Management Science Letters 4 (2014) 1531–1536

Contents lists available at GrowingScience

Management Science Letters

homepage: www.GrowingScience.com/msl

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

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C H R O N I C L E

Article history:
Received January 4, 2014
Accepted 1 June 2014
Available online
June 3 2014

Keywords:
Self-targeted Subsidies
Social Welfare
Income Deciles
Atkinson Social Welfare Function
Social Inequality Aversion Parameter

A B S T R A C T

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.

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doi: 10.5267/j.msl.2014.6.007

2. The proposed study

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

$$W = \frac{1}{H}\sum_{h=1}^{H}\left(\frac{n_h}{1-\varepsilon}\right)\left(\frac{M_h}{n_h}\right)^{1-\varepsilon} \qquad \varepsilon \neq 1 \tag{1}$$

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

$$W = \frac{1}{H}\sum_{h=1}^{H} n_h \, Ln\left(\frac{M_h}{n_h}\right). \tag{2}$$

The utility function of this paper is stated as follows,

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

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,

$$V_h = V\left(M_h, P\right), \tag{4}$$

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

$$\frac{\partial W}{\partial p_i} = \sum_{h=1}^{H} \frac{\partial W}{\partial V_h}.\frac{\partial V_h}{\partial p_i} \qquad i = 1,2,3 \tag{5}$$

Let η_h be the marginal social utility of household income of h. Therefore, we have

$$\frac{\partial W}{\partial p_i} = -\sum_{h=1}^{H} \eta_h x_{ih} \qquad i = 1,2,3 \tag{6}$$

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.,

$$\frac{dr_2}{dr_1} = \frac{1-r_2}{1-r_1} \tag{7}$$

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,

$$r_i = \frac{c_i - p_i}{c_i} \tag{8}$$

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,

$$w_{ih} = \frac{p_i x_{ih}}{M_h}. \tag{9}$$

In addition, the portion of each family from social welfare is characterized as follows,

$$w_i^{\varepsilon} = \frac{\sum_{h=1}^{H} \eta_h . w_{ih} . M_h}{\sum_{h=1}^{H} M_h} . \tag{10}$$

Therefore, we have,

$$w_i^{\varepsilon} = \sum_{h=1}^{H} \left(\frac{M_h}{n_h} \right)^{-\varepsilon} . w_{ih} . \frac{M_h}{\sum_{h=1}^{H} M_h} \tag{11}$$

and

$$\Delta W = -\left(\frac{dp_1}{dr_1} \right) \sum_{h=1}^{H} \eta_h \, x_{1h} - \left(\frac{dp_2}{dr_2} . \frac{dr_2}{dr_1} \right) \sum_{h=1}^{H} \eta_h \, x_{2h} - \left(\frac{dp_3}{dr_3} \right) \left(\frac{dr_3}{dr_1} \right) \sum_{h=1}^{H} \eta_h x_{3h} . \tag{12}$$

Using the relationships stated previously we have

$$\Delta W = H\bar{M} \left[\frac{w_1^{\varepsilon}}{1-r_1} + \frac{w_2^{\varepsilon}}{1-r_1} + \left(\frac{dr_3}{dr_2} \right) \frac{w_3^{\varepsilon}}{1-r_3} \right] . \tag{13}$$

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

$$w_i = \beta_i \bar{M} + \left(\theta_{i1} + \theta_{i2} \right) P_i + \left(\theta_{j1} + \theta_{j2} \right) P_j + u_i . \tag{14}$$

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

$$w_{ih} = \beta_i M_h + \left(\theta_{i1} + \theta_{i2} \right) P_i + \left(\theta_{j1} + \theta_{j2} \right) P_j + u_i . \tag{15}$$

with

$$\frac{\partial w_{ih}}{\partial p_j} = \frac{\theta_{j1} + \theta_{j2}}{1-r_j} \qquad i \neq j \tag{16}$$

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

$$S_i = \sum_{h=1}^{H} \left(c_i - p_i \right) x_{ih} , \tag{17}$$

and

$$S_i = \sum_{h=1}^{H} \left(\frac{r_i}{1-r_i} \right) p_i x_{ih} = \sum_{h=1}^{H} \left(\frac{r_i}{1-r_i} \right) w_{ih} M_h . \tag{18}$$

Therefore, total amount of welfare paid to all three commodities are calculated as follows,

$$S = S_1 + S_2 + S_3 = \sum_{i=1}^{3} S_i = \sum_{i=1}^{3}\sum_{h=1}^{H}\left(\frac{r_i}{1-r_i}\right) w_{ih} M_h \,. \tag{19}$$

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

$$\Delta S = \sum_{i=1}^{3} \frac{\partial s_i}{\partial r_1} + \sum_{j=2}^{3}\sum_{i=1}^{3} \frac{\partial S_i}{\partial r_j}\frac{dr_j}{dr_1}. \tag{20}$$

Since $\Delta S = 0$ therefore we have,

$$\frac{dr_2}{dr_1} = -\frac{\sum_{i=1}^{3}\left[\frac{\partial S_i}{\partial r_1} + \frac{\partial S_i}{\partial r_2}\cdot\frac{dr_2}{dr_1}\right]}{\sum_{i=1}^{3}\frac{\partial S_i}{\partial r_2}} \tag{21}$$

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

$$\Delta S_1 = \frac{1}{(1-r_1)^2}\sum_{h=1}^{H} w_{1h} M_h + \frac{r_1}{1-r_1}\sum_{h=1}^{H} M_h\left(\frac{\partial w_{1h}}{\partial r_1}\right) + \frac{r_1}{1-r_1}\sum_{h=1}^{H} M_h\left(\frac{\partial w_{1h}}{\partial r_2}\right)\left(\frac{dr_2}{dr_1}\right). \tag{22}$$

Using

$$\bar{M} = \frac{\sum_{h=1}^{H} M_h}{H}, \quad w_i = \frac{\sum_{h=1}^{H} w_{1h} M_h}{\sum_{h=1}^{H} M_h} \tag{23}$$

or

$$\Delta S_1 = \frac{H w_1 \bar{M}}{(1-r_1)^2}\left[1 + \frac{r_1}{w_1}(\theta_{11} + \theta_{12})\right], \tag{24}$$

and

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

Substituting $r_3 = 0$ yields

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

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

$$\frac{dr_3}{dr_1} = -\frac{\left[\frac{w_1}{(1-r_1)^2}\right]\left[1 + \frac{r_1}{w_1}(\theta_{11} + \theta_{12})\right] + \left[\frac{w_2}{(1-r_1(1-r_2)}\right]\left[1 + \frac{r_2}{w_2}(\theta_{21} + \theta_{22})\right]}{w_3\left\{1 - \left[\left(\frac{r_1}{1-r_1}\right)\left(\frac{\theta_{13} + \theta_{23}}{w_3}\right) + \left(\frac{r_2}{1-r_2}\right)\left(\frac{\theta_{13} + \theta_{23}}{w_3}\right)\right]\right\}} \tag{27}$$

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

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

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.

$$w_i = a_{i1} + a_{i2}m + a_{i3}p_{1r} + a_{i4}p_{2r} + a_{i5}p_{3r} + u_i \qquad i = 1,2,3 \tag{28}$$

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

Variable	w_1	w_2	w_3	p_{1r}	P_{2r}	P_{3r}	m
Statistics	-5.25	-5.96	-4.97	-3.54	-3.41	-2.93	-6.07
Critical value	-1.96	-1.96	-1.96	-1.96	-1.96	-1.96	-1.96

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

Statistics	e_1	e_2	e_3
Value	-5.6	-4.71	-4.51
Critical value	-4.32	-4.32	-4.32

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

$$\hat{w}_1 = 0.03 - 0.009m - 0.01p_{1r} - 0.002p_{2r} + 0.01p_{3r} \tag{29}$$

$$\hat{w}_2 = 0.005 - 0.007m - 0.008p_{1r} + 0.0005p_{2r} + 0.001p_{3r} \tag{30}$$

$$\hat{w}_3 = 0.014 - 0.005m - 0.003p_{1r} + 0.0005p_{2r} + 0.0003p_{3r} \tag{31}$$

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

Commodity	Subsidized price	Non-subsidized price	Social welfare rate
Gas	1000	4545	0.78
Sugar	2000	5670	0.65

Using Eq. (27), the changes of beans respect to sugar is $\frac{dr_3}{dr_2} = 379.64$. Table 6 demonstrates the change on social welfare based on various values of ε.

Table 6
The summary of change on social welfare

ε	ε = 0	ε = 1	ε = 1.5	ε = 2
$\left(\frac{\Delta W}{H\overline{M}}\right)$	4.463	0.453	0.254	0.124

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.

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