

Indirect Tax and Poverty in Syria

Qunli Chen

(Student number 5390828)

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Supervisor: Dr. Paul Makkdissi

ECO 7997

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Abstract

This paper has an empirical implementation of Consumption Dominance (CD) curves to determine whether indirect tax reforms can achieve the goal of poverty reduction in a stochastic dominance framework. The advantage of CD-Curves analysis of reforms only needs to censor to poverty indices and poverty lines instead of depending on the social evaluation functions, which is proved in Makdissi and Wodon (2002) and further developed by Duclos, Makdissi and Wodon (2008). Moreover, the robustness of estimating the effects of marginal tax reforms can extend to a wide class of poverty measures, which means that the ethical poverty-improving judgment can be made at unlimited order of stochastic dominance. I will empirically demonstrating the strong points of CD test with the data from the 2003-2004 survey in Syria.

Key Words: Marginal tax reform, Poverty indices, Poverty line, Stochastic dominance, Consumption Dominance curves (CD-Curves), Normalized CD (\overline{CD}) curves

2. Introduction

Martin Feldstein (1975) argues that finding optimum taxes is not easy and may not work effectively in the real world, since an optimal tax reform “must take as its starting point the existing tax reform”¹ and a haphazard adjustment of tax rate cannot make a piecemeal change in the optimum tax system. Moreover, disagreements on the choice of the social welfare functions have occurred in the economic profession, since assessing an optimal tax rate relies on the specific social welfare function. A tax rate may be considered to be optimal for a certain social welfare function, but is not for other social welfare functions. Hence, more and more economists shift their attentions from finding optimum taxes to designing the desirable indirect tax reforms. Consequently, Ahmad and Stern (1984) began building the framework on social improving marginal tax reforms. Though the method developed by Ahmad and Stern does not heavily lie on making controversial assumptions in regard to the exact social welfare functions, there exists a typical difficulty of calculating the implicit tax rates. Thus, an alternative, so-called “Daltonian School” approach is firstly derived and developed in Yitzhaki and Sternrod (1991). This method aims to identify “social efficient”² marginal tax reforms that can improve the existing tax system for a class of social evaluation functions. Using this method needs to do stochastic dominance test. Yitzhaki and Sternrod (1991) analyze the benefit distributive effect of a marginal tax reform between two consumptions by comparing non-intersecting concentration curves. This limits their analysis to the second order of stochastic dominance. Therefore, we expect a new tool that can simply work well like the test of concentration curves, but it can test any order of stochastic dominance. Then Makdissi and Wodon (2002) proposes CD test that can easily distinguish a social improving tax reform by just comparing CD-Curves of a pair of

¹ See Feldstein (1975), p.77

² See Duclos, Makdissi and Wodon (2005), p.107-8

consumptions or even a bunch of mixed consumptions. As an extension, Duclos and Makdissi and Wodon (2005) explain marginal tax reforms as a poverty-reducing policy and modify CD-Curves to obtain \overline{CD} curves. CD test can be robust over a large class of poverty indices and poverty lines at any order of stochastic dominance.

The main part of this paper contributes to the empirical application of CD-Curves. I will apply this methodology to the Household Income and Expenditure Survey (HIES) 2003-2004 conducted by the Central Bureau of Statistics (CBS) of the Syrian Arab Republic. By comparing any pair of expenditures chosen from this data set, we could tell which expenditures should be imposed a marginal tax increase in order to marginally decrease the tax rate on another expenditure to keep government total revenue constant. The results of CD-Curves test are drawn as figures presented in Appendix. Furthermore, we assess the estimator of CD-Curves to find the critical poverty line beyond which a tax reform will not reduce poverty any more.

The paper is organized as follow: Section 2 will set up the methodological framework, showing the conditions for CD-Curves test. In the process of constructing CD-Curves, I will quickly review two other approaches that I have mentioned above. Section 3 will describe the economic background and poverty in Syrian based on the findings from the case study of United National Development Programme. I also will briefly explain the situation of the data and sampling from the Syrian 2003-04 survey. Section 4 will present the test results with the figures and a table. Section 5 will give a conclusion.

2. Methodology

The interpretation of marginal commodity tax reforms as a poverty-reducing policy was thriving and developing at the beginning of 20 century in the literatures such as Makdissi and Wodon (2002), Liberati (2003), Duclos et al. (2005), though Besley and Kanbur (1988) concern to this subject somehow. It is worth noting that the methodological framework presented in this section follows the recent extension in Duclos, Makdissi and Wodon (2008). I am starting from poverty measures.

2.1 Poverty measurements

To propose an anti-poverty strategy, a government should employ poverty measures in specification. There exist the different views about the choices of measuring poverty, including the choice of poverty line and poverty indices, which can get different results. In general, in order to reduce an additive poverty index, a government can look at poverty indices such that

$$(1) \quad P(z) = \int_0^a p(y, z) dF(y),$$

Where $P(z)$ is an additive poverty index of measuring an individual share of total poverty, z is the poverty line restricted within the equivalent (real) income³ space $[0, a]$. $p(y, z)$ is the share of total poverty of a consumer with equivalent income y given poverty line z . If $y > z$, then $p(y, z) = 0$ implies that the consumer with this condition is not a poor. $F(y)$ is the cumulative distribution of income y based on $[0, a]$.

³ Note that defining z and y as “real” or equivalent variables is to respect a vector of reference prices denoted by q^R , following King (1983).

The method developed in Duclos, Makdissi and Wodon (2008) can identify poverty improvement due to tax reforms over wide spectra of poverty indices, instead of being limited in a specific poverty index and a specific poverty line. Hence, then we consider the class of poverty indices Π^s that the additive poverty indices belong to, such as

$$(2) \quad \Pi^s = \left\{ P(z) \left| \begin{array}{l} p(y, z) = 0 \quad \text{if } y > z, p(y, z) \in \hat{C}^s \\ (-1)^i p^{(i)}(y, z) \geq 0 \text{ for } i = 0, 1, \dots, s, \\ p^{(t)}(z, z) = \text{for } t = 0, 1, \dots, s - 2 \text{ when } s \geq 2 \end{array} \right. \right\},$$

Where \hat{C}^s is the set of functions that are s -time piecewise differentiable⁴ based on $[0, z]$, and the superscript s represents an s th-order derivative with respect to y . Makdissi and Wodon (2002) notes that the class of poverty indices respecting Assumption (1) and (2) and the continuity assumption is denoted by Π^s , we will discuss these assumptions later.

Foster et al. (1984) gives a well-known subclass of additive poverty indices such as

$$(3) \quad FGT^\alpha(z) = \int_0^z \left(\frac{z-y}{z} \right)^\alpha dF(y).$$

$FGT^0(z)$ is called poverty headcount ratio. As Watts (1968) notes, it is "little but its simplicity to recommend it"⁵. $FGT^1(z)$ gives the normalized average poverty gap. For $\alpha \geq s-1$, $FGT^\alpha(z)$ belongs to $\Pi^s(z)$. However, Sen (1976) argues that the headcount ratio and the poverty gap index cannot take account of the intensity and the depth of poverty.

⁴ When the $(s-1)$ th derivative is a piecewise differentiable function, the function and its $(s-2)$ first derivative are differentiable everywhere. See Duclos, Makdissi and Wodon (2008), p 1511

⁵ See Watts (1968), p. 326

Before going further way, we need to describe some characteristics of the class of poverty indices with the order of $s = 1, 2, \dots$, which are consider as the different level of poverty improvement. When $s = 1$, for the first order, all the additive poverty indices belonging to the first class of poverty indices Π^1 are weakly decreasing with an increase individual's income, since we get $p^{(1)}(y, z) \leq 0$. This class of poverty indices is Paretian which means that increasing an individual's income will reduce poverty. In addition, these indices also are symmetric, so interchanging two individuals' incomes does not change poverty. We call the first class poverty improving as "Pen-improving".

When $s = 2$, all the poverty indices belonging to Π^2 are convex and respect the Pigou-Dalton Principle which says that an income transfer from a higher income person to a low income person decreases poverty.⁶ The second order poverty improving can be called as "Dalton-improving".⁷

When $s = 3$, the additive poverty indices belongs to Π^3 and respect to composite transfer principle,⁸ which interprets that the transfers comprising of a progressive transfer at a low income level and a regressive transfer at a higher income level will lead to poverty reduction, if the variance of distribution of the transfers do not increase. The third order poverty improving is called as "Kolm-improving" to respect the contribution of Kolm(1976). In general, with s increase, the weight measuring the effect of a transfer within the lower part of distribution

⁶ Duclos, Makdissi and Wodon (2008), p. 1521

⁷ Mayshar and Yitzhaki (1995)

⁸ Foster and Shorrocks (1988)

increases. As $s \rightarrow \infty$, poverty indices only take account of the individual with the lowest income noted by Davidson and Duclos(2000).

2.2 Stochastic Dominance

To identify poverty reducing tax reforms, we need to define first stochastic dominance curves.

Following the statement in Davidson and Duclos (2000), we consider two distributions of incomes that characterized by the cumulative distribution functions (CDFs), which denote F_A and F_B . Set $D_A^1(x) = F_A(x)$ and

$$(4) \quad D_A^s(x) = \int_0^x D_A^{s-1}(y)dy \quad \text{for all } x \in \mathbb{R}$$

Define $D_B^1(x)$ and $D_B^s(x)$ analogously. For any order s , we have

$$(5) \quad D^s(x) = \frac{1}{(s-1)!} \int_0^x [x - y]^{(s-1)} dF(y)$$

If $D_A^s(x) \geq D_B^s(x)$, we can interpret that distribution B stochastically dominates distribution A at the order s for all $x \in \mathbb{R}$. It means that poverty is lower in A than in B for all indices of order s .

Consider the poverty line z set within the income space and by $D_A^s(x) \geq D_B^s(x)$, we can explain that B stochastically dominates distribution A at order s up to the poverty line.

Duclos, Makdissi and Wodon (2008) rewrite (5) for order of dominance $s = 1, 2, \dots$, as

$$(6) \quad D^s(z) = \frac{1}{(s-1)!} \int_0^z [z - y]^{(s-1)} dF(y)$$

If the poverty line is defined in equivalent (real) income space⁹, we also can obtain stochastic dominance curves expressed by

$$(7) \quad D^s(z) = \frac{1}{(s-1)!} \int_0^{\eta(y^R, \theta, q, q^R)} \int_0^{\eta(y^R, \theta, q, q^R)} [z - \rho(y, \theta, q, q^R)]^{(s-1)} dF(y, \theta)$$

Since $z = \eta(z, \theta, q, q^R) = \rho(y, \theta, q, q^R)$ for $q=q^R$.¹⁰

Hence, dominance curves are in the form of the sums of powers of poverty gaps, which weigh the sums of individual income deviating from the mean distribution. $D^1(z)=F(y)$ is the "poverty incidence" curve and $D^2(z)$ yields the "poverty intensity" curves. As s increases, the larger weight is assigned to the largest poverty gaps.

By (7), we can find a marginal change in price will have the impact on dominance curves.

Moreover, if we set the consumer' prices denoted by a vector q , and assume the producers' prices normalized to 1. We then have $q = 1+t$ and $dq= dt$, where t is a vector of tax rates. Hence, the definition (7) also indicates that price changes relate to the changes of taxation will affect the shape of dominance curves. With these notations, we have the definition of CD-Curves for $s=1,2, \dots$, as

$$(8) \quad CD_k^s(z) = \frac{\partial D^s(z)}{\partial t_k},$$

⁹ Equivalent income is implicitly defined by $v(y^R, \theta, q^R)=v(y, \theta, q)$ and explicitly defined as $y^R= \rho(y, \theta, q, q^R)$., where $v(y, \theta, q)$ is the indirect function; θ is the consumers' preference; q^R is the reference price vector

¹⁰ By the definition of implicit indirect utility function, the utility given by y^R under q^R is same with the utility given by y under q

Where k is a vector of good K . I will detail CD-Curves test later and here I want to know how price changes associate to tax reforms will lead to the change of poverty and consumer welfare.

We have the explicit income function defined as $y^R = \rho(y, \theta, q, q^R)$. Let $x_k(y, \theta, q)$ be the consumption of good k of a consumer who has income y and preference θ given price q . Using Roy's Identity, we have

$$(9) \quad \frac{\partial \rho(y, \theta, q, q^R)}{\partial t_k} \Big|_{q=q^R} = -x_k(y, \theta, q^R)$$

By (7) and (9), we can define the impact of price change relevant to tax reform on dominance curves as

$$(10) \quad \frac{\partial D^s(z)}{\partial t_k} \Big|_{q=q^R} = \begin{cases} x_k(z, q^R) f(z) & \text{if } s = 1 \\ \frac{1}{(s-2)!} \int_z^y x_k(y, q^R) (y-z)^{s-2} dF(y) & \text{if } s = 2, 3, \dots \end{cases}$$

Where $f(z)$ says that poverty line, z (or income at exact poverty line), is distributed in the income function.

2.3 Indirect Tax Reform and CD-Curves

Santoro (2007) refers to three methodological analyses on the effect of marginal tax reforms on welfare improvement and poverty reduction. First is to apply and extend Ahmad and Stern's methodology. Second is the development of "Daltonian school" approach described in the chain of literature such as Yitzhaki and Thirsk (1990), Yitzhaki and Stemrod (1991), Mayshar and Yitzhaki (1995). Third is to interpret marginal commodity tax reform as poverty reducing policies appearing in Makdissi and Wodon (2002), Liberati (2003), Duclos et al. (2005).

Before analyzing CD-Curves test, I want to shortly review the first two approaches that mainly focus on the valuation of social improving tax reforms. By Ahmad and Stern approach, we need to consider the problem of maximizing a social welfare function if denoted by $W(V^1(q, y), \dots, V^n)$, where q are consumer prices and y is income for each individuals denoted $i = 1, \dots, n$, given the indirect utility function $V(q, y)$. Assume government tax revenue denoted by R is a collection of taxation on commodity k . let X_k be the aggregated demand and t_k be the tax rate of commodity k , so we have $R = \sum_k t_k X_k$. Then the marginal revenue from the taxation of Commodity k can be expressed as $MR = \frac{\partial R}{\partial t_k} \geq 0$. Consider a pair of commodities j and l ($j \neq l$) under revenue neutrality condition and they have

$$(11) \quad \theta_l \equiv \frac{dW}{dt_l} / MR_l \geq \theta_j \equiv \frac{dW}{dt_j} / MR_j$$

Equation (11) suggests that a non- negative effect on social welfare can immediately seen by totally differentiating W with respect to tax adjustment. Hence they concluded that “existing marginal rates are not optimal”² and social welfare improving can be achieved by increasing taxation on j and decreasing taxation (or increasing subsidy) on l in the context of revenue neutrality. However, by (11), there emerge two limitations. First, a marginal tax reform has a non-negative effect on welfare, but it cannot guarantee to achieve optimality, because of the diverse criteria of choosing tax noted in Ahmad and Stern (1991). Second, equation (11) does not give a specific suggestion about the size of reforms, even if it implies that social welfare can improve by increasing a marginal taxation on j and decreasing (or subsidizing) a marginal taxation on l in the context of revenue neutrality.

Furthermore, Ahmad and Stern (1984) use the welfare weights, denoted by β^i as important estimator of tax reform analysis, where i is a subscript of the single household. It also starts from a social welfare function such as

$$(12) \quad W = \sum_i^n \frac{y_i^{1-\varepsilon}}{1-\varepsilon}, \quad \varepsilon \neq 1$$

Where y^i is income and ε is the inequality aversion parameter. Then set $\beta^1 = y_1^{-\varepsilon} = 1$, representing the welfare weight for the poorest Household. Then we have $\beta^i = (y_1/y_i)^{\varepsilon}$ to weigh the other households' welfare. This is ordinally consistent with the Atkinson social welfare function. Combining the definition of the welfare weights and other items in particular listed in the necessary conditions of doing a test, we then can make welfare judgment for any given tax reform.

To avoid depending on controversial characteristics of the exact social welfare function, Yitzhaki and Slemord (1991) develops "Daltonian school" approach to identify social welfare improving tax reforms. That method is modified and extended from the criterion, so called "second degree stochastic dominance" in financial literature. To tell the difference from financial raking portfolio according to expected utility, Yitzhaki and Slemord rank the commodities (with taxes on them) that are the components of total income. They apply the "marginal conditional stochastic dominance" (MCSD) rule based on the assumption of nonnegative marginal utility of income. Then they note that if MCSD rule holds, a subsidy for one commodity can be financed by an increasing taxation on another commodity with unchanged total revenue, which will improve social welfare. MCSD rule builds three evaluation criterions (of social improving tax reforms): whether rising taxation on good A and using this gain to finance good B will increase

social welfare; whether a marginal adjustment of taxation on a pair good can improve welfare; whether a tax reform can take account of efficiency as a condition of welfare economy. Yitzhaki and Slemord (1991) embody MCSD rule into the implication of concentration curves. They interpret that if the concentration curve of one good is higher than the concentration curve of another good, then former good dominates the latter good. Note only non-intersecting concentration curves can prove that a tax reform is a welfare improving.

Though “Daltonian school” approach reduces the works in the procedure of testing, it still levies on making necessary assumptions in regard to a particular social welfare function. However, the CD-Curves method derived and developed by Makdissi and his associates can completely give up using a specific social evaluation function and just center to wide spectra of poverty indices and poverty lines. Note that the condition of stochastic dominance to support CD-Curves test is also applied on “Daltonian school” approach.

Here, we need to define a valuable estimator called “economic efficiency cost”, denoted by γ that is the important component to construct the framework of CD-Curves test. Let us go back to government budget constraint, $R(q) = \sum_{k=1}^K t_k X_k(q)$, where X_k consists of the average consumption of good k with the tax rates denoted by t_k . Note that a tax may be positive or negative (subsidy). If a government imposes a marginal taxation on a pair of goods j and l ($j \neq l$), since revenue-neutrality is hold, then we have

$$(13) \quad dR(q) = [X_l(q) + \sum_{k=1}^K t_k \frac{\partial X_k(q)}{\partial q_l}] dq_l + [X_j(q) + \sum_{k=1}^K t_k \frac{\partial X_k(q)}{\partial q_j}] dq_j = 0.$$

For expositional simplicity, we can rewrite equation (15) as

$$(14) \quad dq_j = -\gamma_{lj} \left(\frac{x_j}{x_l}\right) dq_l$$

Where γ_{lj} is defined by

$$(15) \quad \gamma_{lj} = \frac{x_j + \sum_{k=1}^K t_k \frac{\partial x_k}{\partial q_j}}{x_j} / \frac{x_l + \sum_{k=1}^K t_k \frac{\partial x_k}{\partial q_l}}{x_l},$$

Mayshar and Yitzhaki (1995) interpret γ_{lj} as “economic deadweight loss” or “the average welfare cost” due to collecting one more dollar public funds by increasing marginal tax on the j th good and subsidizing the l th good. Moreover, Yitzhaki and Thirsk (1990) and Yitzhaki and Slemrod (1991) note that γ should not be larger than 1, otherwise there is no the second order dominance because of the increase of welfare loss incurred by a tax reform. However, in the literature of poverty analysis, such requirement is not argued. If a loss is not burden by the poor, a tax reform can lead to dominate at any order of stochastic dominance.¹¹

By (8) and (10), we can obtain the definition of CD-Curves. Furthermore, Duclos, Makdissi and Wodon (2008) define the normalized CD-Curves such that

$$(16) \quad \overline{CD}_k^s(z) = \frac{CD_k^s(z)}{x_k(q)}$$

Where $CD_k^s(z)$ is the ethically weighted cost of taxing k and $\overline{CD}_k^s(z)$ is the ethically weighted cost of taxing k normalized by the average consumption of good k . With s and z change, social cost due to tax reform is changed. $\overline{CD}_k^1 = \frac{x_k(z)}{x_k}$ is the ratio of the consumption of an individual

¹¹ See Duclos, Makdissi and Wodon (2008), p. 1519

who has income y sharing in the aggregate consumption of k . $\overline{CD}_k^2 = \int_0^z C_k^1(u) dF(z)$ gives the ratio of the consumption of those individual who have the income less than z sharing the total consumption of k . For the higher order of s than 2, $\overline{CD}_k^s(z)$ heavily weighs the share of individual with the low income.

Since we have CD-Curves, then we face the question how to use CD curves to identify a poverty-reducing tax reform. Duclos Makdissi and Wodon (2008) show that a necessary and sufficient condition for a marginal tax reform, $dq_j = \gamma_{lj} \left(\frac{x_l}{x_j}\right) dq_l > 0$, to be s -order poverty reducing, that is to say, to decrease poverty weakly for all $P(z) \in \Pi^s$, for all $z \in [0, z^+]$ and for a given $s \in \{1, 2, 3, \dots\}$, is that

$$(17) \quad \overline{CD}_l^s(y) - \gamma_{lj} \overline{CD}_j^s(y) \geq 0, \forall y \in [0, z^+]$$

Equation (17) indicates that there exists a special restriction on choosing poverty line that cannot exceed the maximum value of z^+ , if a marginal tax reform could lead to poverty reduction at any ethically order. Moreover, equation (17) in particular distinguishes two situations in terms of the economic efficiency cost " γ ". When $\gamma = 1$, equation (17) says that the marginal tax reform will be a dominant tax reform and reduce poverty at any order of s , if the CD -Curve of good l lies over the CD -Curve of good j everywhere for all $P(z) \in \Pi^s$ for all the poverty lines under the maximum poverty line. When $\gamma \neq 1$, CD -Curves still can identify that a marginal tax reform can make poverty reduction, if the CD -Curve of good l is everywhere higher the CD -Curve of good j multiplied by γ . About this condition, Yitzhaki and Thirsk (1990) argue that if $\gamma > 1$, a tax reform cannot be socially improving based on the findings of concentration curves. However, in

the context of poverty reduction, the reform can still be poverty reducing if the extra efficiency cost is paid by those whose incomes are higher than the maximum poverty line.

Here we can make some comparison between *CD*-Curves and concentration curves. As mentioned before, *CD*-Curves can prove a social-improving tax reform or a poverty-reducing tax reform at any ethical order of stochastic dominance, but concentration curves testing is limited at the second dominance order. Furthermore, only non-intersection concentration curve can identify a tax change is social improving. For *CD*-Curves, however, crossing can be allowed, only if the existence of the first crossing point exceeds the maximum poverty line. Then we can say that poverty is reduced by tax reforms for all the choices of poverty indices within $\Pi^s(z)$ for all the choices of poverty lines within $[0, z^+]$ at any order of s .

2.4. Critical poverty line and critical efficiency ratio

If stochastic dominance test fails at a certain order of dominance, we have two options. One, we can limit the range of poverty indices by rising the order of dominance. Second, we can set the maximum poverty line to z^+ .

By (17), we can obtain $\gamma_{lj} \leq \frac{\overline{CD}_l^s}{\overline{CD}_j^s}$, where $\frac{\overline{CD}_l^s}{\overline{CD}_j^s}$ can be simplicity denoted by $\delta^s(z)$ follow Duclos and Makdissi and Wodon (2008). $\delta^s(z)$ is expressed as relative distributive benefit of taxing j in order to subsidy l under balanced budget and is defined by

$$(18) \quad \delta^s(z) = \begin{cases} \frac{\overline{CD}_l^s(z)}{\overline{CD}_j^s(z)} & \text{if } \overline{CD}_j^s(z) \neq 0 \\ \gamma^{++} & \text{if } \overline{CD}_j^s(z) = 0 \end{cases}$$

When $\overline{CD}_j^s(z) = 0$, the relative distributive benefit goes to effectively infinite and we then can define it as γ^{++} . By $\gamma \leq \delta^s(z)$, we can make an ethical judgement that a marginal tax reform can be poverty improvement at any dominance order for all $z \in [0, z^+]$, if the economic efficiency cost of taxing j instead of taxing l is less than the relative distributive benefit of taxing on two goods for all poverty indices within I^s for all poverty lines within $[0, z^+]$.

When the value of γ is not certain, we assume $\gamma \leq \gamma^+$ and hence γ^+ is the last possibility to hold the follow equation

$$(19) \quad \overline{CD}_l^s(z) - \gamma^+ \overline{CD}_j^s(z) \geq 0 \quad \forall z \in [0, z^+]$$

For $\gamma > \gamma^+$, to satisfy equation (19), we must have $\delta^s(z) = \gamma^{++}$ for all $z \in [0, z^+]$ or there exists a critical value of γ ($\gamma = \gamma^+$) over which equation (19) cannot hold anymore. The critical economic efficiency threshold relevant to the maximum poverty line, z^+ , is written by

$$(20) \quad \gamma_s(z^+) = \mathbf{inf} \{ \delta^s(z) \mid z \in [0, z^+] \}$$

It is worth noting that the critical economic efficiency threshold occurs when $\overline{CD}_l^s(z)$ and $\gamma \overline{CD}_j^s(z)$ intersect at the maximum poverty line, z^+ .

Furthermore, we can find the critical upper poverty threshold denoted $z_s(\gamma^+)$ in order to restrain the maximum poverty line. If given $\gamma \leq \gamma^+$, then $\gamma = \gamma^+$ is last chance to hold (19) for z in the space $[0, z^+]$. Therefore, to always hold equation (19), we have to try to find the value that larger than z^+ and then to denote it as z^{++} . An alternative is to find a critical value of z^+ over which equation (19) cannot hold. Then $z_s(\gamma^+)$ is given by

$$(21) \quad z_s(\gamma^+) = \sup \{z \mid \delta^s(y) \geq \gamma^+, y \in [0, z], z \leq z^{++}\}$$

Equation (20) and equation (21) say that increasing tax on j and giving a subsidy for l can achieve s -order poverty reduction, if the economic efficiency cost γ and the maximum poverty line z^+ are not beyond the critical values. $\gamma_s(z^+)$ offers the critical economic efficiency threshold and $z_s(\gamma^+)$ yields the critical upper poverty threshold, which are important values to confirm a poverty improving tax reform at any order of dominance. I will use these critical thresholds in the empirical analysis.

3. A portrait of Syrian economy

The information about poverty in Syria in this section comes from a case study supported by the Government of Syria, United National Development Program (UNDP) and international stakeholders that propose a poverty reduction strategy for Syria. The main investigators, Heba El-Laithy¹² and Khalid Abu-Ismaïl¹³, report the extension and determinants of poverty in Syria since the latter half of the 1990's. They also offer multiple socio-economic measurements that

¹² Heba El Laithy is Professor of Statistics at Cairo University and author of many publications on poverty and inequality in Egypt.

¹³ Khalid Abu-Ismaïl is UNDP's Regional Policy Advisor on Macroeconomics and Poverty Reduction at the Sub-Regional Resource Facility for Arab States (Bureau of Development Policy), Beirut.

can be considered by Syria government in the process of economic reforms and tackling poverty alleviation. The findings of this report are based on data from two HIESs provided by CBS in 1996-1997 and 2003-2004. Note that the data from the second survey will be used in CD- Curves test. The data samples 29800 observations. The collection of the variables in this paper concerns to five important expenditures that are components of each household's income. They consist of food, non-food, utility expenditure, social expenditure and total expenditure, which are all monthly expenditures per capita normalized in this paper.

3.1 Poverty in Syria

The report shows that Syria's GDP per capita has a slightly increase from 1996-97 to 2003-04. The average expenditure per capita rose from 3,085 to 3,541 SL (Syrian Lira) per month during the two periods. However, almost 11.4 per cent of population in Syria cannot satisfy their basic food and non-food needs. If using the higher "household specific"¹⁴ expenditure poverty lines, overall poverty rises up to 30.12 per cent (almost 5.1 million individuals). By the international measure, 10.36 per cent of population is under \$2 per day. In the report, El-Laithy and Abu-Ismail also refer to the regional difference of the poverty. North-Eastern region has the deepest level of poverty. The Middle and Coastal region has the intermediate level of poverty and the Southern region has the low level of poverty. In addition, the investigators emphasize that poverty in rural area is 3 times higher than in the urban area for a national level. Overall poverty in Syria decreased from 1996-97 to 2003-04, but there exists significant regional disparity. In

¹⁴ Household-specific' methodology is to construct the poverty line that meet the particular household's minimum nutritional requirements, depending on the household members' age, gender composition and location. See El-Laithy and Abu-Ismail, 2005, p. 23-24.

Middle and Southern region, both urban and rural areas reduced poverty rapidly. Conversely, Northern –Eastern region increased poverty and worsened expenditure.

By the ‘house-specific’ method, the estimated poverty lines, which take account of regional pattern difference in associated to prices, expenditure patterns, the size and age composition of poor households, is showed in the following table.

Table 3.1: Estimated Poverty lines for 2003-2004 (SL per month), El-Laithy and Abu-Ismail (2005)

	Southern		North-Eastern		Middle		Coastal		Total
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	
Lower Household Specific: Average per capita	1664	1500	1454	1279	1482	1304	1591	1584	1458
Upper Household Specific: Average per capita	2441	1978	2144	1694	2047	1748	2412	2303	2052
Lower Per Capita Poverty Line	1664	1507	1454	1278	1480	1305	1591	1582	1459

Here, the ‘low’ poverty line falls between the ‘lower household specific’ poverty line¹⁵ and the ‘upper’ poverty line¹⁶, which reflects a basic basket of food and non-food needs of a poor household. I will censor it when I illustrate the results of CD test.

The growth of Syrian economy was bonded to oil revenue and the change of oil price since 1980 foreign trade increased. Oil revenue occupied between 10 and 11 per cent of GDP over the 1994-

¹⁵ The ‘lower household specific’ poverty line is calculated based on the essential food and non-food need for a household. See El-Laithy and Abu-Ismail, 2005, p. 25.

¹⁶ The ‘upper’ poverty line is the actual expenditure of the poor, which consists of the expenditure on essential needs and the expenditure to satisfy a reasonable level of basic needs. See El-Laithy and Abu-Ismail, 2005, p. 25.

2002, and between 40 and 46 per cent of the national revenue, except for 2001. However, the growth based on oil export was unsustainable. Oil revenue as the source of government budget decreased from 70 per cent per year to only 20 per cent in recent years.¹⁷ Hence, the Syrian government's fiscal adjustment should "be reasonably raised with a minimal incidence on the poor and vulnerable and which, at the same time, afford adequate revenue buoyancy potential for Syria"¹⁸.

El-Laithy, Abu-Ismaïl and their associates recommended three main paths to adjust tax structure and to help the Syrian government to alleviate budgetary pressure. Tax system change that closely connects with indirect tax reformation is to introduce Value-Added Tax. VAT is a goods and services tax (GST) that is charged when a good or service is sold. The sellers collect VAT from the buyers and then hand it over to the tax department of a government. VAT is widely considered as a fair tax system that affects the non-poor more than the poor, because the non-poor make more purchases theoretically. For more indirect tax reforms of targeting poverty, the reporters require to raise taxation on luxury goods, such as cigarettes and tobacco, and fall tax rates but expand tax base of some important expenditures in terms of households' living needs. Overall, the tax adjustment should aim to minimize the incidence of taxation on the poor vulnerable groups. In the early years, IMF reported that Syria would launch VAT by 2011 if the economic conditions meet. According to IMF calculations, only SL 12 (USD 0.25) will be paid by the poorest 30 per cent of Syrian population for every SL 100 (USD 2.12).¹⁹ Hence, the

¹⁷ http://www.thaindian.com/newsportal/entertainment/syria-to-introduce-vat-next-year_10056703.html

¹⁸ See El-Laithy and Abu-Ismaïl, 2005, p. 74-75.

¹⁹ <http://www.syria-today.com/index.php/business-news/features/9874-the-right-formula>

Syrian government can expect to have an increase budget balance by VAT and then transfer some of the revenue to enhance poverty alleviation.

4. Empirical illusion with Syria's data set

This section empirically applies the methodological framework above to Syrian house level data from 2003-04 survey. My purpose is by CD-Curves test to analyze the desirable tax reforms in Syria and assess the potential impact of marginal change of taxation on poverty with the government balanced budget. As we know, CD-Curves can allow we to test any order stochastic dominance, so I decide to set the ethical order up to 3, $s=3$. In addition, I let poverty line's range be $[0, 2]$. The lower poverty lines in El-Laithy and Abu-Ismaïl's report are between SL1278 per capital and SL1664 per capita per household per month depending on the region in 2003-2004.

The lower poverty line at national level is SL1459 per capita. We normalize all income using the poverty line for Damascus and adjust for price differentials between rural and urban regions.

CD-Curves can estimate many pairs of expenditures at any order dominance, for expositional simplicity, but we only choose 5 expenditures that can reflect essential living standard of a poor Syrian household. The results of CD-Curve test for all five variables are graphically listed in Appendix. Based on these graphs of CD-Curves, we can identify whether it is possible for the Syrian government to tackle poverty alleviation by adjusting taxation at margin.

Figure 1, Figure 2 and Figure 3 in Appendix provide the \overline{CD} curves of food expenditure and non-food expenditure at the stochastic dominance order up to 3, which imply there exists the possible adjustments of taxation at margin for this pair of expenditures. For less complication, I set $\gamma = 1$ which means that the marginal economic efficiency cost of funds (*MECF*) from taxation on one

good is equal to *MECF* from taxation on another good.²⁰ Hence, equation (19) for the comparison between \overline{CD} curves of two expenditures ($l \neq j$) becomes

$$(22) \quad \overline{CD}_l^s(y) - \overline{CD}_j^s(y) \geq 0, \forall y \in [0, z^+]$$

Equation (22) says that the \overline{CD} curve of the subsidized good l is at least as high as the \overline{CD} curve of the taxed good j , if a marginal tax reform can be considered as the poverty reducing policy with constant budget constraint. Note that all graphics of the \overline{CD} curves listed in Appendix are drawn based on equation (22).

The horizontal axis in a \overline{CD} curves graph describes total per capita expenditure on a pair of expenditures normalized by the poverty line. For example, the value of 0.4 in figure 1 implies that a household is at the level of 0.4-time that particular poverty line. If the value is 1, then it means that a household income is exactly at the level of that poverty line. Setting the maximum poverty line up to 2 in the Syrian case is to double the poverty line. In addition, the vertical axis in a \overline{CD} graph is interpreted as the cumulative share of each good consumed by a household with normalized per-capita expenditure below y/z .

As we seen, the \overline{CD} of food expenditure is everywhere above the \overline{CD} of non-food expenditure at the dominance order up to 3 showed on Figure 1, Figure 2 and Figure 3. It means that food expenditure dominates non-food expenditure throughout the interval of consider for all the

²⁰ $\gamma = MECF_j / MECF_l$ for an increase tax rate of j and an decrease tax rate of l . See Duclos, Makdissi and Wodon (2008)

poverty lines under 2 for the orders up to 3. Hence, according to equation (19), the Syrian government should implement a marginal tax reform, by increasing taxation on non-food expenditure and using that revenue to finance food expenditure under the condition of government revenue-neutrality, can decrease all poverty indices belonging to Π^1 , Π^2 and Π^3 for all the poverty lines inferior to 2. Hence, with a marginal tax reform between food and non-food expenditure, Figure 1 presents the potential “Pen-improving” tax reform; Figure 2 presents the potential “Dalton-improving” tax reform; Figure 3 presents the potential “Kolm-improving” tax reform.

There is no intersection between the \overline{CD} curves of food and non-food for all the poverty lines inferior to the double poverty line in Figure 1, Figure 2 and Figure 3 respectively. As we notice, the first order \overline{CD} curve of food turns to rapidly decrease after the peak of 0.0043, so we can predict that it would intersect with the \overline{CD} of non-food beyond the double poverty line. In fact, they will cross at $z_I(1) = 2.736$ that is the critical poverty line, $z(\gamma)$, at the first order of dominance with $\gamma = 1$ showed in Table 1. The standard error of the sampling distribution of $z_I(1)$ is estimated to be 0.0912, which indicates that for a 95% confident interval the true value of $z_I(\gamma)$ would be in the space $[2.557, 2.915]^{21}$. It means that we can 95% certain that a balanced budget marginal tax reform will decrease all the poverty indices belonging to Π^1 for all the poverties lines below 2.557 when $\gamma=1$. Taxing non-food expenditure and subsidizing food expenditure, therefore, is feasible to reduce any poverty index at the first order respecting to equation (19). However, we cannot find the critical poverty line for the second and the third

²¹The rage of the true value of $z_I(\gamma)$ can be calculated by $z_I(\gamma=1) \pm 1.96 \times 0.0912$. I will use the same formula to calculate the interval of other true values of the critical poverty lines.

order dominance with $\gamma=1$ showed in Table 1 in Appendix, which indicates that the \overline{CD} curve of food expenditure will not intersect with the \overline{CD} curve of non-food forever and the former always dominates the latter.

Table 1 (See the last page of Appendix) also shows that with the value of $\gamma = 1.5$, we have the first order critical poverty line 1.596 with standard error estimated to be 0.025 for a 95% confident interval. When $\gamma = 1.5$, it means that *MECF* from taxing non-food expenditure is extra 50 per cent higher than *MECF* from taxing food expenditure. Note that the higher value of γ , the less efficiency cost is to tax on non-food expenditure in the analysis of food and non-food expenditures. Hence, we can calculate the real value of $z_I(\gamma)$ within the space [1.547, 1.645]. Then we can 95% certainly say that food/non-food tax reform will decrease poverty at the first order, if the poverty line is below 1.547. The second order and third order critical poverty lines are 2.6177 and 3.97 with 0.1353 and 0.1351 standard errors respectively. And we can calculate the true values of the poverty lines with 95% of confident interval are between [2.37, 2.8829] for the second dominance order and within the range [3.7052, 4.2348] for the third dominance order. Thus we can 95% certain that taxing non-food expenditure and subsidizing food expenditure would relieve the second order poverty in Syria if the government sets the maximum poverty line below 2.37 when $\gamma = 1.5$. However, for the third dominance we have 95% of confidence to support the government to exercise the food/non-food marginal tax reform in order to reducing the number of poor households in Syria, if the maximum poverty line set up is below 3.7052.

Figure 4 in Appendix presents the first order comparison between the \overline{CD} curves of food expenditure and utility expenditure with $\gamma = 1$. As we see, the \overline{CD} curve of food lies above the \overline{CD} curve of utility everywhere over the range of the poverty line, $z \in [0, 2]$. Therefore, the result suggests that it would be appropriate to raise taxation on utility expenditure and to fall taxation on food expenditure in the context of unchanged government budget. Such a tax reform will reduce all poverty indices belonging to Π^1 for all the poverty inferior to 2 and achieve “Pen-improving”. Moreover, Figure 4 also show that below the twice poverty line, food expenditure always dominates utility expenditure at the first order, which implies that marginally increasing taxation on utility expenditure is more effective to reduce poverty than on food expenditure for all indices of order $s = 1$. There is no intersection between the food/non-food \overline{CD} curves showed in Figure 4. We also can draw the second order and the third order \overline{CD} curves of food and utility expenditure to prove that food expenditure has a dominant position. Hence, a marginal change of taxations between the two expenditures could reduce all poverty indices belonging to Π^2 and all the Π^3 for all the poverty lines under 2.

Figure 5 in Appendix is to compare the \overline{CD}^s curves of food and social expenditure at the first dominance. The result suggests that the Syrian government should extra tax social expenditure and then subsidize food expenditure in order to tackle poverty alleviation. The non-interesting \overline{CD} curves imply that there is no critical poverty threshold under the poverty line 2. We can find the critical poverty line by extending multiple-time poverty line. Hence, up to the two-time poverty line, the poor households in Syria can get benefit if their government can conduct the first order dominance marginal tax reform. Furthermore, the benefit can extend to the order of

$s=2, 3$, which is same with the examples of food/non-food expenditure and food/utility expenditure.

Figure 6 (of Appendix) shows that the \overline{CD} of food lies everywhere over the \overline{CD} of total expenditure over the whole range of poverty within $[0, 2]$ at the first order dominance. The dominant of food expenditure implies that subsidizing food expenditure can support the poor households, so the government should choose to extra tax total expenditure according to a revenue neutrality tax reform. We also can analogize that the dominant of food expenditure will extend to the order of $s=2, 3$, since $\Pi^3 \in \Pi^2 \in \Pi^1$. For that reason, Syria government can always adjust taxation on this pair of expenditures until the two \overline{CD} curves cross. In general, total expenditure consists of a bunch of household's specific expenditures, including food, non-food, utility expenditure and social expenditure. Food satisfies either the non-poor or the poor's basic living need. Food subsidy can significantly affect social welfare improvement in terms of Syria as a developing country, as we see in the \overline{CD} curves graphs all including food expenditure. Therefore, tax makers should impose extra taxation on other specific consumptions instead of food for the object of reducing poverty.

Figure 7 in Appendix says that a tax reform at the margin, which increases tax rate of nonfood consumption and decrease tax rate of utility expenditure, can improve poverty in Syria for all $z \in [0, 2]$ for all $P(z) \in \Pi^1$ at the first order and up to higher order. Utility expenditure is more important than non-food expenditure such as oil, clothes and luxury goods for a poor Syria household. Hence, to finance utility expenditure is more meaningful for government purpose of

reducing poverty. As we see, an intersection does not happen up to the poverty line $z=2$, but will be before the poverty line $z=3$ based on a decrease trend of the \overline{CD} of utility expenditure.

Figure 8 (See Appendix) gives the locations of the \overline{CD} curves of utility expenditure and social expenditure at the first order within the range of the poverty line, $z \in [0, 2]$. Though the \overline{CD} curve of utility expenditure lies above the \overline{CD} curve of social expenditure at all, the gap between the \overline{CD} curves is very small. Hence, it indicates that a small subsidy for utility expenditure and a small increase tax rate of social expenditure will reduce poverty at the first order respecting equation (19) in Syria at the context of unchanged tax revenue. The same result can extend to the second order poverty reduction and the third order poverty reduction.

Figure 9 and Figure 10 in Appendix picture the estimated \overline{CD} curves of utility expenditure and total expenditure at first order dominance and the second order dominance respectively. Figure 9 shows that the first order \overline{CD} curves cross before the maximum poverty line we set, so this not a Pen-improving tax reform for the pair of expenditures $\gamma = 1$. Hence, it is not feasible to decrease poverty for all the poverty indices belonging to Π' by taxing utility expenditure and decreasing taxation on total expenditure at margin for a balanced government budget constraint. As mentioned before, we can find the critical upper poverty threshold at the location where curves cross, which is almost the value of 1 in this case. Thus we interpret that Syria government can reduce poverty by practicing the first-order marginal tax reform up to the critical poverty line 1, but after 1 a tax change will increase the burden of the poor household. In Figure 10, it is worth

noting that the second-order \overline{CD} curves of utility/total expenditure have crossed before total expenditure is everywhere higher than the \overline{CD} curve of utility expenditure. The result implies that there is no the second dominance between this pair of expenditures and thus it is not possible to improve poverty by adding extra taxation on utility expenditure and offering a decreasing marginally taxation on total expenditure with unchanged tax revenue for all Dalton-improving poverty indices for all poverty line inferior to 2. Yet, since we can find the critical poverty line at exactly location where the second-order \overline{CD} curves cross, the Syrian government can consider an application of marginal tax reforms under the critical poverty line. Moreover, this result of comparing the \overline{CD} curves of utility/total expenditure proves that if a marginal tax reform cannot reduce all the first poverty indices belonging to Π^1 , then such a reform also cannot make poverty reduction for all the poverty indices belonging to Π^2 and even the higher class of poverty indices for a restricted interval of poverty line.

Figure 11 in Appendix estimates the \overline{CD} curves of social expenditure and total expenditure. As we see, total expenditure everywhere dominates social expenditure at the first order. Thus, it is appropriate to tax total expenditure and then provide a subsidy for social expenditure in order to alleviate the poverty in Syria. For all poverty line less than 2 for all poverty indices belonging to Π^1 , such a marginal tax change respects equation (19) at the first order of dominance and the result will also extend to the order of s.....

5. Conclusion

In this paper, we are interested in an empirical illustration of the impact of indirect tax reforms on poverty improvement with a combination of CD-Curves methodology and the data from the 2003-04 survey in Syria. For a government, it is more useful and easier to identify the desirable tax reforms than to design a new tax, since change in actual tax system is "slow and piecewise". An analysis of the effect of a marginal tax reform with CD-Curves can just depend on assessing the data set instead of estimating individual demand and utility function. Using CD-Curves to determine poverty improving can only censor the poverty line and poverty indices and do not need to find the exact social evaluation function. Moreover, CD-Curves can check poverty reducing tax reforms over any order class of poverty indices of any level of poverty line at unlimited dominance. Findings from my case study imply that CD-Curves test can help a government to recognize a poor-benefit marginal tax reform between any pair of expenditures and even a bunch of multiple mixed expenditures.

To find CD-Curves' critical values, such as the critical efficiency ratio threshold and the critical upper poverty line, can provide policy makers the estimators to evaluate the actual economic efficiency cost ratio and poverty line. Evaluating γ is to find the aggregate deadweight loss due to change of taxation structure. Hence, policy makers can consider the critical efficiency ratio as a watershed below which a tax change is not poverty improving.

As mentioned before, there exist different views of choosing poverty line. Therefore, to find the critical poverty line can solve that problem. We acknowledge from the empirical illustration that

below the critical poverty line, a marginal tax reform can reduce poverty. Note again that CD-Curves are crossing at which the critical poverty line is. Hence, policy makers can raise the maximum poverty line up to the critical poverty threshold in order to alleviate poverty.

Intersecting CD-Curves can still identify poverty improvement, which completely differs from the judgment of concentration curves. Another departure from concentration curves is that the economic efficient ratio, γ , can be flexible to be larger or smaller than the value of 1. For the difference values of γ , policy makers can find different level of maximum poverty line to match it.

By the investigation on Syria case, we identify the subsidized good and the taxed good between a pair of expenditures under balanced government budget constraint by CD-Curves test. For example, Syrian government should raise taxation on non-food expenditure to subsidize food expenditure and also should marginally increase taxation on social expenditure instead of utility expenditure. Hence, it will help governments to make poverty alleviation schedule.

References

- Ahmad, Ehasham and Stern, Nicholas 'The Theory of Reform and Indian Indirect Taxes' *Journal of Public Economics*, vol. 25, no. 3, 1984, pp.259-298.
- Atkinson, A.B 'On the Measurement of Poverty' *Econometrica*, vol. 55, no. 4, 1987, pp. 759-64.
- Besley, Timothy and Kanbur, Ravi 'Food Subsidies and Poverty Alleviation' *the Economic Journal*, vol. 98, no. 392, 1988, pp. 701-19.
- Davidson, Russell and Doclos, Jean-Yves 'Statistical Inference for Stochastic Dominance and for the Measurement of Poverty and Inequality' *Econometrica*, vol. 68, no. 6, 2000, pp. 1435-64
- Duclos, Jean-Yves; Makdissi, Paul 'Restricted and Unrestricted Dominance for Welfare, inequality, and Poverty Ordering' *Journal of Public Economic Theory*, vol. 6, no. 1, 2004, pp. 145-64.
- Duclos, Jean-Yves; Makdissi, Paul and Wodon, Quentin 'Poverty-Reduction Tax Reforms with Heterogeneous Agents' *Journal of Public Economic Theory*, vol. 7, no. 1, 2005, pp. 107-16.
- Duclos, Jean-Yves; Makdissi, Paul and Wodon, Quentin 'Poverty-Dominant Transfer Programs: The Role of Targeting and Allocation Rules' *Journal of Development Economics*, vol. 77, no. 1, 2005, pp. 53-73.
- Duclos, Jean-Yves; Makdissi, Paul and Wodon, Quentin 'Socially Improving Tax Reforms' *International Economic Review*, vol. 49, no. 4, 2008, pp. 1505-37.
- Feldstein, Martin 'On the Theory of Tax Reform' *Journal of Public Economics*, vol. 6, no. 1, 1975, pp.77-104.
- Foster, James; Greer, Joel and Thorbecke Erik 'A Class of Decomposable Poverty Measures' *Economics*, vol. 25, no. 3, 1984, pp. 761-76.
- Foster, J, E and Shorrocks, A.F 'Poverty Ordering and Welfare Dominance' *Social Choice and Welfare*, vol. 5, no. 2-3, 1988b, pp. 179-98.
- Guesnerie, Roger 'On the Direction of Tax Reform' *Journal of Public Economics*, vol.7, no. 2, 1977, pp. 179-202.
- Heba El-Laithy and Khalid Abu-Ismaïl 'Poverty in Syria: 1996-2004; Diagnosis and Pro-Poor Policy Considerations' *United Nations Department Programme*, 2005.
- Howes, S 'Asymptotic Properties of Four Fundamental Curves of Distributional Analysis' Unpublished Paper, Sticerd, London School of Economics, 1993.

- King, Mervyn A 'Welfare Analysis of Tax Reforms Using Household Data' *Journal of Public Economics*, vol. 21, no. 2, 1983, pp.183-214.
- Kolm, Serge-Christophe 'Unequal Inequalities I' *Journal of Economic Theory*, vol. 12, no. 3, 1976, pp. 416-42.
- Liberati, Paolo 'Poverty Reducing Reforms and Subgroup Consumption Dominance Curves' *Review of Income and Wealth*, vol. 49, no. 4, 2003, pp. 589-601.
- Makdissi, Paul and Wodon, Quentin 'Consumption Dominance Curve: Testing for the Impact of Indirect Tax Reform on Poverty' *Economics Letters*, vol. 75, no. 2, 2002, pp. 227-235.
- Makdissi, Paul and Wodon, Quentin 'Poverty-Reducing and Welfare-Improving Marginal Public Price and Price Cap Reforms' *Journal of Public Economic Theory*, vol. 9, no. 4, 2007, pp. 683-98.
- Mayshar, Joram and Yitzhaki, Shlomo 'Dalton-Improving Indirect Tax Reform' *American Economic Review*, vol. 85, no. 4, 1995, pp. 793-807.
- Sen, Amartya 'Poverty: An Ordinal Approach to Measurement' *Econometrica*, vol. 44, no. 2, 1976, pp. 219-31.
- Santoro, Alessandro 'Marginal Commodity Tax Reform: A Survey' *Journal of Economic Reviews*, vol. 21, no. 4, 2007, pp. 827-48.
- Watts, H, W 'An Economic Definition of Poverty' in *On Understanding Poverty*, ed. By D. P. Moynihan, New York: Basic books, 1968.
- Yitzhaki, Shlomo and Slemrod, Joel 'Welfare Dominance: An Application to Commodity Taxation' *American Economic Review*, vol. 81, no. 3, 1991, pp. 480-96.
- Yitzhaki, Shlomo and Thirsk, Wayne 'Welfare Dominance and the Design of Excise Taxation in the Cote d'Ivoire' *Journal of Development Economics*, vol. 33, no. 1, 1990, pp.1-18.

Appendix

Figure 1

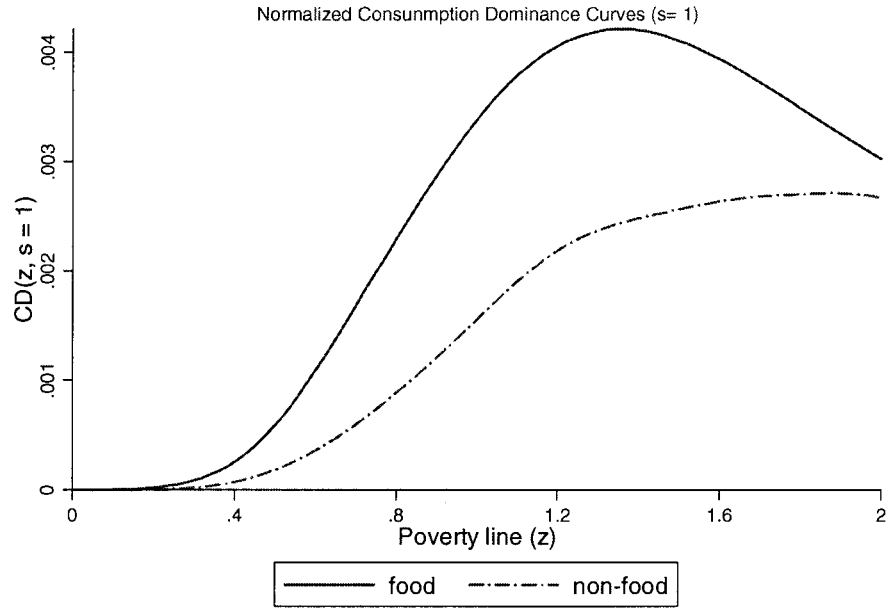


Figure 2

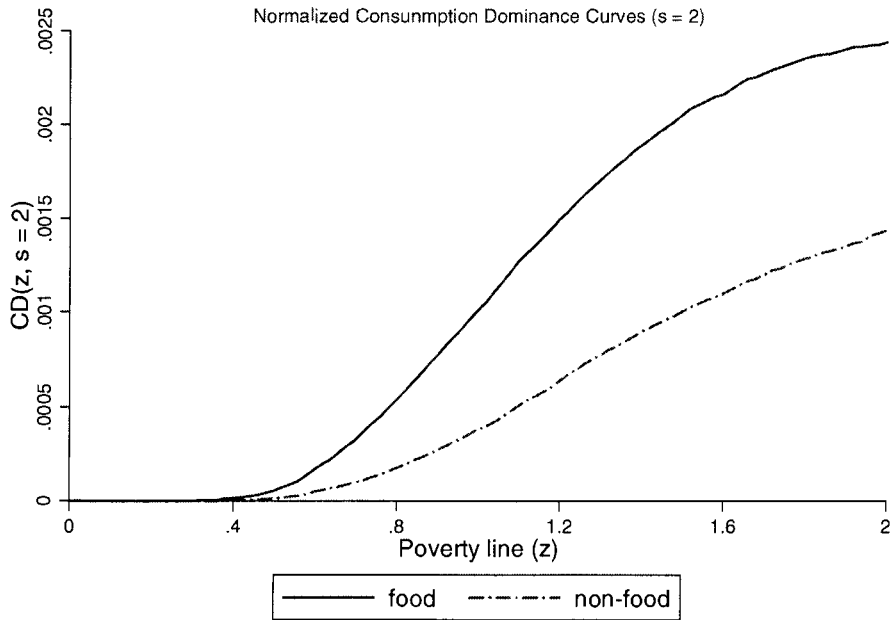


Figure 3

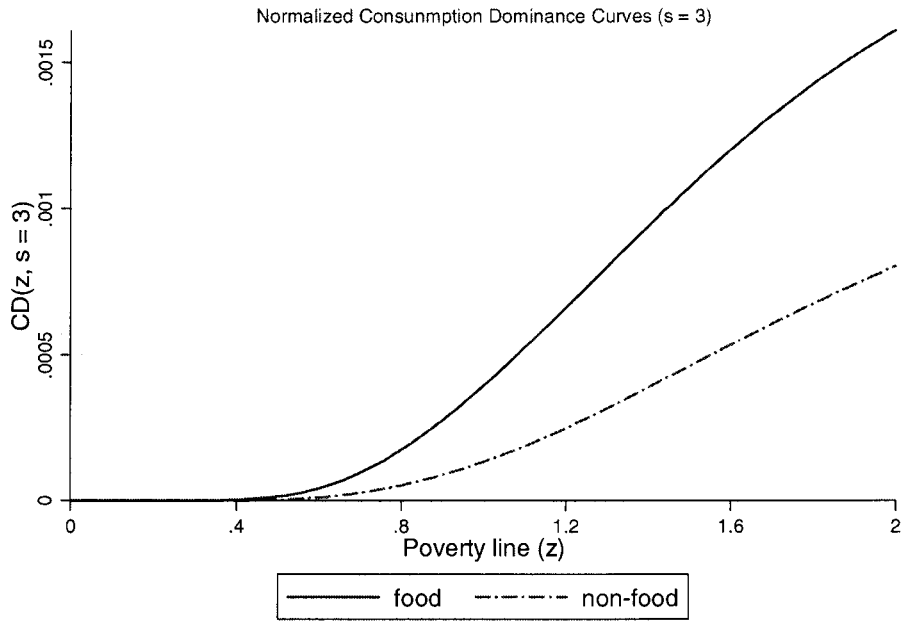


Figure 4

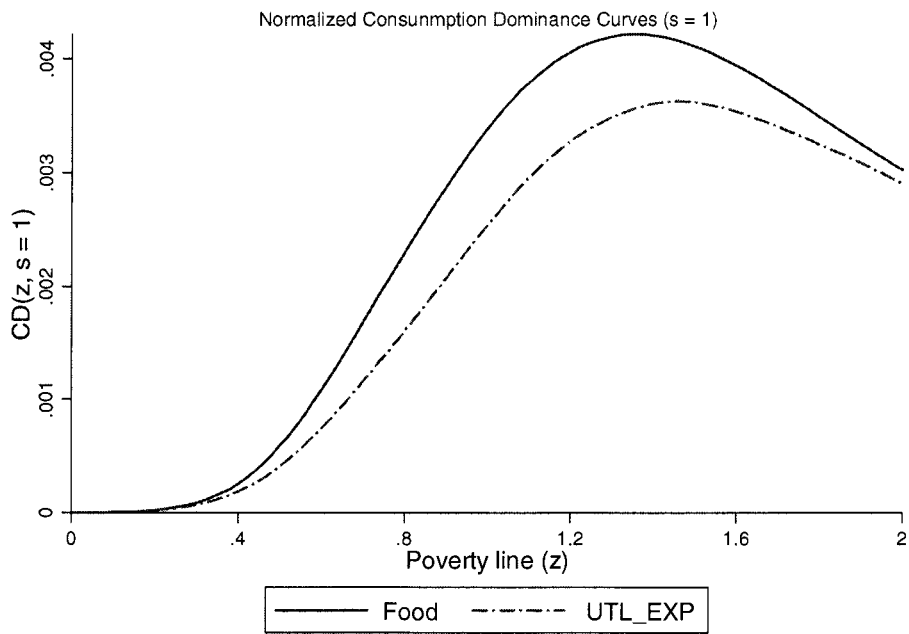


Figure 5

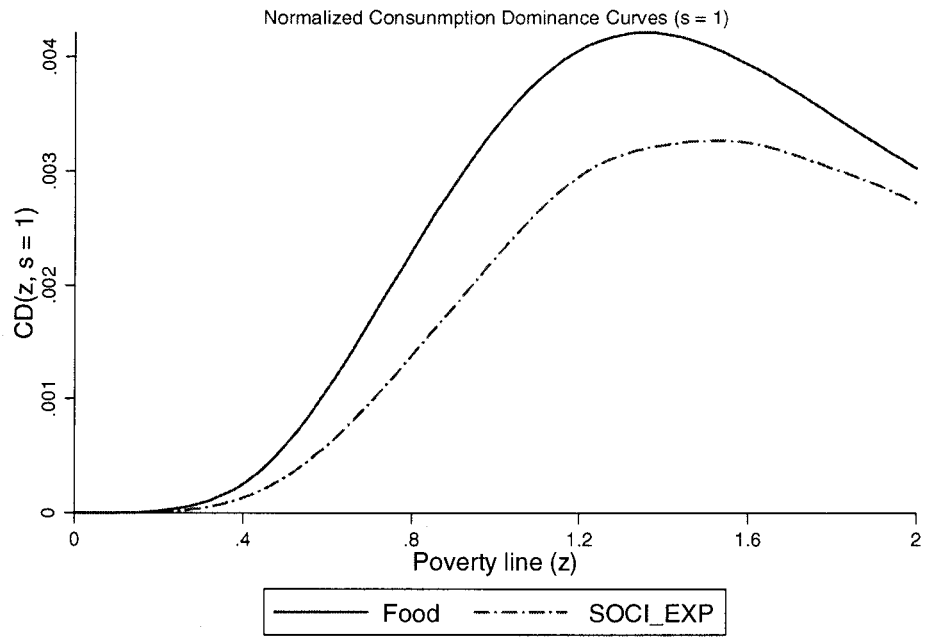


Figure 6

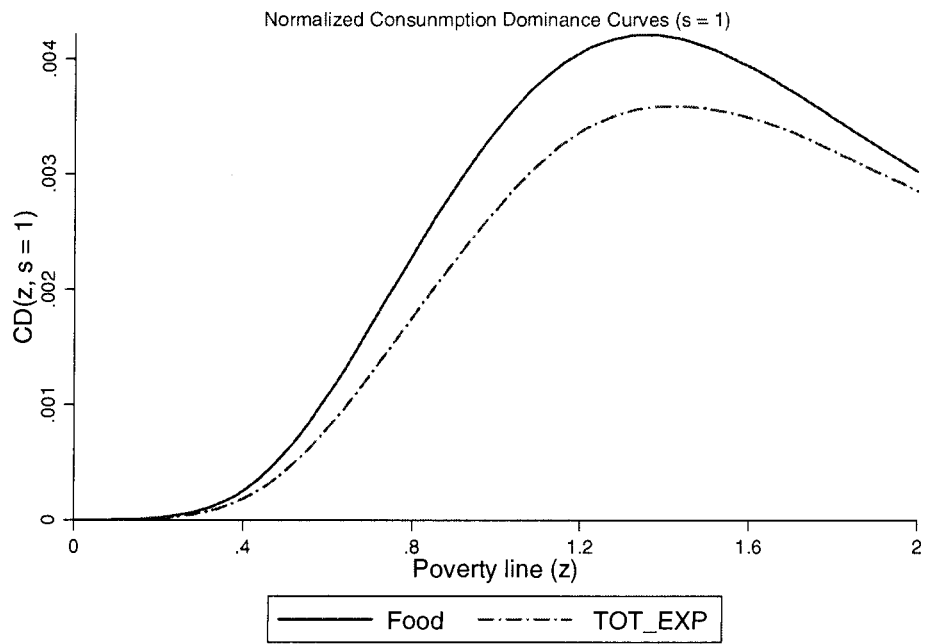


Figure 7

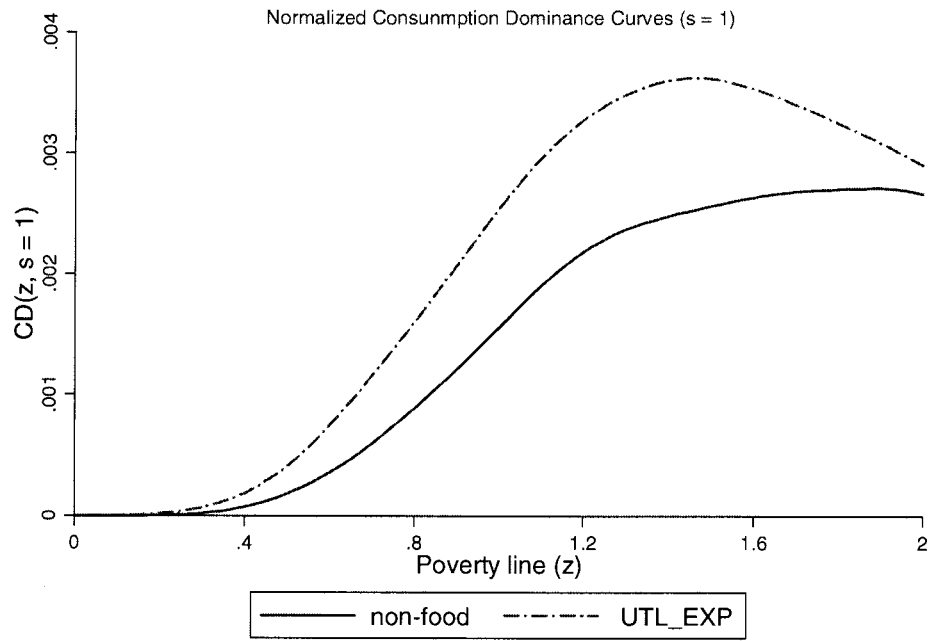


Figure 8

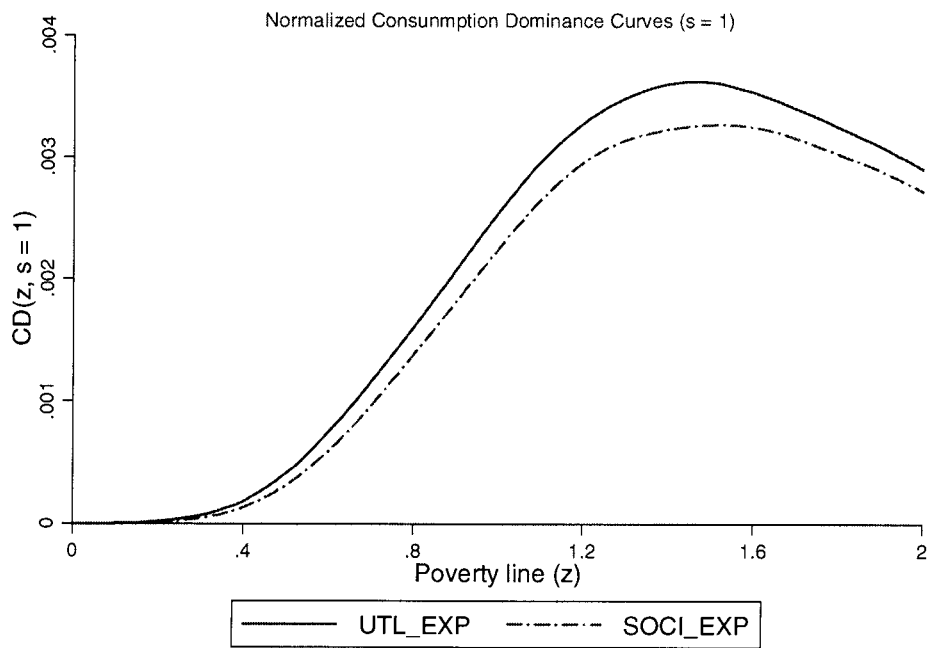


Figure 9

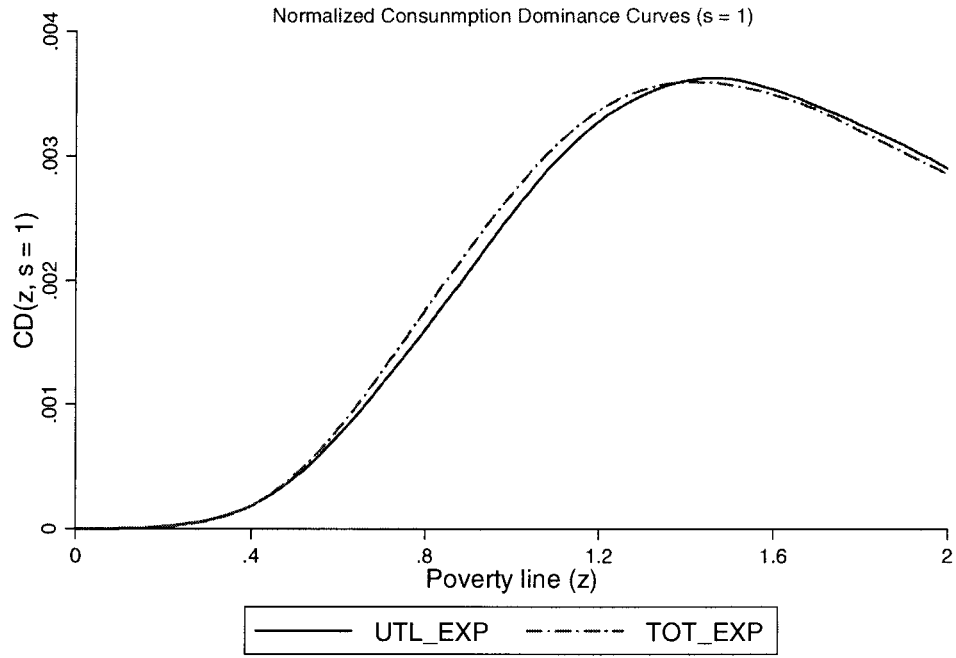


Figure 10

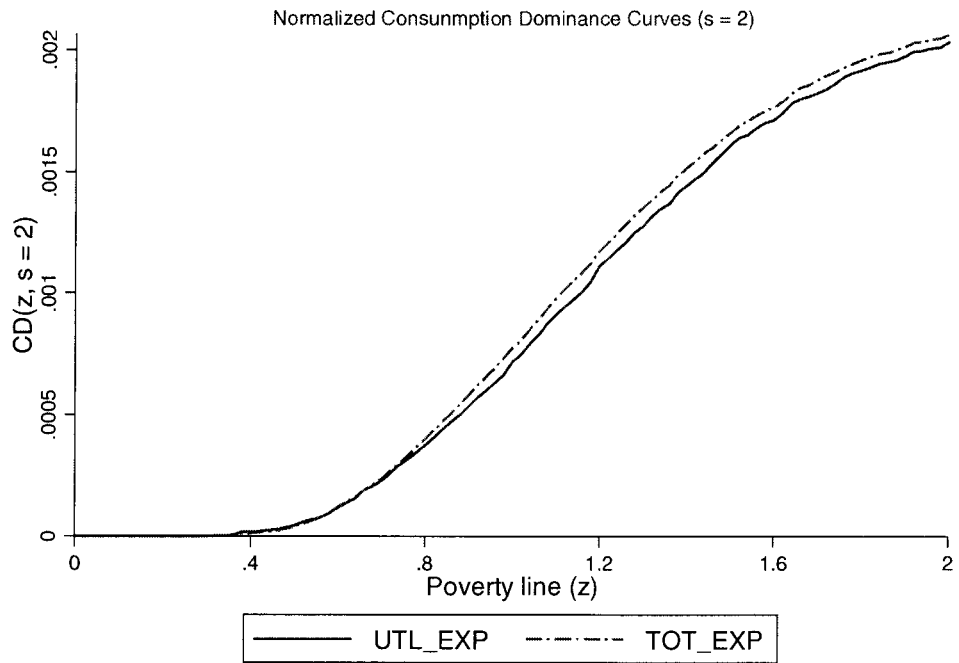


Figure 11

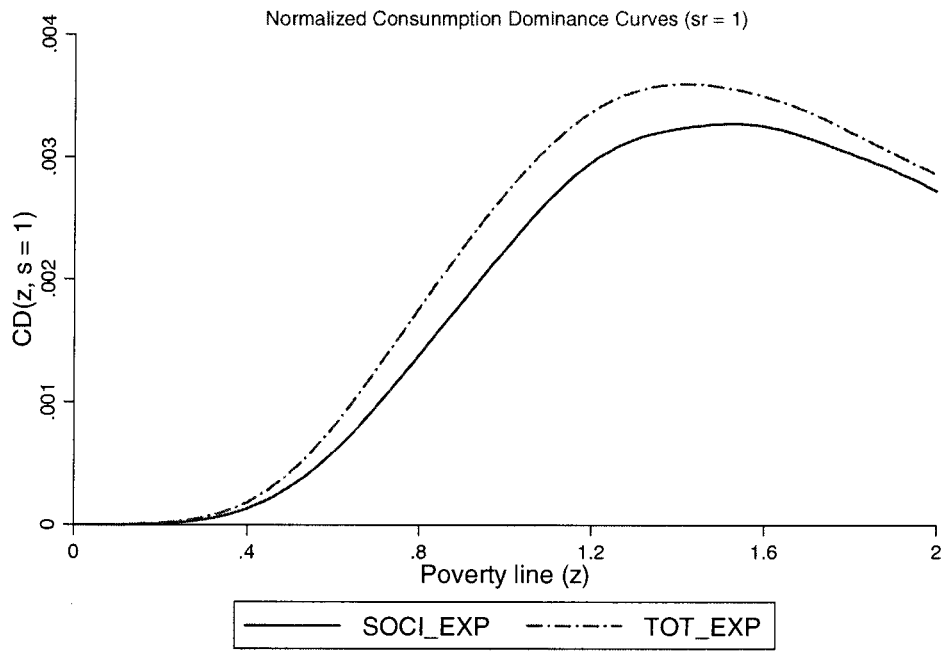


Table 1

Marginal Tax Reform for Food versus Nonfood Expenditure, Syria 2003-2004

Critical poverty line $z_s(\gamma)$ for different ratio of economic efficiency costs γ and for different order of dominance s

	$\gamma = 1$	$\gamma = 1.5$
$Z_1(\gamma)$	2.736 (0.0912)	1.596(0.025)
$Z_2(\gamma)$	-	2.6177(0.1352)
$Z_3(\gamma)$	-	3.97 (0.1351)