depict the level and trend of nominal and real energy prices over the period 1991–2008. Apparently, the nominal prices have been increased by government through the period of study. In the last decade (1998-2008), nominal prices of LPG, gasoline, natural gas, gas oil, kerosene, electricity, and fuel oil were increased 10.6%, 11.1%, 9.2%, 5.1%, 5.1%, 7.5%, and 6.6%, respectively. However, deduction of annual inflation rate from the nominal price growth rate makes an inverse picture. In the same period, real prices were growing -3.6%, -3.1%, -4.7%, -8.3%, -8.3%, -6.3% and -7.1% respectively, that evidence the energy prices got cheaper relatively.



Source: MoE (2010)

Fig. 6. Nominal energy prices in Iran (1991–2008)



Source: MoE (2010)

Fig. 7. Real energy prices in Iran (1991–2008)

IEA (1999) defines an energy subsidy as any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers. Table 2 shows an approximate of energy subsidy in Iran by sector and energy type in 2008. All the figures are calculated by taking the gap between the domestic and global prices, adding all of direct financial payments which reduce the final prices for consumers. Table 2 indicates that all types of subsidies in energy sector were totally near to 442,033 billion IR. Rials (44.5 billion USD), or 6,002 thousand IR. Rials per person (605 USD) in 2008. Among the consumers, transportation sector accounted for 40.2% of total energy subsidies. The next most significant consumers were residential and industrial sectors that accounted for 25.2% and 17.8% of total energy subsidies, respectively. Commercial sector received the least amount of subsidy (3.6%). From the fuel perspective, most of subsidies are paid for gas oil (27.3%), and then electricity and gasoline fuels (26.2% and 18.2% respectively). The least amount of subsidies was paid for LPG which has the smallest share in total energy consumption. Total amount of energy subsidies is equal to about 11% of GDP at 2008.

Table 2
Energy subsidy in Iran at 2008 (Billion IR Rials)

Sector	Residence	Industry	Agriculture	Transport	Commerce	Public	Total	%	% of GDP
Gasoline	-	285.8	124.8	79914.6	2.4	235.7	80563.3	18.2	0.020
Kerosene	319	239.5	-	80.7	252.1	26364.5	27255.7	6.2	0.007
Gas oil	2724.8	12809.9	18649.3	80214.6	1915.1	4486.6	120800.3	27.3	0.030
Fuel oil	-	23505.7	-	12837.8	3841.1	791.2	40975.7	9.3	0.010
LPG	9619.4	1232	-	2421.2	-	-	13272.7	3	0.003
Electricity	47596	27321	15006	134.3	8673.3	17044.5	115775.5	26.2	0.028
Natural gas	25173.9	13411.3	209.9	2100.8	1448.6	1045.3	43389.7	9.8	0.011
Total	111478.6	78817.9	34071.2	177623.2	16119.9	23922.2	442033	100	0.108
%	25.2	17.8	7.7	40.2	3.6	5.4	100	-	-
% of GDP	0.027	0.019	0.008	0.044	0.004	0.006	0.108	-	-

Source: MoE (2010) and author calculation - 1 USD = 9,917 Rials

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

- 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 Iranian economy.
- 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 about the necessity of subsidies reform, the parliament approved the Reform Act on January 5, 2010. The Reform Act envisaged the replacement of product subsidies with targeted transfers to the population, with some assistance to Iranian companies and the government. The Reform Act stipulated that households would receive at least fifty percent of the increase in revenues derived from the reform. Initially, the benefits were to be paid in cash, while in a second phase, some of the additional revenues were to be used to support higher social benefits and public goods. Thirty percent of the additional revenues were to be used to assist Iranian companies restructure to adjust to the new, dramatically higher energy costs. The remaining twenty percent of the additional revenues would go to the government to cover government's own higher energy bill. Article 15 of the Reform Act authorized the government to establish a new Subsidy Targeting Organization to ensure efficient centralized management of the reform.[1]

On December 19, 2010, Iran increased domestic energy and agricultural prices by up to 20 times, making it the first major oil-exporting country to reduce substantially implicit energy subsidies. In the next phases, prices would be increased stepwise until all the subsidies would be

[1] The Reform Act is available at this address: http://www.icana.ir/News/Parliament/2010/1/52183/0/Default.aspx. The English version can be accessed in Guillaume et al. (2011)

removed. Since starting the first phase, the government has compensated the burdened charges by transferring 450,000 IR. Rials (near to 40 USD) per person to the head of households.

As the reform is newborn, it is too early to evaluate its effects on the economy. However, looking to the published official data shows that the first phase of the reform increased the monthly inflation rate averagely 1%. Fig. 8 depicts Consumer Price Index (CPI) at urban areas in the preceding and following months of starting the reform (CBI, 2011).

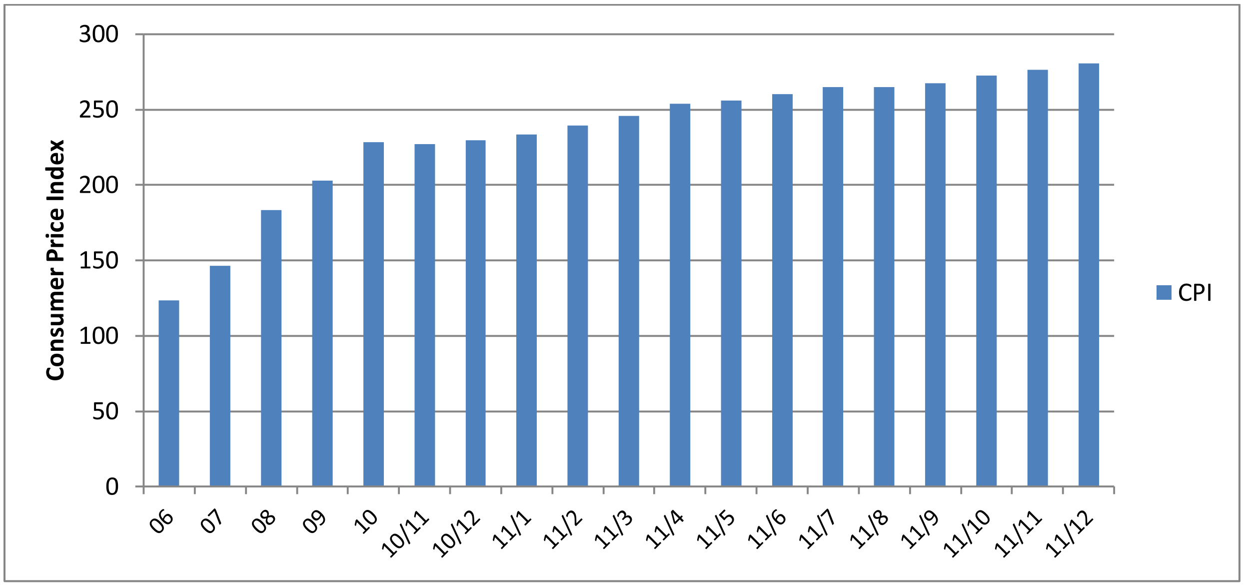


Fig. 8. Consumer Price Index (CPI) at urban areas before and after starting the reform in Iran, 2004/2005=100

4. Literature review

Several literatures studied the impact of new energy prices on total prices at production and consumption levels. The input-output price model is an approach used to analyze the effects caused by fluctuations in energy prices. For instance, Liop and Pié (2008) analyzed the effects of a tax on intermediate energy use and a reduction in intermediate energy demand on production and consumption prices in Catalan. Using a competitive price and a mark-up price formulation in the framework of an input-output model, they found a tax on intermediate energy uses increases the consumer price index, and this decreases the intermediate demand for energy and has a negative effect on private real income. However, levying a tax combining with a reduction in the intermediate demand for energy not only reduces energy consumption, but also has no effects on prices and positive impact on private real income. Liop (2008) used the same research questions and methodology for Spanish water sector. The results of this study are completely the same as before. Nguyen (2008) studied the impacts of increasing electricity tariff to the long-run marginal cost on prices of other products in Vietnam using a static input-output approach. He ascertained that such an increase would drive up the prices of all other sectors. While it would be difficult to implement this increase at one time, the author proposed to increase the electricity tariff gradually.

Liu et al. (2009) evaluate how the alternative policies, such as increasing the prices of intermediate electricity use and implementing energy saving projects and reducing intermediate electricity use, may affect production prices, consumption prices, and real income of rural and urban households in Chinese economy. Applying an adjusted input-output price model, they found increase in energy price causes a general increase of production and consumption prices, while decreases household real income especially in urban areas. Combination of two complementary policies may somewhat diminishes the prices. Combining the portfolio and input-output approaches, Suzuki and Uchiyama (2010) measured the risk of an increase in the producer price in Japanese non-energy sectors due to an increase in the price of imported fossil fuels. They also measured the energy cross-price elasticities in Japanese non-energy sectors, using an input-output price model. Their results indicate that almost all non-energy sectors have reduced their risk as the result of improvement in energy usage by upstream sectors.

Some of the international studies have investigated the effects of subsidy phase out in the economy of Iran (Birol et al., 1995; Jensen and Tarr, 2003; AlShehabi, 2011). For instance, Birol et al. (1995) tried to quantify the potential gains from both the removal of energy subsidies and the improvement in autonomous energy efficiency in Iran and two other oil-exporting countries. In a scenario that domestic energy prices arrive at international prices and energy efficiencies improve to autonomous energy-efficiency improvement rate, they found the savings in the economy of Iran could be as high as 20% over the period 1993-2005. Using a multisector Computable General Equilibrium (CGE) model, Jensen and Tarr (2003) estimate the gains of tariffication of nontariff barriers, lowering the tariffs, unification of the exchange rate for import purchases, and energy pricing reform in Iran. Regarding the relative importance of the reforms, they found that the largest gains come from the energy pricing reform, as this reform alone results in an estimated gain of 32% of consumption.

AlShehabi (2011) studied the effects of eliminating crude oil and fuel oil subsidies on the labor market using two alternative policy options. The first option redistributes additional revenues as extra income to households, while the second directs revenue into increased investment. He found even though real GDP and household welfare rises in the first scenario, the wages and quantities employed of labor suffer due to the Dutch disease effect and the increased costs of inputs. In the second scenario and in the short time, channeling of revenues cause a contraction in the labor market, nevertheless it expands the market over time due to capital accumulation effects and shifts in the structure of economy.

The pitfall of such studies is disregarding the negative effects which may slow down the pace of the reform or in extreme cases, stop the policy. Several studies have been domestically carried out to estimate the economic effects of energy subsidies reform in Iran. For instance, Khiabani (2008) used a standard CGE model to examine the effects of increase in the price of energy carriers on production costs, inflation and economic welfare of different income deciles. The results indicate that if the fuel prices arrive at the international prices, total inflation rate increases by 35 percent, output and employment decreases by 4.5 and 6.8 percent respectively, and the government revenue rises by 40 percent. Using an autoregressive distributed lag model (ARDL), Ghaderi and Estedlal (2009) measured the effects of an increase in the price of electricity by quantifying compensating variation (CV) and dead weight loss (DWL) of Iranian residential consumers. They show that although CV and DWL is larger in higher income groups, lower income groups will be affected more due to bigger expenditure share of electricity.

Applying a CGE model and using a Micro Consistent Matrix, Manzoor et al. (2010) examined the effects of energy implicit and explicit subsidies phase out in Iran. They concluded that the policy increases the inflation rate around 57.9 to 69.07 percent, reduces the total output about 2.11 to 2.22 percent, and declines the household welfare around 11.80 to 12.62 percent. Akhoond zade et al. (2011) used an Almost Ideal Demand System (AIDS) to appraise the welfare effects of energy price reform in Iranian construction and transportation sectors. The results demonstrated that the share of energy cost in total expenditure in transportation sector is more in the middle income groups. This ratio declines in construction sector as income grows. The CV is larger in the higher income groups and more significant in the urban areas.

Using input-output and social accounting matrix (SAM) price models, researchers studied the effects of energy subsidies reform in Iran. Perme (2005) indicated that removing the subsidies of refined petroleum products, natural gas, and electricity would increase the average national price index by 19.52, 11.07, and 4.83 percent, respectively. If all the energy subsidies are removed contemporaneously, the price index would be raised by 35.4 percent. Sharifi et al. (2008) showed that the most affected sectors from energy subsidies reform are non-ferrous mineral product, forestry, and refined petroleum product. They found that electricity has the highest inflationary impacts among the energy carriers. Shahmoradi et al. (2010) found that increasing the inland fuel prices to the international level will increase consumer and producer price indices by 108 and 118 percent, respectively. The freight and passenger rail transportation would be impressed primarily by 263 percent increase in service prices. In the absence of any protection program, social welfare would be decayed 79 percent, significantly in rural areas. Finally, the study of Heydari and Perme (2010) evidences that removing the fuels and bread subsidies increases the expenditures of urban and rural households at least 33 and 40 percent, respectively.

5. Methodology

5.1 Input-output price model

The input-output price model or as usually called the Leontief price model is the analytical framework that can examine the effects of energy price fluctuations in a static manner. The starting point in derivation of the model is summing down the *j*th column in a usual input-output table.

$$x_j = \sum_{i=1}^{n} z_{ij} + v_j$$

or

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

where X, Z, and V are total outlay, transaction, and value added matrixes and i depicts the unity vector. Substituting $Z = A\hat{x}$ and postmultiplying by $\hat{X}^{-1}$,

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

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, so each price is equal to unity. The vector *i* can be interpreted as the index prices in the base year. If we denote these base year index prices by P vector, the input-output price model is as Eq. (3) (Miller and Blair, 2009).

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

Following Suzuki and Uchiyama (2010), we make two modifications to Eq. (3). First, energy prices will be externalized by decomposition of 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 indicate the index prices in energy and non-energy sectors, V_{ce} and V_{cn} indicate the value added in energy and non-energy sectors per unit of their production, and as an example in technical matrix (A), A_{en} show the share of energy input transferred to non-energy sectors in the total outlay of non-energy sector. In a country like Iran that the energy prices are set administratively, price of energy is an exogenous variable. While the production costs of non-energy products can be influenced by the prices of energy carriers, the only significant equation that can be derived from Eq. (4) is as follows.

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

Eq. (5) can be used 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.

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

The second modification is extraction of imported non-energy commodities from the price model. Indeed, domestic energy prices are not the determinants of the prices of imported non-energy products. For this purpose, Eq. (6) needs to be modified 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.

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

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

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

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

$$P_C = \sum_{j=1}^{n} p_j . \frac{C_j}{C} \qquad (9)$$

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

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

where P_j and P^R_j indicate the consumption price of good j before and after the reform, respectively. The results help us to estimate an approximation of compensatory payments that the government should transfer to the consumers to cover their increasing expenditure, at least in the short-run.

5.2 Decomposition of the price model

While the Leontief price model assumes that the economic structure is not altering through the time, Eq. (8) links the price change of non-energy products to the price change of energy carriers. If Eq. (8) is decomposed into the constituent parts, impact of every part can be tracked. When our purpose is studying the impact of energy subsidies reform on the price of non-energy products, the decomposition in our study would be restricted to the price of energy carriers. Therefore, ΔP_e can be decomposed into the increase in the prices of each of final energies as

$$\Delta P_e = \Delta P_{ELE} + \Delta P_{NG} + \Delta P_{GA} + \Delta P_{KE} + \Delta P_{GO} + \Delta P_{FO} + \Delta P_{LPG} \tag{11}$$

where ELE, NG, GA, KE, GO, FO, and LPG indicate electricity, natural gas, gasoline, kerosene, gas oil, fuel oil, and LPG, respectively. Substituting Eq. (11) in Eq. (8) yields

$$\Delta P_n = (I - B'_{nn})^{-1} A'_{en} \left[\Delta P_{ELE} + \Delta P_{NG} + \Delta P_{GA} + \Delta P_{KE} + \Delta P_{GO} + \Delta P_{FO} + \Delta P_{LPG}\right] \tag{12}$$

Multiplication of the first term in the latter decomposed parts reveals how much the rate of producer prices in non-energy sectors would be increased by changing the price rate of each fuel. When all the diagonal elements in ΔP_e are set to one, ΔP_n represents the cross-price elasticity of each fuel in the non-energy sectors. The elasticities obtained from Eq. (12) can be decomposed into direct and indirect impacts by substituting the Leontief inverse matrix with the equivalent power series. For instance, where the first term of Eq. (13) indicates the direct impact of electricity price change, the remainder reflects the price effects in the next rounds (Suzuki and Uchiyama, 2010).

$$\Delta P_{n.ELE} = (I - B'_{nn})^{-1} A'_{en} \Delta P_{ELE} = (I + B_{nn} + B_{nn}{}^2 + \ldots) A'_{en} \Delta P_{ELE} \tag{13}$$

6. Empirical results

In this study, Iran's national input-output table 2001 is used which is the last official survey-based table published by Statistical Center of Iran (SCI, 2005). The original table consists of 91 commodities that aggregated into 37 sectors for simplicity. Table 3 depicts the structure of our aggregated input-output table that comprises a primary energy (crude oil and natural gas), final energies (sectors 2-10), and non-energy products (sectors 11-37). Due to the low share of coal in production of final energies in Iran, this sector (11) is shifted to non-energy sectors. In addition, while the subject of the paper is restricted to the energy subsidies reform, the prices in sectors (3) and (10), i.e. water and the other refined petroleum products, are assumed to remain unchanged.

Table 3

Introduction of primary energy, final energies, and non-energy sectors in input-output of Iran

Sector No.	energy sectors	Sector No.	Non-energy sectors	Sector No.	Non-energy sectors
1	Crude oil and natural gas (primary energy)	11	Coal and lignite; peat	25	Jewelry and other products
2	Electricity	12	Other ores and minerals	26	Constructions
3	Water	13	Agriculture, forestry and fishery products	27	Wholesale and retail services
4	Natural gas	14	Food products	28	Lodging and serving services
5	Gasoline	15	textile and leathery products	29	Transport services
6	Kerosene	16	Pulp, paper and wood products	30	Communication and financial services
7	Gas oil	17	Chemical products	31	Real estate and rental services
8	Fuel Oil	18	Glass and glass products	32	Research, development and technical services
9	LPG	19	Basic metals and metal products	33	Production and maintenance services
10	Other refined petroleum products	20	General and specific purpose machinery	34	Public administration
		21	Electrical machinery	35	Education
		22	Media equipment	36	Health services
		23	Medical appliances	37	Other services
		24	Transport equipment		

6.1 Direct and indirect elasticities of fuels in non-energy sectors

Based on the methodology of decomposition of input-output price model, total, direct, and indirect cross-price elasticities of electricity, natural gas, gasoline, kerosene, gas oil, fuel oil, and LPG are calculated in the non-energy sectors. Fig. 9 and table 4 illustrate the cross-price elasticities by fuel and sector.

As explained before, the elasticities are calculated by equalizing the rate of price increase of each fuel to unity. Therefore, the elasticities should be interpreted in the way that how many percent the price of a specific non-energy sector would raise, if the price of a specific fuel increases twofold. For instance, the results in Table 4 show that the price elasticity of electricity in construction sector (sector 26) is 1.54. It means that if the price of electricity per Kwh doubles, the price in construction sector would increase 1.54% per unit of output. From total elasticity, only 0.05 percent directly stems from increasing the electricity price consuming in the construction sector and the remainder (1.49%) roots in increasing the price of the other inputs due to indirect impact of electricity.

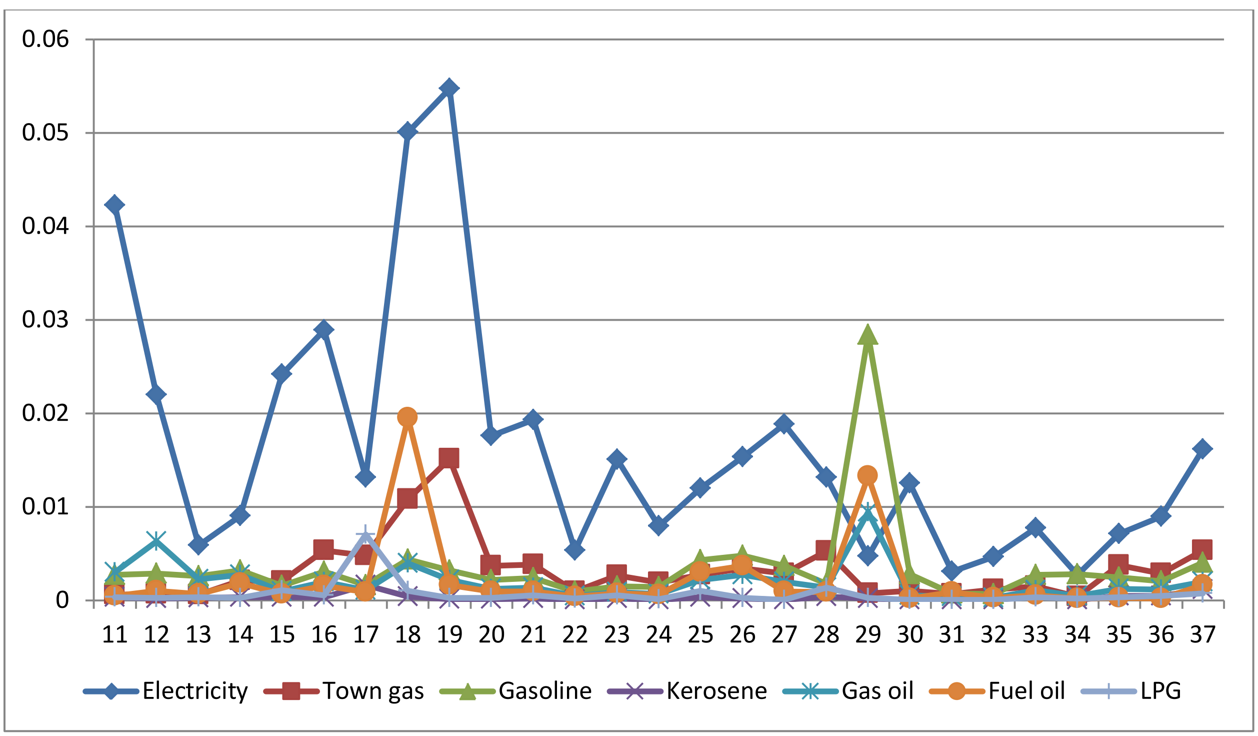


Fig. 9. Comparison of total cross-price elasticities of fuels in non-energy sectors in Iran

Looking to Fig. 9, it is clear that except in transportation sector (29), electricity has the highest cross-price elasticities across the final energies. In other words, increase in electricity price can raise the production cost and consequently total inflation rate, relatively more than the other fuels. The highest price elasticity of electricity is in basic metals and metal products (5.47%), glass and glass products (5%), and coal and lignite (4.22%). In these sectors, the price increase is usually due to the direct consumption of electricity. The highest indirect elasticities are in basic metals and metal products (1.67%), construction (1.49%), and electrical machinery (1.30%).

The results for natural gas are similar to electricity. Total elasticities of natural gas in the main consumers of electricity are the highest, i.e. basic metals and metal products (1.50%) and glass and glass products (1.07%). Similarly to electricity, the price changes in the former sectors are because of the huge direct consumption of natural gas in these sectors. In addition, the greatest indirect elasticities of natural gas belong to basic metals and metal products (0.39%), construction (0.33%), and electrical machinery (0.32%).

Unsurprisingly, due to 99 percent gasoline consumption in transportation sector, increase in the price of gasoline affects the price of this sector mainly. If the price of gasoline increases twofold, transport services would experience increase in their prices by 2.85 percent. The direct and indirect elasticities of gasoline in transportation sector are 2.53 and 0.30 percent, respectively. The second and the third impressed sectors are construction and glass and glass products that experience total elasticities by 0.48 and 0.43 percent, respectively. Kerosene has one of the lowest impacts on production prices. The greatest cross-price elasticities of kerosene are in chemical products, other services, and production and maintenance services.

Owing to enormous direct consumption, transport services, other ores and minerals, and glass and glass products have the largest cross-price elasticities of gas oil in Iran by 0.94, 0.62, and 0.39 percent, respectively. The most indirect effects of increase in the price of gas oil reveals in food products and jewelry and other products. If gas oil price doubles, price in the preceding sectors would increase 0.19 and 0.17 percent, respectively. The highest elasticities of fuel oil belong to glass and glass products (1.95%) and transport services (1.32%), mainly due to direct impact. Concerning the indirect price elasticities, the price of fuel oil mainly impresses construction, jewelry and other products, and glass and glass products indirectly. Doubling the price of LPG raises the prices of chemical products, and lodging and serving services by 0.70 and 0.13 percent, respectively. This impact is mainly due to direct consumption of LPG in these sectors. The highest indirect impact of increase in LPG price appears in chemical products and textile and leathery products.

Table 4

Total, direct, and indirect cross-price elasticities of fuels in non-energy sectors in Iran

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	4.23	3.99	0.24	0.06	0.01	0.05	0.27	0.16	0.11	0.03	0.02	0.01	0.30	0.26	0.05	0.05	0.00	0.05	0.03	0.01	0.02
12	2.20	1.99	0.20	0.06	0.02	0.05	0.29	0.16	0.12	0.02	0.01	0.01	0.63	0.58	0.05	0.10	0.04	0.06	0.03	0.01	0.02
13	0.59	0.28	0.31	0.06	0.00	0.06	0.26	0.10	0.16	0.02	0.01	0.01	0.22	0.14	0.08	0.07	0.00	0.06	0.03	0.01	0.02
14	0.90	0.27	0.63	0.21	0.12	0.09	0.32	0.02	0.30	0.03	0.01	0.02	0.27	0.08	0.19	0.18	0.07	0.12	0.03	0.00	0.02
15	2.42	1.71	0.71	0.20	0.07	0.13	0.16	0.01	0.15	0.03	0.00	0.03	0.10	0.01	0.08	0.07	0.01	0.06	0.11	0.00	0.10
16	2.89	2.30	0.59	0.53	0.40	0.13	0.30	0.11	0.20	0.03	0.02	0.01	0.19	0.10	0.09	0.15	0.07	0.09	0.05	0.01	0.04
17	1.31	0.83	0.48	0.48	0.35	0.13	0.16	0.03	0.13	0.16	0.13	0.03	0.11	0.04	0.06	0.08	0.02	0.06	0.70	0.60	0.11
18	5.01	4.26	0.74	1.08	0.94	0.13	0.43	0.10	0.33	0.04	0.03	0.01	0.40	0.23	0.17	1.95	1.72	0.23	0.10	0.08	0.02
19	5.47	3.79	1.68	1.51	1.11	0.40	0.32	0.03	0.29	0.01	0.00	0.01	0.22	0.06	0.16	0.17	0.03	0.13	0.03	0.01	0.02
20	1.76	0.65	1.11	0.37	0.08	0.29	0.21	0.03	0.18	0.01	0.00	0.01	0.12	0.03	0.09	0.09	0.01	0.08	0.03	0.01	0.02
21	1.93	0.63	1.30	0.38	0.05	0.33	0.24	0.04	0.20	0.02	0.00	0.01	0.13	0.03	0.10	0.09	0.00	0.09	0.05	0.01	0.05
22	0.53	0.27	0.26	0.10	0.02	0.07	0.09	0.01	0.08	0.01	0.00	0.00	0.04	0.01	0.04	0.04	0.00	0.04	0.02	0.00	0.01
23	1.50	0.94	0.57	0.27	0.11	0.16	0.15	0.03	0.12	0.02	0.00	0.01	0.09	0.03	0.06	0.07	0.01	0.06	0.05	0.01	0.04
24	0.79	0.17	0.62	0.19	0.04	0.15	0.14	0.01	0.13	0.00	0.00	0.00	0.07	0.01	0.06	0.06	0.00	0.06	0.01	0.00	0.01
25	1.19	0.00	1.19	0.27	0.04	0.23	0.43	0.17	0.26	0.03	0.01	0.02	0.22	0.04	0.18	0.30	0.03	0.27	0.10	0.03	0.07
26	1.54	0.04	1.50	0.34	0.00	0.34	0.48	0.13	0.35	0.02	0.01	0.01	0.27	0.09	0.18	0.37	0.01	0.36	0.02	0.00	0.02
27	1.88	1.76	0.13	0.29	0.26	0.03	0.37	0.20	0.17	0.01	0.00	0.00	0.20	0.14	0.06	0.10	0.01	0.08	0.01	0.00	0.01
28	1.31	0.91	0.40	0.53	0.44	0.08	0.17	0.02	0.16	0.04	0.03	0.01	0.14	0.03	0.10	0.09	0.00	0.09	0.14	0.12	0.01
29	0.47	0.24	0.23	0.07	0.03	0.05	2.84	2.54	0.30	0.02	0.00	0.01	0.94	0.84	0.11	1.32	1.19	0.13	0.03	0.00	0.03
30	1.25	1.05	0.20	0.10	0.07	0.03	0.28	0.21	0.06	0.01	0.00	0.00	0.05	0.03	0.02	0.02	0.00	0.02	0.01	0.00	0.00
31	0.30	0.02	0.29	0.07	0.01	0.06	0.07	0.00	0.07	0.00	0.00	0.00	0.04	0.00	0.04	0.09	0.00	0.09	0.01	0.00	0.01
32	0.46	0.32	0.14	0.11	0.08	0.03	0.07	0.02	0.05	0.01	0.00	0.00	0.02	0.00	0.02	0.02	0.00	0.02	0.01	0.00	0.01
33	0.77	0.53	0.24	0.15	0.10	0.05	0.27	0.19	0.08	0.10	0.09	0.01	0.11	0.07	0.04	0.05	0.01	0.04	0.03	0.02	0.02
34	0.27	0.23	0.04	0.04	0.03	0.01	0.28	0.24	0.04	0.01	0.00	0.00	0.05	0.03	0.01	0.02	0.00	0.02	0.02	0.02	0.00
35	0.71	0.59	0.13	0.38	0.35	0.03	0.25	0.20	0.04	0.05	0.04	0.00	0.12	0.10	0.02	0.02	0.00	0.02	0.04	0.03	0.01
36	0.90	0.78	0.12	0.28	0.25	0.03	0.20	0.17	0.04	0.05	0.04	0.01	0.12	0.10	0.02	0.02	0.00	0.02	0.04	0.02	0.03
37	1.62	1.37	0.24	0.53	0.47	0.06	0.40	0.32	0.08	0.11	0.10	0.01	0.19	0.16	0.04	0.16	0.12	0.04	0.07	0.06	0.02

6.2 Price effects on producers and consumers

Estimation of the cross-price elasticities of fuels paves the way to examine the impact of energy subsidies reform on production costs and household's expenditures and real incomes in Iran. Table 5 shows the domestic and regional energy prices before the reform and the price change after it. As it is clear, the price gap between the domestic and regional prices has been tremendous in Iran. Before implementation of the reform, the ratio 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 started on December 2010, the government increased the domestic prices of the respective fuels by 172, 569, 300, 506, 809, 201, and 223 percent. Article 1 of the Subsidy Reform Law ascertains that the domestic sale prices of energy carriers should be adjusted gradually until the end of the 5th Five-Year Development Plan (2010-2015), up to a level which shall not be less than 90 percent of Persian Gulf FOB[1] prices. However, it is not clear when and in how many steps the next phases of the reform will be implemented.

Table 5

Domestic and regional energy prices before and after the reform (Rials)

	Domestic energy prices at 2008/09 – before the reform	Average regional market prices at 2008/09	Domestic energy prices at 2010 – after the 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

a: Export price (Rials/kwh), b: Export price (Rials/m3), c: FOB price of refined petroleum products in Persian Gulf (Rials/liter)
Source: MoE (2010) and MoP (2009) - 1 USD = 9,917 IR. Rials at 2008.

[1] Freight on Board (FOB)

Due to the ambiguity about the next phases and the market prices of fuels in 2015, impact of the subsidy reform on production and consumption prices is examined in two scenarios. The first scenario is the price changes implemented at the first phase of the reform in 2010. While the reform is started recently, analyzing the price impact of the first phase is essential from the policy point of view. Furthermore, the results can be compared with the real initial increase in prices, reported by CBI. The second scenario assumes that the domestic energy prices were raised immediately to average regional market prices in 2008/09. Practically, the results of this scenario can improve our understanding about the overall inflationary impacts of a full energy price adjustment in Iran.

Total, direct, and indirect impact of energy subsidies reform are illustrated in Table 6 and Fig. 10 and 11 under two previously defined scenarios. Apparently, removing of energy subsidies affects the sectors glass and glass products, transport services, and basic metals and metal products principally. While the first phase of the reform increases the production prices of the former sectors by 0.59, 0.44, and 0.24 percent, removing of total energy subsidies will increase the production prices by 1.40, 1.05, and 0.70, respectively. Four sectors are impressed to the lowest degree by increasing energy prices, i.e. research, development and technical services, public administration, media equipment, and real estate and rental services. It is expected that by removing the whole or a part of the energy subsidies in Iran, the production prices of the previous sectors would not exceed 0.08 and 0.03 percent, respectively.

Table 6

Effects of energy subsidies reform on producer prices (%)

Sector number	Scenario 1: First phase			Scenario 2: Complete energy subsidies reform		
	Tot.	Dir.	Ind.	Tot.	Dir.	Ind.
11	0.12	0.10	0.02	0.33	0.26	0.07
12	0.12	0.10	0.03	0.39	0.32	0.07
13	0.05	0.02	0.03	0.17	0.07	0.09
14	0.10	0.03	0.07	0.28	0.10	0.18
15	0.08	0.04	0.05	0.23	0.09	0.14
16	0.14	0.09	0.05	0.39	0.25	0.14
17	0.10	0.06	0.04	0.37	0.25	0.12
18	0.59	0.50	0.09	1.40	1.17	0.23
19	0.24	0.14	0.10	0.70	0.42	0.28
20	0.09	0.02	0.07	0.24	0.06	0.18
21	0.09	0.02	0.08	0.26	0.05	0.21
22	0.03	0.01	0.02	0.08	0.02	0.06
23	0.07	0.03	0.04	0.19	0.08	0.12
24	0.05	0.01	0.04	0.13	0.02	0.11
25	0.13	0.02	0.11	0.34	0.05	0.29
26	0.16	0.01	0.14	0.41	0.05	0.36
27	0.10	0.07	0.03	0.26	0.19	0.08
28	0.09	0.05	0.04	0.29	0.17	0.12
29	0.44	0.39	0.05	1.05	0.92	0.13
30	0.04	0.03	0.01	0.11	0.08	0.03
31	0.03	0.00	0.03	0.08	0.00	0.08
32	0.02	0.01	0.01	0.07	0.03	0.03
33	0.05	0.03	0.02	0.17	0.12	0.06
34	0.02	0.02	0.01	0.06	0.04	0.02
35	0.06	0.05	0.01	0.19	0.16	0.03
36	0.05	0.04	0.01	0.18	0.14	0.03
37	0.13	0.10	0.02	0.38	0.32	0.06

The same as price elasticities, comparison of the total and direct effects in both scenarios reveal that the sectors experience the greatest total impact are the main consumers of energy and consequently, they get the impact mostly due to the large share of energy in their inputs. Nevertheless, the picture for indirect effects is different. The main increase in the price of non-energy inputs due to increase in energy prices occurs in the sectors construction, jewelry and other products, and basic metals and metal products. While increasing the energy prices in the first phase would increase the production prices of the former sectors by 0.01, 0.02, and 0.14 percent, it raises the production prices via increase in the prices of the other inputs by 0.14, 0.11, and 0.10 percent, respectively. The indirect impacts in the second scenario are 0.36, 0.29, and 0.28 percent, respectively.

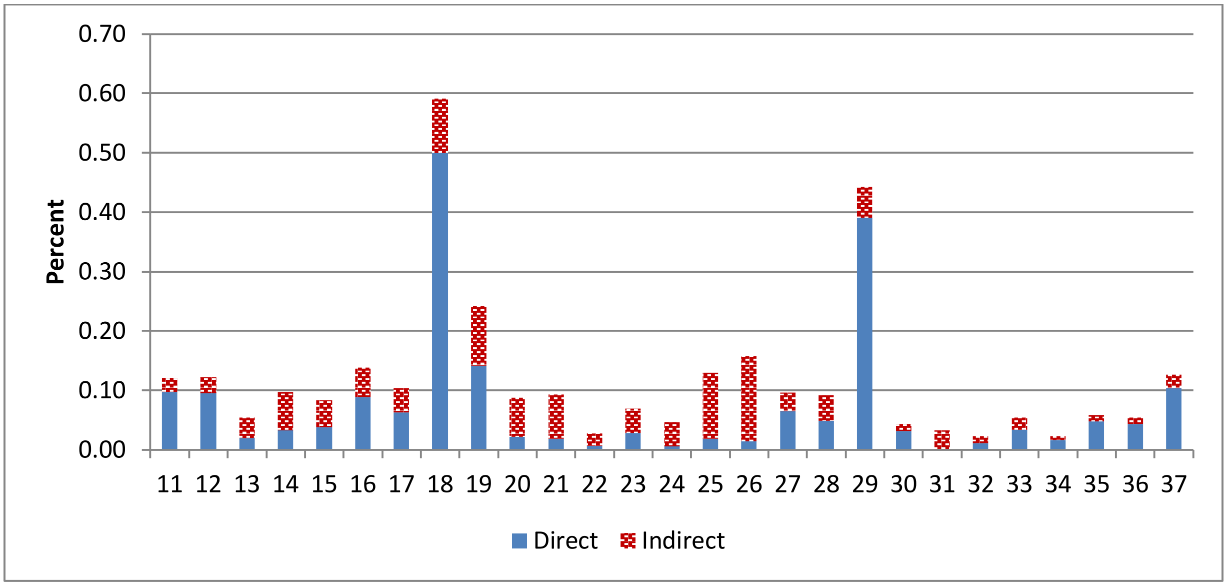


Fig. 10. Direct and indirect impact of first phase (scenario 1) on production prices

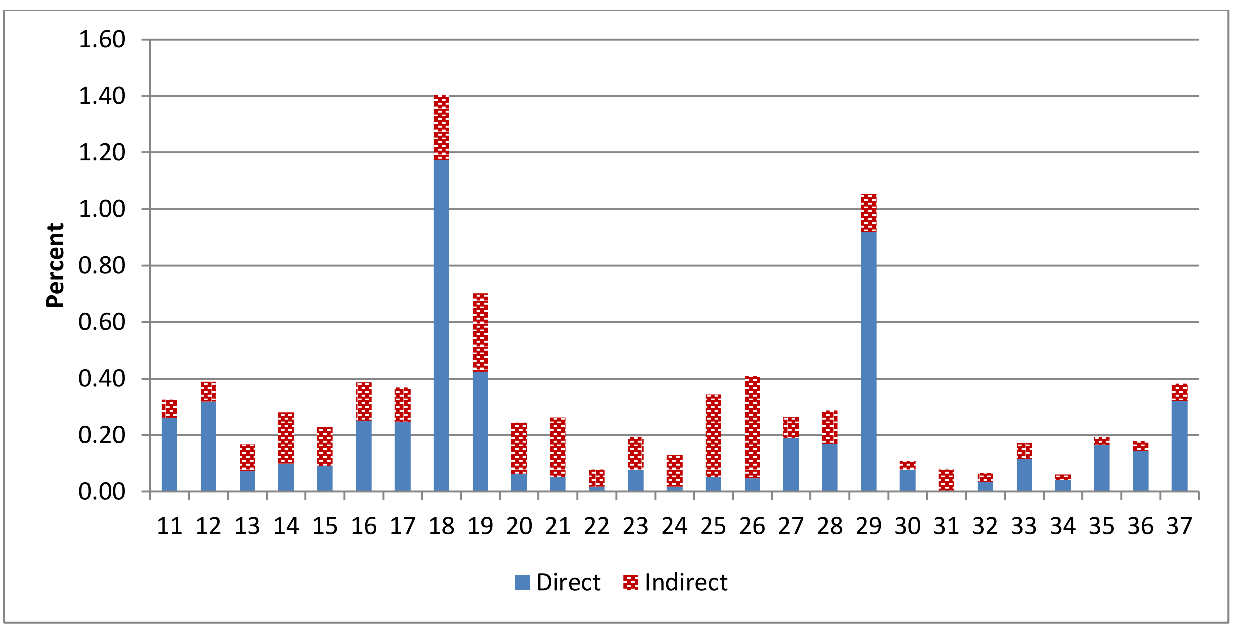


Fig. 11. Direct and indirect impact of complete energy subsidies reform (scenario 2) on production prices

To understand the impact of the reform on Iranian households, changes in consumption prices and real income of urban and rural households are estimated. Fig. 12 and Table 7 show that by removing entire energy subsidies in Iran, consumption prices would increase 45.7 percent that is a really strong and likely destructive shock for the households. Results reveal that the rural families suffer the burden of inflation more than the urban families. When the consumption price increases 42.8 percent in the urban areas, it grows by 55.5 percent in the rural areas. Comparison of the change in consumption prices in the first and the second scenarios reveal the fact that gradual phase out of energy subsidies can control and deteriorate devastating shocks which may affect households, especially the poor. The results from the first scenario show that the first phase of the reform will increase the consumption prices by 16.4% nationwide. Likewise the second scenario, the rural households would be hit by inflation more than the urban households, i.e. 17.5 percent vis-à-vis 16 percent.

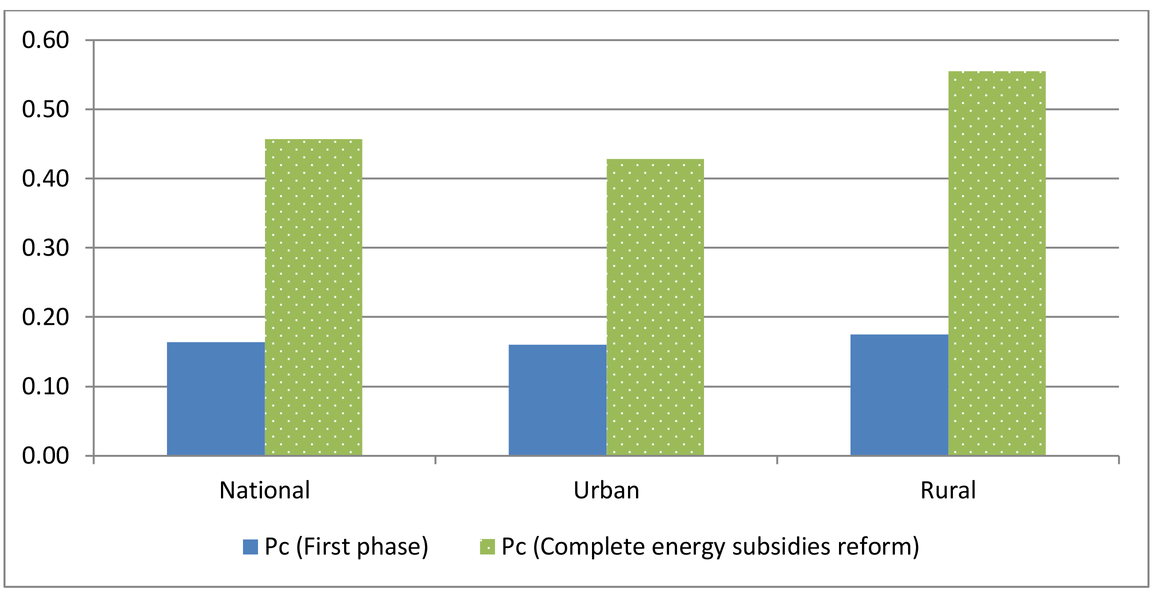


Fig. 12. Impact of energy subsidies reform on consumption prices

The household's annual real income loss would be more than 238,000 and 664,000 billion IR. Rials (around 21,000 and 60,000 million USD) in two scenarios, respectively. Due to more expenditure of urban households, what they lose is near to 3.18 and 2.68 more than the rural households. Because the Reform Law is mandated the government to compensate the burdened charges, the compensatory payments per person are calculated in Table 2.5. If the government removes the total energy subsidies, it should transfer 9.495 million IR. Rials to each person annually, whereas the transferred amount should be near to 3.405 million IR. Rials in the first phase of the reform. Comparing what transferred to the people in the first phase of the reform and what the model propose to transfer show that the payment is more than needed. At present, the government pays 450,000 IR. Rials to each registered person per month, while the model proposes to pay 283,750 IR. Rials. In addition, the model advises the payment to urban residents per month should be more than rural residents, i.e. 216,000 IR. Rials vis-à-vis 67,750 IR. Rials. This is in contrary to current even payment of the compensatory payment to all of the people, regardless of their income group or living place.

Table 7

Effects on consumption prices and real incomes

	National	Urban	Rural
Household consumption price changes, Scenario 1 (%)	0.164	0.160	0.175
Household consumption price changes, Scenario 2 (%)	0.457	0.428	0.555
Change in household annual real income at 2010 prices, Scenario 1 (Million IR. Rials)	-238,333,589	-181,428,899	-56,904,689
Change in household annual real income at 2010 prices, Scenario 2 (Million IR. Rials)	-664,677,472	-484,519,372	-180,158,100
Compensatory payment per person at 2010 prices, Scenario 1 (Million IR. Rials)	3.405	2.592	0.813
Compensatory payment per person at 2010 prices, Scenario 2 (Million IR. Rials)	9.495	6.922	2.574

7. Conclusions

The study examined the impact of energy subsidies reform in Iran under two reform scenarios. The former is in fact what started as the first phase of the reform on December 2010, and the latter is removing the whole energy subsidies in one shot at 2008/09 prices. The paper used the input-output price model to study the impact of the reform on consumption and production prices in Iran, and a decomposition model to derive the cross-price elasticities of fuels in non-energy sectors.

What our study found is the tremendous inflationary impact of the complete energy subsidies reform on the production and consumption prices. The results show that a full reform would increase the consumption prices by 45.7 percent. Although rural households are impressed more by increase in consumption prices, families in urban areas lose more real income due to their more expenditure. In the reform procedure, the sectors glass and glass products, transport services, and basic metals and metal products would experience the highest increase in production prices. In addition, looking at the cross-price elasticities confirms that electricity and gasoline have the highest impact on the production prices.

To propose some policy implications, the following points can be mentioned. First, a gradual and phased reform imposes less inflation on producers and households and provides enough room for policy makers to modify the next phases to alleviate the negative effects. Second, while the real income losses of households are different due to their income group or geographical attitude and location, the government should compensate their loss discriminately. Finally, while increase in the prices of some fuels such as electricity and gasoline has more inflationary impacts, the pace of the reform for these fuels should be more gradual.

As the last considerable point, it is essential to mention the results of the study should be interpreted cautiously. First, the input-output table used in this study is for 2001. This raises our concerns about the rigidity of the economic structure in Iran after a decade. Second, the Leontief price model has some deficiencies due to its restrictive assumptions such as the lack of substitution between factors and the null role of final demand in the economy price setting. However, the general equilibrium perspective of the model makes it possible to release the partial analyses and have a better understanding about the possible negative consequences of the reform at two production and consumer levels.

References:

Akhoond zadeh, T., Raghfar, H., Shirin Bakhsh, S. (2011) Welfare effects of energy prices reform in Iranian construction and transportation sectors (1997-2006), Social Welfare, Volume 36, pp. 255-287 (In Persian).

AlShehabi, O.H. (2011) Energy and labor reform: Evidence from Iran, Journal of Policy Modeling, Article in press

Birol, F., Aleagha, A.V., Ferroukhi, R. (1995) The economic impact of subsidy phase out in oil exporting developing countries: a case study of Algeria, Iran and Nigeria, Energy Policy, Volume 23, Issue 3, pp. 209-215.

Central Bank of Iran (CBI) (2011) Price index of consuming goods and services at urban areas, several reports

Coady, D., El-Said, M., Gillingham, R., Kpodar, K. Medas, P., Newhouse, D. (2006) The magnitude and distribution of fuel subsidies: Evidence from Bolivia, Ghana, Jordan, Mali, and Sri Lanka, IMF Working Paper, No. WP/06/247.

Ellis, J. (2010) The effects of fossil-fuel subsidy reform: A review of modeling and empirical studies, International Institute for Sustainable Development.

Ghaderi, J., Estedlal, S. (2009) Impact of increasing electricity prices on the welfare of various income groups in Iran (1967-2004), Economic Researches, Volume 9, pp. 101-120 (In Persian).

Guillaume, D., Zytek, R. (2010), Islamic Republic of Iran: Selected issues paper, IMF country report, No. 10/76.

Guillaume, D., Zytek, R., Farzin, M.R. (2011) Iran-The chronicles of the subsidy reform, IMF working paper, No. WP/11/167.

Gupta, S., Clements, B. Fletcher, K., Inchauste (2002) Issues in domestic petroleum pricing in oil-producing countries, IMF working paper, No. WP/02/140.

Heydari, K., Perme, Z. (2010) Estimation of impacts fuels and bread pricing reform on household expenditure, Rahbord Quarterly, Volume 57, pp. 181-195 (In Persian).

International Energy Agency (IEA) (1999) World energy outlook insights, Looking at energy subsidies: Getting the prices right

International Energy Agency (IEA) (2007) World energy outlook 2006, International Energy Agency, Paris.

International Monetary Fund (IMF) (2011) Islamic Republic of Iran, Staff report for the 2011 Article IV consultation, No. 11/241

Jensen, J., Tarr, D. (2003) Trade, exchange, and energy pricing reform in Iran: Potentially large efficiency effects and gains to the poor, Review of Development Economics, Volume 7, Issue 4, pp. 543-562.

Khiabani, N. (2008) A computable general equilibrium model to appraise the increasing of energy prices in the economy of Iran, Quarterly Energy Economics Review, Volume 16, pp. 1-34 (In Persian)

Larsen, B., Shah, A. (1995) World fossil fuel subsidies and global carbon emission, In: Bovenberg, L., Cnossen, S. (Eds.) Public Economics and the environment in an imperfect world.

Liu, H., Guo, J., Qian, D., Xi, Y. (2009) Comprehensive evaluation of household indirect energy consumption and impacts of alternative energy policies in China by input–output analysis, Energy Policy, Volume 37, Issue 8, pp. 3194-3204.

Llop, M. (2008) Economic impact of alternative water policy scenarios in the Spanish production system: An input–output analysis, Ecological Economics, Volume 68, Issues 1-2, pp. 288-294.

Llop, M., Pié, L. (2008) Input–output analysis of alternative policies implemented on the energy activities: An application for Catalonia, Energy Policy, Volume 36, Issue 5, pp. 1642-1648.

Manzoor, D., Shahmoradi, A., Haghighi, I. (2010) Effects of energy implicit and explicit subsidies phase out in Iran: A computable general equilibrium model based on a micro consistent matrix, Quarterly Energy Economics Review, Volume 26, pp. 21-54 (In Persian).

Miller, R.E., Blair, P.D. (2009), Input-output Analysis: Foundations and Extensions, Cambridge University Press

Ministry of Energy (MoE) (2010), Energy balance of Iran 2009, Division of Electricity and Energy, Tehran (In Persian).

Ministry of Petroleum (MoP) (2009), Hydrocarbon balance of Iran 2008, Institute of International Energy Studies (IIES), Tehran (In Persian).

Myers, N., Kent, J. (2001), Perverse subsidies: How tax Dollars can undercut the environment and the economy, Island Press, Washington, D.C.

Nguyen, K.Q. (2008) Impacts of a rise in electricity tariff on prices of other products in Vietnam, Energy Policy, Volume 36, Issue 8, pp. 3145-3149.

Perme, Z. (2005) Impact of energy subsidies phase out on total price level in Iran, Journal of Trade Studies, Volume 34, pp. 117-147 (In Persian).

Shahmoradi, A., Mehrara, M., Fayazu, N. (2010) Deregulation of energy prices and the effects on household welfare and government budget: An input-output approach, Iranian Economic Researches, Volume 42, pp. 1-24 (In Persian).

Sharifi, A., Sadeghi, M., Ghasemi, A. (2008) Appraisal of inflationary impact of energy subsidies phase-out in Iran, Journal of Economic Studies, Volume 31, pp. 91-119 (In Persian).

Statistical Center of Iran (SCI) (2005) Iran's national input-output table 2001, Available at http://www.amar.org.ir/nationalaccount/default-486.aspx (In Persian).

Statistical Center of Iran (SCI) (2010) Iran Statistical Yearbook 2009, Tehran, Available at http://amar.sci.org.ir/EPlanList.aspx (In Persian).

Suzuki, K., Uchiyama, Y. (2010), Quantifying the risk of an increase in the prices of non-energy products by combining the portfolio and input–output approaches, Energy Policy, Volume 38, Issue 10, pp. 5867-5877

United Nations Environment Programme (UNEP) (2003) Energy subsidies: Lessons learned in assessing their impact and designing policy reforms, United Nations Publication.

United Nations Environment Programme (UNEP) (2008) Reforming energy subsidies – Opportunities to contribute to the climate change agenda, Division of Technology, Industry and Economics.