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# Distributional Consequences of Subsidy Removal from Agricultural and Food Industry Sectors in Iran: A Price-based SAM Analysis

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## ABSTRACT

**This paper explores the distributive impacts of subsidy removal in agricultural sectors and related industry in Iran, using a social accounting matrix (SAM)-based price model. The structural path analysis approach is used to decompose the overall influences into direct, global, and total effects. The simulation results reveal that a shock therapy strategy, which involves the removal of all subsidies from all food producing sectors at once, amplifies the adverse effects of this policy option, especially on the low income households. Also, results indicate that removing subsidy from food producing sectors has distributional consequences for the Iranian households. The rural low income group is the most adversely affected group while the urban high income group is the least affected among the Iranian households. In addition, reducing subsidy in food industry sector has the largest impact on the households' welfare. Based on the results of the path decomposition of the households' expenditure, it is expected that less than 50 percent of the overall effects of subsidy removal appear almost immediately after implementing this policy.**


**JEL classification: O5; O2; D58**

**Keywords**: Agriculture, Food industry, Income distribution, Iran, Path analysis, SAM, Subsidy.

## INTRODUCTION

Iran has embarked on a major policy decision to reduce the considerable subsidies currently directed to its agricultural and food sectors, and energy sector. Historically, the economy of Iran has been marked by various market distortions. Subsidy payments, price controls, price and market guarantees, commodity procurements, and various tariffs and non-tariff barriers are parts of these distortions. Subsidy payments have become a well known consumer and producer support policy after the Islamic Revolution in 1979. According to the Central Bank of Iran (Tsd.cbi.ir/display/content.aspx), the production subsidy expenditure substantially increased from 514.9 billion Rials (Officially one US dollar is about 12260 Iranian Rials in year 2013. in 1991 to 10,468 billion Rials in 2001 and to 85,433.7 billion Rials in 2008. The subsidy expenditure numbers are 459.1, 9,467.5, and 68,534.9 billion Rials, respectively, for the same years for agricultural products. Even in real term, the subsidy expenditures of agricultural products have increased from 5,598.8 to 37,389.5 billion Rials during 1991-2008 period. Accordingly, the share of subsidy in agriculture and food sectors in nominal term has been more than 80 percent of the overall subsidy payments on productions. Recently, the government of Iran has decided to remove subsidies and to make a direct payment to all income groups. This paper explores the distributive impacts of subsidy reduction in agricultural sector and related industry in Iran, using a price-based social accounting matrix (SAM) model that is based on the latest

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published input-output table released by Iran's Statistical Centre.

In fact, since 1980, many developing countries facing persistent budget deficits and balance of payment difficulties have adopted structural adjustment policies to correct the structural imbalances in the economy and to bring their economies back to a sustainable growth path. Under these policies, there has been a general shift away from the quantitative restrictions and price controls towards liberalization and privatization, and an intension to remove subsidies from production and consumption. In line with the world economic changes, the process of economic adjustment in Iran was initiated, for the first time, with the beginning of the First Five-Year Development Plan (FFYDP) in 1988. Aiming to accelerate the economic growth; removal of subsidy, liberalizing the trade regime and exchange system have been at the heart of this economic adjustments program. The adverse effects of partial implementation of the structural adjustment policies on the economy of Iran, especially the inflationary consequences of this policy, prevented full implementation of the policy. Recently, the government of Iran has decided one more time to perform structural adjustment with some modification that is removing subsidies and making payments directly to all income groups at the same time. But, the main question is: what are the consequences of the new economic policy concerning removal of subsidy from agriculture and food industry sectors on raising consumption expenditure of different income groups in Iran? What is the compensation requirement for offsetting the adverse effects of this policy?

In the past, a number of empirical studies examined the impacts of implementing these reform policies in different countries and showed that, in most countries, the initial impact of the reforms was worsening growth rates and income distribution. These studies showed that the programs hurt the poor segment of population the most. For example, in case of Pakistan, the study of Kemal (1994 and 2001), Amjad and Kemal (1997), and Iqbal and Siddiqui (1999) suggested that the impact of structural adjustment programs was unevenly distributed among the population, hurting the most vulnerable group the most. The work of Davies and Rattsø (2000) for Zimbabwe is another example of the disadvantage of the economic adjustment. According to this study, income distribution has worsened, mostly because of a shift in inflation with a rigid nominal wage regime in the economy. Results of adopting structural adjustment reforms in Malawi given by Chirwa (2005) suggested that domestic trade liberalization benefited the non-poor while the poor were the likely losers. Nwafor *et al*. (2006) indicated removal of petroleum subsidies would increase the national poverty level in Nigeria due to the consequent rise in inputs' costs which was higher than the rise in selling prices of most firms and farms. Parra and Wodon (2008) examined the impact of food and energy price shocks, which can be caused by subsidy removal, on consumers in Ghana. Their results revealed that an increase in the overall level of prices for food and oil would had a larger negative impact on the cost of living of households and the differences in increases in the cost of living for urban and rural households were fairly similar. Therefore, they suggested that special attention should be given to compensatory mechanisms in rural areas because rural households are significantly poorer than urban households and, thus, have fewer means to deal with price shocks. Youssef (2008) studied the role of food subsidies on poverty alleviation in Egypt. This analysis revealed that despite the normative goals of economic stabilization and structural adjustment, the reforms did not effectively alleviate poverty. He suggested that the need, therefore, arises for reforming, not eliminating, the current food subsidy system. Also, Dini and Lippit (2009) showed that food subsidy removal led to a deep crisis in global food market in 2007 with rising of poverty and dying of some people around the world due to lack of access to food. There are some other studies, however, that support the beneficial effects of the reform policies. For example, White (1997), citing the case of African countries, argued that welfare indicators were expected to perform better in countries adopting adjustment policies than those which do not. Also, the study of Townsend and McDonald (1998) for South Africa indicated that the reforms favored the poorer households. According to Bhanumurthy and Mitra (2004), in the post reform period compared to pre reform in India states, mean per capita consumption





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expenditure has gone up and inequality has fallen, which means a fall in poverty after economic reforms. Tambunan (2005) concluded that structural reforms lead to increase in output and also, sometimes, to reduced prices; and these two factors are, respectively, negatively and positively correlated with poverty. However, inflation is the most important channel through which macroeconomic reform policies influence poverty reduction.

The contradictory results of the aforementioned studies reveal the fact that the impacts of the reform policies are economy-specific and vary depending on the undertaken policy. This is the main motivation for our study of the distributive impacts of removing production subsidies in the context of Iranian economy. Given that, we try to examine consequences of removing subsidies from agricultural and food industry sectors with an emphasis on distributional consequences for the poor, medium, and rich income households separately in the urban and rural areas and to calculate the compensation requirement for such a reform policy.

## MATERIALS AND METHODS

### Technical Description of SAM

Basically, a SAM, as shown in the simplified framework in Table 1, is a square matrix representing the circular flow in an exchange economy. In this matrix, the activities of each sector (account) in the economy are recorded as one row and one column. The row entries indicate the details of receipts (income) by each account, while the columns record the corresponding expenditures. For example, reading the entries in Table 1 down the column II, shows that activities pay for commodities or materials ($R_{12}$) and primary factors ($R_{32}$), which are combined to generate output, pay tax to government ($R_{52}$). Column IV shows that households pay commodities ($R_{14}$) for consumption of goods and services, they pay taxes to government ($R_{54}$), transfer income to households and pay households for receiving services ($R_{44}$), and save the rest of their income ($R_{84}$).

Similarly, government pays commodities ($R_{15}$) for consumption and has subsidy and income transfer to households ($R_{45}$); institutions pay dividend to owners of capital and bonds ($R_{46}$), taxes to government ($R_{56}$), debts to foreigners ($R_{76}$), and have their own saving ($R_{86}$).

In the same way, entries across the rows in Table1 indicate the agent's receipts from different accounts. For instance, the commodity receives from sales of raw material to the producers ($R_{12}$) and supply of consumption goods and services to the households ($R_{14}$), government ($R_{15}$), foreign countries (export, $R_{17}$) and for investment ($R_{18}$), and similarly for the other rows. Since receipts must equal expenditure for each and every account, the vector of column sums (expenditures) must equal the vector of row sums (income). Hence, a SAM is a form of double entry booking keeping where each cell of the matrix identifies the origin, destination, and magnitude of economic transactions.

In reality, a SAM can include several types of accounts. The SAM constructed for this study consists of (I) commodities, (II) activities, (III) factors of production, tax and subsidies, (IV) households, (V) government, (VI) public and private institutions, and (VII) the rest of the

**Table 1**. A general representation of social accounting matrix.

| | Account | | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Current Account | I | Commodities | 0 | $R_{12}$ | 0 | $R_{14}$ | $R_{15}$ | 0 | $R_{17}$ | $R_{18}$ | $\Gamma_1$ |
| | II | Activities | $R_{21}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\Gamma_2$ |
| | III | Factors | 0 | $R_{32}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\Gamma_3$ |
| | IV | Households | 0 | 0 | $R_{43}$ | $R_{44}$ | $R_{45}$ | $R_{46}$ | $R_{47}$ | $R_{48}$ | $\Gamma_4$ |
| | V | Government | $R_{51}$ | $R_{52}$ | $R_{53}$ | $R_{54}$ | 0 | $R_{56}$ | $R_{57}$ | 0 | $\Gamma_5$ |
| | VI | Institutions | 0 | 0 | $R_{63}$ | 0 | 0 | 0 | $R_{67}$ | 0 | $\Gamma_6$ |
| | VII | ROW | $R_{71}$ | 0 | 0 | 0 | 0 | $R_{76}$ | 0 | 0 | $\Gamma_7$ |
| VIII | Capital account | | 0 | 0 | 0 | $R_{84}$ | $R_{85}$ | $R_{86}$ | $R_{87}$ | $R_{88}$ | $\Gamma_8$ |
| IX | Total | | $\Gamma_1$ | $\Gamma_2$ | $\Gamma_3$ | $\Gamma_4$ | $\Gamma_5$ | $\Gamma_6$ | $\Gamma_7$ | $\Gamma_8$ | |





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world (ROW) accounts. Each of the last five accounts has separate capital account in addition to the current account. This SAM is based on the 2001 use and supply matrix of input-output tables, the latest input-output tables released by the Statistical Centre of Iran (SCI, 2006). The original input-output table of Iran is aggregated into 49 activities that, totally, produce 63 commodities and services. The names of the commodities are presented in Table 2. Table 3 presents the names of activities together with information on tax and subsidies paid to the activities.

In the Iranian SAM, primary factors include labor, capital, and land, while land is used only in the two farming and horticultural sectors within agricultural activities. Since the distributional consequences of policy changes are the focus of this study, the households are classified into 6 socioeconomic groups; low, medium, and high urban income groups and low, medium, and high rural income groups, based on the expenditure shares of these income groups in the Iranian total expenditures, using 2001 Survey of Rural and Urban Household income and Expenditure data published by statistical center of Iran. We considered the four first deciles groups as low income groups, the next four second deciles groups as medium income groups, and the two remaining deciles groups as high income groups.

The majority of data used in construction of the Iranian SAM were from the 2001 input-output table. Data on interindustry transactions, total household expenditure, government expenditure, imports and exports, subsidy and indirect taxes, and aggregate labor and capital income and land rent, all were obtained from input-output table. Households income and expenditure were disaggregated into 6 income classes based on the information available in 2001 Survey of Household Expenditure (SCIa, 2002; SCIb, 2002). Data on savings were calculated as a residual, using the input-output table.

## From SAM to a Price Formation Model

According to Pyatt and Round (1979), a SAM-based "quantity model" is derived from a SAM table by separating endogenous and exogenous accounts and assuming that activity levels may vary while prices are fixed in the economy. Suppose in Table 1, commodities, activities, factors and households accounts are considered as endogenous, and the rest (government, institutions, rest of the world and capital account, etc.) are taken as exogenous. Let $A_{ij}$ denote the matrixes of normalized coefficients obtained by dividing each element of Table 1 ($R_{ij}$) by the column sum, and let $\acute{\Gamma}_i$ be the income of exogenous groups (i= 5, 6, 7, 8). Reading down the SAM columns for the endogenous accounts, then, the income generating model is derived as:

$$\Gamma_1= A_{12}\,\Gamma_2 + A_{14}\,\Gamma_4 + A_{15}\,\acute{\Gamma}_5 + A_{17}\,\acute{\Gamma}_7 + A_{18}\,\acute{\Gamma}_8$$
$$\Gamma_2= A_{21}\,\Gamma_1$$
$$\Gamma_3= A_{32}\,\Gamma_2$$
$$\Gamma_4= A_{43}\,\Gamma_3 + A_{44}\,\Gamma_4 + A_{45}\,\acute{\Gamma}_5 + A_{46}\,\acute{\Gamma}_6 + A_{47}\,\acute{\Gamma}_7 + A_{48}\,\acute{\Gamma}_8 \quad (1)$$

Let's define "*A*" a matrix of normalized coefficients for the endogenous accounts:

$$A = \begin{bmatrix} 0 & A_{12} & 0 & A_{14} \\ A_{21} & 0 & 0 & 0 \\ 0 & A_{32} & 0 & 0 \\ 0 & 0 & A_{43} & A_{44} \end{bmatrix} \quad (2)$$

Given the above model and further assuming that $\Gamma = (\Gamma_1, \Gamma_2, \Gamma_3, \Gamma_4)$ is the vector of endogenous accounts or variables and y is the vector of exogenous variables, the model (1) can be written in matrix notation as:

$$\Gamma = A\Gamma + y \quad (3)$$

By solving the above equations for endogenous variables, the following expression can be derived, which indicates endogenous variables ($\Gamma$) as a function of exogenous variables and, consequently, reflects the changes in the income of endogenous accounts ($\Gamma$) as a result of a shock on exogenous variables (y):

$$\Gamma= (I-A)^{-1}\, y= My \Rightarrow \Delta\Gamma= M\Delta y \quad (4)$$

Where, *M* is termed as the income multiplier matrix.

As asserted by Roland-Holst and Sancho (1995), by adding the two assumptions of generalized homogeneity and fixed input coefficient to the earlier assumption of excess capacity in the production activities, which imply that prices can be computed independently of activity levels, a price formation and cost transmission variant of the SAM model can be derived in which prices are responsive to costs but not to activity levels.





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**Table 2**. Name of the commodities and services in the SAM of Iran.

| Commodities and services | Name | Commodities and services | Name |
|---|---|---|---|
| C1 | Farm products | C33 | Agricultural and Machinery equipments |
| C2 | Horticulture products | C34 | Special-purpose machinery |
| C3 | Livestock and hunting products | C35 | Office machinery |
| C4 | Forestry and logging products | C36 | Electrical machinery and apparatus |
| C5 | Fishery products | C37 | Radio, television and communication equipment and apparatus |
| C6 | Crude petroleum | C38 | Medical appliances, precision and optical instruments, watches |
| C7 | Other mines | C39 | Transport equipment |
| C8 | Preserved .meat | C40 | Electricity, gas and water |
| C9 | Fruits, vegetable and Sea food preserved | C41 | Construction services |
| C10 | Edible oil | C42 | Wholesale and retail trade services |
| C11 | Dairy prod | C43 | Hotel & restaurant services |
| C12 | Sugar and tea | C44 | Land transport services |
| C13 | Grain mill and Bread | C45 | Water transport services |
| C14 | Other food products | C46 | Air transport services |
| C15 | Beverages | C47 | Supporting and auxiliary transport services |
| C16 | Tobacco | C48 | Postal and telecommunications services |
| C17 | Spinning and weaving , textiles and wearing | C49 | Bank services |
| C18 | Carpets and rugs | C50 | Financial intermediation services |
| C19 | Leather, fur and leather products | C51 | Insurance services |
| C20 | Paper & paper products, wood products | C52 | Real estate services |
| C21 | Bedzin | C53 | Rental and leasing services |
| C22 | Other ref Petro products | C54 | Research and development services |
| C23 | Basic chemicals | C55 | Other professional, technical and business services |
| C24 | Fertilizers and pesticides | C56 | Agricultural, mining and manufacturing services |
| C25 | Medicines | C57 | Maintenance, repair and installation services |
| C26 | Other chemicals | C58 | Public administration and compulsory social security services |
| C27 | Rubber and plastics products | C59 | Defense services |
| C28 | Non-metallic products | C60 | Education services |
| C29 | Furniture; other transportable goods | C61 | Health and social work services |
| C30 | Basic metals | C62 | Recreational, cultural and sporting services |
| C31 | Fabricated metal products | C63 | Other services |
| C32 | General-purpose machinery | | |

Given these assumptions and following Roland-Holst and Sancho (1995), let $P_i$ be a price index for group $i$'s activity with symbol prime ($'$), denoting the exogeneity of the group; then, using column normalized expenditure coefficients and readings down the columns of the SAM in Table 1, the price index (price formation) for the first four endogenous groups are given by:

$$P_1= P_2A_{21} + \acute{P}_5A_{51} + \acute{P}_7A_{71}$$

$$P_2= P_1A_{12} + P_3A_{32+} \acute{P}_5A_{52}$$

$$P_3= P_4A_{43} + \acute{P}_5 A_{53+} \acute{P}_6A_{63}$$

$$P_4= P_1A_{14} + P_4A_{44}+ \acute{P}_5 A_{54}+ \acute{P}_8 A_{84} \qquad (5)$$

Let Á be defined as a matrix of normalized expenditure coefficients for the exogenous accounts,

$$Á = \begin{bmatrix} A_{51} & A_{52} & A_{53} & A_{54} \\ 0 & 0 & A_{63} & 0 \\ A_{71} & 0 & 0 & 0 \\ 0 & 0 & 0 & A_{84} \end{bmatrix} \qquad (6)$$





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**Table 3.** Subsidy payments and tax received on productions in Iran, 2001 (Million Rials).

| Sector | Name | Tax | Subsidy | Net Subsidy | Percent of subsidy |
|---|---|---|---|---|---|
| S1 | Farming | 78916 | 435864 | 356949 | 0.9509 |
| S2 | Horticulture | 19273 | 152095 | 132822 | 0.5602 |
| S3 | Agricultural service | 9366 | 56999 | 47634 | 1.0291 |
| S4 | Livestock and hunting | 51633 | 25000 | -26633 | 0.0488 |
| S5 | Forestry | 3398 | 0 | -3398 | 0.0000 |
| S6 | Fishery | 37747 | 0 | -37747 | 0.0000 |
| S7 | Exploitation crude petroleum and natural gas | 230660 | 341 | -230320 | 0.0003 |
| S8 | Other mining | 15374 | 17 | -15357 | 0.0003 |
| S9 | Manufacture of Edible oil | 29139 | 0 | -29139 | 0.0000 |
| S10 | Other food industry | 1006959 | 10529567 | 9522608 | 13.8043 |
| S11 | Manufacture of tobacco products | 12208 | 0 | -12208 | 0.0000 |
| S12 | Wearing and textile industry | 138019 | 131056 | -6963 | 0.6092 |
| S13 | Leather industry | 15655 | 0 | -15655 | 0.0000 |
| S14 | Wood and paper industry | 48709 | 155000 | 106291 | 2.1618 |
| S15 | Manufacture of petroleum refinery products | 1022235 | 0 | -1022235 | 0.0000 |
| S16 | Chemical industry | 185678 | 110000 | -75678 | 0.4101 |
| S17 | Rubber and plastic industry | 172392 | 0 | -172392 | 0.0000 |
| S18 | Manufacture of other non-metallic mineral products | 133247 | 0 | -133247 | 0.0000 |
| S19 | Manufacture of furniture | 31419 | 0 | -31419 | 0.0000 |
| S20 | Manufacture of basic metals | 641208 | 0 | -641208 | 0.0000 |
| S21 | Manufacture of fabricated metal products | 90775 | 0 | -90775 | 0.0000 |
| S22 | Manufacture of machinery and equipment | 106473 | 0 | -106473 | 0.0000 |
| S23 | Manufacture of office machinery | 2059 | 0 | -2059 | 0.0000 |
| S24 | Manufacture of electrical machinery | 48533 | 0 | -48533 | 0.0000 |
| S25 | Manufacture of communication equipment | 65621 | 0 | -65621 | 0.0000 |
| S26 | Manufacture of medical, precision and optical inst. | 9181 | 0 | -9181 | 0.0000 |
| S27 | Manufacture of transport equipment | 2259310 | 0 | -2259310 | 0.0000 |
| S28 | Electricity, gas and water supply | 921258 | 23260 | -897998 | 0.0835 |
| S29 | Construction | 3897536 | 1000 | -3896536 | 0.0011 |
| S30 | Wholesale and retail trade | 282594 | 809340 | 526746 | 0.6663 |
| S31 | Repair services | 32709 | 0 | -32709 | 0.0000 |
| S32 | Hotels and restaurants | 87829 | 45000 | -42829 | 0.3353 |
| S33 | Land transport; transport via pipelines | 1735337 | 163000 | -1572337 | 0.2929 |
| S34 | Water transport | 7795 | 0 | -7795 | 0.0000 |
| S35 | Air transport | 142255 | 0 | -142255 | 0.0000 |
| S36 | Supporting and auxiliary transport activities | 377671 | 0 | -377671 | 0.0000 |
| S37 | Post and telecommunications | 418111 | 50500 | -367611 | 0.5842 |
| S38 | Bank | 227422 | 2000 | -225422 | 0.0154 |
| S39 | Insurance services | 41154 | 0 | -41154 | 0.0000 |
| S40 | Other Financial intermediation | 39556 | 0 | -39556 | 0.0000 |
| S41 | Real estate activities | 733416 | 0 | -733416 | 0.0000 |
| S42 | Renting of machinery and equipment | 5413 | 0 | -5413 | 0.0000 |
| S43 | business activities | 323062 | 7751 | -315311 | 0.0535 |
| S44 | Public administration and compulsory social security | 193427 | 0 | -193427 | 0.0000 |
| S45 | defense | 39305 | 0 | -39305 | 0.0000 |
| S46 | Education | 48469 | 0 | -48469 | 0.0000 |
| S47 | Health and social work | 46263 | 0 | -46263 | 0.0000 |
| S48 | Recreational, cultural and sporting activities | 54444 | 59405 | 4961 | 0.8466 |
| S49 | Other service activities | 27188 | 0 | -27188 | 0.0000 |

and $z = \acute{P}\acute{A}$ as the matrix of exogenous costs, with $\acute{P} = (\acute{P}_5, \acute{P}_6, \acute{P}_7, \acute{P}_8)$, a vector of prices for the exogenous sectors, and $P = (P_1, P_2, P_3, P_4)$ as the vector of prices for the endogenous sectors of the SAM; then, using the same matrix $A$ of normalized expenditure coefficient





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(2), the price formation model (5) can be written in matrix notation as:

$$P= PA + z= z (I-A)^{-1}= zM \quad (7)$$

From the above model, it is implied that $\Delta P= \Delta zM$, where $M$ is the same multiplier matrix as before. However, as Roland-Holst and Sancho (1995) noted, the interpretation of $M$ is different depending on whether we read its entries across the rows or down the columns. A distinction can be made by referring to $M$ as the income multiplier matrix, and to its transpose, $M$', as the price-transmission matrix. Thus, each element in matrix $M$, such as $m_{ij}$, reflects the effects on price for group $j$ in response to unitary exogenous changes in sector $i$ costs.

## Decomposition of Matrix Multiplier

To analyze the effect on price $P_j$ of any exogenous price (cost) increase, one needs to decompose multiplier matrix. The Block-Decomposition, proposed by Stone (1985) and Pyatt and Round (1979), and the Structural Path Analysis (SPA), introduced by Lantner (1974) and Gazon (1976), are the two approaches for this purpose. As noted by Defourny and Thorbecke (1984), the SPA, provides much more detailed way to decompose multipliers as compared to the first approach. In fact, in SPA, the network of all the paths which connect one sector (account) to another is identified. The effects of one sector on another can go through an elementary path or a circuit. A path is known as an elementary path if it does not go through a sector more than once. The path would be defined as a circuit if the origin and the destination sectors coincide. Furthermore, in the SPA approach, the term influence is used to measure the magnitude of a change in one sector due to a unitary change in another sector. There are three types of influences, namely; direct influence, total influence, and global influence. The direct influence of sector $i$ on sector $j$ is the change in sector $j$ as the result of a unitary change in sector $i$, with the other sectors remaining constant, except those along the elementary path from sector $i$ to sector $j$. The total influence of sector $i$ on sector $j$ is the influence transmitted from sector $i$ to sector $j$ along the elementary path and circuit that connect the two sectors. The global influence of sector $i$ on sector $j$ measures the full effects on sector $j$ as a result of a unitary change in sector $i$. Defourny and Thorbecke (1984) utilized this approach in a SAM-based quantity model and Roland-Holst and Sancho (1995) used this approach in a SAM-based price model.

Given the above explanations and applying the SPA framework to the equation (7), the effect on price $P_j$ of any exogenous price increase affecting $P_i$, before considering any general equilibrium feedbacks, is given by the partial derivative of price j with respect to price i, which is shown by $a_{ji}$ (i.e., $\partial P_j/\partial P_i= a_{ji}$) with $a_{ji}$ belonging to the $A$' matrix. Also, the impact of an exogenous cost change in sector $i$ on price $P_j$ is derived by partial derivative of price j with respect to $z_i$, which is shown by $m_{ji}$ (i.e., $\partial P_j/\partial z_i= m_{ji}$) with $m_{ji}$ belonging to the price transmission matrix, M'. In the SAM-based price model, the elements of matrix $A$**'** constitutes the direct cost (price) influence, while the elements of the price transmission matrix $M$' give the global influence. The total cost influence is the product of the direct influence and the price path-multiplier. The latter is the ratio of two determinants: the determinant of matrix (I-A'), and the determinant of the $q$-th sub-matrix of (I-A'). The latter determinant is obtained by excluding the poles of the elementary $q$-th path from matrix (I-A'). (See Defourny and Thorbecke (1984) for deriving the path multiplier $M_P$ for the SAM-based quantity model) The following relations summarize the above explanation:

$$I^g(i \to j)_r = m_{ji} = \sum_{r \in R} I^t(i \to j)_r = \sum_{r \in R} I^d(i \to j)_r . M_p,$$
$$I^t(i \to j)_r = I^d(i \to j)_r . M_p \quad (8)$$

Where, $I$ refers to influence; $g$, $t$, and $d$ denote, respectively, the global, total, and direct influences; $R$, is the set of all elementary path joining sectors (accounts) i and j; $r$ denotes the r-th elementary path; and $M_p$ stands for price path multiplier.

As Equation (8) shows, in the SPA the global influence linking any two sectors $i$ and $j$ (i.e., $m_{ji}$) can be decomposed into a number of different elementary paths, each accounting for different shares of global influence. This feature enables one to find paths accounting for the largest share of total influence of an account on another account.





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## RESULTS

Table 3 presents the amounts of subsidy paid to different economic sectors in 2001 as reported in the use matrix of input-output table (SCI, 2006). Based on this table (column 3), only 19 out of 49 sectors receive subsidy. The share of subsidy in total value product of the sectors varies from a minimum of 0.0003 percent (in exploitation of crude petroleum and natural gas and other mining) to a maximum of 13.8 percent (in food industry sector). Agricultural sectors including farming, horticulture, agricultural service, and livestock and hunting are among the high subsidy receiving sectors. Accordingly, it is expected that subsidy reduction results in an increase in the consumer prices.

Generally, for each household group, the related consumer price index measures implicit cost of purchasing the benchmark basket of goods and services. Therefore, an increase in the index reflects additional income needed to keep purchasing the original basket. Thus, this index provides a measure of the welfare impact on the households. In the context of the SAM-based price model, the elements of price/cost transmission matrix (M') for the household groups reflect the consumer price index for the associated income group. Table 4 shows the appropriate elements of price/cost transmission matrix for the household groups.

As the last row of Table 4 shows, reduction of subsidy from food industry sector (S10) requires the largest compensation for all income groups, as compared to all other agricultural and food industry sectors. It means that changes in the cost of this sector (S10) lead to the largest change in the cost of living for all socioeconomic groups. For example, a one Rial reduction of subsidy from this sector would require an additional income of 0.507 Rial to keep the rural low income group (LRH) unaffected. From a different point of view, Table 4 indicates that 50.7 percent of the initial shock on production cost in the food industry is transmitted to rural low income households as a change in the purchasing cost of the benchmark basket of goods and services. Similarly, for this income group, an increase in the cost of the farming and livestock and hunting sectors (S1, S4) will increase 33.1 and 29.9%, respectively, the purchasing cost of the benchmark basket of goods and services. The wide use of the products of sector 1 and sector 4 as inputs to the other sectors, especially to the food industry sector, is responsible for such a result.

Using the above values, we calculated changes in the households' price indices in response to subsidy reduction in the five mentioned sectors. Results are reported in Table 5. The numbers in each of the columns in this table reflect the percentage change of the households' price indices following the subsidy reduction. For example, the value 0.157 (row 2, column 2) shows that a 50 percent removal of subsidy in farming sector, would result in 0.157 percent of increase in the consumer price index for the rural low income group. The overall households' price index rises by almost 15 percent by removing 50 percent of subsidy from all agricultural and food industry activities. Increase in overall households' price index is doubled if we remove all subsidies from agricultural and food industry activities.

As row 6 in the table shows, more than 90 percent of the rises in households' price index is related to subsidy removal from food industry sector, whereas for agricultural sectors the effects on the households' price index of subsidy reduction are minor. Each one of these sectors experiences smaller than one percent increase in the consumer price index.

**Table 4**. Cost/price transmission matrix for various income groups.[a]

| Sectors | LRH | MRH | *H*RH | LUH | MUH | *H*UH | All HH |
|---|---|---|---|---|---|---|---|
| S1 | 0.331 | 0.240 | 0.188 | 0.211 | 0.169 | 0.137 | 1.276 |
| S2 | 0.124 | 0.099 | 0.079 | 0.091 | 0.080 | 0.070 | 0.543 |
| S3 | 0.024 | 0.018 | 0.015 | 0.016 | 0.014 | 0.013 | 0.100 |
| S4 | 0.299 | 0.227 | 0.176 | 0.197 | 0.163 | 0.138 | 1.199 |
| S10 | 0.507 | 0.367 | 0.282 | 0.356 | 0.294 | 0.248 | 2.053 |

[a] L= Low income; M=Medium income, and *H*=high income; U= Urban; R= Rural, and H=households.





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

**Table 5**. Consumer price effects of 50% subsidy reduction (Percent).[a]

| SEC | LRH | MRH | *H*RH | LUH | MUH | *H*UH | All HH |
|---|---|---|---|---|---|---|---|
| S1 | 0.157 | 0.114 | 0.089 | 0.101 | 0.080 | 0.065 | 0.606 |
| S2 | 0.035 | 0.028 | 0.022 | 0.026 | 0.022 | 0.020 | 0.152 |
| S3 | 0.012 | 0.009 | 0.008 | 0.008 | 0.007 | 0.007 | 0.052 |
| S4 | 0.007 | 0.006 | 0.004 | 0.005 | 0.004 | 0.003 | 0.029 |
| S10 | 3.498 | 2.531 | 1.945 | 2.456 | 2.031 | 1.709 | 14.170 |
| 50% of all | 3.709 | 2.688 | 2.069 | 2.595 | 2.144 | 1.803 | 15.009 |

[a] L= Low income; M=Medium income, and *H*=high income; U= Urban; R= Rural, and H=households.

The impacts on price index of different income groups indicate that the subsidy reduction in food producing sectors tend to most adversely affect the rural low income group. The price index would rise by 3.71 percent if we remove 50 percent of the subsidies from all food producing sectors (entry in column 2, row 7), while for the other groups the price index would rise by less than 3 percent. As Table 5 shows, urban high income group would be less affected by the subsidy reduction from each of the sectors.

As already mentioned, the price transmission matrix *M*' provides information on the global influence of a change in the cost of exogenous variables on the endogenous accounts. To obtain a measure of how sectoral linkages contribute to the global influence, the path decomposition technique has been applied to the SAM for Iran. Results are reported in Tables 6 to 11. The first column of these tables indicates the global effects on the households' group price indices (households' expenditures) when subsidy from the sector indicated in the table is reduced by one Rial. In the second column, important elementary paths are identified. Each path reveals how a one Rial subsidy reduction from the indicated sector affects the given household group as it goes through different poles to the destination. Consequently, each path shows its contribution to the global influence as indicated in the last column of the table. Third column of the tables reveal direct effects of the specified paths. They indicate the immediate effects of subsidy removal from the related sector. The direct effects are amplified through the price path multipliers (PM), presented in column 4, and result in total effects (TE) are reported in column 5. Finally, the next two columns show the proportion of global price (cost) effect explained by influence being carried along different paths, respectively, with and without considering adjacent circuit.

Table 6 considers impacts on different income groups of rising farming (S1) cost of production following a one Rial reduction in subsidy from this sector. As this table shows, the paths specified in the table account for 30.7% (for HUH) to 54.3% (for LRH) of the global price influence. The rest of the influences are transmitted from a relatively large number of paths, each of which has a small share in the global price effect and are not presented here. Among the paths presented in the table, the path linking farming activity (S1) through farming commodity (C1) to the households expenditure (the first row in each section of the table) has the largest share in transmitting production cost increases to the household's price indices variations (25.9 to 43.5%). The other paths account for a relatively small proportion of changes in the households price indices.

Based on the global influence figures reported in the table, the lower income rural households are most adversely affected by subsidy reduction. This is true for the low income urban households as compared with the other two urban income groups. In general, the rural low income group bears the largest expenditure increase while the urban high income group experiences the least. The wide use of the farming products by these low income groups is responsible for such a result. This implies that the immediate adverse effect of this policy option is higher for lower income groups in Iran.

Table 7 reports the effects on different income groups of rising horticulture (S2) cost of production due to a one Rial reduction in subsidy from this sector. In this case, the cost influence transmitted through the paths specified in the table accounts for a higher share of global price





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

**Table 6.** Path decomposition of cost/price transmission in the farming sector (S1) to various income groups.[a]

| Income group | GE | Elementary paths | DE | PM | TE | TE/GE | DE/GE |
|---|---|---|---|---|---|---|---|
| Low Rural Household (LRH) | 0.331 | S1-C1-LRH | 0.116 | 1.239 | 0.144 | 0.435 | 0.351 |
| | | S1-C1- S4-C3-LRH | 0.005 | 1.528 | 0.007 | 0.023 | 0.015 |
| | | S1-C1- S11-C16-LRH | 0.002 | 1.241 | 0.002 | 0.008 | 0.006 |
| | | S1-C1- S9-C10-LRH | 0.003 | 1.600 | 0.005 | 0.015 | 0.009 |
| | | S1-C1- S10-C13-LRH | 0.006 | 1.536 | 0.010 | 0.030 | 0.019 |
| | | S1-C1- S10-C9-LRH | 0.001 | 1.546 | 0.002 | 0.006 | 0.004 |
| | | S1-C1- S10-C12-LRH | 0.004 | 1.546 | 0.006 | 0.018 | 0.011 |
| | | S1-C1- S10-C14-LRH | 0.002 | 1.547 | 0.003 | 0.010 | 0.006 |
| Total | | | 0.139 | | 0.179 | 0.543 | 0.422 |
| Mid Rural Household (MRH) | 0.240 | S1-C1-MRH | 0.077 | 1.287 | 0.099 | 0.412 | 0.320 |
| | | S1-C1- S4-C3-MRH | 0.005 | 1.580 | 0.007 | 0.030 | 0.019 |
| | | S1-C1- S11-C16-MRH | 0.001 | 1.297 | 0.002 | 0.007 | 0.005 |
| | | S1-C1- S9-C10-MRH | 0.002 | 1.672 | 0.003 | 0.012 | 0.007 |
| | | S1-C1- S10-C13-MRH | 0.003 | 1.593 | 0.005 | 0.020 | 0.013 |
| | | S1-C1- S10-C9-MRH | 0.001 | 1.593 | 0.001 | 0.006 | 0.004 |
| | | S1-C1- S10-C12-MRH | 0.001 | 1.593 | 0.002 | 0.010 | 0.006 |
| | | S1-C1- S10-C14-MRH | 0.002 | 1.594 | 0.003 | 0.011 | 0.007 |
| Total | | | 0.091 | | 0.122 | 0.508 | 0.381 |
| High Rural Household (HRH) | 0.188 | S1-C1-HRH | 0.057 | 1.295 | 0.074 | 0.391 | 0.302 |
| | | S1-C1- S4-C3-HRH | 0.003 | 1.591 | 0.005 | 0.029 | 0.018 |
| | | S1-C1- S11-C16-HRH | 0.001 | 1.306 | 0.001 | 0.004 | 0.003 |
| | | S1-C1- S9-C10-HRH | 0.001 | 1.683 | 0.002 | 0.008 | 0.005 |
| | | S1-C1- S10-C13-HRH | 0.002 | 1.606 | 0.003 | 0.014 | 0.009 |
| | | S1-C1- S10-C9-HRH | 0.001 | 1.606 | 0.001 | 0.005 | 0.003 |
| | | S1-C1- S10-C12-HRH | 0.001 | 1.606 | 0.001 | 0.007 | 0.004 |
| | | S1-C1- S10-C14-HRH | 0.001 | 1.607 | 0.002 | 0.009 | 0.005 |
| Total | | | 0.066 | | 0.088 | 0.468 | 0.351 |
| Low Urban Household (LUH) | 0.211 | S1-C1-LUH | 0.062 | 1.335 | 0.083 | 0.391 | 0.293 |
| | | S1-C1- S4-C3-LUH | 0.001 | 1.627 | 0.002 | 0.010 | 0.006 |
| | | S1-C1- S11-C16-LUH | 0.001 | 1.343 | 0.002 | 0.008 | 0.006 |
| | | S1-C1- S9-C10-LUH | 0.001 | 1.731 | 0.002 | 0.010 | 0.006 |
| | | S1-C1- S10-C13-LUH | 0.002 | 1.631 | 0.004 | 0.019 | 0.012 |
| | | S1-C1- S10-C9-LUH | 0.001 | 1.631 | 0.001 | 0.007 | 0.004 |
| | | S1-C1- S10-C12-LUH | 0.001 | 1.631 | 0.002 | 0.008 | 0.005 |
| | | S1-C1- S10-C14-LUH | 0.001 | 1.632 | 0.002 | 0.011 | 0.007 |
| Total | | | 0.072 | | 0.098 | 0.464 | 0.338 |
| Mid Urban Household (MUH) | 0.169 | S1-C1- S10-C14-LRH | 0.041 | 1.500 | 0.061 | 0.363 | 0.242 |
| | | S1-C1- S4-C3-MUH | 0.001 | 1.810 | 0.002 | 0.010 | 0.006 |
| | | S1-C1- S11-C16-MUH | 0.001 | 1.511 | 0.001 | 0.006 | 0.004 |
| | | S1-C1- S9-C10-MUH | 0.001 | 1.947 | 0.001 | 0.008 | 0.004 |
| | | S1-C1- S10-C13-MUH | 0.001 | 1.795 | 0.002 | 0.014 | 0.008 |
| | | S1-C1- S10-C9-MUH | 0.001 | 1.795 | 0.001 | 0.007 | 0.004 |
| | | S1-C1- S10-C12-MUH | 0.001 | 1.795 | 0.001 | 0.007 | 0.004 |
| | | S1-C1- S10-C14-MUH | 0.001 | 1.796 | 0.002 | 0.012 | 0.006 |
| Total | | | 0.047 | | 0.072 | 0.427 | 0.278 |
| High Urban Household (HUH) | 0.137 | S1-C1-HUH | 0.023 | 1.556 | 0.035 | 0.259 | 0.166 |
| | | S1-C1- S4-C3-HUH | 0.001 | 1.883 | 0.001 | 0.009 | 0.005 |
| | | S1-C1- S11-C16-HUH | 0.000 | 1.570 | 0.001 | 0.004 | 0.003 |
| | | S1-C1- S9-C10-HUH | 0.000 | 2.023 | 0.001 | 0.006 | 0.003 |
| | | S1-C1- S10-C13-HUH | 0.001 | 1.871 | 0.001 | 0.008 | 0.004 |
| | | S1-C1- S10-C9-HUH | 0.000 | 1.871 | 0.001 | 0.006 | 0.003 |
| | | S1-C1- S10-C12-HUH | 0.000 | 1.871 | 0.001 | 0.004 | 0.002 |
| | | S1-C1- S10-C14-HUH | 0.001 | 1.872 | 0.001 | 0.010 | 0.005 |
| Total | | | 0.026 | | 0.042 | 0.307 | 0.192 |

[a] GE= Global effect; DE= Direct effect; PM= Price path multiplier effect, TE= Total effect.

influence; 52.4 percent for high rural households to 63.7 percent for medium urban households groups. Similar to the previous case, the path that more directly links horticultural activity (S2) through horticultural products (C2) to the household's expenditures has the largest share in transmitting production cost increases to the household's price indices variations (51.8 to 57.8%). Demand for unprocessed horticultural products is mostly responsible for noting this result. For the same reason, the immediate impact of a rise in cost of the horticultural





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

**Table 7.** Path decomposition of cost/price transmission in the horticultural sector (S2) to various income groups.[a]

| Income group | GE | Elementary paths | DE | PM | TE | TE/GE | DE/GE |
|---|---|---|---|---|---|---|---|
| Low rural household | 0.124 | S2-C2-LRH | 0.060 | 1.120 | 0.067 | 0.539 | 0.481 |
| | | S2-C2- S32-C43-LRH | 0.000 | 1.170 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C9-LRH | 0.000 | 1.457 | 0.000 | 0.002 | 0.001 |
| | | S2-C2- S10-C14-LRH | 0.000 | 1.458 | 0.000 | 0.003 | 0.002 |
| | | S2-C2- S10-C15-LRH | 0.000 | 1.457 | 0.000 | 0.001 | 0.001 |
| Total | | | 0.060 | | 0.068 | 0.545 | 0.486 |
| Mid rural household | 0.099 | S2-C2-MRH | 0.047 | 1.175 | 0.055 | 0.561 | 0.477 |
| | | S2-C2- S32-C43-MRH | 0.000 | 1.224 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C9-MRH | 0.000 | 1.508 | 0.000 | 0.002 | 0.001 |
| | | S2-C2- S10-C14-MRH | 0.000 | 1.508 | 0.000 | 0.003 | 0.002 |
| | | S2-C2- S10-C15-MRH | 0.000 | 1.508 | 0.000 | 0.001 | 0.001 |
| Total | | | 0.048 | | 0.056 | 0.567 | 0.481 |
| High rural household | 0.079 | S2-C2-HRH | 0.034 | 1.185 | 0.041 | 0.518 | 0.437 |
| | | S2-C2- S32-C43-HRH | 0.000 | 1.233 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C9-HRH | 0.000 | 1.521 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C14-HRH | 0.000 | 1.522 | 0.000 | 0.002 | 0.001 |
| | | S2-C2- S10-C15-HRH | 0.000 | 1.521 | 0.000 | 0.001 | 0.001 |
| Total | | | 0.035 | | 0.041 | 0.524 | 0.441 |
| Low urban household | 0.091 | S2-C2-LUH | 0.043 | 1.212 | 0.053 | 0.578 | 0.477 |
| | | S2-C2- S32-C43-LUH | 0.000 | 1.257 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C9-LUH | 0.000 | 1.537 | 0.000 | 0.002 | 0.001 |
| | | S2-C2- S10-C14-LUH | 0.000 | 1.537 | 0.000 | 0.003 | 0.002 |
| | | S2-C2- S10-C15-LUH | 0.000 | 1.537 | 0.000 | 0.001 | 0.001 |
| Total | | | 0.044 | | 0.053 | 0.585 | 0.482 |
| Mid urban household | 0.080 | S2-C2-MUH | 0.037 | 1.373 | 0.050 | 0.630 | 0.459 |
| | | S2-C2- S32-C43-MUH | 0.000 | 1.414 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C9-MUH | 0.000 | 1.693 | 0.000 | 0.002 | 0.001 |
| | | S2-C2- S10-C14-MUH | 0.000 | 1.694 | 0.000 | 0.003 | 0.001 |
| | | S2-C2- S10-C15-MUH | 0.000 | 1.693 | 0.000 | 0.001 | 0.001 |
| Total | | | 0.037 | | 0.051 | 0.637 | 0.463 |
| High urban household | 0.070 | S2-C2-HUH | 0.028 | 1.420 | 0.040 | 0.572 | 0.403 |
| | | S2-C2- S32-C43-HUH | 0.000 | 1.498 | 0.000 | 0.000 | 0.000 |
| | | S2-C2- S10-C9-HUH | 0.000 | 1.760 | 0.000 | 0.001 | 0.001 |
| | | S2-C2- S10-C14-HUH | 0.000 | 1.761 | 0.000 | 0.002 | 0.001 |
| | | S2-C2- S10-C15-HUH | 0.000 | 1.760 | 0.000 | 0.001 | 0.001 |
| Total | | | 0.028 | | 0.040 | 0.577 | 0.406 |

[a] GE= Global effect; DE= Direct effect; PM= Price path multiplier effect, TE= Total effect.

production activity, represented by ratio of direct to global influence (last column), is high and constitutes the largest share of the global effects (40.1 to 47.7%). In addition, as Table 7 shows, the pattern of distributional impacts of sectoral cost increase on the households' expenditures, represented by the global influence figures, are very similar to the farming case, though, the absolute magnitudes of expenditure increase are much less than that of farming sector.

The expenditure changes in response to a one Rial subsidy reduction in agricultural services are reported in Table 8. According to the global influence figures in the table, the impacts on the households' expenditure are small, varying from 1.4 to 2.4%. Furthermore, in contrast to the previous two cases, the direct link between agricultural services and the households' expenditure represents a relatively small proportion of the global effects (6.7 to 8.4%). A larger proportion (10.6 to 23.3%) results from indirect impacts of longer paths that include farming activity and farming products.

Table 9 indicates the results of path decomposition of cost influence of livestock and hunting activity on the households' income groups following a one Rial subsidy reduction in this activity. Based on the global influence figures in the table, the impacts of this policy option on the households' expenditure are relatively large compared to those of the last two sectors. The global influence varies from 13.8 to 29.9% of the benchmark consumption basket. An interesting point revealed in this case is that the impacts of production cost increase on the urban households differ from those of rural





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

**Table 8.** Path decomposition of Cost/price transmission in the agricultural service sector (S3) to various income groups.[a]

| Income group | GE | Elementary paths | DE | PM | TE | TE/GE | DE/GE |
|---|---|---|---|---|---|---|---|
| Low rural household | 0.024 | S3-C56-LRH | 0.001 | 1.109 | 0.002 | 0.067 | 0.061 |
| | | S3-C56- S1-C1-LRH | 0.004 | 1.304 | 0.006 | 0.233 | 0.179 |
| | | S3-C56- S2-C2-LRH | 0.001 | 1.187 | 0.001 | 0.044 | 0.037 |
| | | S3-C56- S5-C4-LRH | 0.000 | 1.112 | 0.000 | 0.007 | 0.006 |
| | | S3-C56- S6-C5-LRH | 0.000 | 1.148 | 0.000 | 0.003 | 0.003 |
| Total | | | 0.007 | | 0.008 | 0.353 | 0.284 |
| Mid rural household | 0.018 | S3-C56-MRH | 0.001 | 1.173 | 0.001 | 0.079 | 0.067 |
| | | S3-C56- S1-C1-MRH | 0.003 | 1.353 | 0.004 | 0.206 | 0.152 |
| | | S3-C56- S2-C2-MRH | 0.001 | 1.245 | 0.001 | 0.046 | 0.037 |
| | | S3-C56- S5-C4-MRH | 0.000 | 1.178 | 0.000 | 0.003 | 0.003 |
| | | S3-C56- S6-C5-MRH | 0.000 | 1.215 | 0.000 | 0.005 | 0.004 |
| Total | | | 0.005 | | 0.006 | 0.339 | 0.263 |
| High rural household | 0.015 | S3-C56-HRH | 0.001 | 1.186 | 0.001 | 0.084 | 0.071 |
| | | S3-C56- S1-C1-HRH | 0.002 | 1.362 | 0.003 | 0.183 | 0.135 |
| | | S3-C56- S2-C2-HRH | 0.000 | 1.256 | 0.001 | 0.041 | 0.032 |
| | | S3-C56- S5-C4-HRH | 0.000 | 1.191 | 0.000 | 0.002 | 0.001 |
| | | S3-C56- S6-C5-HRH | 0.000 | 1.228 | 0.000 | 0.005 | 0.004 |
| Total | | | 0.004 | | 0.005 | 0.314 | 0.243 |
| Low urban household | 0.016 | S3-C56-LUH | 0.001 | 1.203 | 0.001 | 0.067 | 0.056 |
| | | S3-C56- S1-C1-LUH | 0.002 | 1.401 | 0.003 | 0.200 | 0.142 |
| | | S3-C56- S2-C2-LUH | 0.001 | 1.280 | 0.001 | 0.051 | 0.040 |
| | | S3-C56- S5-C4-LUH | 0.000 | 1.205 | 0.000 | 0.000 | 0.000 |
| | | S3-C56- S6-C5-LUH | 0.000 | 1.243 | 0.000 | 0.004 | 0.003 |
| Total | | | 0.004 | | 0.005 | 0.322 | 0.241 |
| Mid urban household | 0.014 | S3-C56-MUH | 0.001 | 1.371 | 0.001 | 0.080 | 0.058 |
| | | S3-C56- S1-C1-MUH | 0.001 | 1.572 | 0.002 | 0.166 | 0.106 |
| | | S3-C56- S2-C2-MUH | 0.001 | 1.446 | 0.001 | 0.055 | 0.038 |
| | | S3-C56- S5-C4-MUH | 0.000 | 1.377 | 0.000 | 0.000 | 0.000 |
| | | S3-C56- S6-C5-MUH | 0.000 | 1.418 | 0.000 | 0.005 | 0.003 |
| Total | | | 0.003 | | 0.004 | 0.305 | 0.205 |
| High urban household | 0.013 | S3-C56-HUH | 0.001 | 1.420 | 0.001 | 0.072 | 0.051 |
| | | S3-C56- S1-C1-HUH | 0.001 | 1.632 | 0.001 | 0.106 | 0.065 |
| | | S3-C56- S2-C2-HUH | 0.000 | 1.498 | 0.001 | 0.048 | 0.032 |
| | | S3-C56- S5-C4-HUH | 0.000 | 1.427 | 0.000 | 0.000 | 0.000 |
| | | S3-C56- S6-C5-HUH | 0.000 | 1.469 | 0.000 | 0.006 | 0.004 |
| Total | | | 0.002 | | 0.003 | 0.232 | 0.152 |

[a] GE= Global effect; DE= Direct effect; PM= Price path multiplier effect, TE= Total effect.

households. For the urban households, the direct link between livestock and hunting activity and the households' expenditure represents a relatively small proportion of the global influence (5.6 to 6.7%), whereas the indirect impacts of longer paths that include food industry (S10) and preserved meat (C8) account for the largest share of the global influence (22.9 to 26.7%). For the rural households, the cost influence transmitted from both paths is relatively close to each other. Larger demand of the urban households for the processed meats relative to that of unprocessed ones may explain this result.

Table 10 shows the results of path decomposition of cost influence of food processing industry on the households' income groups due to a one Rial subsidy reduction in this activity. As this table shows, the paths identified in the table account for 51.5 to 66.2% of the global price influence. Based on the global influence figures in the table, the impacts of this policy option on the households' expenditure are the largest compared to all previous cases. The global influence varies from 24.8 to 50.7% of the benchmark consumption basket. Similar to the previous cases, the rural low income group is the most adversely affected group while the urban high income group is the least affected household. Pattern of expenditure responses to subsidy reduction is almost similar for different groups of households. For all groups, the most important path appears to go through demand for meats (C8) and then dairy products (C11). For rural lower income, the path through grain mill and bred demand (C13) is also an effective one.





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

**Table 9**. Path decomposition of Cost/rice transmission in the livestock and hunting sector (S4) to various income groups.[a]

| Income group | | GE | Elementary paths | DE | PM | TE | TE/GE | DE/GE |
|---|---|---|---|---|---|---|---|---|
| Low household | rural | 0.299 | S4-C3-LRH | 0.035 | 1.320 | 0.046 | 0.153 | 0.116 |
| | | | S4-C11-LRH | 0.012 | 1.344 | 0.016 | 0.052 | 0.039 |
| | | | S4-C3- S10-C8-LRH | 0.040 | 1.548 | 0.063 | 0.210 | 0.135 |
| | | | S4-C3- S10-C11-LRH | 0.014 | 1.548 | 0.021 | 0.071 | 0.046 |
| | | | S4-C3- S10-C14-LRH | 0.005 | 1.549 | 0.008 | 0.028 | 0.018 |
| Total | | | | 0.106 | | 0.154 | 0.514 | 0.354 |
| Mid household | rural | 0.227 | S4-C3-MRH | 0.032 | 1.385 | 0.044 | 0.194 | 0.140 |
| | | | S4-C11-MRH | 0.008 | 1.409 | 0.011 | 0.049 | 0.034 |
| | | | S4-C3- S10-C8-MRH | 0.027 | 1.611 | 0.044 | 0.195 | 0.121 |
| | | | S4-C3- S10-C11-MRH | 0.009 | 1.611 | 0.015 | 0.066 | 0.041 |
| | | | S4-C3- S10-C14-MRH | 0.004 | 1.611 | 0.007 | 0.029 | 0.018 |
| Total | | | | 0.080 | | 0.121 | 0.532 | 0.354 |
| High household | rural | 0.176 | S4-C3-HRH | 0.024 | 1.400 | 0.034 | 0.192 | 0.137 |
| | | | S4-C11-HRH | 0.005 | 1.425 | 0.008 | 0.043 | 0.030 |
| | | | S4-C3- S10-C8-HRH | 0.019 | 1.628 | 0.031 | 0.174 | 0.107 |
| | | | S4-C3- S10-C11-HRH | 0.006 | 1.628 | 0.010 | 0.058 | 0.036 |
| | | | S4-C3- S10-C14-HRH | 0.003 | 1.629 | 0.004 | 0.025 | 0.015 |
| Total | | | | 0.057 | | 0.086 | 0.491 | 0.325 |
| Low household | urban | 0.197 | S4-C3-LUH | 0.009 | 1.417 | 0.013 | 0.067 | 0.047 |
| | | | S4-C11-LUH | 0.010 | 1.437 | 0.015 | 0.076 | 0.053 |
| | | | S4-C3- S10-C8-LUH | 0.030 | 1.636 | 0.049 | 0.251 | 0.153 |
| | | | S4-C3- S10-C11-LUH | 0.012 | 1.636 | 0.020 | 0.102 | 0.063 |
| | | | S4-C3- S10-C14-LUH | 0.004 | 1.636 | 0.006 | 0.031 | 0.019 |
| Total | | | | 0.066 | | 0.104 | 0.526 | 0.334 |
| Mid household | urban | 0.163 | S4-C3-MUH | 0.007 | 1.597 | 0.011 | 0.066 | 0.042 |
| | | | S4-C11-MUH | 0.008 | 1.616 | 0.012 | 0.076 | 0.047 |
| | | | S4-C3- S10-C8-MUH | 0.024 | 1.812 | 0.044 | 0.267 | 0.148 |
| | | | S4-C3- S10-C11-MUH | 0.009 | 1.812 | 0.016 | 0.101 | 0.056 |
| | | | S4-C3- S10-C14-MUH | 0.003 | 1.812 | 0.005 | 0.031 | 0.017 |
| Total | | | | 0.050 | | 0.088 | 0.542 | 0.309 |
| High household | urban | 0.138 | S4-C3-HUH | 0.005 | 1.656 | 0.008 | 0.056 | 0.034 |
| | | | S4-C11-HUH | 0.005 | 1.679 | 0.009 | 0.064 | 0.038 |
| | | | S4-C3- S10-C8-HUH | 0.017 | 1.886 | 0.032 | 0.229 | 0.121 |
| | | | S4-C3- S10-C11-HUH | 0.006 | 1.886 | 0.012 | 0.086 | 0.045 |
| | | | S4-C3- S10-C14-HUH | 0.002 | 1.887 | 0.003 | 0.025 | 0.013 |
| Total | | | | 0.035 | | 0.063 | 0.459 | 0.252 |

[a] GE= Global effect; DE= Direct effect; PM= Price path multiplier effect, TE= Total effect.

Direct effects of this policy option as indicated by the last column of the table are substantial. Thus, considerable share of expenditure effects of this scenario is realized immediately.

Table 11 compares the effects of a 50 percent reduction of sectoral subsidy, as reported in Table 3, from all agricultural and food industry sector on different households' expenditure as percentage of the total households' group expenditure, using the global influence figures reported in Tables 6 to 10. As this table shows, implementing this policy will result in a 19.5 percent increase in the expenditure of low income rural households, whereas, the impact on the expenditure of high income urban households will be negligible (0.8%). It is clear that total removal of subsidy from these sectors will double the above figures, meaning that the expenditure of low income rural households will increase by 39 percent. Furthermore, as indicated in the table, most of the increase in the expenditure for all income groups comes from the subsidy removals in food industry sector. The farming sector is in the second place, though by much less effect.

Data in Table 11 is reorganized in Table 12 to more clearly show the impact of reducing subsidy in each of the mentioned sectors on all households as a percentage of total expenditure of all Iranian households. The first section of the table, for instance, indicates that a 50 percent reduction of subsidy in farming sector will increase on average 0.059 percent of the Iranian households. Increase in expenditure of the





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**Table 10.** Path decomposition of cost/price transmission in the food industry sector (S10) to various income groups.[a]

| Income group | GE | Elementary paths | DE | PM | TE | TE/GE | DE/GE |
|---|---|---|---|---|---|---|---|
| Low rural household | 0.507 | S10-C8-LRH | 0.110 | 1.369 | 0.150 | 0.297 | 0.217 |
| | | S10-C9-LRH | 0.009 | 1.369 | 0.012 | 0.024 | 0.017 |
| | | S10-C11-LRH | 0.037 | 1.378 | 0.052 | 0.102 | 0.074 |
| | | S10-C12-LRH | 0.020 | 1.369 | 0.027 | 0.053 | 0.039 |
| | | S10-C13-LRH | 0.045 | 1.369 | 0.061 | 0.120 | 0.088 |
| | | S10-C14-LRH | 0.014 | 1.370 | 0.020 | 0.039 | 0.029 |
| | | S10-C15-LRH | 0.007 | 1.369 | 0.009 | 0.018 | 0.013 |
| Total | | | 0.241 | | 0.331 | 0.653 | 0.476 |
| Mid rural household | 0.367 | S10-C8-MRH | 0.074 | 1.428 | 0.106 | 0.289 | 0.203 |
| | | S10-C9-MRH | 0.006 | 1.427 | 0.009 | 0.025 | 0.017 |
| | | S10-C11-MRH | 0.025 | 1.436 | 0.036 | 0.098 | 0.068 |
| | | S10-C12-MRH | 0.010 | 1.427 | 0.014 | 0.039 | 0.028 |
| | | S10-C13-MRH | 0.022 | 1.427 | 0.031 | 0.084 | 0.059 |
| | | S10-C14-MRH | 0.011 | 1.428 | 0.016 | 0.043 | 0.030 |
| | | S10-C15-MRH | 0.006 | 1.427 | 0.008 | 0.022 | 0.015 |
| Total | | | 0.154 | | 0.220 | 0.601 | 0.421 |
| High rural household | 0.282 | S10-C8-HRH | 0.051 | 1.443 | 0.073 | 0.261 | 0.181 |
| | | S10-C9-HRH | 0.004 | 1.443 | 0.006 | 0.023 | 0.016 |
| | | S10-C11-HRH | 0.017 | 1.452 | 0.025 | 0.087 | 0.060 |
| | | S10-C12-HRH | 0.006 | 1.443 | 0.008 | 0.028 | 0.020 |
| | | S10-C13-HRH | 0.011 | 1.443 | 0.016 | 0.058 | 0.040 |
| | | S10-C14-HRH | 0.007 | 1.444 | 0.010 | 0.037 | 0.026 |
| | | S10-C15-HRH | 0.004 | 1.443 | 0.006 | 0.021 | 0.015 |
| Total | | | 0.100 | | 0.145 | 0.515 | 0.356 |
| Low urban household | 0.356 | S10-C8-LUH | 0.082 | 1.452 | 0.119 | 0.334 | 0.230 |
| | | S10-C9-LUH | 0.006 | 1.452 | 0.009 | 0.026 | 0.018 |
| | | S10-C11-LUH | 0.033 | 1.459 | 0.049 | 0.137 | 0.094 |
| | | S10-C12-LUH | 0.008 | 1.452 | 0.011 | 0.031 | 0.022 |
| | | S10-C13-LUH | 0.017 | 1.452 | 0.025 | 0.071 | 0.049 |
| | | S10-C14-LUH | 0.010 | 1.452 | 0.015 | 0.041 | 0.028 |
| | | S10-C15-LUH | 0.005 | 1.452 | 0.008 | 0.022 | 0.015 |
| Total | | | 0.162 | | 0.236 | 0.662 | 0.456 |
| Mid urban household | 0.294 | S10-C8-MUH | 0.065 | 1.611 | 0.105 | 0.358 | 0.222 |
| | | S10-C9-MUH | 0.005 | 1.611 | 0.008 | 0.026 | 0.016 |
| | | S10-C11-MUH | 0.025 | 1.617 | 0.040 | 0.135 | 0.084 |
| | | S10-C12-MUH | 0.004 | 1.611 | 0.007 | 0.024 | 0.015 |
| | | S10-C13-MUH | 0.009 | 1.611 | 0.014 | 0.049 | 0.030 |
| | | S10-C14-MUH | 0.008 | 1.611 | 0.012 | 0.041 | 0.026 |
| | | S10-C15-MUH | 0.004 | 1.611 | 0.007 | 0.023 | 0.014 |
| Total | | | 0.120 | | 0.193 | 0.657 | 0.408 |
| High urban household | 0.248 | S10-C8-HUH | 0.045 | 1.674 | 0.076 | 0.307 | 0.183 |
| | | S10-C9-HUH | 0.003 | 1.674 | 0.005 | 0.022 | 0.013 |
| | | S10-C11-HUH | 0.017 | 1.681 | 0.029 | 0.116 | 0.069 |
| | | S10-C12-HUH | 0.002 | 1.674 | 0.004 | 0.016 | 0.009 |
| | | S10-C13-HUH | 0.004 | 1.674 | 0.007 | 0.029 | 0.017 |
| | | S10-C14-HUH | 0.005 | 1.675 | 0.008 | 0.033 | 0.020 |
| | | S10-C15-HUH | 0.003 | 1.674 | 0.005 | 0.021 | 0.012 |
| Total | | | 0.080 | | 0.134 | 0.543 | 0.324 |

[a] GE= Global effect; DE= Direct effect; PM= Price path multiplier effect, TE= Total effect.

Iranian households reaches 2.29 percent if government decides to remove 50 percent of subsidy from food industry sector instead of farming sector. As the last section of this table shows, most part of this increase comes from the substantial increase (18.9%) in the expenditure of the low income rural household. Removing subsidy from the other sectors indicated in the table results in a negligible increase in the households' expenditure. This implies that if the Iranian government decides to remove subsidy from all these sectors, the low income rural households has to be compensated proportionally.

## CONCLUSIONS

The results of this study indicate that a shock strategy, which involves the removal of all





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

**Table 11.** Effects of 50 percent reduction of subsidy in agriculture and food industry sectors on households' expenditure.

| Income group | Total household expenditure (Million Rials) | Paths | GE (Million Rials) | % of household expenditure |
|---|---|---|---|---|
| Low rural household | 14,077,210 | S1-LRH | 72067 | 0.512 |
| | | S2 -LRH | 9467 | 0.067 |
| | | S3-LRH | 676 | 0.005 |
| | | S4-LRH | 3738 | 0.027 |
| | | S10 -LRH | 2668041 | 18.953 |
| Total | | | 2753989 | 19.563 |
| Mid rural household | 37,611,262 | S1-MRH | 52250 | 0.139 |
| | | S2 -MRH | 7514 | 0.020 |
| | | S3-MRH | 525 | 0.001 |
| | | S4-MRH | 2831 | 0.008 |
| | | S10 -MRH | 1930601 | 5.133 |
| Total | | | 1993722 | 5.301 |
| High rural household | 46,577,430 | S1-HRH | 40977 | 0.088 |
| | | S2 -HRH | 5991 | 0.013 |
| | | S3-HRH | 439 | 0.001 |
| | | S4-HRH | 2199 | 0.005 |
| | | S10 -HRH | 1483836 | 3.186 |
| Total | | | 1533443 | 3.292 |
| Low urban household | 64,115,651 | S1-LUH | 46083 | 0.072 |
| | | S2 -LUH | 6929 | 0.011 |
| | | S3-LUH | 452 | 0.001 |
| | | S4-LUH | 2460 | 0.004 |
| | | S10 -LUH | 1873648 | 2.922 |
| Total | | | 1929571 | 3.010 |
| Mid urban household | 143,957,071 | S1-MUH | 36768 | 0.026 |
| | | S2 -MUH | 6072 | 0.004 |
| | | S3-MUH | 402 | 0.0003 |
| | | S4-MUH | 2039 | 0.001 |
| | | S10 -MUH | 1548824 | 1.076 |
| Total | | | 1594104 | 1.107 |
| High urban household | 165,229,681 | S1-HUH | 29843 | 0.018 |
| | | S2 -HUH | 5305 | 0.003 |
| | | S3-HUH | 365 | 0.0002 |
| | | S4-HUH | 1723 | 0.001 |
| | | S10 -HUH | 1303310 | 0.789 |
| Total | | | 1340547 | 0.811 |

subsidies from agricultural and food industry sectors at once, would amplify the adverse effects of this policy, particularly on low income groups, and hence is not recommended. Also, results of the households' welfare effects of subsidy reduction, which provide a basis for compensating households for any changes in the level of subsidy in agricultural and food industry sectors, reveal that the cost increase in the food industry sector requires the largest amounts of compensation to keep the consumers' welfare unaffected. Thus, any decision to reduce subsidy in this sector should be accompanied with a compensated welfare program for the low income groups in Iran. However, starting subsidy removal from agricultural sectors is suggested considering negligible effect of removal of





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**Table 12.** Effects of 50% reduction of subsidy in agricultural and food industry sectors on all households.

| Sectors | Paths | *GE* (Million Rials) | Total household expenditure (Million Rials) | % of household expenditure |
|---|---|---|---|---|
| Farming sector | S1-LRH | 72067 | 14077210 | 0.512 |
| | S1-MRH | 52250 | 37611262 | 0.139 |
| | S1-HRH | 40977 | 46577430 | 0.088 |
| | S1-LUH | 46083 | 64115651 | 0.072 |
| | S1-MUH | 36768 | 143957071 | 0.026 |
| | S1-HUH | 29843 | 165229681 | 0.018 |
| Total | | 277989 | 471568305 | 0.059 |
| Horticulture sector | S2-LRH | 9467 | 14077210 | 0.067 |
| | S2-MRH | 7514 | 37611262 | 0.020 |
| | S2-HRH | 5991 | 46577430 | 0.013 |
| | S21- | 6929 | 64115651 | 0.011 |
| | S2-MUH | 6072 | 143957071 | 0.004 |
| | S2-HUH | 5305 | 165229681 | 0.003 |
| Total | | 41278 | 471568305 | 0.009 |
| Agricultural service sector | S3-LRH | 676 | 14077210 | 0.005 |
| | S3-MRH | 525 | 37611262 | 0.001 |
| | S3-HRH | 439 | 46577430 | 0.001 |
| | S3-LUH | 452 | 64115651 | 0.001 |
| | S3-MUH | 402 | 143957071 | 0.0003 |
| | S3-HUH | 365 | 165229681 | 0.0002 |
| Total | | 2859 | 471568305 | 0.001 |
| Livestock and hunting sector | S4-LRH | 3738 | 14077210 | 0.027 |
| | S4-MRH | 2831 | 37611262 | 0.008 |
| | S4-HRH | 2199 | 46577430 | 0.005 |
| | S4-LUH | 2460 | 64115651 | 0.004 |
| | S4-MUH | 2039 | 143957071 | 0.001 |
| | S4-HUH | 1723 | 165229681 | 0.001 |
| Total | | 14991 | 471568305 | 0.003 |
| Food processing sector | S10- | 2668041 | 14077210 | 18.953 |
| | S10- | 1930601 | 37611262 | 5.133 |
| | S10- | 1483836 | 46577430 | 3.186 |
| | S10- | 1873648 | 64115651 | 2.922 |
| | S10- | 1548824 | 143957071 | 1.076 |
| | S10- | 1303310 | 165229681 | 0.789 |
| Total | | 10808259 | 471568305 | 2.292 |

subsidy from these sectors on household expenditures.

Results of the path decomposition of the households' expenditures in the farming, horticulture, and livestock and hunting sectors show that the paths that more directly link these activities to the household's expenditures have the largest share in transmitting production cost increases to the household's price indices variations. This implies that most part of the products produced by these production activities are consumed as unprocessed by the households. This behavior is more severe among the low income groups. Thus, any increase in the cost of production following a reduction in subsidy in these activities will immediately increase households' expenditure and will reduce welfare of the households. From this point of view, the





[ DOR: 20.1001.1.16807073.2014.16.1.1.5 ]

lower income rural households are most adversely affected by subsidy reduction. Hence, it is concluded that this policy option has distributional consequences for the Iranian households and must be considered in implementing this policy. Furthermore, the results of the path decomposition indicate that less than 50 percent of the full effects of subsidy reduction on the households' expenditure would be realized in the shorter period. This implies that most of the cost influences will appear in the longer period of time when the cost increase is transmitted to all sectors which utilize the products of the sectors as intermediate inputs. Thus, deciding to remove subsidies from agriculture and food sectors should not be based on the immediate effects. As such, in evaluating the consequences of alternative options in reducing subsidy in agriculture and food industry sectors, it is recommended that both the immediate and the longer term effects of each policy alternative be estimated and the amounts of required compensation for each of the income groups receive due consideration.

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## پیامد های توزیعی حذف یارانه از بخش های کشاورزی و صنایع غذایی در ایران: تحلیلی بر اساس الگوی قیمتی مبتنی بر ماتریس حسابداری اجتماعی

**و. انصاری، ح. سلامی، و ت. ومن**

### چکیده

این مطالعه اثرات توزیعی کاهش یارانه بخش های کشاورزی و صنایع وابسته در ایران را با استفاده از ماتریس حسابداری اجتماعی بر اساس الگوی قیمتی بررسی می‌کند. در این راستا از روش تحلیل ساختاری مسیر استفاده شد تا اثر کلی این سیاست به اثر مستقیم، تمام اثر و کل اثر تفکیک شود. نتایج شبیه سازی نشان می‌دهد که راهبرد تکانه‌ای که حذف یکباره همه یارانه‌ها از بخشهای تولید کننده غذا را در پی دارد، اثرات سوء این سیاست را تشدید می‌کند. همچنین نتایج نشان می دهد که حذف یارانه ازبخش های تولید غذا دارای پیامد های توزع درآمدی برای خانوارهای ایرانی است. در میان خانوارهای ایرانی، گروه خانوارهای کم درآمد روستایی بیشترین زیان را متحمل می‌شوند درحالیکه خانوارهای بالا درآمد شهری کمترین تأثیر پذیری را دارند به علاوه نتایج نشان میدهد حذف یارانه از بخش صنایع غذایی بیشترین اثر را بر رفاه خانوارها دارد. بر اساس نتایج حاصل از تجزیه مسیر، انتظار می رود کمتر از ۵۰ درصد از اثرات خذف یارانه ها بر خانوارها تقریبا بلافاصله بعد از عملی کردن این سیاست ظاهر شود.





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