The impact of self-targeted subsidies on social welfare in Iran

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ABSTRACT

Society welfare plays essential role on supporting poor and low income deciles governments normally pay subsidies on different goods to decrease the prices and as a result, increase purchasing power. However, due to lack of a good target, the relatively rich and high income deciles benefit more than the poor from subsidies do. Therefore, it seems necessary to design self-targeted safety-net programs and targeted subsidies. The primary objective of this study is to investigate the welfare consequences of self-targeted subsidies. In other words, this study tries to find out whether or not transferring one unit of subsidies paid on the subsidized goods mostly used by the rich to the nonsubsidized goods mostly used by the poor improves social welfare. For this purpose, using Atkinson social welfare function, we calculated the change in social welfare caused by self-targeted subsidies. The results show that self-targeted subsidies increase social welfare. The extent of this increase is negatively related to inequality aversion parameter, while positively related to the share of nonsubsidized goods in low income deciles budget.

1. Introduction

Adoption of a multidimensional method to deprivation applies the challenge of getting insight on the interaction between different dimensions (Atkinson, 1998, 2003). According to Adams (2000), food subsidy programs such as bread are under increasing criticism in most developing countries due to large contributions to government budget deficits (Salevurakis & Abdel-Haleim, 2008). Many believe food subsidies may influence government’s budget and increases poverty (Ali & Adams, 1996). Alderman and Lindert (1998) reported some evidences from two self-targeting programs, one in South Africa and one in Tunisia on subsidy programs. They explained that although self-targeting could clearly improve the distribution of food subsidies to the poorest members of society, its power to reduce poverty was limited by preference patterns.
2. The proposed study

According to Atkinson (1998, 2003), social welfare \((W)\) is defined as follows,

\[
W = \frac{1}{H} \sum_{h=1}^{H} \left( \frac{n_h}{M_h} \left( \frac{M_h}{n_h} \right)^{1-\varepsilon} \right) \quad \varepsilon \neq 1
\] (1)

where \(M_h, n_h\) and \(H\) represent income, family size, the number of family in population, respectively. In addition, \(\varepsilon\) represents the inequality aversion parameter. When \(\varepsilon = 1\), Eq. (1) becomes as follows,

\[
W = \frac{1}{H} \sum_{h=1}^{H} n_h \ln \left( \frac{M_h}{n_h} \right).
\] (2)

The utility function of this paper is stated as follows,

\[
U_h = U \left( x_{1h}, x_{2h}, x_{3h} \right),
\] (3)

where \(x_{1h}, x_{2h}\) and \(x_{3h}\) represent gas, sugar and beans, respectively. The proposed study of this paper uses indirect utility function defined as follows,

\[
V_h = V(M_h, P),
\] (4)

where \(P\) represent price. Social welfare for each family can be stated as follows,

\[
\frac{\partial W}{\partial p_i} = \sum_{h=1}^{H} \frac{\partial W}{\partial V_h} \frac{\partial V_h}{\partial p_i} \quad i = 1, 2, 3
\] (5)

Let \(\eta_h\) be the marginal social utility of household income of \(h\). Therefore, we have

\[
\frac{\partial W}{\partial p_i} = -\sum_{h=1}^{H} \eta_h x_{ih} \quad i = 1, 2, 3
\] (6)

where \(I = 1, 2, 3\) represent gas, sugar and beans, respectively. There are two assumptions with our investigations. First, the change on the price of gas and sugar will not change the ratio of \(P_2/P_1\) and the second assumption assumes the total amount welfare is constant, i.e.,

\[
\frac{dr_2}{dr_1} = \frac{1-r_1}{1-r_2}
\] (7)

where \(r_2\) and \(r_1\) represent social welfare paid for sugar and gas, respectively. Generally, the social welfare is paid according to the following relationship,

\[
r_i = \frac{c_i - p_i}{c_i}
\] (8)

where \(c_i\) and \(p_i\) represent the cost of items before and after welfare program, respectively. The welfare of item \(i\) for family \(h\) is defined as follows,

\[
w_{ih} = \frac{p_i x_{ih}}{M_h}.
\] (9)

In addition, the portion of each family from social welfare is characterized as follows,
\[ w^c_i = \frac{\sum_{h=1}^H \eta_{ih} w_{ih} M_h}{\sum_{h=1}^H M_h}. \]  

(10)

Therefore, we have,

\[ w^c_i = \left(\frac{M_h}{\eta_h}\right)^{-c} \cdot w_{ih} \cdot \frac{M_h}{\sum_{h=1}^H M_h}. \]  

(11)

and

\[ \Delta W = -\left(\frac{dp_1}{dr_1}\right) \sum_{h=1}^H \eta_{ih} x_{ih} - \left(\frac{dp_2}{dr_2}\right) \sum_{h=1}^H \eta_{ih} x_{2ih} - \left(\frac{dp_3}{dr_3}\right) \sum_{h=1}^H \eta_{ih} x_{3ih}. \]  

(12)

Using the relationships stated previously we have

\[ \Delta W = H\bar{M} \left[ \frac{w^c_1}{1-r_1} + \frac{w^c_2}{1-r_2} + \left(\frac{dr_3}{dr_1}\right) \frac{w^c_i}{1-r_3} \right]. \]  

(13)

where \( \bar{M} = \frac{\sum_{h=1}^H M_h}{H} \). A standard model for estimating demand is as follows,

\[ w_i = \beta_i \bar{M} + (\theta_{i1} + \theta_{i2}) P_i + (\theta_{i1} + \theta_{i2}) P_j + u_i. \]  

(14)

For each family, we may write the equation as follows,

\[ w_{ih} = \beta_i M_h + (\theta_{i1} + \theta_{i2}) P_i + (\theta_{i1} + \theta_{i2}) P_j + u_i. \]  

(15)

with

\[ \frac{\partial w_{ih}}{\partial p_j} = \frac{\theta_{i1} + \theta_{i2}}{1-r_j} \quad i \neq j \]  

(16)

Total amount of welfare paid for commodity \( i \) is calculated as follows,

\[ S_i = \sum_{h=1}^H (c_i - p_i) x_{ih}. \]  

(17)

and

\[ S_i = \sum_{h=1}^H \left(\frac{r_i}{1-r_j}\right) p_i x_{ih} = \sum_{h=1}^H \left(\frac{r_i}{1-r_j}\right) w_{ih} M_h. \]  

(18)

Therefore, total amount of welfare paid to all three commodities are calculated as follows,
\[ S = S_i + S_r + S_c = \sum_{i=1}^{r} S_i = \sum_{i=1}^{r} \sum_{h=1}^{H} \left( \frac{r_i}{1-r_i} \right) w_{ih} M_h. \]  \hspace{1cm} (19)

Besides, the changes of welfare paid is calculated as follows,

\[ \Delta S = \sum_{i=1}^{3} \frac{\partial S_i}{\partial r_i} + \sum_{j=1}^{3} \sum_{i=1}^{r} \frac{\partial S_i}{\partial r_j} dr_j. \]  \hspace{1cm} (20)

Since \( \Delta S = 0 \) therefore we have,

\[ \frac{dr_i}{dr_j} = -\frac{\sum_{i=1}^{r} \frac{\partial S_i}{\partial r_i} dr_i}{\sum_{i=1}^{r} \frac{\partial S_i}{\partial r_j} dr_j} \]  \hspace{1cm} (21)

and since government does not pay subsidy for beans, i.e. \( r_3 = 0 \), we have

\[ \Delta S_i = \frac{1}{(1-r_i)^2} \sum_{h=1}^{H} w_{ih} M_h + \frac{r_i}{1-r_i} \sum_{h=1}^{H} M_h \left( \frac{\partial w_{ih}}{\partial r_i} \right) + \frac{r_i}{1-r_i} \sum_{h=1}^{H} M_h \left( \frac{\partial w_{ih}}{\partial r_2} \right) \frac{dr_2}{dr_i}. \]  \hspace{1cm} (22)

Using

\[ \bar{M} = \frac{\sum_{h=1}^{H} M_h}{H}, \quad w_i = \frac{\sum_{h=1}^{H} w_{ih} M_h}{\sum_{h=1}^{H} M_h} \]  \hspace{1cm} (23)

or

\[ \Delta S_i = \frac{H w_i \bar{M}}{(1-r_i)^2} \left[ 1 + \frac{r_i}{w_i} (\theta_{11} + \theta_{12}) \right], \]  \hspace{1cm} (24)

and

\[ \Delta S_2 = \frac{H w_2 \bar{M}}{(1-r_1)(1-r_2)} \left[ 1 + \frac{r_2}{w_2} (\theta_{21} + \theta_{22}) \right]. \]  \hspace{1cm} (25)

Substituting \( r_3 = 0 \) yields

\[ D = H w_3 \bar{M} \left\{ 1 - \left[ \frac{r_1}{1-r_1} \left( \frac{\theta_{13} + \theta_{23}}{w_3} \right) + \frac{r_2}{1-r_2} \left( \frac{\theta_{13} + \theta_{23}}{w_3} \right) \right] \right\}. \]  \hspace{1cm} (26)

The rate of changes of beans respect to sugar is calculated as follows,

\[ \frac{dr_3}{dr_1} = \frac{\left[ \frac{w_1}{(1-r_1)^2} \left[ 1 + \frac{r_1}{w_1} (\theta_{11} + \theta_{12}) \right] + \frac{w_2}{1-r_1 (1-r_2)} \left[ 1 + \frac{r_2}{w_2} (\theta_{21} + \theta_{22}) \right] \right]}{w_3 \left\{ 1 - \left[ \frac{r_1}{1-r_1} \left( \frac{\theta_{13} + \theta_{23}}{w_3} \right) + \frac{r_2}{1-r_2} \left( \frac{\theta_{13} + \theta_{23}}{w_3} \right) \right] \right\}} \]  \hspace{1cm} (27)
3. The results

In this section, we present details of our findings on testing the historical data. Table 1 shows details of some basic statistics on shares of three basic foods, i.e. gas, sugar and beans.

**Table 1**
The summary of some basic statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Shares of family income on Gas</th>
<th>Shares of family income on Sugar</th>
<th>Shares of family income on Beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>0.05</td>
<td>0.007</td>
<td>0.006</td>
</tr>
<tr>
<td>1989</td>
<td>0.04</td>
<td>0.008</td>
<td>0.010</td>
</tr>
<tr>
<td>1990</td>
<td>0.06</td>
<td>0.006</td>
<td>0.013</td>
</tr>
<tr>
<td>1991</td>
<td>0.06</td>
<td>0.007</td>
<td>0.011</td>
</tr>
<tr>
<td>1992</td>
<td>0.010</td>
<td>0.010</td>
<td>0.011</td>
</tr>
<tr>
<td>1993</td>
<td>0.166</td>
<td>0.016</td>
<td>0.009</td>
</tr>
<tr>
<td>1994</td>
<td>0.237</td>
<td>0.039</td>
<td>0.019</td>
</tr>
<tr>
<td>1995</td>
<td>0.109</td>
<td>0.011</td>
<td>0.013</td>
</tr>
<tr>
<td>1996</td>
<td>0.143</td>
<td>0.014</td>
<td>0.009</td>
</tr>
<tr>
<td>1997</td>
<td>0.070</td>
<td>0.006</td>
<td>0.003</td>
</tr>
<tr>
<td>1998</td>
<td>0.083</td>
<td>0.007</td>
<td>0.005</td>
</tr>
<tr>
<td>1999</td>
<td>0.077</td>
<td>0.007</td>
<td>0.006</td>
</tr>
<tr>
<td>2000</td>
<td>0.090</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td>2001</td>
<td>0.118</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td>2002</td>
<td>0.0124</td>
<td>0.022</td>
<td>0.006</td>
</tr>
<tr>
<td>2003</td>
<td>0.177</td>
<td>0.009</td>
<td>0.007</td>
</tr>
<tr>
<td>2004</td>
<td>0.158</td>
<td>0.006</td>
<td>0.005</td>
</tr>
<tr>
<td>2005</td>
<td>0.199</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td>2006</td>
<td>0.202</td>
<td>0.006</td>
<td>0.007</td>
</tr>
<tr>
<td>2007</td>
<td>0.212</td>
<td>0.019</td>
<td>0.009</td>
</tr>
</tbody>
</table>

The proposed study of this paper gathers the same information over the same period mentioned in Table 1 and the following regression analysis is performed.

\[
 w_i = a_{i1} + a_{i2} m + a_{i3} p_1 + a_{i4} p_2 + a_{i5} p_3 + u_i \quad i = 1, 2, 3 \tag{28}
\]

The first step to perform the regression statistics is to make sure that the data are stationary and this is confirmed through Augmented Dickey-Fuller (ADF) test. Table 3 shows details of ADF test.

**Table 3**
The summary of ADF test

<table>
<thead>
<tr>
<th>Variable</th>
<th>( w_1 )</th>
<th>( w_2 )</th>
<th>( w_3 )</th>
<th>( p_1r )</th>
<th>( p_2r )</th>
<th>( p_3r )</th>
<th>( m )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics</td>
<td>-5.25</td>
<td>-5.96</td>
<td>-4.97</td>
<td>-3.54</td>
<td>-3.41</td>
<td>-2.93</td>
<td>-6.07</td>
</tr>
<tr>
<td>Critical value</td>
<td>-1.96</td>
<td>-1.96</td>
<td>-1.96</td>
<td>-1.96</td>
<td>-1.96</td>
<td>-1.96</td>
<td>-1.96</td>
</tr>
</tbody>
</table>

The results of Table 3 clearly show that all variables become stationary after taking one difference between variables. In addition, Engle-Granger cointegration test has been applied on residuals and Table 4 shows the results of our survey.

**Table 4**
The summary of Engle-Granger cointegration test

<table>
<thead>
<tr>
<th>Statistics</th>
<th>( e_1 )</th>
<th>( e_2 )</th>
<th>( e_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>-5.6</td>
<td>-4.71</td>
<td>-4.51</td>
</tr>
<tr>
<td>Critical value</td>
<td>-4.32</td>
<td>-4.32</td>
<td>-4.32</td>
</tr>
</tbody>
</table>

Eq. (29) to Eq. (31) demonstrate the results of regression estimation.

\[
 \hat{w}_1 = 0.03 - 0.009 m - 0.01 p_1 + 0.002 p_2 + 0.01 p_3 \tag{29}
\]
\[
 \hat{w}_2 = 0.005 - 0.007 m - 0.008 p_1 + 0.0005 p_2 + 0.001 p_3 \tag{30}
\]
\[
 \hat{w}_3 = 0.014 - 0.005 m - 0.003 p_1 + 0.0005 p_2 + 0.0005 p_3 \tag{31}
\]
In our study, we considered year 2007 prices for gas and sugar as a basis for estimation and Table 5 shows details of the prices.

**Table 5**
The summary of prices of gas and sugar

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Subsidized price</th>
<th>Non-subsidized price</th>
<th>Social welfare rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>1000</td>
<td>4545</td>
<td>0.78</td>
</tr>
<tr>
<td>Sugar</td>
<td>2000</td>
<td>5670</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Using Eq. (27), the changes of beans respect to sugar is \( \frac{dr_1}{dr_2} = 379.64 \). Table 6 demonstrates the change on social welfare based on various values of \( \varepsilon \).

**Table 6**
The summary of change on social welfare

<table>
<thead>
<tr>
<th>( \varepsilon )</th>
<th>( \varepsilon = 0 )</th>
<th>( \varepsilon = 1 )</th>
<th>( \varepsilon = 1.5 )</th>
<th>( \varepsilon = 2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{\Delta W}{H_M} )</td>
<td>4.463</td>
<td>0.453</td>
<td>0.254</td>
<td>0.124</td>
</tr>
</tbody>
</table>

The results of Table 6 show that social welfare for the first four groups of people is increased while the social welfare for the rest of groups is reduced. In other words, the results indicate that poor people may benefit from the changes of the prices.

**4. Conclusion**

During the past few years, there have been different discussions in Iranian society on eliminating any subsidy programs especially on energy and some basic foods such as sugar and beans. This study has examined the effect of change on prices of gas and sugar on social welfare. The results of our survey have indicated that the program could reduce the gap between rich and poor people. In other words, social welfare for the first four groups of people has been increased while the social welfare for the rest of groups was reduced. In other words, the results indicate that poor people may benefit from the changes of the prices. The results show that self-targeted subsidies increase social welfare. The extent of this increase is negatively related to inequality aversion parameter, while positively related to the share of nonsubsidized goods in low income deciles budget.

**References**


