Indirect Tax Reform in Serbia

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Abstract

This paper utilizes the Consumption Dominance Curve methodology proposed by Makdissi and Wodon in 2002. The study of CD-curves can help to determine the formation of Serbian indirect tax reforms aiming at poverty reduction. Three combinations of hypothetical tax reforms are discussed in this paper. The results provide a viable approach to alleviate the poverty in Serbia.

Keywords: Indirect tax reform, Consumption Dominance Curve, Poverty line, Serbia

I. Introduction

Reducing poverty is an inevitable challenge for both developed and developing countries. One of the techniques deployed by agencies such as Economy and Finance department is the marginal indirect tax reform. An indirect tax reform refers to the taxation of consumption instead of income. This can be a tax increase on one good whose proceeds are used to subsidize another good. Tax reforms have consequences for the efficiency with which resources in the economy are allocated, and for the welfare distribution of household. Also, there has been a debating subject of whether a balance-neutrality indirect tax reform could help the poor. Makdissi and Wodon (2002) have introduced the Consumption Dominance curve (CD-curve) to test the indirect tax reform on poverty alleviation for any order of stochastic dominance. This is the theoretical foundation of the present paper.

The chief objective of this paper is to determine whether it is possible to find a poverty-reducing or welfare-improving tax reform in Serbia by applying the CD-curve theorem introduced by Makdissi and Wodon (2002). To achieve the goal, CD-curves are drawn for different pairs of goods and different ethical orders. Critical values for poverty line and economic efficiency cost are also acquired to

provide sufficient information for analysis.

This paper is organized as follows. Section II introduces Makdissi and Wodon (2000)'s study on the impact of marginal tax reform on poverty. Section III describes the background of poverty in Serbia. Moreover, a brief description of data is provided in this part. Section IV focuses on empirical analysis using adjusted dataset and methodology provided in Section II. Section V presents a conclusion.

II. Theoretical Framework

i. Notation and definitions

For the purpose of assessing a wide range of potential poverty indices and poverty line, Makdissi and Wodon (2002) have introduced a method that employs stochastic dominance techniques. This method is based on the comparison of Consumption Dominance curves (CD-curves). Details of this method are provided as follows.

Suppose that the objective of the government is to reduce an additive poverty index through an indirect tax reform

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

where F is the cumulative distribution of income base on [0,a], y is the equivalent income , z is the poverty line defined in equivalent income space. p (y,z) is a function that measures the share of poverty that an individual with a income of y contributes.

As mentioned above, this paper focuses on a wide range of poverty indices instead of specific poverty index. Classes of poverty of indices are defined as:

$$\pi^s:=\{P|\ p(y,z)\in C^s \text{ et } (-1)^i \frac{\partial^i p(y,z)}{\partial y^i}\geq 0\ \forall\ i=1,2,\cdots,s\} \qquad (2)$$

where C^s represents the set of continuous functions *s* differentiable on [0.a].

Assume the first order class as $\pi^1(z)$, all the indices incorporated in this class will decline if an individual's income at some given percentile grows without any changes on others. This class of indices is Paretian, which means poverty will be decreased when any individual's income increased, given all things being equal (Duclos and Makdissi (2008)). Besides, these indices are symmetrical because that interchange the income of two individuals does not affect poverty indices.

The second order class belongs to the first order class, and includes the indices that respect the Pigou-Dalton principle. The core of this principle is that the social welfare must increase following a mean-preserving redistribution from the rich to the poor.

The third order class of indices belongs to the second order class and includes indices that are sensitive to a favorable composite transfers .Favorable composite transfers are composed of a beneficial Pigou-Dalton transfer within a lower part of the distribution, coupled with a reverse Pigou-Dalton transfer within an upper part of the distribution with the distribution variance unchanged. A transfer in a lower percentile is more significant than one in a higher percentile. In other words, a progressive transfer occurring in a low part of the distribution will reduce poverty

even if it is accompanied by an equivalent regressive transfer in the distribution (Makdissi and Wodon (2002)).

The generalized transfer principle proposed by Fishburn and Willig (1984) is used to interpret indices with *s* greater than 3. The principle suggests that in the fourth order of indices, a combination of a transfer in a lower percentile and one in a higher percentile will reduce poverty. The principle states that the higher the order, the more the transfer taking place in the lower part contributes to a reduction in poverty.

ii. Budgetary impact

Assume that the economy consists of K consumption goods. Given a balanced budget, the government's objective is to reduce poverty by reducing tax (or increasing the subsidy) on good *i* marginally through increasing tax (or decreasing subsidy) on good *j*.

Let R denotes the total revenue from the indirect tax reform. Suppose there are I individuals, then

$$R = I \sum_{k=1}^{K} t_k X_k \qquad (3)$$

where X_k indicates aggregate total consumption of good k, and t_k states the tax rate on good k if $t_k > 0$ of the subsidy if $t_k < 0$.

Therefore, the impact of the indirect tax reform on total revenue is

$$dR = \lambda \{[X_i + \sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial t_i}]dt_i + [X_j + \sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial t_j}]dt_j\} \quad (4)$$

Since this reform is implemented within a balanced budget constraint, dR=0.

Equation (4) can be rewritten as

$$\{[X_i + \sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial t_i}]dt_i + [X_j + \sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial t_j}]dt_j\} = 0 \quad (5)$$

By manipulating equation (5), we have

$$dt_j = -\gamma(\frac{X_i}{X_j})\, dt_i \text{ where } \gamma = \frac{1+\frac{1}{X_i}\sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial t_i}}{1+\frac{1}{X_j}\sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial t_j}} \quad (6)$$

Wildasin (1984) interprets γ as the differential efficiency cost of raising one dollar of public funds by taxing the *j*th commodity and using the proceeds to subsidy the *i*th commodity. According to Yitzhaki and Thirsk(1900) and Yitzhaki and Slemrod (1991), the second order dominant reform will be ruled out when γ is larger than one due to the increasing deadweight loss caused by fiscal reform. Nevertheless, in a poverty reduction framework, the impact of the indirect tax reform with $\gamma > 1$ can still be dominant at the second order or even higher orders if the loss is supported by the non-poor.

iii. Impact on Poverty

For an individual with an income of y, the impact to his share of poverty due to a

marginal change of tax reform for two goods *i* and *j* is:

$$dp(y,z)=\frac{\partial p(y,z)}{\partial y}\frac{\partial y}{\partial t_i}dt_i+\frac{\partial p(y,z)}{\partial y}\frac{\partial y}{\partial t_j}dt_j \quad (7)$$

By using Roy (1947)'s identity and assuming that the vector of reference price as the vector of price before the reform, Besley and Kanbur (1988) shown that the change in equivalent income caused by a marginal change of tax reform is

$$\frac{\partial y}{\partial t_k}=-x_k(y) \quad (8)$$

where $x_k(y)$ is the Marshallian demand for good *k*.

This equation says that "observed pre-reform consumption of good *k* is a sufficient statistic to show the impact on consumer welfare of a marginal change in the price of good *k*" (Duclos, Makdissi and Wodon 2008).

Using equation (6) and (8) into (7), we get

$$d\ p(y,z)=-\frac{\partial p(y,z)}{\partial y}\left[\frac{x_i(y)}{X_i}-\gamma\ \frac{x_j(y)}{X_j}\right]X_i dt_i \quad (9)$$

To get cumulative impact of poverty, let equation (9) be integrated

$$dP(F,z)=-X_t\ dt_i\int_0^a \frac{\partial p(y,z)}{\partial y}\left[\frac{x_i(y)}{X_i}-\gamma\ \frac{x_j(y)}{X_j}\right]dF(y) \quad (10)$$

It is clear that dt_i and $\frac{\partial p(y,z)}{\partial y}$ are negative, then equation (10) will be result in a negative value as long as $\left[\frac{x_i(y)}{X_i}-\gamma\ \frac{x_j(y)}{X_j}\right]$ remain positive. In other words, there will be a poverty alleviation based on $\frac{x_i(y)}{X_i}-\gamma\ \frac{x_j(y)}{X_j}>0$.

Makdissi and Wodon (2002) introduce the concept of Consumption Dominance

Curve or CD-Curve of order *s* according to the development above. Consumption Dominance is defined as follows:

$$CD_k^s(y)=\begin{cases} \frac{x_k(y)}{X_k}.\mathrm{f(y)} & \mathrm{s}=1 \\ \int_0^y CD_k^{s-1}(u)du & s>1 \end{cases} \quad (11)$$

For s=1, $CD_k^1(y)=\frac{x_k(y)}{X_k}.\mathrm{f(y)}$, which is the ratio of consumption of good *k* for an individual with income *y* and the aggregate consumption of good *k* times the density of income at y.

For s ≥ 2, $CD_k^2(y)=\int_0^y CD_k^1(u)du$, which indicates that the share of total consumption of good *k* for the individuals whose income is lower than *y*.

Using equation (11) into (10), we get:

$$dP(F,z)=-X_t\, dt_i \int_0^a \frac{\partial p(y,z)}{\partial y}[\, CD_i^1(y)-\gamma\, CD_j^1(y)\,]\, dy \quad (12)$$

Similar result can be made that $CD_i^1(y)-\gamma\, CD_j^1(y)>0$ implies $dP\,(F,z)$ <0, given the sign of other elements.

Integrating part $\int_0^a \frac{\partial p(y,z)}{\partial y} CD_i^1(y)\, dy$ from equation (12), the following is obtained:

$$\int_0^a \frac{\partial p(y,z)}{\partial y} CD_i^1(y)dy=\frac{\partial p(y,z)}{\partial y} CD_i^2(y)|-\int_0^a \frac{\partial^2 p(y,z)}{\partial y^2} CD_i^2(y)dy \quad (13)$$

Since $\frac{\partial p(a,z)}{\partial y}$=0 and $CD_i^2(0)$=0, it is clear that

$$\int_0^a \frac{\partial p(y,z)}{\partial y} CD_i^1(y)dy = -\int_0^a \frac{\partial^2 p(y,z)}{\partial y^2} CD_i^2(y)dy \quad (14)$$

For $s \in \{2, 3, 4...\}$, the following is obtained:

$$\int_0^a \frac{\partial p(y,z)}{\partial y} CD_i^1(y)dy = (-1)^{s-1} \int_0^a \frac{\partial^s p(y,z)}{\partial y^2} CD_i^s(y)dy \quad (15)$$

Using equation (15) into equation (12), the following is obtained:

$$dP(F,z) = -X_t \, dt_i \int_0^a \frac{\partial p(y,z)}{\partial y} [\, CD_i^s(y) - \gamma \, CD_j^s(y) \,] \, dy \quad (16)$$

Therefore, the CD-Curve method can be used to test dominance for any order.

Considering the application of normalized CD-Curves to evaluate the socially improving tax reform, the following two theorems provided by Duclos, Makdissi and Wodon (2008) are qualified as an instrument capable of testing whether marginal tax reform are poverty reducing or welfare improving.

Theorem I (Duclos, Makdissi and Wodon 2008): A necessary and sufficient condition for a marginal tax reform, $dt_j = -\gamma(\frac{X_i}{X_j})\, dt_i > 0$, to be *s* order poverty reducing, that is to say, to decrease poverty weakly for all

$P(F,z) \in \pi^s$, $s \in \{1,2,3...\}$ and for all $z < z^+$, is that $CD_i^s(y) - \gamma \, CD_j^s(y) \geq 0, \forall y \leq z^+$.

Theorem II (Duclos, Makdissi and Wodon 2008): A necessary and sufficient condition for a marginal tax reform, $dt_j = -\gamma(\frac{X_i}{X_j})\, dt_i > 0$, to be *s* order welfare improving, that is ,to increase social welfare weakly for all $W \in \pi^s$ and for a given

s∈{1,2,3...} is that $CD_i^s(y) - \gamma\, CD_j^s(y) \geq 0, \forall y \in [0,\infty]$.

State it differently, given a balanced budget, a indirect tax reform carried by marginally increasing subsidy for good *i* and financing it by increasing tax on good *j* will marginally reduce poverty or increase social welfare for any order class of indices and for all poverty line below z^+ if and only if

$CD_i^s(y) - \gamma\, CD_j^s(y) \geq 0, \forall y \leq z^+$.

For $\gamma = 1$, Theorem imply that the indirect tax reform will reduce poverty or improve social welfare at a given order of dominance if the CD-Curve of good *i* lies above the CD-Curve of good *j* for every income level under poverty line . In other words, if the CD-Curve of good *i* and the CD-Curve of good *j* do not intersect at order s=1,s=2,s=3,the tax reform is regarded as poverty-reducing at order s=1,s=2,s=3 respectively. If the two CD-Curves intersects and the first intersection is above the critical poverty line, the marginal tax reform will still be poverty-reducing at order s=1, s=2, s=3 respectively.

For $\gamma \neq 1$, one needs to multiply the CD-Curve of good *j* by the economic efficiency ratio, γ , then compare it with the CD-Curve of good *i.* The remaining steps will be similar with the situation where $\gamma = 1$.

For $\gamma > 1$, due to the existence of the deadweight loss, a tax reform cannot be

socially improving, according to Yitzhaki and Thirsk (1990) and Yitzhaki and Slemrod (1991). However, Duclos, Makdissi and Wodon (2008) argued that a tax reform could still be an efficient instrument for poverty reduction. In such case, the efficiency cost must be paid by the household whose income is higher than the poverty line.

iv. Critical efficiency ratio and critical poverty

According to the Theorems presented by the Duclos, Makdissi and Wodon (2008), suppose a given value of $\gamma = \gamma^+$ such that $CD_i^s(y) - \gamma\, CD_j^s(y) \geq 0, \forall y \leq z^+$. Therefore, there must be a critical value of γ for all z ∈ [0, z^+], beyond which the equation will not hold. This critical efficiency ratio is denoted by $\gamma^s(z^+)$ and defined as

$$\gamma^s(z^+) = \sup\{\gamma \mid CD_i^s(y) - \gamma\, CD_j^s(y) \geq 0, \forall y \in [0, z^+]\}.$$

In short, this critical value of γ associates with maximum poverty line z^+, where $CD_i^s(y)$ and $\gamma\, CD_j^s(y)$ intersect at maximum poverty line z^+.

Similarly, one can define a critical value of poverty line $z^s(\gamma^+)$ by

$$z^s(\gamma^+) = \sup\{z \mid CD_i^s(y) - \gamma\, CD_j^s(y) \geq 0, \forall y \in [0, z^+]\}.$$

This value of $z^s(\gamma^+)$ is the maximum poverty line which makes this specific stochastic dominance test works.

"For a given z^+ and γ^+, $z^s(\gamma^+)$ and $\gamma^s(z^+)$ respectively give the critical upper poverty line and the critical economic efficiency ratio up to which the tax reform is necessarily s-order poverty improving" (Duclos, Makdissi and Woden 2008).

III. Empirical Illustration

i. An overview of poverty in Serbia

Table 1 Key poverty indicators in Serbia, 2002-2007
(standard errors are presented in brackets)

	2002	2007
Absolute poverty line per adult equivalent, in dinars	5 234	8 883
Percentage of the poor	14.0	6.6
	(0.74)	(0.61)
Depth of poverty, percent	3.0	1.3
	(0.20)	(0.17)
Severity of poverty, percent	1.0	0.4
	(0.08)	(0.07)

Source: LSMS 2002 and 2007.

"*Living Standard Measurement Study-Serbia 2002-2007*", Statistical Office of the Republic of Serbia.

According to the Living Standard Measurement Study (LSMS) data, poverty has remarkably decreased during the 2002-2007 period by more than 50%. In 2002, 14% Serbians whose consumption per adult equivalent (in dinars) was lower than

the poverty line (5,234) were regarded as poor. However, in 2007, the proportion had shrunk to 6.6%. The other two indicators, depth of poverty and severity of poverty, which reflect poverty distribution, declined as well. Poverty severity index is basically a poverty gap. It measures the gap between the poverty line and the average income of poor people. The greater the gap the deeper poverty they are in. The depth of poverty suggests whether people are living in abject poverty or just a few dollars below the poverty line.

Overall, the significant and sustainable economy growth since 2000 has contributed to the poverty decline. Specifically, according to LSMS data, many factors lead to the dramatic decline in poverty, such as a real salary increase, the growth of pensions, all kinds of social transfers as well as remittances from overseas. Thus, the objective that Serbia government set in Poverty Reduction Strategy to reduce poverty by half by 2010 was achieved as early as 2007.

Table 2 Key poverty indicators by settlement type, 2002-2007

	Poverty index, percent			Poverty depth, percent			Poverty severity, percent		
	2002	2007	Change	2002	2007	Change	2002	2007	Change
Urban	11.2	4.3	-6.8	2.1	0.8	-1.3	0.6	0.3	-0.4
Standard errors	0.86	0.63		0.21	0.16		0.08	0.07	
Rural	17.7	9.8	-8.0	4.2	2.0	-2.2	1.5	0.6	-0.9
Standard errors	1.28	1.18		0.37	0.34		0.16	0.13	
Total	**14.0**	**6.6**	**-7.4**	**3.0**	**1.3**	**-1.7**	**1.0**	**0.4**	**-0.6**
Standard errors	0.74	0.61		0.20	0.17		0.08	0.07	

Note: The changes in percentage points between 2002 and 2007.

"*Living Standard Measurement Study-Serbia 2002-2007*", Statistical Office of the Republic of Serbia.

Similar to other developing countries, poverty is basically a phenomenon which exists in the rural area of Serbia. In 2007, the percentages of the population in rural and urban area are 41.5% and 58.5% respectively. Rural poverty index was over 2 times than that in the urban area. It is also noticed that the poverty index had been cut more in the rural area. However, the gap between rural and urban remains wide from 2002 to 2007. The poverty depth and poverty severity tell a similar story. Disparity between rural and urban is quite noticeable. It is mentioned in LSMS, according to a recently adopted National Economic Development Strategy of the Republic of Serbia (2007), regional discrepancies in development in Serbia are among the largest in Europe, and they have been increased over the past years. From Table 3, the poverty index ranged from 3% in the urban area of Belgrade up to 18.7% in the rural area of South East Serbia in 2007. Belgrade, the capital and the largest city in Serbia, which is the most economically dynamic area, still gets the best position compared with other areas in the country, while Central Serbia(except Belgrade) remains the worst position in Serbia. The overall poverty index in Vojvodina is 6.1%, which is just below the national average

(6.6%). The largest poverty index exists in the rural area in Central Serbia and Vojvodina (10.7% and 9.9% respectively), which causes a large urban and rural discrepancy in these areas.

Table 3 Poverty by regions in Serbia, 2002-2007

	Percentage of the poor			Structure of the poor, percent			Structure of overall population, percent		
	2002	2007	Change	2002	2007	Change	2002	2007	Change
Urban	11.2	4.3	-6.8	45.0	38.6	-6.4	56.4	58.5	2.1
Rural	17.7	9.8	-8.0	55.0	61.4	6.4	43.6	41.5	-2.1
Belgrade	10.8	3.1	-7.7	16.3	10.4	-5.9	21.1	22.3	1.1
Urban	9.3	3.0	-6.3	11.4	8.4	-3.0	17.2	18.3	1.2
Rural	17.2	3.3	-13.9	4.9	1.9	-2.9	4.0	3.9	-0.0
Vojvodina	12.4	6.1	-6.2	23.9	26.3	2.4	27.1	28.3	1.2
Urban	10.7	3.3	-7.4	11.7	8.1	-3.6	15.4	16.2	0.8
Rural	14.5	9.9	-4.6	12.1	18.2	6.0	11.7	12.1	0.4
Central Serbia	16.2	8.4	-7.8	59.9	63.4	3.5	51.8	49.5	-2.3
Urban	12.8	6.1	-6.8	48.5	57.1	8.6	42.3	41.0	-1.3
Rural	19.1	10.7	-8.4	69.1	67.3	-1.9	64.0	61.4	-2.7
West Serbia	16.5	8.4	-8.1	13.2	13.4	0.3	11.2	10.5	-0.7
Urban	15.8	4.0	-11.9	4.9	2.6	-2.3	4.3	4.2	-0.1
Rural	17.0	11.4	-5.5	8.3	10.9	2.6	6.8	6.3	-0.6
Šumadija	13.8	3.7	-10.1	17.0	9.4	-7.6	17.3	16.8	-0.5
Urban	10.4	2.5	-7.8	6.2	3.2	-3.0	8.5	8.5	0.0
Rural	17.1	4.9	-12.2	10.8	6.2	-4.6	8.8	8.3	-0.5
East Serbia	12.9	10.1	-2.8	8.6	13.2	4.6	9.3	8.6	-0.7
Urban	11.8	11.2	-0.6	3.7	6.9	3.2	4.4	4.1	-0.3
Rural	13.9	9.1	-4.8	4.9	6.3	1.4	4.9	4.6	-0.4
South-East Serbia	21.2	13.3	-7.9	21.2	27.3	6.2	14.0	13.5	-0.5
Urban	14.7	8.5	-6.1	7.0	9.3	2.3	6.7	7.2	0.5
Rural	27.2	18.7	-8.5	14.1	18.0	3.9	7.3	6.4	-0.9
Total	**14.0**	**6.6**	**-7.4**	**100.0**	**100.0**	**0.0**	**100.0**	**100.0**	**0.0**

Note: Changes in percentage points between 2002 and 2007.

"*Living Standard Measurement Study-Serbia 2002-2007*", Statistical Office of the Republic of Serbia, 10-22

ii. Consumption Component

Household consumption and household income are two important indicators for measuring well-being of households. However, household income is not the best choice in this case of indirect tax reform because of following reasons. First of all, the data collection of household income may be incomplete due to unregistered business and cover up of income resource on account of distrust of the survey. Secondly, household income is more vulnerable to short-time fluctuations compared to household consumption. The consumption index is more reliable given its stability, scope and balance over an extended period. Therefore, household consumption per capita is preferred to use as the indicator for poverty analysis in this paper.

Table 1 Average monthly expenditure and household expenditure , 2007

	Average expenditure in dinars			Structure in percent		
	Total	Urban area	Other areas	Total	Urban area	Other areas
Total	**52 843**	**57 441**	**45 940**	**100.0**	**100.0**	**100.0**
Food and beverages	17 783	17 876	17 644	33.7	31.1	38.4
Alcoholic drinks and tobacco	2 078	2 011	2 178	3.9	3.5	4.7
Clothes and footwear	2 742	3 281	1 931	5.2	5.7	4.2
Housing, water, power supply, gas and other fuels	9 834	11 723	7 000	18.6	20.4	15.2
Furniture, household furnishing and maintenance	1 625	1 855	1 282	3.1	3.2	2.8
Health care	2 183	2 510	1 693	4.1	4.4	3.7
Transport	4 487	4 592	4 331	8.5	8.0	9.4
Communications	1 790	2 116	1 302	3.4	3.7	2.8
Recreation and culture	3 067	4 095	1 524	5.8	7.1	3.3
Education	751	990	393	1.4	1.7	0.9
Restaurants and hotels	2 451	2 996	1 634	4.6	5.2	3.6
Other goods and services	4 110	4 660	3 284	7.8	8.1	7.1

"*Living Standard Measurement Study-Serbia 2002-2007*", Statistical Office of the Republic of Serbia.

The consumption of Serbian household amounts to 52,843 dinars per month on average. Spending on food and beverage is the largest share of consumption—33.7%, which is followed by the costs of housing, and utilities—18.6%. The cost of transportation service represents 8.5%. Costs of other goods and services represent 7.8%. The monthly average consumption of the households in urban area is 57,441 dinars; compared with the monthly average consumption of the households is 45,940 dinars in other areas.

There are differences in consumption pattern between rural and urban Serbian households. For urban households, the consumption of food and beverage

represents 31.1%, while for rural areas, it represents 38.4%. As for the cost of housing and utilities, the urban area is higher than the rural area, 20.4% against 15.2% respectively.

According to the LSMS data, the share of cost on health service shows the slightest difference between urban and rural area, which is only 0.7%. Also, the costs on education service in urban are two times larger than those in rural area due to a larger number of school children in urban area.

iii. The data

We use micro level data from the Living Standards Measurement Survey, Serbia 2007. It is a nationally representative survey with detailed income and consumption modules for 5,544 households.[1] More specifically, variables include "Spending on food"; "Spending on health"; "Spending on transport"; "Spending on communication"; "Spending on alcohol"; "Spending on tobacco".

The First step of reorganizing the dataset is to determine the variables of interest, which include component variable and living standard index. Component variables are the variables one need to test during the hypothetical tax reform. In

[1] There are 5,557 households in the original dataset with which 13 of them are excluded due to incomplete information.

this paper, primary subject for evaluation is individual consumption change brought by a marginal tax reform. Therefore, one needs to divide each kind of spending by household size, which yields per capita spending of food; per capita spending of clothing and so on. Denote these new generated variables by "food", "health", "transport", "comm", "alcohol", "tobacco" respectively.

For expositional simplicity, a new variable "ls" is generated by dividing per capita consumption which comes from original dataset by the official poverty line. This generates a normalized poverty line equal to one. As a result, an individual with a level of normalized total consumption equal to 1 has a total consumption equal to the poverty line. Next, another new variable "sv" for size variable is generated by multiplying household size and household weight.[2]

iv. Empirical analysis

This section briefly illustrates the normative and statistical tools provided in Section II to individual-level data from Serbia 2007, a nationally representative survey with detailed income and consumption modules for 2007. Several specific variables, such as food, alcohol, health, communication, tobacco and transportation, are chosen to be analyzed during the test of socially improving tax

[2] The household weight for a particular household is the inverse of its household selection probability multiplied by the inverse of the household response rate of its household response rate group.

reform. With the adjusted dataset and the methodology introduced in section II, we will test and evaluate the impact of a marginal tax reform in Serbia. Figure 1 shows the CD-Curves for food, alcohol, health, tobacco, comm, and transport.[3] Per capita incomes (on the horizontal axis) have been normalized by cost of living indices (the national poverty line from LSMS 2002 and 2007). A value of one indicates that a household is at the level of poverty line. With this poverty line, 6.6% of Serbians are considered as poor (those with per capita income below z=1).

Firstly, consider a marginal tax reform that increases the tax rate on transport and uses the proceeds to subsidize food. Figure 2 shows the CD-Curves for transport and food. The two CD^1 curves cross at z^1 (1) =2.7165, which is also the critical value of $z^1(\gamma)$ for γ=1(assume that efficiency costs of taxing food and transport are equal) shown in Table 5. The standard error of z^1 (1) is estimated to be 0.24. This states that a 95% confidence interval for the true value of z^1 (1) would be [2.2461, 3.1869]. In other words, under 95% confidence level, the increase of tax upon transport would allow for an increased subsidy on food, which could result in a reduction of all poverty indices belonging to π^1 (the first order class of poverty

[3] All figures are shown in Appendix.

index) and all poverty lines equal or less than 2.2461 times the official poverty line if γ=1 .

On the other hand, the critical value for economic efficiency cost γ for z=1 is 3.292. This result means that indirect tax form by increasing tax on transport and subsidy on food would be poverty-reducing even if the efficiency cost of taxing transport is 229.2% larger than that of taxing on food. This result also holds true for all poverty line equal to or less than two times of the poverty line even though taxing transport is 35.19% larger than that of taxing on food.

In this case, the two curves cross as shown in Figure 1, that is, Normalized CD-Curve for food is not everywhere above Normalized CD-Curve for transport, which indicates that Theorem II is not satisfied. Another word, the marginal tax reform is not first-order welfare improving tax reform.

For ethical order s=2, these curves represent the cumulative shares of food and transportation expenditures accounted for by those with per capita income below a certain level. Also, it is evident from Figure 3 that there is no critical poverty line due to the fact that CD^2 curves for food and transport do not intersect. There is no critical value for $z^2(\gamma^+)$ when γ =1 shown in Table 5.

As a result, for any poverty line, the marginal tax reform is poverty reducing as

well as welfare improving at the second order for a wide range of values of γ. Specifically, if the government launches an indirect tax reform which increase tax on transport and subsidy on food expenditures, it will reduce poverty for any poverty line and for any poverty index that is monotonic, symmetric and averse to inequality. Also, it will increase social welfare for any social welfare index that is monotonic, symmetric and averse to inequality. Similarly, for order s=3, the marginal tax reform is poverty-reducing and welfare-improving without any limitations on critical value of poverty line.

Table 5 shows that with an economic efficiency cost γ equals to 1.5, the two first-order CD-curves intersect at 1.8365 with an estimate standard error 0.05. The 95% confidence interval for z^1 (1.5) is [1.3661, 2.3069]. Similarly, the tax reform is poverty- reducing up to a poverty line of 1.3661. With regard to the second-order CD-curve, the two cross at 2.745 with an estimate standard error 0.115, which implies that a confidence interval is [2.5196, 2.9704]. It means that an indirect tax reform will reduce poverty up to a poverty line of 2.5196 at the second order.

Table 5

INDIRECT TAXATION FOR FOOD AND TRANSPORT

Critical poverty line $z^s(\gamma^+)$ for different economic efficiency cost γ and for

different order s

	γ=1	γ=1.5
$z^1(\gamma^+)$	2.7165	1.8365
	(0.24)	(0.05)
$z^2(\gamma^+)$	---	2.745
	---	(0.115)
$z^3(\gamma^+)$	---	3.939
	---	(0.1728)

Critical efficiency cost of $\gamma^s(z^+)$ for different critical poverty line z^+ and for different order s

	Z=1	Z=2
$\gamma^1(z^+)$	3.292	1.3519
	(0.17)	(0.047)
$\gamma^2(z^+)$	---	---

Note: Sample size is 5,544 observations. Standard error is in parentheses.

Table 6

INDIRECT TAXATION FOR HEALTH AND COMMUNICATION

Critical poverty line $z^s(\gamma^+)$ for different economic efficiency cost γ and for different order s

	γ=1	γ=1.5
$z^1(\gamma^+)$	2.288	0.347
	(0.23)	(0.46)

$z^2(\gamma^+)$	---	0.6066
	---	(0.04)
$z^3(\gamma^+)$	---	0.708
	---	(0.446)

Critical efficiency cost of $\gamma^s(z^+)$ for different critical poverty line z^+ and for different order s

	Z=1	Z=2
$\gamma^1(z^+)$	0.87	0.87
	(0.09)	(0.06)
$\gamma^2(z^+)$	---	---

Note: Sample size is 5,544 observations. Standard error is in parentheses.

The second case focuses on health and communication. Consider a marginal tax reform that increases the tax rate on communication and increase subsidy on health when γ =1.Figure 5 shows that CD-curve of health is not everywhere above the CD-curve of communication. The two CD-curves cross at 2.288, which is also the critical value of $z^1(\gamma)$ for γ=1. The confidence interval is [1.7392, 2.8368] at 95% confidence level. That is to say when the efficiency costs of taxing health and communication are equal, all poverty lines may be considered inferior to 1.7392 times the official poverty line. Another words, this indirect tax reform will work under all poverty lines below 1.7392 times the official poverty line.The

increase of tax upon communication would allow for an increased subsidy on food, which could result in a reduction of all poverty indices belonging to π^1 and all poverty lines equal or less than 1.7392 times the official poverty line. Yet the two curves intersect, which states that Theorem II is not satisfied. That is, the marginal tax reform for health and communication is not first-order welfare improving tax reform.

For order s=2 and s=3, Figure 6 and Figure 7 state the rationale. There are no intersections for the two CD-curves, as it is clear in Table 6 there are no critical values for $z^2(1)$ and $z^3(1)$. That is to say, the marginal tax reform is poverty reducing as well as welfare improving at the second and the third order for all poverty lines.

Now consider the situation when γ =1.5. The two CD-curves have an intersection at 0.347 with an estimate standard error 0.46. As a result, the 95% confidence interval for the critical poverty line z^1 (1.5) is [-0.5546, 1.2486]. This implies that there is no dominance.

As for order 2 and order 3, the intersections for two CD-curves are 0.6066 and 0.708 with estimate standard error 0.04 and 0.446, respectively. Confidence

interval under 95% confidence level for these two cases are [0.5282, 0.685] and [-0.16616, 1.58216], respectively. The interval [0.5282, 0.685] can be interpreted as the indirect tax reform works up to poverty line of 0.5282 under 95% confidence level. The interval [-0.16616, 1.58216], nevertheless, does not allow for a maximum Z is larger than 0. Thus, the dominance result is not convincing. Now considering the critical value of γ, $\gamma^1(z^+)$ equals to 0.87 for both z=1 and z=2 at the first order. The results indicate that the efficiency cost of taxing communication is 13% smaller than that of taxing health which could reduce poverty for poverty indices belonging to the π^1.

Table 7

INDIRECT TAXATION FOR FOOD AND ALCOHOL

Critical poverty line $z^s(\gamma^+)$ for different economic efficiency cost γ and for different order s

	γ=1	γ=1.5
$z^1(\gamma^+)$	2.932	0.799
	(0.17)	(0.08)
$z^2(\gamma^+)$	---	1.054
	---	(0.12)

$z^3(\gamma^+)$	---	1.28
	---	(0.16)

Critical efficiency cost of $\gamma^s(z^+)$ for different critical poverty line z^+ and for different order s

	Z=1	Z=2
$\gamma^1(z^+)$	0.75	0.75
	(0.06)	(0.04)
$\gamma^2(z^+)$	---	---

The Last comparison is between food and alcohol, which are illustrated by Figure 8, Figure 9 and Figure 10 for order s=1, s=2 and s=3 respectively. Figure 8 shows that a marginal tax reform which increase tax on alcohol and provide a subsidy for food would be poverty-reducing. When γ=1 ,the two CD-curves cross at 2.932 with an estimate standard error 0.17, which means the 95% confidence interval for critical poverty line is [2.5988, 3.2652]. This result states that an increase of taxes on alcohol which would allow for an increase subsidy of food would reduce poverty for poverty line equal or inferior to the 2.5988 times of official poverty line. Also, the marginal tax reform for food and alcohol is not first-order welfare improving tax reform since the two CD-curves intersect.

For order s=2 and s=3, Figure 9 and Figure10 clearly show that the CD-curve of food is everywhere above the CD-curve of alcohol. The results are also shown in the Table 7 by the nonexistence of $z^2(\gamma^+)$ and $z^3(\gamma^+)$.

If γ=1.5, the CD-curves of food and alcohol have an intersection at 0.799 with a standard error 0.08. The 95% confidence interval is then [0.6422, 0.9558]. This is to say if the economic efficiency cost of taxing alcohol is 50% larger than that of taxing food, this indirect tax reform would be effective up to poverty line equals to 0.6422. Through the same rationale, indirect tax reform will be efficient for poverty lines equal to or less than 0.8188 and 0.9664 at order 2 and order 3, respectively, given the critical value of $z^2(\gamma^+)$ and $z^3(\gamma^+)$.

Concerning the critical value of efficiency cost, it may be noted that the efficiency cost of taxing alcohol should be 25% less than taxing of food when tax reform reduces poverty. This result holds true for poverty line equals to two times of the official poverty line.

v. Conclusion

In this paper, three hypothetical marginal tax reforms are analyzed. Using normalized consumption dominance curve with different ethical orders and different critical values, the appropriate tax strategies in Serbia would be increase tax on transport to subsidize food, increase tax on communication to subsidize health and increase tax on alcohol to provide subsidy on food.

Appendix

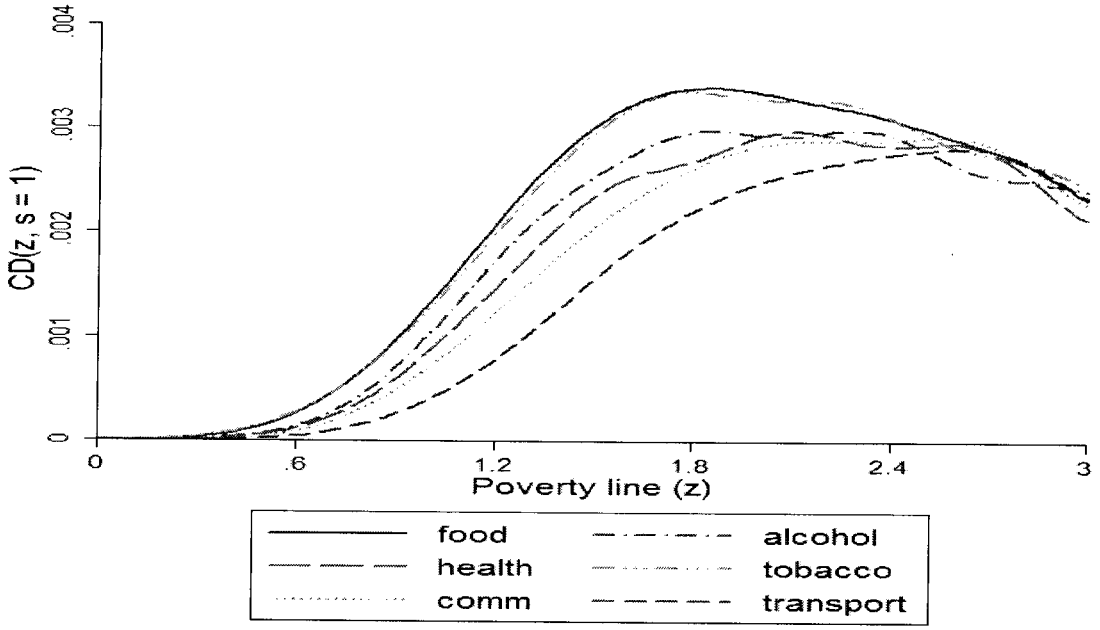

Figure 1

NORMALIZED CD CURVES FOR FOOD, ALCOHOL, HEALTH, TOBACCO, COMM AND TRANSPOT, s=1

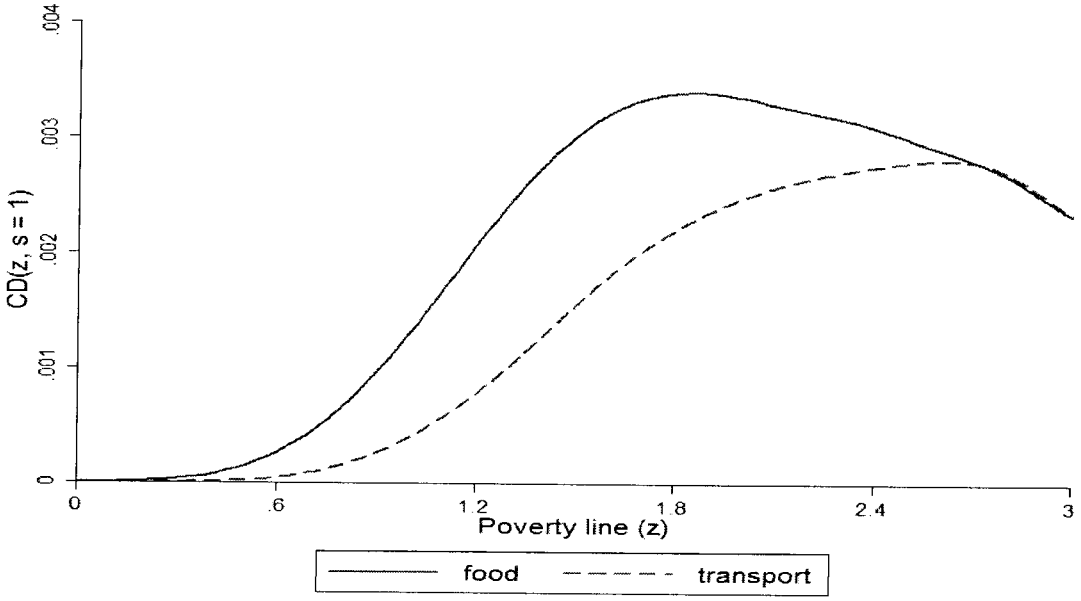

Figure 2

NORMALIZED CD CURVES FOR FOOD AND TRANSPORT, s=1

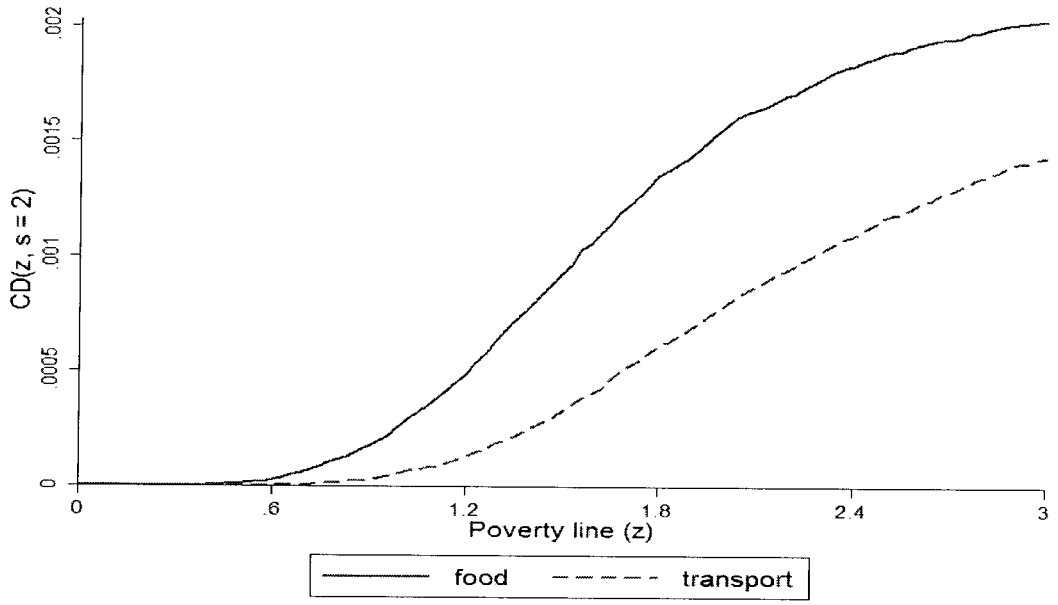

Figure 3

NORMALIZED CD CURVES FOR FOOD AND TRANSPORT, s=2

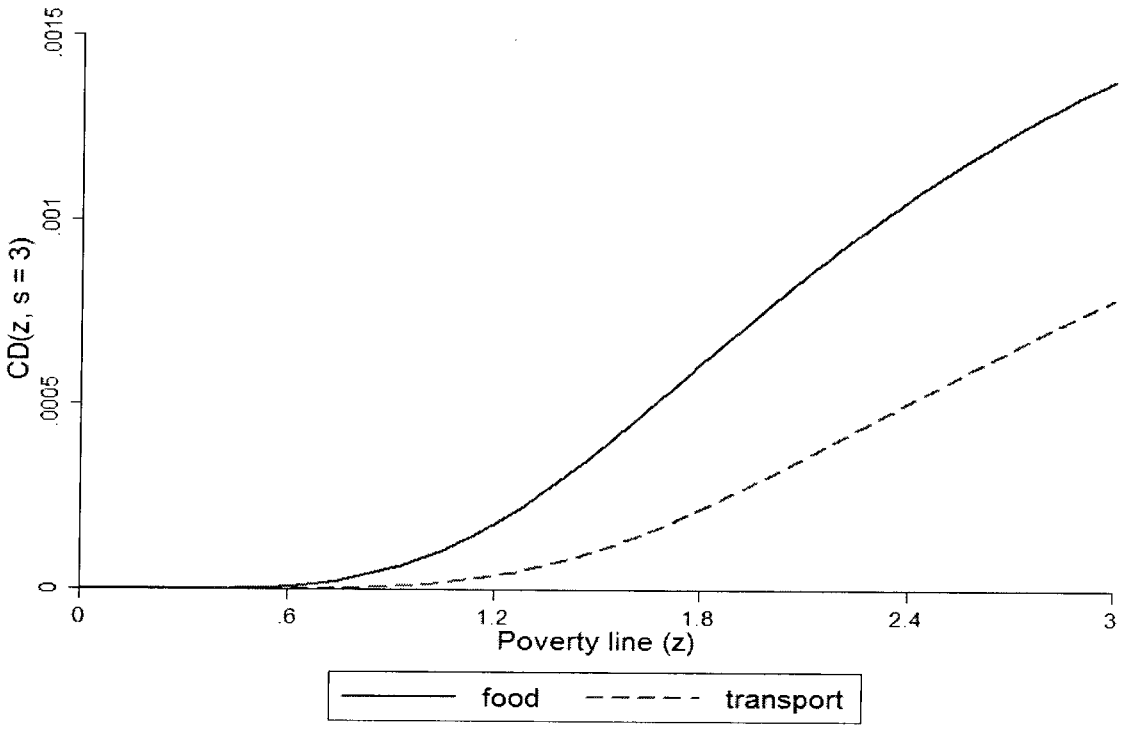

Figure 4

NORMALIZED CD CURVES FOR FOOD AND TRANSPORT, s=3

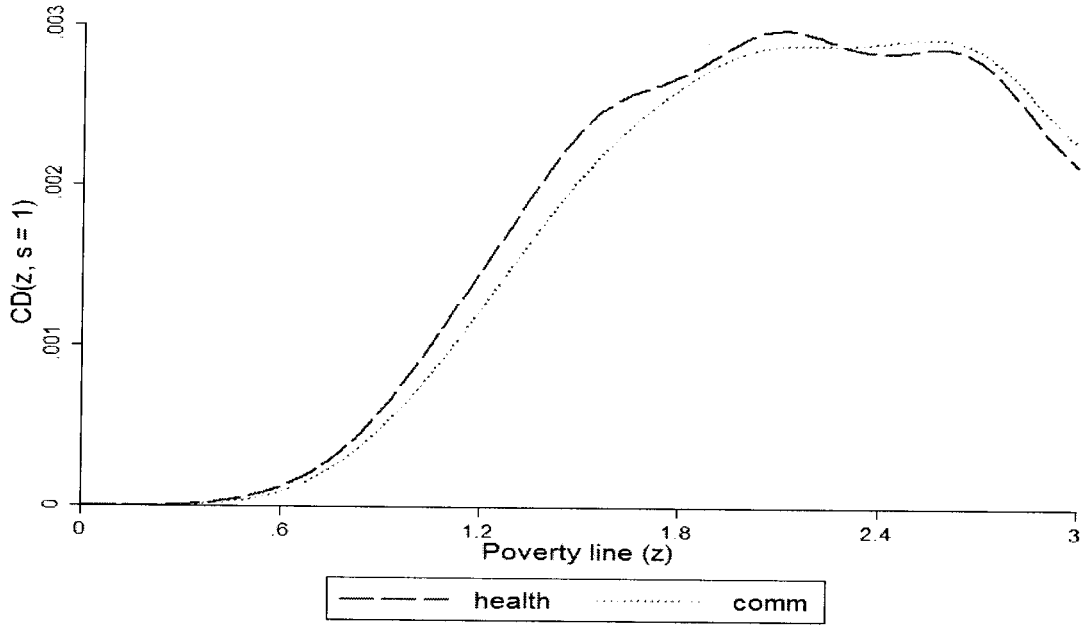

Figure 5

NORMALIZED CD CURVES FOR HEALTH AND COMMUNICATION, s=1

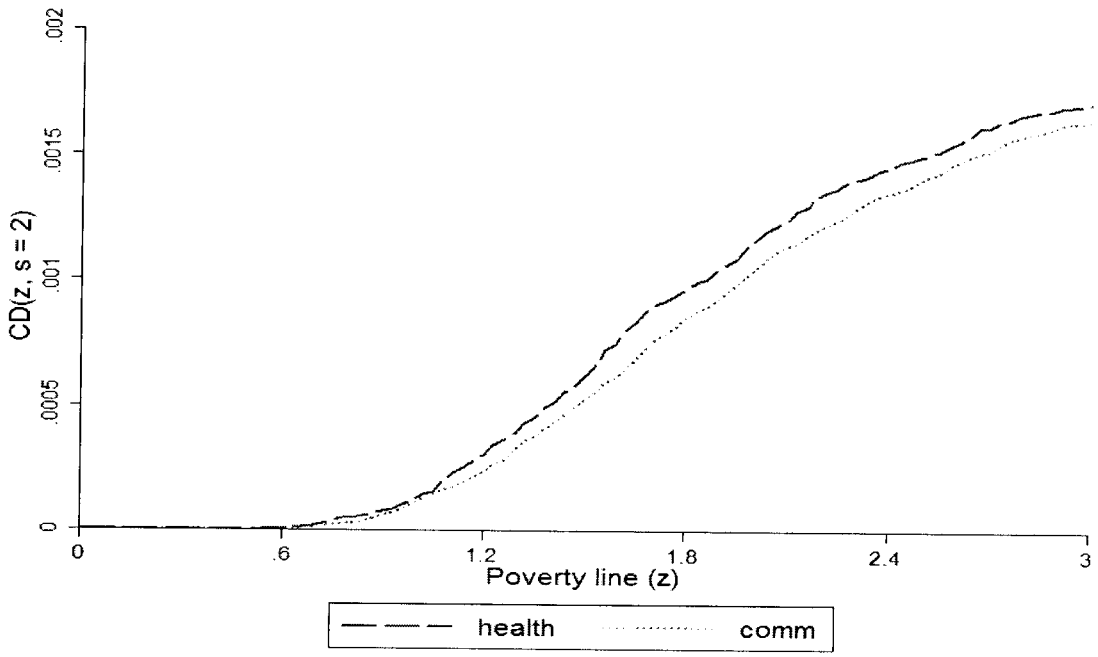

Figure 6

NORMALIZED CD CURVES FOR HEALTH AND COMMUNICATION, s=2

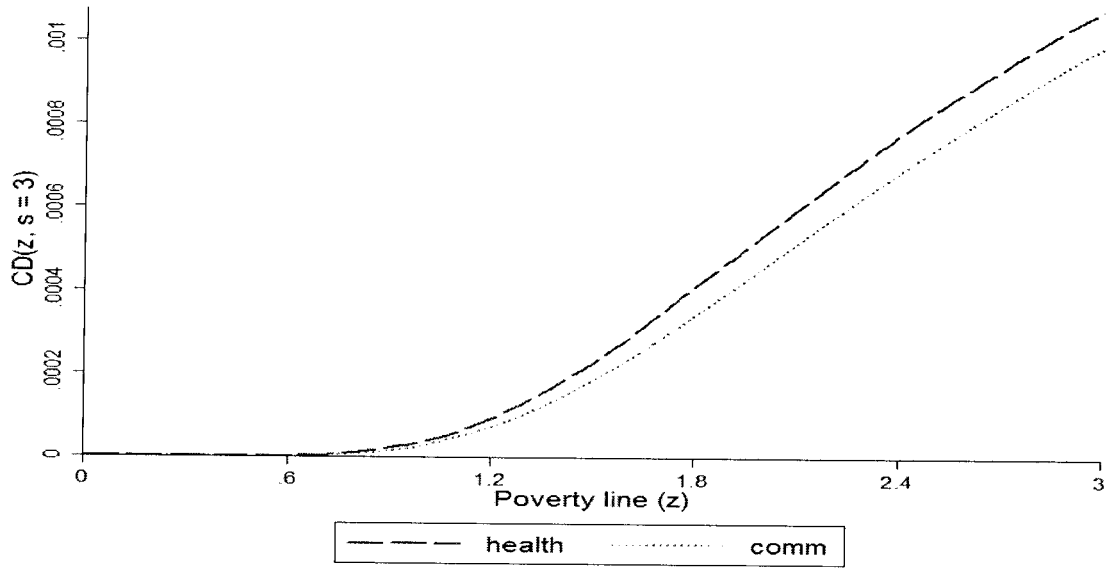

Figure 7

NORMALIZED CD CURVES FOR HEALTH AND COMMUNICATION, s=3

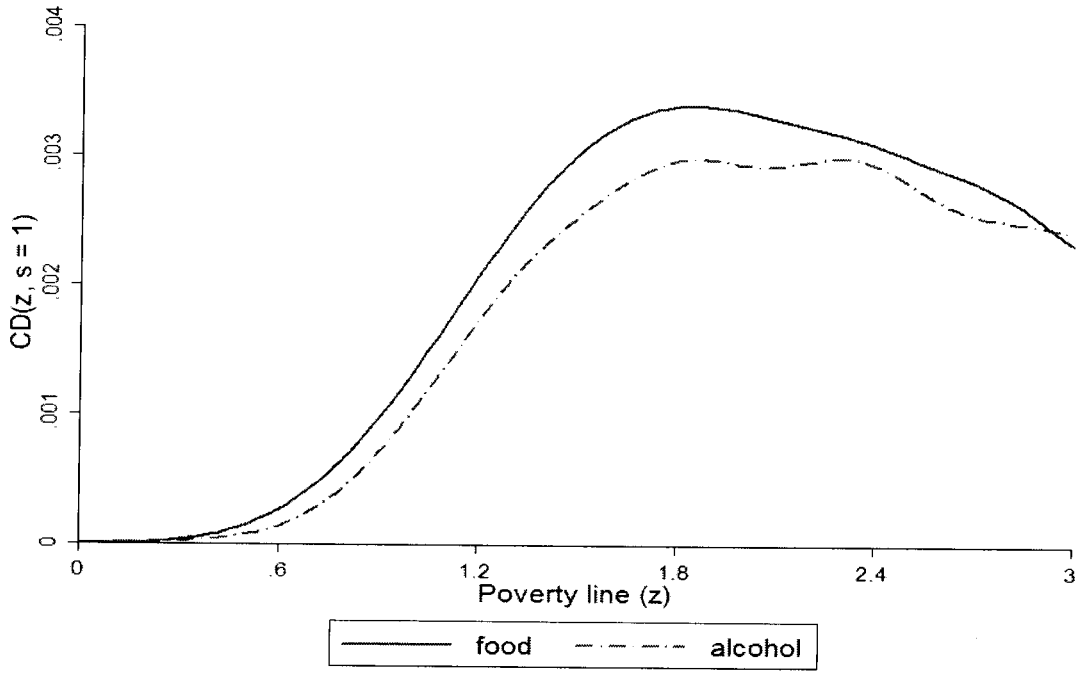

Figure 8

NORMALIZED CD CURVES FOR FOOD AND ALCOHOL, s=1

Figure 9

NORMALIZED CD CURVES FOR FOOD AND ALCOHOL, s=2

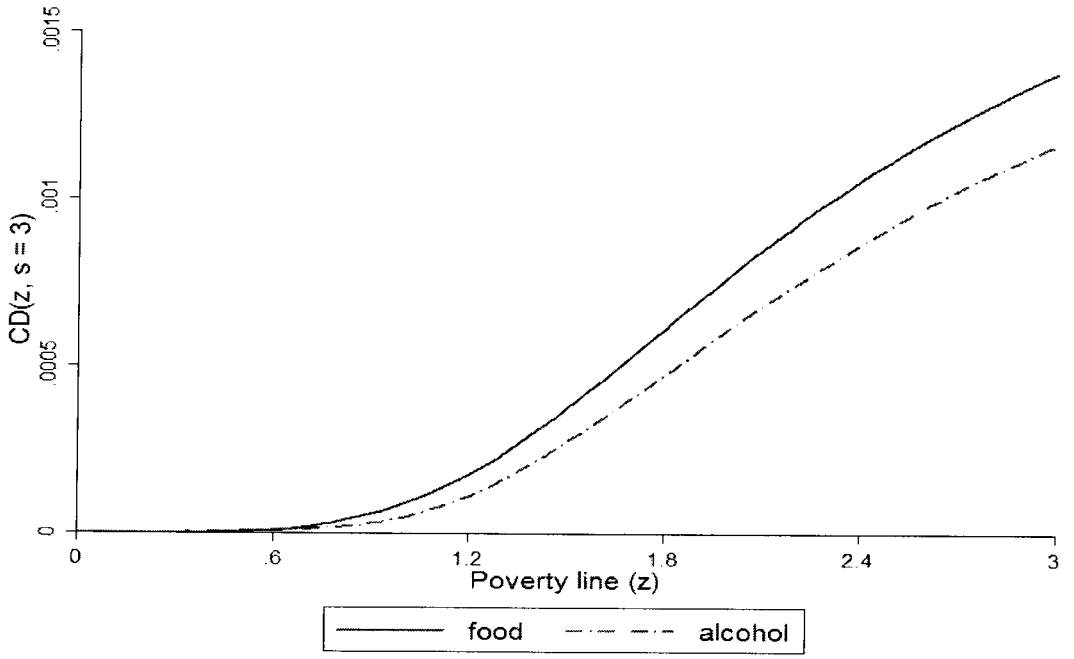

Figure 10

NORMALIZED CD CURVES FOR FOOD AND ALCOHOL, s=3

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