Comparing the Impact on Poverty of Food Subsidies and Regional Targeting. Evidence from Tunisia Using Household Survey*

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Abstract

This paper assesses the impact on the poor population welfare of hypothetical reforms, which advise to substitute a direct transfer program, based on a regional targeting, to the current universal food subsidies system. The outcomes show that this reform would allow an important reduction of poverty, varying between 8.4 and 34 percent according the way poverty is measured. Further, dominance tests are used to assess the likely effects of the reform on a wide range of poverty lines and poverty measures. The main result is that providing assistance to the poor based on regional targeting program would be more effective in reducing poverty than universal food subsidies scheme within a wide range of poverty measures and poverty lines including all those estimated and generally used for Tunisia.

Keywords : Poverty; Regional Targeting; Food Subsidies; Transfers.

JEL classification : D12; D63; H53; I32; I38.

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1. Introduction

Alleviating poverty is a major objective of economic development. Economic growth is generally considered as a necessary condition for lessening poverty [Bhagwati (1985)]. Yet growth alone may not be sufficient to improve significantly the well-being of the low-income households [Stewart (1985)]. As a consequence, programs that are specifically designed to decrease poverty need to be addressed in developed as well as developing countries. Among available means to channel assistance to the poor, targeting by commodities (i.e. by subsidizing food staples that are mainly consumed by the poorest), has been very popular, especially in developing countries. The experience with food subsidies shows, however, that the leakage to the non-poor people is frequently important whereas success in lessening the extent of poverty is limited.

Although the universal food subsidies program (henceforth UFSP) was considered as a suitable means to improve the welfare and nutritional intake of the poor in the beginning of the 70s, it no longer makes the unanimity in Tunisia. The cost of the program was as high as 3 percent of GDP and more than 7 percent of government expenditures in 1990[1]. In addition to its cost, the large leakage to the non-poor made an overhaul of this system an urgent priority. Moreover, implementing new policies to combat poverty becomes necessary since (1) poverty stagnated between 1990 - 1995, in spite of a sustained growth of the real income *per capita* and a stabilized social expenditure, and in view of (2) the likely adverse effects on poverty that the economic changes induced by the post- free trade agreement (FTA) with EU will have. Within this context, focusing on more targeted transfers, that use exactly the same food subsidies funds, is worthy.

The objective of alleviating poverty is to raise people to a specified poverty line, expressed in terms of the minimum income (or expenditure) level required to be out of poverty. The key assumption of this paper is the impossibility to identify, at a lower cost, individuals with income below the poverty line. While such identification is ideal to achieve a significant reduction of poverty given an available budget, it is unlikely to be administratively feasible. In reality, it requires accurate and up-to-date information on the households' characteristics and a complicated and costly means to identify who is really poor [Besley and Kanbur (1993)].[2] In addition, programs based on means tests frequently suffer from ineffective implementation and high administrative costs, and their overall costs always show an upward trend due to the incentive they give to households to change their characteristics or to masquerade as poor in order to become eligible.[3]

As a consequence, targeting poor regions could be preferred to targeting poor persons. Although some benefits will inevitably leak to the non-poor living in targeted regions and not to the poor that live in untargeted areas, geographic targeting has many appealing features. No means tests are needed, and no new administrative mechanism for selecting beneficiaries individually needs to be set up. Regional targeting is also easy to implement and to monitor, and hence typically involves less fraud and much lower administrative costs than many other targeting options [Bigman and Fofack (2000) and Bigman and Srinivasan (2002)]. In addition, when some geographic regions have exceptionally high incidence of poverty, the importance of location to poverty outcomes could justify targeting poor areas rather than poor individuals, mainly when labor and other factors are not fully mobile [Park et al. (2002)].

Searching for a poverty-alleviating reform requires ranking the population according to its economic well-being. A definition of a well-being indicator has to be agreed upon to allow determination of who is poor and who is non-poor. The definition of such an indicator could be expanded. For instance, Mayshar and Yitzhaki (1996) allow well-being to be

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[1] See the World Bank (1995, 1999).

[2] For more information about targeting by means test, see for example Ravallion and Chao (1989), Glewwe (1992), Baker and Grosh (1995), and Bibi (2003).

[3] On this issue, see for instance Baker and Grosh (1994), Bigman and Srinivasan (2002). However, according to Besley (1990), many of the non-poor could avoid to masquerade because of the psychic costs of the social stigma resulting from the participation in programs meant specifically for the poor.

affected by two variables, namely ability and needs. Given ability, the greater are the needs of a household, the lower is its welfare level; and, given needs, the greater is the ability, the higher is the well-being of a household. This kind of extension is appealing for treatment of household size, in which there are economies to scale in the intra-household consumption, but this is beyond the scope of this paper. Instead, we focus on total expenditure *per capita* which we consider as a relevant proxy for both household's welfare and (permanent) income [Jorgenson (1998), and Slesnick (1998)].[4]

This paper discusses some technical issues of designing anti-poverty programs that are based on regional targeting, and, using 1990 Tunisian households survey, provides an evaluation of their likely effects on poverty relative to those achieved under UFSP. Section 2 lays out the theoretical background of the paper. Section 3 exposes the relevant features of poverty under UFSP, using appropriately estimated poverty lines. Section 4 presents simulations results of awarding assistance to the poor based on regional targeting using dominance tests. Section 5 provides a brief summary and offers some concluding comments.

2. Theoretical Background

It is commonly argued that perfect targeting, such that income can be observed accurately and where there are no incentives for the government to bring any poor out of poverty, is very costly.[5] Thus, poverty alleviation programs whose targeting is based on easily observable characteristics, such as household's region of residence, may be particularly appealing. Several authors have investigated the potential of regional-targeted-transfers in a model that minimizes poverty given a fixed amount of transfer funds.[6] Results show that it is

[4] As revealed by Deaton (1997), this option is always based on practicality and available data. That is why we measure poverty in terms of consumption expenditures.

[5] Besley and Kanbur (1993) provide an excellent discussion about the cost of perfect targeting.

[6] See, for example, Baker and Grosh (1994), Besley and Kanbur (1993), Bigman and Fofack (2000), Bigman and Srinivasan (2002), Datt and Ravallion (1993), Jalan and Ravallion (1998), Kanbur (1987), Park et al. (2002), and Ravallion (1993).

possible to achieve the same outcome on poverty as attained under untargeted transfer, while realizing substantial savings of the available budget.

Considering we wish to assess the likely effects on poverty of a reform that replaces the UFSP by a direct transfer system which is based on regional targeting, it is necessary to specify an individual well-being indicator that is sensitive to price system variations. This indicator could be presented in terms of the equivalent income function as defined by King (1983): for a given budget constraint (p, y), equivalent income is defined as that income level which allows, at the reference price system p^r, the same utility level that can be reached under the given budget constraint:

$$v(p^r, y_e) = v(p, y) \tag{1}$$

where $v(.)$ is the indirect utility function, y is the income level, and p is the price system. Notice that since p^r is fixed across all households, y_e is an exact monetary metric of actual utility $v(p, y)$ because y_e is an increasing monotonic transformation of $v(.)$. Indeed, inverting the indirect utility function, we obtain equivalent income in terms of the expenditure function:

$$\begin{aligned} y_e &= e(p^r; v(p, y)) \\ &= y_e(p^r, p, y) \end{aligned} \tag{2}$$

where $e(.)$ is the expenditure function and $y_e(.)$ is the equivalent income function.

When p^r is set to be equal to the non-food subsidies price system, the move from the benchmark situation to another with food subsidies price system, p^s, can be then considered as a first possibility of a poverty alleviation scheme. Hence, targeting by commodities provides an equivalent gain, TC, for each person, which could be captured using the following formula:

$$\begin{aligned} TC &= y_e(p^r, p^r, y) - y_e(p^r, p^s, y) \\ &= y - y_e(p^r, p^s, y). \end{aligned} \tag{3}$$

Suppose now that UFSP has to be replaced by an alternative scheme, RT, based on regional targeting. The impact of this reform on the individual well-being will be given by:

$$y_e(p^r, p^r, y + RT) = y + RT. \tag{4}$$

In order to describe how this alternative anti-poverty policy could be deduced and to evaluate the relative efficiency of each policy in reducing poverty, it is necessary to specify a poverty measure. Hence, the way poverty is measured is important for achieving these two goals. Since the pioneering publication on poverty measurement of Sen (1976), many poverty measures have been suggested in the literature.[7] We select the popular FGT class of poverty measures, introduced by Foster et al. (1984), as it involves several indices that are in line with the main axioms developed in the literature. This class is defined as:[8]

$$\mathrm{P}_\alpha(z_e, y_e) = \frac{100}{N}\sum_{i=1}^{N}\left(\frac{z_e - y_e^i}{z_e}\right)^\alpha I(y_e^i \le z_e), \tag{5}$$

where $I(.)$ is an indicator function equal to 1 when its argument is true and 0 otherwise, z_e is the equivalent poverty line, i.e. the minimum expenditure level required to reach the indifference curve separating the poor from the non-poor, N is the population size, and α can be considered as a measure of poverty aversion: a larger α gives greater emphasis on the poorest poor. When α becomes very large, $\mathrm{P}_\alpha(.)$ approaches a Rawlsian measure which considers only the poorest households' welfare. The family of measures given by expression (5) involves many commonly used poverty measures as special cases. For instance, when $\alpha = 0$, $\mathrm{P}_0(.)$ is the headcount ratio, while when $\alpha = 1$, $\mathrm{P}_1(.)$ is the deficit of poverty measure (or the poverty gap). For $\alpha > 1$, $\mathrm{P}_\alpha(.)$ becomes sensitive to inequality within the poor.

The issue is how to target a direct transfer using regional information to decrease poverty as much as possible. Formally, the problem is to use the budget devoted to UFSP in order to deduce an alternative set of direct transfer so as to minimize a given poverty measure,

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[7] For a survey of the literature on the axiomatic foundations and the design of poverty indices, see, for instance, Zheng (1997, 2000).

[8] The substitution of the equivalent income to the income in the class of poverty measures FGT was equally done by Besley and Kanbur (1988) to study the impact of infra-marginal subsidies' reforms and by Ravallion and van de Walle (1991) to study the impact on poverty of food pricing reforms.

$P_\alpha(.)$.[9] The issue that remains to be solved is how to distribute this available budget through the different regions?

One of the typical features of the FGT class of poverty measures is that it is additively decomposable.[10] So, let us consider J mutually exclusive subgroups of population with poverty measure $P_{j,\alpha}(.)$ in the subgroup j:

$$P_\alpha(z_e, y_e) = \sum_{j=1}^{J} \beta_j P_{j,\alpha}[z_e, y_e(p^r, p, y_j)], \tag{6}$$

where y_j is the income distribution in subgroup j and β_j is its population share. If each subgroup of the population is defined by reference to its region of residence, the optimal allocation of the available budget between the different regions can be deduced from the following optimization program:

$$\begin{aligned} &\text{Min.}P_\alpha(z_e, y_e) = \sum_{j=1}^{J} \beta_j P_{\alpha,j}\big(z_e, y_e(p^r, p^r, y_j + RT_j)\big) \\ &\text{subject to} \\ &\sum_{j=1}^{J} \beta_j RT_j = B, \end{aligned} \tag{7}$$

where RT_j is the transfer to be awarded to each one in j and B is the *per capita* cost of this program.[11] The first order condition for minimization of $P_\alpha(.)$ with respect to RT_j is given by:

$$\beta_j \frac{\partial P_{\alpha,j}\big(z_e, (y_j + RT_j)\big)}{\partial RT_j} + \lambda = 0. \tag{8}$$

The parameter λ is the shadow price which results from a marginal increase of the available budget. The equation (8) indicates that this budget has to be distributed so as the last monetary unit allocated to each region allows the same poverty reduction. Given that:

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[9] This paper focuses on targeting in the form of cash transfers. Nevertheless, the methodology followed here does not exclude the possibility that this design takes the form of food stamps, rations, etc.

[10] The characteristic of any subgroup of poor population can be of regional nature (rural or urban zone, northern region or the south...) or socio-demographic (number of child by household, the occupation nature of the household head, his level of education, etc.). Note that the decomposability characteristic of the FGT poverty measure is not always respected in all poverty measures suggested in the literature. For instance, see Zheng (1997).

[11] This framework assumes then that targeting within j is not possible.

$$\frac{\partial \mathrm{P}_{\alpha,j}}{\partial RT_j} = -\frac{\alpha}{\beta_j N z_e} \mathrm{P}_{\alpha-1,j}\left(z_e,(y_j+RT_j)\right), \tag{9}$$

the optimal distribution of the available budget through the different regions is achieved when:

$$\mathrm{P}_{\alpha-1,j}\left(z_e,(y_j+RT_j)\right) = \mathrm{P}_{\alpha-1,k}\left(z_e,(y_k+RT_k)\right). \tag{10}$$

The first order condition given by equation (8) is very instructive. When the objective is to minimize the poverty measure $\mathrm{P}_\alpha(.)$, the available budget has to be allocated so as to equalize $\mathrm{P}_{\alpha-1,j}(.)$. Following Kanbur (1987), the intuition behind this result is obvious when $\alpha = 1$. The poverty deficit measure $\mathrm{P}_1(.)$ is proportional to the sum of the poverty gaps. The amount by which this sum changes when each income increases marginally is given by the number of households having an equivalent income per capita below the equivalent poverty line, which is proportional to $\mathrm{P}_0(.)$. Expression (10) stresses the fact that any poverty measure is a statement about poor population welfare on the average, whereas the optimal allocation of available budget requires marginal information. Therefore, while $\mathrm{P}_{\alpha-1}(.)$ is not in itself the objective of the design, it turns out to play the crucial role of an indicator in fixing the share of the available budget which has to benefit each region. Hence, the solution of this optimization program can be obtained numerically and it will only depend on the poverty aversion, α, and the distribution of income in region j:

$$RT_j^i = RT_j = RT_\alpha(y_j), \tag{11}$$

where RT_j^i is the transfer awarded to an individual i living in the region j.

Expression (11) clearly shows that under regional targeting of transfers, all individuals within a region are treated identically as with a universal transfer scheme; but only some regions are targeted by this system. Indeed, the scheme works as follows: transfers are awarded to everyone living in the poorest region up to equalize its $\mathrm{P}_{\alpha-1,j}(.)$ to the next poorest region, then transfers are awarded to each person living in these two equally-poor regions until reaching the $P_{\alpha-1,j}(.)$ of the third poorest region. This pattern is repeated until expending the entire budget. Thus, the available budget will be spent to minimize $P_{\alpha-1,j}(.)$ of the poorest regions down to a common measure $\overline{P}_{\alpha-1,j}(.)$ below the initial one. If the available budget is not large enough, $P_{\alpha-1,j}(.)$ of the richest regions will be lower than $\overline{P}_{\alpha-1,j}(.)$ and so they will be excluded from the benefits of regional targeting program.[12]

In order to assess how well regional targeting alleviates poverty, relative to targeting by commodities, we look at the cost resulting from the inclusion of the non-poor and the exclusion ratio of the poor.[13] Interestingly, note that targeting by commodities, using UFSP, has no exclusion error and so, it is an optimal program when the objective is to minimize this kind of error. Nevertheless, as stated by Ravallion and Datt (1995), the ability of a design to concentrate benefits on the poor should not be confused with its impact on poverty; the former being one determinant of the latter.

The net effect on the individual welfare will then be appreciated with regard to the difference in the poverty level between the different schemes under consideration:

$$\Delta P_\alpha = \sum_{j=1}^{J} \beta_j [P_{\alpha,j}(z_e, y_e(p^r, p^s, y_j)) - P_{\alpha,j}(z_e, y_j + RT_j)]. \tag{12}$$

Furthermore, since poverty measures are estimated using sample observations, we need to test whether the observed reduction in poverty following the proposed design is statistically significant, which is possible using the test of Kakwani (1993):

$$\kappa = \frac{\Delta P_\alpha}{\sigma(\Delta P_\alpha)} \tag{13}$$

where $\sigma(.)$ is the standard error of ΔP_α:

[12] An alternative framework allowing the possibility of targeting within regions will not exclude any region from the benefits of such scheme [see for instance Ravallion (1998a)]. Yet the goal here is just to check whether using a simple targeting model could be more effective in reducing poverty than UFSP.

$$\sigma(\Delta \mathrm{P}_{\alpha}) = \sqrt{\frac{\left(\mathrm{P}_{2\alpha}(.) - [\mathrm{P}_{\alpha}(.)]^{2}\right)_{TC} + \left(\mathrm{P}_{2\alpha}(.) - [\mathrm{P}_{\alpha}(.)]^{2}\right)_{RT}}{I}}.$$

Since the UFSP entails a distortion of the relative price system, the average of the equivalent gain distribution will be less important than per capita cost of UFSP, i.e. *B*. The difference between these two arguments corresponds to the excess burden of UFSP and it constitutes a part of the inefficiency cost induced by choosing targeting by commodities. The evaluation of the extent of this cost requires the estimation of a demand system. If the estimation of the excess burden cost is found to be exaggerated, the impact of a revenue-neutral reform which uses the UFSP budget risks therefore to be overestimated. The removal of the excess burden cost estimated will explain a great part of the estimated welfare improvement, and it is not sure that such would be the case in reality. Since the objective of this study is to assess the impact of an alternative poverty alleviation program, we choose to ignore the importance of this cost since, if the reform is good under this assumption, it is at least as good under an alternative one.

3. Data and Methodology

The methodology presented in previous section is applied on a data set from the 1990 Tunisian survey. This is a multipurpose household survey which provides information on expenditures and quantities for food items and expenditures for non-food items, as well as on many other dimensions, that characterize the behavior of 7734 households. Information includes the consumption of education, housing, region of residence, demographic information, and economic activities. Nevertheless, it does not include information on income distribution. Therefore, as stated above, the easiest approach is to choose the total expenditures *per capita* of households as a *proxy* for the individuals' well-being.

[13] For instance, see Cornia and Stewart (1995)

In any study of poverty, a cut-off point needs to be selected to serve as a poverty line across the distribution of households' expenditure *per capita*.[14] The determination of the poverty line is rarely formulated in utilitarian terms [Ravallion (1996)]. In theory, a utilitarian approach should enable us to display a downward-sloping indifference curve that separates the poor from the non-poor. Hence, the compensated expenditure function would allow to determine, for any given price system, the minimum expenditure level required to reach this indifference curve. For instance, let the individual welfare be represented by the Stone-Geary utility function. Thus, the maximization of this function subject to the budgetary constraint gives the following non-compensated expenditures functions:

$$x_k^h = z_k + \sigma_k (y^h - z) \text{ with } \sum_k \sigma_k = 1 \qquad (14)$$

where σ_k is a positive parameter, z_k can be interpreted as some minimum expenditure on commodity *k*, and x_k^h is the expenditure *per capita* on commodity *k* by household *h* having an income level *per capita*, y^h. Bourguignon and Fields (1997) have underlined that when we estimate and use this model to study the consumption behavior, it has to be assumed that all individuals having an income level below the minimum, $z = \sum_k z_k$, required to buy the minimum bundle (z_1,.., z_k,.., z_K), can be considered as being poor. However, Ravallion and van de Walle (1991) find difficult to base poverty line on a basket of reference consumption.

It is both natural and convenient to decompose poverty line into two components: a food poverty line (z_f) and a non-food poverty line (z_{nf}). If we assume that food commodities make up a basket of goods that is separable from others, the food component of poverty line could be estimated using a linear demand system (*LES*), given by equation (14). [15] This assumption enables us to keep the usage of the *LES* model only for the estimation of the food poverty line.

[14] There is a large literature dealing with the determination of the poverty line. For a recent survey, see Ravallion (1998b).

The estimation results of the *LES* model using the restricted least square are reported in table A-1 in annex.[16] This table reveals an estimated value of 167.7 *Tunisian Dinars* (henceforth TD) *per capita per year* for z_f under UFSP.[17]

The non-food poverty line (z_{nf}) is estimated using the Ravallion's (1998b) method. It consists in observing households' behavior whose income is just equal to the food poverty line ($y^h = z_f$). These households are in a position to afford basic foodstuffs but prefer to devote part of their income to non-food commodities. This income part can be deemed as the lower non-food poverty line z^l_{nf} :

$$z^l_{nf} = z_f - y_f \tag{15}$$

To estimate the non-food component of poverty line, we can use the *AIDS* model of Deaton and Muelbauer (1980) or *IQAIDS* model of Banks et al. (1997). The main hypothesis behind the *AIDS* model is the linearity of Engel curve when the latter describes a relationship between food budget share and the logarithm of individual's (y^h) income deflated by the food poverty line. However, it is possible that the slope of the Engel curve is not constant in which case, the below *IQAIDS* model becomes appealing:

$$w^h_f = \omega_f + \theta \ln\left(\frac{y^h}{z_f}\right) + \delta\left[\ln\left(\frac{y^h}{z_f}\right)\right]^2 + u^h_f. \tag{16}$$

The estimation parameters of the *IQAIDS* model are reported in table A-2 in annex. As equation (16) reveals, the coefficient ω_f is an estimated average of households' food share having total expenditures *per capita* equal to the food poverty line (z_f). The lower non-food poverty line (z^l_{nf}) could be then given by the following equation:

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[15] We have underlined that the linear demand system allows to estimate a poverty line by reference to a fixed consumption bundle that is too restrictive. To reduce disadvantages of the *LES* choice, we have chosen to decompose the poverty line into two components and to reduce the use of this system only for the estimation of food poverty line.

[16] Ayadi and Matoussi (1995) have followed the energy approach to estimate the food component of poverty line. They found that food poverty line is equal to 152 *Tunisian Dinars*. Hence, table A-1 shows that our results allow households to reach easily their needs in calorific energy.

[17] In 1990, one *Tunisian Dinar* is close to one US dollar.

$$z_{nf}^{l} = (1-\omega_f)z_f. \quad (17)$$

Ravallion (1998b) considers the lower poverty line as an "ultra-poverty line", such that households with consumption expenditures below that threshold face a serious venture of under-nutrition. Equation (17) allows us then to have a relation between the food poverty line (z_f) and the lower poverty line (z^l):

$$z^{l} = (2-\omega_f)z_f \quad (18)$$

In addition, we can determine the upper poverty line (z^u) which is the required minimum income level for a household that allows him to devote, for food items, a budget that is equal to the food poverty line (z_f). The upper poverty line which can be obtained numerically, allows us to estimate an upper non-food poverty line that corresponds to the maximum reasonable expenditure for basic non-food items. The following table gives the lower non-food, the upper non-food, and the global poverty lines estimated following the Ravallion's (1998b) approach: [18]

Table 1: Lower and upper poverty lines under UFSP (TD *per capita per year*)

	Lower	upper
Food poverty line, z_f	161.7	161.7
Non food poverty line, z_{nf}	65,9	133,2
(Global) poverty line, z	227,6	294.9

To assess how well UFSP and geographic targeting work, we have now to determine the equivalent poverty line, $y_e(p^r, p^s, z)$. An estimate of the equivalent gain at point z, TC_z. is then required. We use a non-parametric estimation procedure to estimate it, following the technique of kernel density estimation developed by Silverman (1986):

[18] The official poverty line estimated by the National Statistic Institute corresponds to 278 (139) TD for the urban (rural) area. On the other hand, the poverty line estimated by Ayadi and Matoussi (1995), who have followed the Ravallion (1998b) method to estimate its non-food component, varies between 213 and 262 TD.

$$\hat{TC} = \frac{\int_0^{+\infty} TC\hat{\mathrm{f}}(TC, z)\mathrm{d}TC}{\int_0^{+\infty} \hat{\mathrm{f}}(TC, z)\mathrm{d}TC}. \tag{24}$$

In the application of this method, we use the non-parametric kernel estimation procedure, with Gaussian Kernel and bandwidth chosen to minimize the mean integrated square error of a wide range of possible population densities. The estimated distribution tends asymptotically to the true distribution if the latter is continuous.[19] The following table gives the lower and upper equivalent poverty line that corresponds to those estimated above:[20]

Table 2: Lower and upper equivalent poverty line (TD *per capita per year*)

	Lower	*Upper*
$z = e(p^s, v_z)$	227,6	294,9
$z_e = e(p^r, v_z) = y_e(p^r, p^s, z)$	253,1	323,6

Arguably, a general equilibrium model is required to elicit the sharing out of food subsidy benefits between firms and households. Most computable general equilibrium models assume that the supply curve of each commodity is horizontal such that consumers reap the entire benefits of the indirect transfers. For simplicity, we assume such framework. Hence, through UFSP, consumer price is lowered below marginal cost by 37 percent for hard wheat, 35 percent for tender wheat, 9 percent for other wheat, 14 percent for poultry and eggs, 18 percent for milk, 24 percent for sugar, and 34 percent for grain oil. The budgetary cost *per capita per year* of UFSP is 34.8 TD. The outcomes of this program on poverty are summarized in the following table.

[19] See Silverman (1986).

[20] Although the approach followed here allows to resolve some defects involved in preceding approaches, the arbitrariness is not entirely excluded with utilitarian approach. That is why, there is a good case for considering quite a wide range of the whole distribution of income when we have to assess the likely effects of regional targeting.

Table 3: The outcomes of UFSP on poverty

α	z_e	$P_\alpha(z_e, y)$	$P_\alpha(z_e, y + TC)$	ΔP_α (%)	κ
0	255	15.9	12.5	-21.4	-14.9
0	325	26.2	21.8	-16.8	-15.4
1	255	4.3	3.1	-27.9	-15.5
1	325	7.9	6.1	-22.8	-16.9
2	255	1.7	1.2	-29.4	-13.9
2	325	3.4	2.5	-26.5	-15.9

The presence of UFSP is a meaningful source of welfare improvement for the poor, as the statistically significant decline of all poverty measures proved. For the lower poverty line, the extreme poverty decline is between 21.4 and 29.4 percent according to whether the poverty measure retained is $P_0(.)$ or $P_2(.)$. Further, table 3 shows that in relative terms, the subsidies on foodstuffs benefited more the poorest of the poor than the richest. So targeting by commodities is progressive in relative terms. For instance, we note that poverty reduction is less important as the poverty line rises for a given poverty measure.

In order to have economically homogeneous regions, eight regional groups are identified: Great Tunis, Northeast, Northwest, Middle East, Middle West, Sfax, Southeast, Southwest. Table A-3 in annex summarizes the distribution of the equivalent gain in each region and table 4 presented below reports some basic information on these regions in term of population weights, β_j, the mean and standard error of equivalent income (expenditures) *per capita per year* in the benchmark situation as well as the extent to which UFSP decreases poverty in these regions; using the upper poverty line.

Table 4: Outcome of UFSP on regional poverty (z_e = 325 TD *per capita per year*)

Regions	β_j (%)	$y_e(p^r, p^r, y_j)$	$P_0(z_e, y)$	$P_0(z_e, y+TC)$	$P_1(z_e, y)$	$P_1(z_e, y+TC)$
Great Tunis	16.84	955 (2134)	9.82	7.94	2.57	1.88
Northeast	12.64	733 (1606)	24.1	19.2	6.59	4.81
Northwest	17.54	510 (972)	38.6	34.3	13.3	10.6
Middle East	12.10	846 (1690)	14.2	11.5	4.0	3.09
Middle West	15.05	529 (1055)	36.3	29.4	11.7	9.13
Sfax	5.76	618 (1117)	26.3	20.9	7.65	6.02
Southeast	11.17	589 (1369)	27.3	22.7	6.26	4.59
Southwest	8.90	511 (920)	34	28.1	10.0	7.88

Note: (Standard error in parenthesis)

The impact of the targeting-by-commodities program on reducing poverty does not indicate, however, that it is an optimal transfer design. Indeed, although UFSP reduces the incidence and, to some extent, the severity of poverty in the poorest regions of Tunisia, i.e. mainly the west regions, the poverty level in these regions remain really high as table 4 reveals. Further, the magnitude of the income transfer to the non-poor, that is the leakages of the program benefits, is very important. The richest quintile group of the population received 2.1 times more of the equivalent gains from food subsidies than the poorest, with an average equivalent gain *per capita per year* of 47.33 TD and 22.79 TD respectively. This mistaken award of transfers to the non-targeted group reduces the vertical efficiency of this scheme and leads to a leakage of program benefits. The restructuring of this scheme becomes then a pressing priority.

4. Simulation results of regional targeting

Two transfer schemes based on regional targeting are simulated using the upper poverty line. The first assumes that the objective is to minimize the poverty gap, $P_1(.)$; whereas the second is based on the distribution of the available budget so as to decrease as much as possible the severity of poverty, i.e. $P_2(.)$. As described above, when minimizing, say, $P_1(.)$, transfers are first targeted to households living in the northwest area, since this area experiences the higher $P_{0,j}(.)$, until they reach the headcount ratio of the middle west area, then transfers are equally awarded to households living in both northwest and middle west regions until they reach the headcount ratio of the southwest area. The available budget is wholly expended and, so, this scheme stops when the headcount ratio in the six poorest regions equalizes 0.233.[21] Because the incidence of poverty is lower than this threshold in Great Tunis and Middle East region, they are excluded from this design. The transfers scheme resulting from regional targeting simulations are reported in table A-3 in annex.

It is equally useful to test whether direct transfers based on regional targeting alleviate more poverty than universal transfers do; especially when the latter serves more poor people than targeting by commodities.[22] Likewise, the targeting by commodities and the universal transfer effects, the effects of regional targeting transfers on the poor population welfare, for different values of aversion to the poverty, are summarized in the following table: [23]

[21] The same process is followed when minimizing the severity of poverty, i.e. $P_2(.)$. The available budget is spent to decrease $P_{1,j}(.)$ of the six poorest regions up to 0.053. Poverty measures for each region before and after each transfer scheme are presented in the table A-3 in annex.

[22] Note that the debate about the choice between a universal transfer system and a system based on targeted transfers to poor people is not yet closed. Political considerations or negative effects on the individuals' incentive could justify the choice of a universal transfer system. See, for example, Creedy (1996).

[23] We have to note here that the available budget allows to lift all the poor out of poverty if perfect targeting is not a policymaker's pipe dream and if we admit that equivalent poverty line can never exceed the limit of 358 TD.

Table 5: Regional targeting efficiency (z_e = 325 TD *per capita per year*)

	$y_e(p^r, p^r, y_j)$	*TC*	*UT*	$RT_1(y_j)$	$RT_2(y_j)$
Leakage	0	83.4	76.34	70.42	70.58
Under-coverage	100	0	0	12.86	12.86
$P_0(.)$	26.2	21.8’’	20.9**	19.9++	19.97++
$P_1(.)$	7.9	6.1’’	5.34**	4.70++	4.72++
$P_2(.)$	3.4	2.47’’	1.98**	1.65++	1.63++

’’ Poverty differences between UFSP and no poverty alleviation program are significant at 1 percent level.
** Poverty differences between universal transfer scheme and UFSP are significant at 1 percent level.
++ Poverty differences between regional targeting of transfers and universal transfer scheme are significant at 1 percent level.

A close examination of this table shows that even universal transfer allows a better effect on poverty than UFSP. Simulations show that under *UT*, the 7 points decline of leakage entails a significant reduction of poverty varying between 4 and 19.8 percent according to whether poverty is measured by $P_0(.)$ or $P_2(.)$.

Performances of the universal transfer relative to UFSP do not indicate, nevertheless, that it is the optimal transfer scheme. Despite the presence of under-coverage with regional targeting scheme, the more important decline in leakage allows for poverty alleviation more than a universal transfer does.[24] Poverty is reduced by 23 percent from the original level - given by the UFSP - when the aim is to minimize the poverty gap (P_1), and this difference is statically significant. The depth of poverty, as measured by the FGT poverty measures with $\alpha = 2$ would be reduced from the original level even further. Indeed, when the objective is to minimize $P_2(.)$, poverty would be decreased by 34 percent from the original level.[25]

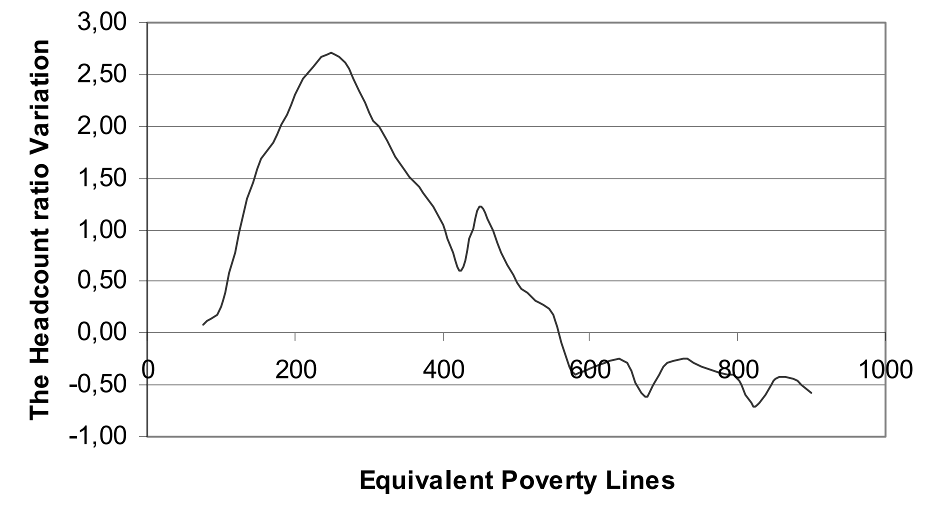
The analysis that we have just led is based on the choice of an equivalent poverty line z_e and a poverty measure $P_\alpha(.)$ whose specification can be made arbitrary. Several choices of

[24] Although leakages have declined relative to food subsidies scheme and universal transfer scheme, they remain always important.

poverty measures exist and different levels of poverty lines could be advocated. The robustness of the above results facing the multiple choices of poverty lines and measures should be examined. Drawing on results from the theory of stochastic dominance developed by Atkinson (1987), we study the robustness of direct transfers outcomes based on regional targeting relative to those achieved under targeting by commodities scheme.[26]

Suppose that it is not possible to have an assent neither about the choice of the equivalent poverty line, nor about the choice of the poverty measure. Then, it can be shown that poverty will certainly fall between the old and the proposed design, regardless of the poverty line and the poverty measure chosen, if the headcount ratio for the former always exceeds that for the later. In the stochastic dominance literature, this finding is known as "first-order dominance" (FOD). When comparing the regional targeting schemes, table 6 shows that they produce similar outcome, hence we will focus henceforth on the impact of the transfer scheme minimizing P_2.[27] Figure 1 illustrates the relationship of UFSP and direct transfers based on regional targeting to FOD and the headcount ratio.

Figure 1: First Order Dominance



[25] Anoth... d be saved while allowing the same poverty alleviation achieved by UFSP. Simulation results show that it is possible to alleviate poverty as well as with UFSP while allowing a substantial budgetary saving, varying between 50 and 64 percent.

[26] For robustness tests applied to poverty analysis, see, for example, Ravallion and van de Walle (1991) and Bishop et al. (1996). For a literature survey about poverty orderings, see for instance Zheng (2000).

[27] We have also verified that outcome differences between them are not statistically significant at 5 percent level.

By plotting the cumulative percentages variation of the population below various equivalent poverty lines, we find that difference in the headcount ratio could be positive for some equivalent poverty lines and negative for others. The impact of transferring benefits to the poor based on regional targeting relative to the UFSP is therefore ambiguous. Yet, if we can admit that the equivalent poverty line is never higher than 550 TD, then it is possible to argue that regional targeting of transfers is unambiguously more effective in serving poor people than UFSP, no matter what the poverty measure is. It is perhaps useful here to note that this range includes all the poverty lines estimated for Tunisia. Yet, if we admit an equivalent poverty line exceeding the limit of 550 TD, the outcome becomes ambiguous and FOD is unable to rank the relative effectiveness of direct transfer based on regional targeting in alleviating poverty.

Considering that these two schemes cannot be ranked by FOD, it is possible to order them by second-order dominance (SOD). A fall in poverty with regional targeting of transfers requires that the difference between the $P_1(.)$ under regional targeting and the $P_1(.)$ under UFSP, $\Delta P_1(.)$, cannot be negative, regardless of the equivalent poverty line chosen and for all FGT poverty measures with $\alpha \geq 1$. Figure 2 illustrates the relationship of targeting by commodities and regional targeting of transfers to SOD and the poverty deficit measure. The resulting curve is equivalent to what Ravallion (1994) refers to as a poverty deficit curve.

Figure 2: Second Order Dominance

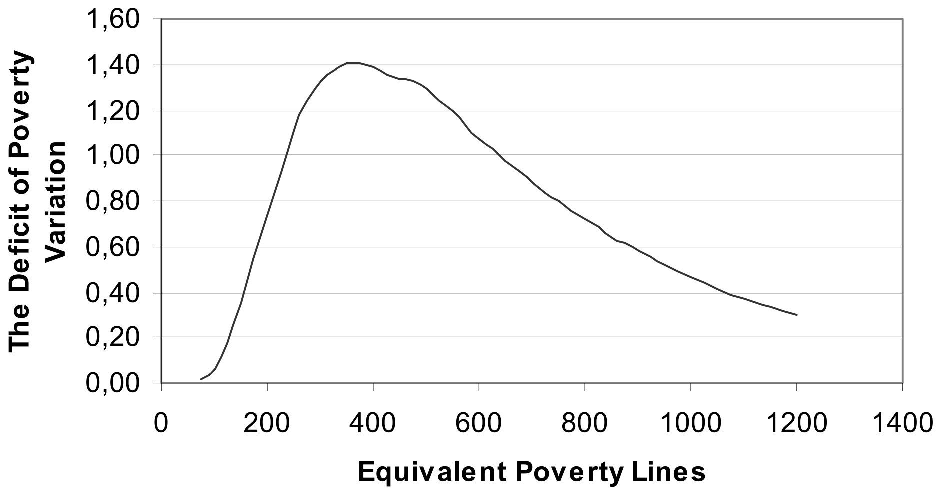


Figure 2 shows that direct transfers based on regional targeting second-order-dominates UFSP, if the maximum admissible equivalent poverty line is less than 1200 TD; this holds for all FGT poverty measures with $\alpha \geq 1$.[28] Indeed, since the deficit of poverty under UFSP is larger than the deficit of poverty under regional targeting at each equivalent poverty line up to 1200 TD, then we can conclude that the proposed design is more effective in decreasing the poverty deficit. Nevertheless, if it is inadmissible that poverty line is less than 1200 TD, the outcome becomes ambiguous and SOD is unable to rank the relative effectiveness of the proposed design in reducing poverty; and an unambiguous ranking may be possible at a higher order of dominance. The need to test higher orders of dominance becomes thin since the hypothesis of an equivalent poverty line exceeding the limit of 1200 TD is arguably far from being plausible.

[28] This holds also for all poverty measure in line with the Pigou-Dalton principle of transfers, which supports that a transfer of income from a non-poor person to a poorer one improves the social welfare.

5. Conclusion

With the economic growth decline and the advent of tight budgetary constraints in 1980s and 1990s, many governments have moved away from UFSP towards more targeted programs. In addition, governments having in hand efficient anti-poverty programs are more prepared to prevent severe and long-term losses for their vulnerable groups when they deal with macroeconomic shocks [Ferreira et al. (1999)]. Among targeting options, regional targeting of transfers could be a useful mechanism to channel assistance to the less well-off segment of the population. Hence, this paper presents some technical issues required in designing poverty alleviation programs based on regional targeting, and estimates their likely effects on poverty relative to the effects achieved under the current UFSP.

To assess how well regional targeting of direct transfers alleviates poverty, we have focused on the poverty outcome of direct transfers based on regional targeting relative to targeting by commodities. The system that alleviates more poverty for a given budget is preferred. The outcomes of a regional targeting design show that, although this transfer scheme would entail some under-coverage of poor people, it produces less leakage and, consequently, an important well-being improvement of the poor population. Indeed, all FGT poverty measures observe a decrease that varies between 8.4 and 34 percent according to the equivalent poverty line and the poverty measure chosen.

Dominance tests are equally used to avoid diverse views on both the appropriate functional form of the poverty measure and the choice of the equivalent poverty line, since these choices may be critical. The main result is that regional targeting design would second-order-dominate UFSP within a wide range of poverty lines. Thus, once the headcount ratio is excluded, it is possible to conclude that giving assistance to the poor based on regional targeting should be more effective to lessen poverty than UFSP, regardless of the equivalent poverty line and the poverty measure chosen.

Under regional targeting, all individuals within a region are treated identically as with a universal transfer scheme; but only certain regions are targeted with this system. Giving benefits only to some regions could be politically impossible to implement. This concern could be solved by narrowing the target areas from the level of regions to villages or municipalities. In reality, an anti-poverty program that is more targeted would generate more political support, improve its coverage, reduce leakages to the non-poor and so enable to go further in lessening poverty. For instance, Baker and Grosh (1994) argue that regional targeting is an effective way to award transfers to the poor but the smaller the target areas are, the greater is the poverty reduction that is possible to achieve, revenue-neutral. Moreover, Jalan and Ravallion (1998) find that the greatest poverty alleviation is achieved when the target areas are villages or municipalities.

Before implementing targeted program, another issue relating to the indirect effects on poverty has to be discussed. These effects would arise through the impact of food subsidies removal on conditions in other markets, such as those for labor. In reality, only computable general equilibrium models would allow to include all indirect and direct effects of more targeted schemes to capture their net impact on poverty.

The present study is mainly illustrative. The focus on geographical targeting at a smaller level and the analysis of the indirect effects of a more targeted program require more detailed data and are beyond the scope of this paper. We leave this issue for future research. The outcome of this analysis highlights, however, the potential returns from a more refined research that could provide guidelines for policymakers on the optimal level of targeting as well as its expected benefits.

6. References

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7. Annex

Table A-1: Results of first stage estimation poverty line

Food Commodities:	z_k	σ_k	R^2
1/ Hard, Tender and Other Wheat	38,752 (88)	0.067 (42)	0.24
2/ Vegetables	28,757 (62)	0.116 (69)	0.45
3/ Fruit	3,851 (7,7)	0.105 (58)	0.37
4/ Poultry & Eggs, Meat and Fish	34,865 (46)	0.337 (125)	0.73
5/ Milk	13.471 (29)	0.088 (54)	0.34
6/ Sugar and Other Sugar Products	5,099 (18)	0.029 (28)	0.12
7/ Mix and Olive Oils	11,804 (29)	0.064 (43)	0.25
8/ Canned foods	13,771 (64)	0.035 (45)	0.26
9/ Other Foods	11,360 (13)	0.159 (52)	0.32
Food Poverty Line ($z_f = \Sigma z_k$)	161,73		

Note: (*t*-ratios in parenthesis)

Table A-2: Results estimation of the budget food share using the *IQAIDS* model:

Model	ω_f	θ	δ	$R^2_{adjusted}$
IQAIDS	0,5923 (170)	-0,062 (-12)	-0,0184 (-10)	0,32

Note: (*t*-ratios in parenthesis)

Table A-3: The distribution of transfers under the different schemes (z_e = 325 TD *per capita per year*)

Regions	β_j (%)	$\overline{TC}_j$	$B = UT$	$B_j = T_1(y_j)$	$B_j = T_2(y_j)$
Great Tunis	16.84	39.78	34.8	0	0
		(35.1)	(0)	(0)	(0)
Northeast	12.64	37,54	34.8	4.95	17.5
		(43,6)	(0)	(0)	(0)
Northwest	17.54	32.6	34.8	90.86	80.86
		(36.8)	(0)	(0)	(0)
Middle East	12.10	34.6	34.8	0	0
		(37.4)	(0)	(0)	(0)
Middle West	15.05	33.5	34.8	65.9	70.3
		(38.8)	(0)	(0)	(0)
Sfax	5.76	30.4	34.8	14.82	32.16
		(31.3)	(0)	(0)	(0)
Southeast	11.17	32.7	34.8	23.05	11,2
		(35.6)	(0)	(0)	(0)
Southwest	8.90	33.7	34.8	55.13	53
		(42.5)	(0)	(0)	(0)

Note: (standard-error in parenthesis)

Table A-4: Poverty measures in each region under no assistance to the poor and different transfer schemes (z_e = 325 TD *per capita per year*)

Regions	$y_e(p^r, p^r, y_j)$			TC			Universal Transfers			$B_j = T_1(y_j)$			$B_j = T_2(y_j)$		
	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2
Great Tunis	9.82	2.57	0.96	7.94	1.88	0.66	7.62	1.63	0.52	9.82	2.57	0.96	9.82	2.57	0.96
Northeast	24.1	6.59	2.67	19.22	4.81	1.83	18.67	4.28	1.52	23.3	6.22	2.47	21.6	5.35	2.03
Northwest	38.6	13.3	6.19	34.3	10.61	4.65	33.1	9.46	3.76	23.3	4.61	1.38	24.8	5.35	1.69
Middle East	14.2	4	1.69	11.5	3.09	1.25	10.5	2.66	0.99	14.2	4	1.69	14.2	4	1.69
Middle West	36.3	11.7	5.38	29.4	9.13	3.99	28.9	8.17	3.27	23.3	5.66	1.95	22.4	5.35	1.8
Sfax	26.3	7.65	3.2	20.9	6.02	2.34	19.6	5.19	1.84	23.3	6.53	2.57	20.2	5.35	1.92
Southeast	27.3	6.26	2.08	22.7	4.59	1.44	21.1	3.66	1.03	23.3	4.47	1.33	25.5	5.35	1.68
Southwest	34	10	4.12	28.1	7.88	3.02	26.9	6.77	2.34	23.3	5.19	1.59	23.9	5.35	1.66
(Mean)	(26.2)	(7.9)	(3.4)	(21.8)	(6.1)	(2.5)	(20.9)	(5.34)	(1.98)	(19.9)	(4.7)	(1.65)	(19.)	(4.72)	(1.63)