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The Distributional Effects of Gasoline Price Reform in Iran: Incremental Price Increases or One Large Hike?

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Abstract. The distributional effect on household expenditures is crucial in implementing an acceptable policy for fuel price reform. The motivation behind this paper is to evaluate the impact of gasoline price shock on urban, rural, and all Iranian household expenditures under two scenarios: The sudden pricing scenario, implemented using the standard input-output price model, and the incremental scenario, conducted with the assumption of government price control via a modified input-output price model. To this end, we use the 2016 input-output data for the Central Bank of Iran. The empirical results indicate that the Iranian household has experienced a progressive distributional impact on their welfare after the two mentioned gasoline price shock scenarios. In other words, the share of expenditure for the highest-income groups in urban, rural, and all Iranian households would increase; which we call the progressive effect. Unlike the high-income households, the groups with the lowest income also have a lower expenditure. However, the progressivity of distributional effects is different in the two mentioned scenarios. In the sudden price shock scenario, for all types of households, the progressivity effect is less than the incremental effect. At the same time, it reveals that the distributional impact of incremental gasoline price reform policy on the poor and medium-income households is compatible with a sudden gasoline price shock scenario in the short term. To reduce the long-term effects on the poor, it is recommended that gasoline price corrections should be based on an incremental pricing policy in line with the inflation of price-driven economic indicators.

***Keywords**: Gasoline, Reform, Price, Input-Output Price Model, Distributional Effects*

INTRODUCTION

Subsidies are critical policy tools adopted by governments to fulfill economic, social, and environmental purposes. Iran, as an energy exporter, undertook major reforms and reconsidered the provision of subsidies for basic commodities, especially energy carriers in 2010. Furthermore, the government's main objective was to gradually reduce and remove subsidies for energy carriers, reprice energy carriers, and ensure fair income distribution.

In response to the financial burden and inefficient energy pricing reflected in the government budget, subsidy reforms were implemented. One of the main goals of these fundamental reforms was to control and reduce the consumption of petroleum products and other energy carriers. The other purpose was to provide a fair distribution of subsidies to all Iranian residents.

However, lower energy prices will contribute to the consideration of some aspects such as supporting vulnerable and low-income groups, helping domestic industries to achieve a comparative advantage

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In global markets, increasing export power, and increasing job opportunities, as well as some political considerations. Regarding the experience of Iran in adopting subsidies on its energy commodities, it has been found that high-income urban households benefit more from these energy subsidies than low-income households.

On the contrary, due to the removal of subsidies for energy carriers and the increase in the price of energy carriers in the short run, Iran's economy experienced inflationary and price effects for several reasons, including a lack of substitution for energy carriers as well as the inadequacy of energy efficiency of energy-intensive appliances. Meanwhile, gasoline is one of the most significant energy carriers in Iran whose price changes have had severe economic, social and political effects.

As pointed out above, in a macroeconomic view, any increase in the price of gasoline, called the gasoline price shock, is expected to affect consumer expenditures through two channels. A rise in fuel prices directly impacts household expenditures on fuel as the first channel. The indirect effect would be an increase in household expenditures on goods and services that use gasoline, the *factor of production*, as a primary input.

In the context of welfare economics, given the increase in household expenditures caused by the gasoline price shock, it is expected that this shock would affect consumer welfare in three ways: Regressive, progressive, and neutral.

The *progressive effect* refers to the situation in which high-income households suffer economically and lose quantitatively more welfare than low-income households as a result of the increase in the prices of energy carriers and the fact that they use more energy carriers.

The *regressive effect*, however, shows that when increasing the price of energy carriers, low-income households face higher living expenses and consequently lose more welfare than those with higher incomes. The *neutral effect* occurs when an increase in energy carrier prices does not affect the household expenditures of both high-income and low-income groups.

Therefore, Iranian policymakers need to make the necessary adjustments to minimize the negative impacts of higher gasoline prices on economic welfare. One of the main solutions acknowledged in recent years by Iranian economists is incremental increases in gasoline prices, which enables Iranian households to adjust to new prices within a reasonable time period.

Hence, it is worth asking whether an incremental increase in gasoline prices can be associated with less inflationary and distributional effects than a large-scale price reform. To answer this question, this study adopts two novel perspectives:

a- The price and distributional effects of gasoline price reforms can be measured using General equilibrium models. In the context of price impact matrix multipliers, the input-output price model is one of the most standard approaches that can be applied and extended to explore these effects.

b- Meanwhile, it is necessary to introduce and apply two types of input-output price models that reflect the comparison of incremental or sudden price shocks to compare the two gasoline price reform scenarios mentioned earlier. A standard input-output price model can measure both the direct and indirect price effects of a sudden gasoline price shock under the scenario of no government price controls. Considering this, it is assumed that there is no substitution for gasoline in the short term. In addition, the direct and indirect price effects of production directly affect the final products and consumers. The other approach is to evaluate the price multipliers under the scenario of government price controls. In doing so, the input-output price model is extended to explore the role of government intervention in controlling the gasoline price shocks which indicate the incremental increase of gasoline prices and prevent the full transfer of gasoline price shocks through price multipliers to the other economic sectors and by extension, to the household expenditures. Therefore, the two different input-output price models will be used to evaluate the effects of the two gasoline price scenarios under the government price controls to analyze the effects on Iranian households in detail.

The rest of this article is organized as follows: Section 2 introduces the literature review. Section 3 describes the general equilibrium approaches and input-output price models for estimating the welfare and inflationary effects of new gasoline prices in Iran. Section 4 presents the database and empirical analysis of the results. The last section makes some conclusions and policy remarks.

1. LITERATURE REVIEW

In this paper, we analyze the growing body of empirical studies that have investigated the economic and social effects of cutting energy subsidies or imposing energy taxes. These studies are being conducted on a national and international level. Several empirical studies are proposed in two groups regarding the assumption that the government would control or remove fuel prices. As the first group of studies shows, the government has tried to achieve socio-economic objectives like the inflationary and welfare effects by removing fuel subsidies or increasing fuel prices. However, the researchers in the second group have not mentioned the government's attempts to control fuel prices so as to consider welfare effects. Meanwhile, a significant amount of work will be devoted to input-output approaches in this section.

In the first group of empirical studies, Sarrakh et al. (2020) utilized the price-gap approach to measure the energy subsidies in Saudi Arabia. They used an input-output price model to quantify the impact of removing energy subsidies on the economy and social safety. The results indicated that energy price reforms would have negative economic effects. However, implementing compensatory measures through a targeted cash transfer towards the welfare and health sectors would have a positive impact on economic sectors. Taking similar compensatory measures by the government to enhance social safety would be beneficial for low-income households as well. Jiang et al. (2015) used an input-output price model to evaluate the potential effects of eliminating fossil fuel subsidies on the income distribution of Chinese households under various scenarios. According to this study, coal and electricity subsidy reform have greater indirect impacts on households than direct impacts. In addition, if the government controls fuel prices and introduces certain compensatory measures in the short term, the negative effects of the energy price reform could be minimized. In another study, Dargahi and Ghorbannejad (2015) used the ARDL approach to estimate the impact of energy price reform on major macroeconomic variables in Iran. For the period 2011-to 2015, simulations indicated that reforming energy prices with and without compensatory policies would result in high inflation and low economic growth. Yet, studies show that by improving productivity through supply-side policies, energy price reform can actually lead to high economic growth. Using a modified supply-driven social accounting matrix, Faridzad et al. (2014) indicated that increased petroleum prices could negatively affect the producer price index (PPI) of Iranian economic sectors. For this study, the cost-of-living index for urban and rural households is measured. Applying a CGE-microsimulation model, Dartanto (2013) found that removing 25% of fuel subsidies in Indonesia increases the poverty rate by 0.259 percentage points. However, if fuel subsidies were completely removed and 50% of them were redistributed to government spending, the poverty rate would be cut by 0.277 percentage points. Using the same method, Li and Jiang (2011) studied the effects of removing energy subsidies. They concluded that by adjusting compensation policies through certain fuel subsidy shares, energy intensity could be reduced and climate change concerns could be addressed. In another study, Saboohi (2001) evaluated the impact of reducing energy subsidies on the living expenses of Iranian households. The results of the empirical analysis revealed that a progressive social security policy would lead to a more equitable distribution of resources and compensation for the poor. Taking away energy subsidies will provide more than enough financial resources to support these efforts.

In the second group of empirical studies, Llop M. (2020), by employing the input-output price model, analyzed the impact of import fuel prices on domestic fuel prices in the Catalan economy. In this paper, different substitution scenarios are used to compare various functions, such as

Leontief, Cobb-Douglas, and CES to provide some cost estimates for domestic fuel. Similarly, Li and Jiang (2016), using a modified input-output model, quantified the energy rebound effect after energy subsidies were removed in China's economic sectors. Empirical results showed that the technological progress made from 2007-to 2010 caused the aggregate rebound effect to decrease by about 1.53%. By increasing renewable energy subsidies and removing 10% of fossil fuel subsidies, Ouyang and Lin (2014) estimated China's economic growth. Based on simulation results, the negative effects on economic growth could be decreased from 4.460% to 0.432%, if only 10% of fossil fuel subsidies were eliminated. Siddig et al. (2014) identified the socio-economic effects of removing fuel subsidies in Nigeria. The empirical results showed that while subsidy removal largely boosts Nigeria's economic growth, it could lower the incomes poor households. Finally, Shahmoradi et al. (2011), using two policy scenarios for price rises and two scenarios for cash subsidy payments tested the effects of increasing the domestic energy price and the cash subsidy payment on the expenditure of Iranian households. According to the study, a government payment increase to the household, from 50% to 60%, could compensate for half of the reduction in welfare payments, and welfare may decline in the short run.

A key problem with many studies, especially the first group, is that the estimation of welfare impacts of fuel subsidy removal is conducted without addressing the government's control over fuel prices nor achieving social security by a sudden or incremental fuel price shock. In addition, the type of input-output model used for measuring sudden or incremental fuel price changes is not considered. Finally, to measure the welfare impacts of fuel price reforms, the primary focus of the study was on different income levels of households. However, according to Wier et al. (2005), household expenditures are preferable to assess the welfare effects for two main reasons: First, the subsidy base is an expenditure, rendering it relevant in estimating the regressivity of the expenditure-based price reforms. Secondly, since households aim to reduce their lifetime consumption, and subsequently consume equal to their permanent income, measuring welfare effects by using their annual income is inappropriate.

2. . METHODOLOGY

Household expenditures could be affected by demanding goods and services that use petroleum products, like gasoline, as a crucial input in their production process. Such factors could transfer to household expenditures, directly or indirectly. In an attempt to measure the effects, two types of input-output price models are employed. Regarding the standard input-output price approach, it is generally assumed that energy products cannot be substituted by any other input after a gasoline price shock. As a result, the price shock's inflationary effects imposed on economic sectors are fully transmitted into the final goods and service prices. For the second approach, a modified input-output price model can be used to evaluate the direct and indirect effects of gasoline price shocks assuming government price controls, which represents the incremental gasoline price shock. Unlike the first approach, this assumption does not allow for unwarranted gasoline price increases. Therefore, inflationary effects cannot fully extend to other sectors of the economy. To measure the distributional impact of household expenditures as welfare effects following two different gasoline price shocks, we will compare these two fundamental approaches.

3.1. Standard input-output price model

In regards to the standard input-output price model, we introduce a model to show how price changes in one economic sector can directly change the prices of other sectors. These measurements can be carried out through price-to-price multipliers. According to the theoretical condition of the standard input-output price model, this fundamental approach indicates that there is no gasoline price control by the government. Assuming that the price variation of the kth sector isΔP_k, the total impacts could be revealed as follows:

$$\Delta P_j = \sum_{i=1}^{n} a_{ij}\Delta P_i, j = 1,2,\dots,n \quad (1$$

Where ΔP_i is the price variation of the ith sector, and a_{ij} is the technical coefficient in the input-output table. With expanding equation (1), we can get equation (2) as follows:

$$\begin{aligned}
\Delta P_1 &= a_{11}\Delta P_1 + a_{21}\Delta P_2 + a_{31}\Delta P_3 + \cdots + a_{n-1,1}\Delta P_{n-1} + a_{n,1}\Delta P_n \\
\Delta P_2 &= a_{12}\Delta P_1 + a_{22}\Delta P_2 + a_{32}\Delta P_3 + \cdots + a_{n-1,2}\Delta P_{n-1} + a_{n,2}\Delta P_n \\
&\vdots \\
\Delta P_{n-1} &= a_{1,n-1}\Delta P_1 + a_{2,n-1}\Delta P_2 + a_{3,n-1}\Delta P_3 + \cdots + a_{n-1,n-1}\Delta P_{n-1} + a_{n,n-1}\Delta P_n \\
\Delta P_n &= a_{1,n}\Delta P_1 + a_{2,n}\Delta P_2 + a_{3,n}\Delta P_3 + \cdots + a_{n-1,n}\Delta P_{n-1} + a_{n,n}\Delta P_n
\end{aligned} \quad (2$$

According to Jiang and Tan (2013), to measure the total impact of the kth sector's price changes on the other economic sectors, we need to remove the kth row and the kth column from equation (2) and rewrite it in matrix form as follows:

$$\begin{bmatrix} a_{n,1} \\ a_{n,2} \\ \vdots \\ a_{n,k-1} \\ a_{n,K+1} \\ \vdots \\ a_{n,n} \end{bmatrix} \Delta P_n = (I - A_{n-1}^T) \begin{bmatrix} \Delta P_1 \\ \Delta P_2 \\ \vdots \\ \Delta P_{k-1} \\ \Delta P_{k+1} \\ \vdots \\ \Delta P_n \end{bmatrix} \quad (3$$

After removing the kth row and the kth column from the $n \times n$ technical coefficient matrix, A_{n-1}^T is the $(n-1) \times (n-1)$ direct technical coefficient matrix. According to equation (3), the impact of ΔP_k on the other economic sectors' price can be expressed as follows:

$$\begin{bmatrix} \Delta P_1 \\ \Delta P_2 \\ \vdots \\ \Delta P_{k-1} \\ \Delta P_{k+1} \\ \vdots \\ \Delta P_n \end{bmatrix} = (I - A_{n-1}^T)^{-1} \begin{bmatrix} a_{n,1} \\ a_{n,2} \\ \vdots \\ a_{n,k-1} \\ a_{n,K+1} \\ \vdots \\ a_{n,n} \end{bmatrix} \Delta P_k \quad (4$$

3.2 Modified input-output price model

As noted above, the standard input-output price model has not considered government price control. The assumption of government intervention for controlling the gasoline price can be formulated by introducing a modified input-output price model adopted by Jiang et al. (2015) and Coady and Newhouse (2005). According to this approach, the inflationary effects are estimated by assuming incremental gasoline price increases, and then distributional impacts are measured as welfare effects. To simplify the modeling, all economic sectors are categorized into two divisions indicated in Table (1): economic sectors with government intervention to control the gasoline price, and sectors without government intervention called uncontrolled sectors. The provided sample of the IO table is based on the quantitative standard IO model.

Table 1. Sample of Input-Output Structure Showing Government Intervention*

↓ Output	Input →	Endogenous		Exogenous	Total Output
		Controlled Sectors	Uncontrolled Sectors	Final Demand	
Endogenous	Controlled Sectors	Xccij	Xcnij	FDc	Xc
	Uncontrolled Sectors	Xncij	Xnnij	FDnc	Xnc
Exogenous	Other Accounts Value-Added	Vc	Vnc		
Total Output		Xc	Xnc		

Source: Research findings

*The endogenous section in Table (1) indicates the number of intermediate production transactions. This section is divided into two sub-sections, with government price control and without government price control. Xcc_{ij} denotes the interaction of the controlled sectors. Xnc_{ij} and Xcn_{ij} show the interaction of government-controlled sector with the uncontrolled sectors, Xnn_{ij} denotes the interaction of the uncontrolled sectors with other uncontrolled sectors. FD_c represents the final demand of the controlled sectors and FD_{nc} is the final demand of the uncontrolled sectors. V_c also represents the added value of the controlled sectors and V_{nc} represents the uncontrolled price sectors.

To extend the model according to the categorization made above, it is necessary to address the model in input-output price structure. Therefore, price changes are presented in input-output price model based on national accounts and the relationship between consumer and producer price is as follows:

$$q^c = p^* + t^c \quad (5)$$

where q^c shows the consumer price for sectors with government price controls and p^* indicates the producer price and t^c is taxes. The variation in consumer prices is dependent on producer price changes and Δ stands for tax variations:

$$\Delta q^c = \Delta p^* + \Delta t^c \quad (6$$

For economic sectors without government intervention to control fuel prices, any fuel price variation can fully transmit to the prices of the final commodities. Equation (7) provides the linkage between the consumer price and the producer price of the non-controlled sectors:

$$q^{nc} = p^{nc} + t^{nc} \quad (7$$

The producer price of non-controlled sectors represented asp^{nc}, can be expressed as $p^{nc} = p^{nc}(q, w)$ in which q shows the consumer cost of intermediate input and w denotes the factor price. Considering the user cost of intermediate input increases to be completely transferred to consumer prices, the factor prices are assumed to be constant. According to equation (7), consumer price variations are given by:

$$\Delta q^{nc} = \Delta p^{nc}(q, \overline{w}) + \Delta t^{nc} \quad (8$$

Where Δq^{nc} denotes the variation of the consumer price of non-controlled sectors, Δp^{nc} indicates the producer price changes and Δt^{nc} represents tax variations. We assume that the kth sector reflects the gasoline price shock throughΔP_k, so that the modified input-output price model can be expressed for non-controlled sectors as follows:

$$\Delta p_j^{nc}(q) = \sum_{i=1}^{n} \alpha_i a_{ij} \Delta q_j^{nc} + \sum_{i=1}^{n} \beta_i a_{ij} \Delta q_j^{c}, j = 1,2, \dots, n \quad (9$$

In which α_i stands for the ratio of intermediate input from non-controlled sectors in the jth sector; β_i denotes the ratio of intermediate input from controlled sectors in the jth sector. In addition, it is assumed that$0 \leq (\alpha n, \beta n) \leq 1$, and $\alpha n + \beta n = 1$.

Equation (9) can be expressed in matrix form as follows:

$$\Delta p^{nc} = \Delta q^{nc} \alpha A + \Delta t^{nc} \alpha A + \Delta p^* \beta A + \Delta t^c \beta A \quad (10$$

The equation above can be written as equation (11) in reduced, in which we assume that tax is constantly held, $\Delta t^{nc} = \Delta t^c = 0$ and$\Delta q^{nc} = \Delta p^{nc}$

$$\Delta p^{nc} = \Delta q^{nc} \alpha AH + \Delta p^* \beta AH + \Delta t^c \beta AH \quad (11$$

Where $H = (I - \alpha A)^{-1}$, the price variations of non-controlled sectors can be denoted as follows:

$$\Delta q = \Delta q^{nc}.\alpha + \Delta q^c.\beta = \Delta p^{nc}.\alpha + \Delta p^*.\beta \quad (12$$

4. The distributional impacts of gasoline price shock

As discussed in previous sections, household expenditures are influenced directly and indirectly by the effect of energy price shock on intermediate and final goods and services. To evaluate the welfare effects of these inflationary changes, the expenditure variation formula, according to Shahmoradi et al. (2011), has been proposed which estimates the distributional impacts of urban and rural household expenditures for different groups and is as follows:

$$Expenditure\ Variations = \frac{\sum_{k=1}^{n} \acute{P}_k C_k}{\sum_{k=1}^{n} P_k C_k} - 1 \qquad (13)$$

where P_k is the producer price for $the\ kth$ sector estimated by the standard or modified input-output price models before the gasoline price shock. $\acute{P}_k$ stands for producer price of $the\ kth$ sector after the gasoline price shock and C_k is the share of household expenditure from total final expenditures of the kth sector.

3. DATABASE

To assess the inflationary and welfare effects of gasoline price shock by the input-output price model, we use the 2016 symmetric and aggregated Iran input-output 15×15 Table (industry-by-industry). This information was provided by the *Central Bank of Iran* in 2021 (CBI, 2021).

According to the government's pricing policy, it is assumed that the price of gasoline would increase from 10 thousand Rials to 30 thousand Rials per liter. The short-term objective is to decrease gasoline subsidies and manage gasoline consumption. Nevertheless, we examine the social and economic effects of the Iranian government's socio-economic objectives regarding energy prices. As discussed in the previous section, the mentioned scenario can be implemented as an incremental price shock or one large hike. The next section provides empirical analyses of the results and presents some discussions.

4. EMPIRICAL RESULTS AND DISCUSSION

As pointed out in the previous sections, the distributional impacts of gasoline price shock could be measured using two fundamental input-output price approaches. The former estimates the welfare effects under the assumption of a sudden gasoline price shock. While the latter evaluates these effects under the incremental gasoline price shock scenario. Empirical results based on the standard input-output price model and the information presented on Table (1) reveal five major findings.

First- The results for urban households show that after a sudden gasoline price shock, decile 1, the poorest urban household, had their expenditure share drop from 3/14% to 2/94%. The poor will probably react to this price shock regarding their fixed income in two ways. To compensate for the expenditure, and to keep gasoline in the consumption basket, the first way is to reduce the share of other goods and services. To compensate for the expenditure, and to maintain consuming other goods and services, the second way is to reduce gasoline consumption. The reaction depends on the necessity of gasoline in the consumption basket for the mentioned expenditure groups.

These changes remain the same until decile 4. Nevertheless, the expenditures of the sixth, seventh, eighth, and ninth deciles, which represent the middle and wealthy consumer groups, have increased. This is because they did not have to reduce their expenditures in exchange for other commodities. However, as a result of the sudden gasoline price shock, decile 10, the richest household, has reduced its expenditures.

It is impossible to determine which economic activities are related to the onset of the reduction or the increase in expenditures due to the full transmission of the gasoline price shock to economic sectors. Nevertheless, it seems that in the short term, Iranian households will not be able to adjust their consumption of goods and services. (e.g., goods or services that use less gasoline as a key input in their production). As a result, the distributional effects of sudden gasoline price shocks for poor households (the first to third deciles), would be severe. At the same time, wealthier households will not reduce gasoline consumption. Instead, they will try to tolerate the direct and indirect inflationary effects of gasoline price shocks. Accordingly, it is expected that after the sudden gasoline price shock, urban households with the highest expenditure would experience a rising share of expenditure.

Second- The result of distributional effects after a sudden gasoline price shock for rural households is the same as for urban households. The expenditure share of the poorest rural household has decreased from 3.27% to 3.06%. The decline in expenditure share has continued up to decile 4. However, the fifth to ninth deciles have experienced an increase in their share of expenditure after the sudden gasoline price shock. The situation of the wealthiest rural households (decile 10) is similar to that of the urban households in which the expenditure share has slightly reduced from 24/44% to 24/42%, an insignificant change.

Table 2. The Comparison of households' expenditures before and after a sudden gasoline price shock, based on the standard input-output price model

	The Share of household expenditures					
	Before the gasoline price shock			After the gasoline price shock		
	Urban	Rural	All	Urban	Rural	All
Decile 1	3/14%	3/27%	3/16%	2/94%	3/06%	2/96%
Decile 2	4/83%	5/59%	4/92%	4/72%	5/44%	4/81%
Decile 3	5/35%	5/50%	5/37%	5/32%	5/38%	5/33%
Decile 4	6/16%	6/66%	6/21%	6/14%	6/60%	6/18%
Decile 5	7/14%	7/84%	7/22%	7/23%	7/87%	7/29%
Decile 6	8/05%	9/03%	8/16%	8/18%	9/09%	8/28%
Decile 7	9/53%	10/46%	9/64%	9/71%	10/57%	9/81%
Decile 8	11/73%	12/14%	11/78%	12/00%	12/30%	12/01%
Decile 9	15/58%	15/06%	15/52%	15/79%	15/29%	15/75%
Decile 10	28/48%	24/44%	28/02%	27/97%	24/42%	27/58%
Sum	100%	100%	100%	100%	100%	100%

Source: Research findings

Third- The trend in all Iranian households is similar to that observed in urban and rural deciles. After the sudden gasoline price shock, the first to fourth deciles have reduced their share of expenditures in economic sectors. The fifth to ninth deciles, the wealthiest groups, have faced an increase in their expenditures. Decile 10 also acted similarly to poor households. The fifth to ninth deciles will try to maintain the same welfare situation as they had before the gasoline price shock. They will easily overcome these inflationary effects by paying for higher costs. Other groups, particularly the lower deciles, will reduce their expenditures as they cannot afford a more expensive basket. Finally, we discuss below how all these groups will adjust their expenditure after a sudden gasoline price shock.

Fourth- According to Fig (1), it can be observed that after the sudden gasoline price shock, decile 10 has the highest increase in expenditures. Occurring in rural households, all households, and urban households, respectively. On the contrary, the second decile has the highest decrease in expenditures. Occurring in all households, rural households and urban households, respectively.

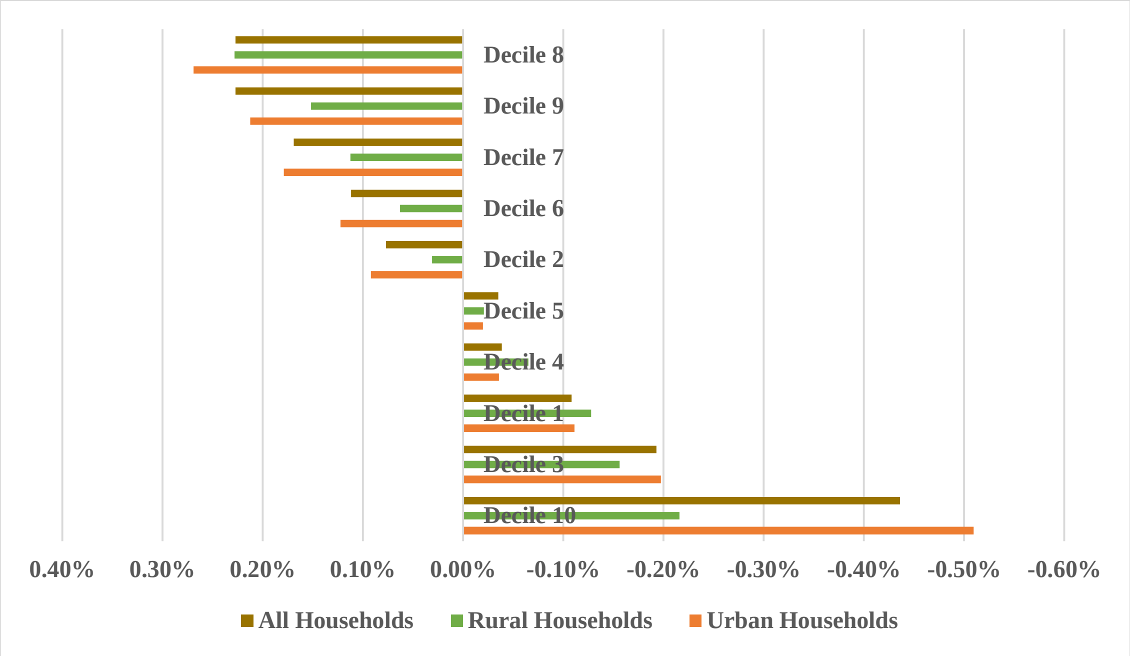

Figure 1.The Changes in households' expenditure shares after the sudden gasoline price shock

Source: Research findings

Fifth- we can consider the changes in household expenditure shares from a different perspective. According to the regressivity effects, expenditure variations can be categorized into three fundamental distributional impacts: progressive, regressive and neutral. Regarding the progressive effect, we expect that households in higher deciles would have to increase their expenditures after the gasoline price shock. According to Fig (1), high-income Iranian households would be forced to face higher expenditures due to the sudden gasoline price shock. On the other hand, low-income households are likely to switch to cheaper commodities. This results in a reduction in their expenditures after the sudden gasoline price shock. Therefore, it is concluded that after this sudden price shock, Iranian households experienced a progressive distributional effect on their welfare.

In Table (2), we discuss the empirical results of the modified input-output price model with implementation of the scenario of incremental gasoline price shock.

First- According to Table (2), the expenditure share for decile 4 urban households has declined. For example, the share of the first decile, the poorest Iranian households, has risen from 4/18% to 3/78% after the incremental gasoline price shock. However, the expenditure shares of middle-class and wealthy-class urban households, decile 5 to decile 10, have increased after the incremental gasoline price shock. Therefore, the results show that high-income households experienced more favorable distributional impacts from the incremental gasoline price shock than the poorest Iranian urban households, which had to decrease their spending on all commodities and suffered from this price scenario.

Second- As reported in Table (2), the distributional impacts show that the expenditure shares of rural households in the first four deciles declined. Like the urban households, the rural households in the fifth to tenth deciles increased their expenditures to maintain their consumption basket.

Table 3. The Comparison of the household's expenditure before and after incremental gasoline price shock based on a modified input-output price model

	The Share of household expenditures					
	Before the gasoline price shock			**After the gasoline price shock**		
	Urban	Rural	All	Urban	Rural	All
Decile 1	3/14%	3/27%	3/16%	2/91%	2/93%	2/96%
Decile 2	4/83%	5/59%	4/92%	4/67%	5/24%	4/81%
Decile 3	5/35%	5/50%	5/37%	5/26%	5/20%	5/33%
Decile 4	6/16%	6/66%	6/21%	6/07%	6/44%	6/18%
Decile 5	7/14%	7/84%	7/22%	7/15%	7/90%	7/29%
Decile 6	8/05%	9/03%	8/16%	8/09%	9/13%	8/28%
Decile 7	9/53%	10/46%	9/64%	9/58%	10/61%	9/81%
Decile 8	11/73%	12/14%	11/78%	11/84%	12/35%	12/01%
Decile 9	15/58%	15/06%	15/52%	15/58%	14/92%	15/75%
Decile 10	28/48%	24/44%	28/02%	28/85%	25/28%	27/58%
Sum	100%	100%	100%	100%	100%	100%

Source: Research findings

Third- The behavior of all Iranian households after the incremental gasoline price shock the same as urban and rural households. After the incremental price shock, the expenditure shares of all Iranian households have been reduced to decile 4. However, the remaining households, the fifth to tenth deciles, have seen an increase in their expenditures. Households have to increase their expenditures to reach the same level of welfare as before the gasoline price shock, similar to urban or rural households.

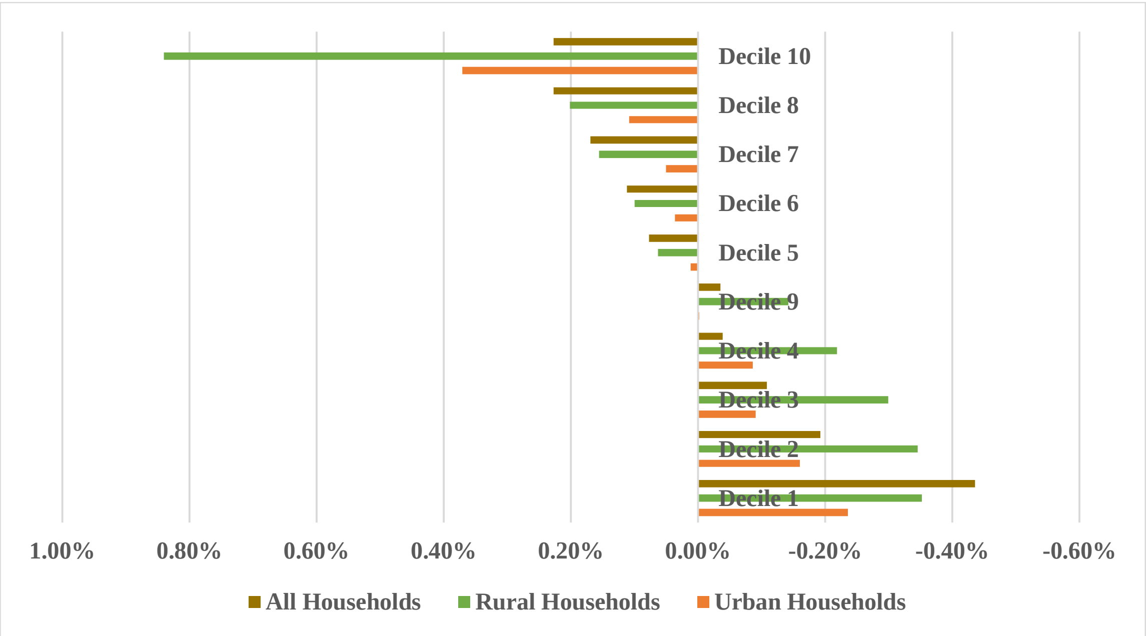

Figure 2. The Changes in households' expenditure shares after the incremental gasoline price shock

Source: Research findings

Fourth- According to Fig (2), the highest increase in expenditures after the incremental gasoline price shock can be seen in decile ten for rural and urban households, respectively. On the contrary, the highest decrease in expenditures occurred in the first decile for all households, rural, and urban, respectively.

Fifth- As discussed in the standard model, Iranian households' expenditure variations after the incremental gasoline price shock can be categorized into three fundamental distributional effects. According to Fig (2), high-income Iranian households would have higher expenditures due to the incremental gasoline price shock. On the contrary, low-income households reduce their expenditures after the incremental gasoline price shock. Therefore, it can be concluded that after this scenario, Iranian households have experienced a progressive distributional effect on their welfare, similar to gasoline price shock's first scenario.

However, the progressivity of distributional effects in the two models and scenarios is different. The expenditure changes after the gasoline price shock can be compared between the two price scenarios. After the sudden price shock, households cannot immediately give up goods and services that depend on gasoline. As a result, they need to focus more on reducing their expenditure. Nevertheless, as high-income households in higher deciles tend to prevent their consumption baskets from changing, they encounter less progressive distributional impacts, and they don't react as strongly to price shocks. With incremental price shocks, the expenditure share of lower-income households does not decline as much as it did with sudden price shock. Thus, households have time to compensate for their reduced expenditures by choosing more substitutable commodities, and expenditure cuts are less likely to occur. On the other hand, higher-income households cannot change their final consumption and will attempt to maintain their welfare situation. As a result, after an incremental price shock, their expenditures would increase. Therefore, we expect higher-income households to experience a more severe distributional impact, resulting in their higher expenditure share over time.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This article evaluated the welfare effects of gasoline price shock in Iran by relying on two fundamental input-output price models. Furthermore, we examined two gasoline price shocks scenarios: the sudden gasoline price shock and the incremental gasoline price shock. The empirical results were presented based on the 2016 input-output table of the *Central Bank of Iran.* Moreover, we discussed the expenditure variations for three household groups: urban, rural, and Iranian households. Here are some policy remarks based on the empirical results:

First- After implementing two scenario variations for a gasoline price shock, it is expected that the expenditure share for the highest-income deciles in urban, rural, and Iranian households would increase. This expenditure variation is known as the progressive distributional effect. The only difference between the two scenarios was the severity of expenditure variations. For high-income households, the progressivity effect in the sudden price shock scenario is less than in the incremental scenario. Unlike the progressivity welfare effect for high-income households, the expenditure share of the lowest-income groups was reduced. Accordingly, we expect that after the gasoline price shock, lower-income groups would likely experience a reduction in their consumption of goods and services. However, high-income households would inevitably continue to increase their expenditures.

Second- Based on the empirical results, after a sudden gasoline price shock, the average decrease in expenditure for low- and mid-income deciles was about 0/17%. However, after the incremental gasoline price reform, the average was about 0/21%. The incremental gasoline price reform created some price expectations and led to a further reduction in middle-income and poor households' expenditures. On the other hand, the sudden gasoline price shock caused the share of expenditures for high-income Iranian households to increase even further. Despite the reducing in the welfare of the middle- and low-income households, the government can incrementally reform gasoline prices to decrease the budget deficit and implement other economic measures. For example, increasing tax revenues or broadening the tax base on commodities mainly consumed by the highest-income households. However, we suggest implementing tax policies and gasoline price reforms incrementally. According to empirical results, after the incremental gasoline price reform, the average increase in the expenditure share for the first three higher-income deciles was 1.5 times larger than after the sudden price reform. Therefore, if the government intended to improve its gasoline subsidy policies, it would have to reform gasoline prices in line with rising wages or inflation. This would enable the government to reduce or eliminate gasoline subsidies.

Third- However, it appears that in the early period of implementation, the distributional impacts of scenario of incremental gasoline price reform on the poor and medium-income households are compatible with the scenario of sudden gasoline price shock. To reduce the severe progressive expenditure effects in the long term, especially on low- and mid-income households, we recommend implementing an incremental policy for gasoline price correction. Reform amounts can be based on the annual consumer inflation rate as well as other price-driven economic indicators. Nevertheless, the success of the mentioned policy depends on the state of economic stability during the fuel price correction.

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