Chapter 7: Analyzing the impact of public policies

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Introduction and summary

- Main question: What is impact on social welfare and poverty of price-changing policies?
- Important information problems in answering that question – main objective of paper is to show how these problems can be (somewhat) circumscribed.
- We are particularly interested in demonstrating the empirical applicability of a social improvement approach: to identify price changes that will be deemed socially desirable by wide spectra of social welfare and poverty analysts

Introduction and summary

- For expositional simplicity, we focus on the effect of indirect tax reforms (TR)
- This includes consideration of subsidies on food, education, energy and transportation

Methodology

- Think of two goods, j and l, and ask whether it is socially desirable to increase t_j in order to decrease t_l
- Tax rates may be positive or negative
- We assume that producer prices are constant for expositional simplicity

First measurement difficulty

- Difficulty: Estimation of the impact of price changes on consumer welfare
- The results can be sensitive to a number of theoretical and econometric assumptions
- The task is particularly problematic when the goal is to find globally optimal tax systems

First measurement difficulty

- Here: we focus on the effect of marginal TR
- Actual changes are "slow and piecemeal" (Feldstein 1975)
- Actual tax system is a departure point for TR
- Evaluating the distributive impact of marginal TR does not require estimates of individual demand and utility functions: it can be assessed directly from the observed data alone

Second measurement difficulty

- Difficulty: choosing a social evaluation function (SEF) to measure the social impact of the TR
- This choice poses a fundamental problem: any particular selection of SEF necessarily embodies arbitrary value judgements
- Strategy followed here: to use classes of SEF that incorporate increasingly stronger judgements on the importance of distributive issues
- We consider SEF that take into account everyone's welfare – the traditional social welfare functions – as well as SEF that censor well-being at a poverty line – the poverty indices

Third measurement difficulty

- Difficulty: Estimation of the impact on government tax revenues of a TR
- This impact is linked to the aggregate deadweight loss of taxation and thus to the economic efficiency of a TR
- Estimating this impact can also be difficult and can lead to considerable disagreements among tax analysts

Third measurement difficulty

- We propose instead to estimate the critical efficiency ratio up to which a TR can be said to be socially improving at a given ethical order
- This leaves policy makers free to assess whether the actual efficiency ratio is likely (or can be safely estimated) to be below that critical value
- A similar device is constructed to handle, for poverty measurement, the role of poverty lines (whose estimation is also notoriously difficult and controversial).

Methodology

- Social improvement is checked through the use of simple Consumption Dominance ($\overline{CD}$) curves
- $\overline{CD}$ curves display cumulative consumption shares (weighted by powers of poverty gaps)
- Increasing t_j and decreasing t_l is poverty improving at any given order of ethical dominance if the $\overline{CD}_l$ curve of that order is higher than the $\overline{CD}_j$ curve at every threshold under a maximum "poverty line"
- When that maximum poverty line extends to infinity, the TR is welfare improving

Methodology

- The poverty improvement conditions are less stringent than the welfare improvement ones
- Increasing the order of ethical dominance facilitates the search for a socially improving TR
- To make the tools usable empirically, we also investigate the sampling properties of estimators of $\overline{CD}$ curves, critical poverty lines and critical economic efficiency thresholds.

Notation and definitions

- q: a vector of K consumer prices
- t: vector of tax rates
- Producer prices set to 1 and invariant to changes in t
- $q = 1 + t$ and $dq_k = dt_k$, with q_k and t_k the price of and the tax rate on good k
- y: exogenous income
- $[0, a]$: range of income
- α: consumer preference parameter
- Ω: set of preferences

Notation and definitions

- $x_k(y, \alpha, q)$: consumption of k
- $F(y, \alpha)$: joint distribution function of α and y
- $F(\alpha | y)$: conditional distribution of α given y
- $F(y)$: marginal distribution of nominal income
- $x_k(y, q)$: expected consumption of k at income y:

$$x_k(y, q) = \int_{\Omega} x_k(y, \alpha, q)\, dF(\alpha|y).$$

Notation and definitions

- $X_k(q)$: *per capita* consumption of k:

$$X_k(q) = \int_0^a x_k(y, q)\, dF(y).$$

- $\overline{x}_k(y, q) = x_k(y, q)/X_k(q)$: normalised consumption
- $y^R = \rho\left(y, \alpha, q, q^R\right)$: real (or equivalent) post-reform income
- Reference prices q^R set to q

Consumer welfare

- How is consumer welfare affected by a marginal change in t_k?
- Using Roy's identity, we find:

$$\left.\frac{\partial\rho(y,\alpha,q,q^R)}{\partial t_k}\right|_{q=q^R} = -x_k\left(y,\alpha,q^R\right).$$

- $X_k(q)$: average welfare cost of increase in t_k

Government budget

- How is government budget affected by TR?
- $R(q) = \sum_{k=1}^{K} t_k X_k(q)$: *per capita* commodity tax revenues
- Define γ as:

$$\gamma = \frac{X_l + \sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial q_l}}{X_l} \Bigg/ \frac{X_j + \sum_{k=1}^{K} t_k \frac{\partial X_k}{\partial q_j}}{X_j}$$

- Revenue neutrality requires $dq_j = -\gamma \left(\frac{X_l}{X_j} \right) dq_l$.

Measuring poverty and social welfare

- We follow the custom and focus for simplicity on classes of poverty and social welfare indices that are additive
- For poverty

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

- z: poverty line in real income space
- $p(y, z) = 0$ for all $y > z$

Measuring poverty

- Consider classes $P(z) \in \Pi^s$ with

$$\Pi^s(z) = \left\{ P(z) \middle| \begin{array}{c} p(y,z) \in \widehat{C}^s(z), \\ (-1)^i p^{(i)}(y,z) \geq 0 \text{ for } i = 0, 1, ..., s, \\ p^{(t)}(z,z) = 0 \text{ for } t = 0, 1, ..., s-2 \end{array} \right\}$$

- $\widehat{C}^s(z)$: set of functions that are s-time piecewise differentiable
- Foster, Greer and Thorbecke (1984) subclass: $\alpha \geq 0$ and

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

Measuring social welfare

- For social welfare, consider U such that:

$$U = \int_0^a u(y)\, dF(y).$$

- Focus on classes Ω^s, $s = 1, 2, \ldots$:

$$\Omega^s = \left\{ U \,\middle|\, \begin{array}{l} u(y) \in C^s(\infty), \\ (-1)^{i+1} u^{(i)}(y) \geq 0 \text{ for } i = 1, 2, ..., s \end{array} \right\}$$

Ethical interpretation

- When $s = 1$: indices are Paretian and symmetric (or anonymous)
- Ordering two distributions for $s = 1$: equivalent to making living standards "parade" (analogy of Pen (1971)).
- First-order welfare-improving TR: Pen-improving TR
- When $s = 2$: indices respect the Pigou-Dalton principle of transfers
- Second-order welfare-improving TR: Dalton-improving TR

Ethical interpretation

- When $s = 3$: indices sensitive to favourable composite transfers
- Third-order welfare-improving TR: Kolm-improving TR
- To interpret higher orders of dominance: can use the generalised transfer principles of Fishburn and Willig (1984)
- essentially postulate that, as s increases, the weight assigned to the bottom of the distribution also increases
- indices then become more "Rawlsian"

Identifying Socially-Efficient Tax Reforms

- We use stochastic dominance curves,

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

which are just sums of powers of poverty gaps, and linear transforms of FGT indices.

- How are dominance curves affected by changes in prices?

$$\frac{\partial D^s(z)}{\partial t_k} = \begin{cases} x_k(z) f(z), \text{ if } s = 1 \\ \frac{1}{(s-2)!} \int_0^z x_k(y) [z-y]^{s-2} dF(y) \text{ if } s = 2, 3, \ldots \end{cases}$$

where $f(z)$ is density of income at z.

Consumption dominance curves

- These derivatives can define "consumption dominance" (*CD*) curves:

$$CD_k^s(z) = \frac{\partial D^s(z)}{\partial t_k}, s = 1, 2, ...$$

- $CD_k^s(z)$ curves can be interpreted as an ethically weighted cost of taxing k.

Normalized consumption dominance curves

- Normalized *CD* curves:

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

- They depict the ethically weighted (or social) cost of taxing k as a proportion of the average welfare cost
- Importantly: they can be used to test the poverty and welfare improvement of tax reforms

Main Theorems

Theorem

A necessary and sufficient condition for a marginal tax reform, $dq_j = -\gamma \left(\frac{X_l}{X_j}\right) dq_l > 0$, to be s-order poverty improving, that is, to decrease poverty weakly for all $P(z) \in \Pi^s(z)$, for all $z \in [0, z^+]$ and for a given $s \in \{1, 2, 3, ...\}$, is that

$$\overline{CD}_l^s(y) - \gamma \overline{CD}_j^s(y) \geq 0, \ \forall y \in \left[0, z^+\right].$$

Main Theorems

Theorem

A sufficient condition for a marginal tax reform, $dq_j = -\gamma\left(\frac{X_l}{X_j}\right) dq_l > 0$, *to be s-order welfare improving, that is, to increase social welfare weakly for all* $W \in \Omega^s$ *and for a given* $s \in \{1, 2, 3, ...\}$, *is that*

$$\overline{CD}_l^s(y) - \gamma\overline{CD}_j^s(y) \geq 0,\ \forall y \in [0, \infty).$$

Critical poverty lines and efficiency ratios

- The ratio $\delta^s(z) = \overline{CD}_l^s(z)/\overline{CD}_j^s(z)$ can be interpreted as the distributive benefit of taxing j instead of l.
- $\delta^1(z)$: normalised ratio of Engel curves at income z.

Critical poverty lines and efficiency ratios

- Recall that γ is the economic cost of taxing j relative to that of taxing l.
- We can re-write conditions of Theorems 1 and 2: check whether $\delta^s(z) \geq \gamma$ for all $z \in [0, z^+]$ and for all $z \in [0, \infty)$
- A tax reform is s-order socially improving if its distributive benefit exceeds its economic cost over a range of alternative poverty lines.

Critical poverty lines and efficiency ratios

- Critical economic efficiency threshold:

$$\gamma_s(z^+) = \inf\left\{\delta^s(z) \left| z \in [0, z^+]\right.\right\}$$

- Critical upper poverty line:

$$z_s(\gamma^+) = \sup\left\{z \left| \delta^s(y) \geq \gamma^+, y \in [0, z], z \leq z^{++}\right.\right\}$$

- Increasing t_j and decreasing t_l is socially improving so long as γ and z are not allowed to exceed certain critical thresholds

Further results

- Pen-improvement not possible when $\gamma \geq 1$
- Welfare improvement of any order not possible when $\gamma > 1$
- Thus, welfare improvement of any ethical order requires economic efficiency
- Poverty improvement at order 1 and 2 is possible even when $\gamma > 1$ when $z^+ < a$: the excess burden of the reform then has to be paid by those households above z^+

References

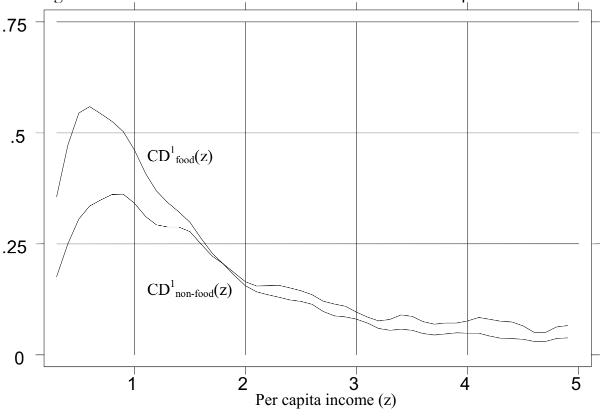
- Duclos, J.-Y., P. Makdissi and Q. Wodon (2008), Socially-Improving Tax Reforms, *International Economic Review*, Vol. 49, No. 4, 1505-1537.
- Audet, M., D. Boccanfuso and P. Makdissi (2007), Food Subsidies and Poverty in Egypt: Analysis of Program Reform Using Stochastic Dominance, *Journal of Development and Economic Policies*, Vol. 9, No. 2, 57-79.

Illustration I: Mexico

- Household-level data from Mexico's 1996 ENIGH, a nationally representative survey with detailed income and consumption modules
- In 1996, there was a VAT exemption on food expenditures in Mexico.

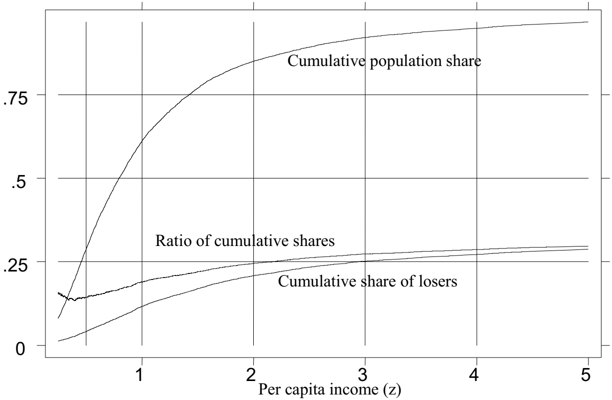
Food vs non food expenditures

Figure 3: Normalized CD curves for food and non-food expenditures



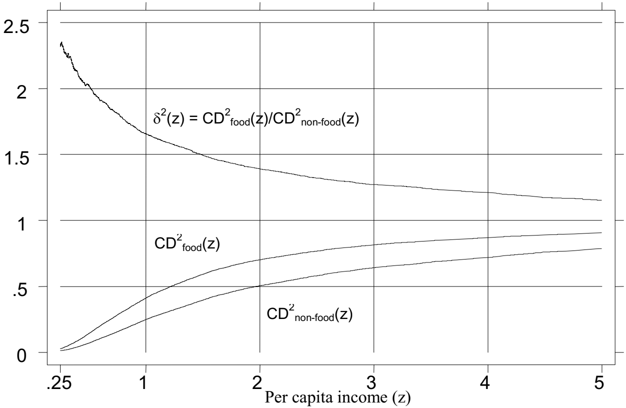
Losers from the reform

Figure 4: Share of losers from food/non-food tax reform



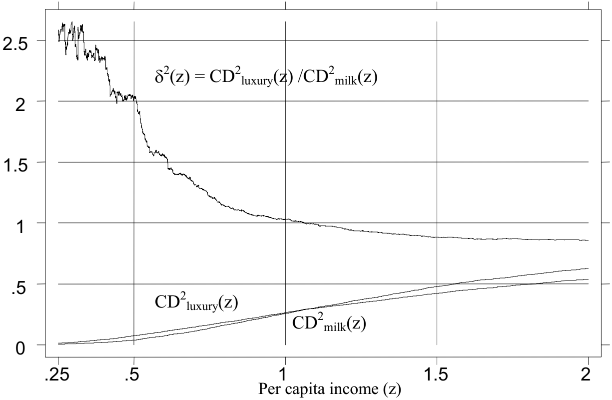
Food vs non food expenditures

Figure 5: CD curves for food and non-food expenditures, s=2



Mixed bundle of food vs pasteurized milk,

Figure 6: CD curves for mixed bundle and pasteurized milk, s=2



Food vs non food expenditures

	Critical efficiency ratios $\gamma_s(z^+)$ for different maximum poverty lines z^+ and for different orders of dominance s		
	z^+=0.5 (28.5% of population covered)	z^+=1 (60.9% of population covered)	z^+=2 (85.0% of population covered)
$\gamma_1(z^+)$	1.782 (0.032)	1.354 (0.027)	0.947 (0.029)
$\gamma_2(z^+)$	2.021 (0.041)	1.657 (0.025)	1.390 (0.018)
$\gamma_3(z^+)$	2.140 (0.049)	1.822 (0.028)	1.551 (0.020)

Food vs non food expenditures

	Critical poverty lines $z_s(\gamma)$ for different ratios of economic efficiency costs γ and for different orders of dominance s (*)		
	γ=0.5	γ=1.0	γ=1.5
$z_1(\gamma)$	4.272 (0.127)	1.793 (0.099)	0.752 (0.030)
$z_2(\gamma)$	-	-	1.483 (0.156)
$z_3(\gamma)$	-	-	2.347 (0.145)

Mixed bundle of food vs pasteurized milk,

	Critical efficiency ratios $\gamma_s(z^+)$ for different maximum poverty lines z^+ and for different orders of dominance s		
	z^+=0.5 (28.5% of population covered)	z^+=1 (60.9% of population covered)	z^+=2 (85.0% of population covered)
$\gamma_1(z^+)$	1.222 (0.080)	0.800 (0.043)	0.705 (0.072)
$\gamma_2(z^+)$	1.997 (0.181)	1.028 (0.039)	0.856 (0.019)
$\gamma_3(z^+)$	2.214 (0.250)	1.256 (0.059)	0.946 (0.025)

Mixed bundle of food vs pasteurized milk,

	Critical poverty lines $z_s(\gamma)$ for different ratios γ of economic efficiency costs and for different orders of dominance s (*)		
	γ=0.5	γ=1.0	γ=1.5
$z_1(\gamma)$	11.390 (0.065)	0.600 (0.033)	0.421 (0.028)
$z_2(\gamma)$	-	1.062 (0.212)	0.613 (0.083)
$z_3(\gamma)$	-	1.623 (0.140)	0.795 (0.052)

Food subsidy in Egypt

- Household-level data from *Egypt Integrated Household Survey* (EIHS) of 1997, a nationally representative survey with detailed income and consumption modules
- In 1997 the list of subsidized foods consists of sugar, oil, wheat and bread.
- In 2003, ths list has been changed for sugar, oil, macaroni, lentils and beans.

Food subsidy in Egypt

- We use per capita consumption.
- We compute the depreciation of durables.
- We use a hedonic regression to impute rental value of housing for owners.

Food subsidy in Egypt

Indirect taxation " Macaroni " against " Tamwin Bread" , Egypt 1997		
Critical efficiency ratio “Gamma” for various poverty lines (Z+)		
	z+ = 1	z+ = 2
gamma2 z+	1.23	1.04
gamma3 z+	1.49	1.13
Critical poverty lines “Z GAMMA” for various efficiency parameters “gamma”		
	gamma = 1	gamma = 1.5
z2 gamma	2.57	0.5
z3 gamma	-	1

Food subsidy in Egypt

Indirect taxation " Beans (kid) " against " Tamwin Bread" , Egypt 1997		
Critical efficiency ratio “Gamma” for various poverty lines (Z+)		
	z+ = 1	z+ = 2
gamma2 z+	1.62	1.07
gamma3 z+	2.03	1.22
Critical poverty lines “Z GAMMA” for various efficiency parameters “gamma”		
	gamma = 1	gamma = 1.5
z2 gamma	-	1.06
z3 gamma	-	1.33

Food subsidy in Egypt

Indirect taxation " other beans " against "Tamwin bread" , Égypte 1997		
Critical efficiency ratio “Gamma” for various poverty lines (Z+)		
	z+ = 1	z+ = 2
gamma2 z+	2.88	1.25
gamma3 z+	5.87	1.81
Critical poverty lines “Z GAMMA” for various efficiency parameters “gamma”		
	gamma = 1	gamma = 1.5
z2 gamma	-	1.63
z3 gamma	-	2.59

Food subsidy in Egypt

Indirect taxation " Tamwin flour " against " Lentils " , Egypt 1997		
Critical efficiency ratio “Gamma” for various poverty lines (Z+)		
	z+ = 1	z+ = 2
gamma2 z+	1.18	1.01
gamma3 z+	1.26	1.08
Critical poverty lines “Z GAMMA” for various efficiency parameters “gamma”		
	gamma = 1	gamma = 1.5
z2 gamma	2.37	0.69
z3 gamma	-	0.81

Introduction

- Main question: Is a fiscal reform pro-poor?
- Does the poor’s income increase relatively or absolutely more or less than average.

Consumer welfare

- Remember how consumer welfare is affected by a marginal change in t_i.
- Using Roy's identity, we have found that:

$$\left.\frac{\partial \rho(y, q, q^R)}{\partial t_i}\right|_{q=q^R} = -x_i\left(y, q^R\right).$$

- $X_i(q)$: average welfare gain of a decrease in t_i

Poverty indices

- For simplicity focus on classes of poverty indices that are additive

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

- z: poverty line in real income space
- $p(y,z) = 0$ for all $y > z$
- Consider classes $P(z) \in \Pi^s$ with

$$\Pi^s(z) = \left\{ P(z) \middle| \begin{array}{c} p(y,z) \in \widehat{C}^s(z), \\ (-1)^i p^{(i)}(y,z) \geq 0 \text{ for } i = 0,1,2,...s, \\ p^{(t)}(z,z) = 0 \text{ for } t = 0,1,2,...,s \end{array} \right\}$$

- $\widehat{C}^s(z)$: set of functions that are s-time piecewise differentiable

Definitions

Definition

A movement from an initial distribution F_0 to a posterior distribution F_1 is judged relatively pro-poor by an index $P(z, F(y))$ if $P(z, F_1((1+g)y)) < P(z, F_0(y))$.

Definition

A movement from an initial distribution F_0 to a posterior distribution F_1 is judged absolutely pro-poor by an index $P(z)$ if $P(z, F_1(y+a)) < P(z, F_0(y))$.

Relative pro-poor impact

- Relative pro-poor impact of dt_i on adjusted equivalent income is given by

$$\partial y^{*R}/\partial t_i = \left(-\frac{x_i(y,q)}{y} + \frac{X_i(q)}{\mu}\right) y$$

- Relative pro-poor impact on individual poverty by

$$dp^{*R}(y,z) = p^{(1)}(y,z) \underbrace{\left[\left(-\frac{x_i(y,q)}{y} + \frac{X_i(q)}{\mu}\right) y\right]}_{\partial y^{*R}/\partial t_i} dt_i$$

Absolute pro-poor impact

- Absolute pro-poor impact of dt_i on adjusted equivalent income is given by
$$\partial y^{*A} / \partial t_i = \left(-x_i\left(y,q\right) + X_i\left(q\right)\right) y$$
- Absolute pro-poor impact on individual poverty by

$$dp^{*R}\left(y,z\right) = p^{(1)}\left(y,z\right) \underbrace{\left[\left(-x_i\left(y,q\right) + X_i\left(q\right)\right) y\right]}_{\partial y^{*A} / \partial t_i} dt_i$$

Pro-Poor Consumption Dominance curves

- "Pro-poorness" is checked through the use of simple Absolute or Relative Pro-Poor Consumption Dominance curves
- Relative pro-poor consumption dominance curves are defined as

$$CD_i^{R:s}(z) = \begin{cases} \left[\frac{x_i(z,q)}{X_i(q)} - \frac{z}{\mu}\right] f(y) & \text{for } s = 1 \\ \int_0^z CD_i^{R:s-1}(y)\,dy & \text{for } s \geq 2, \end{cases}$$

- Absolute pro-poor consumption dominance curves are defined as

$$CD_i^{A:s}(z) = \begin{cases} \left[\frac{x_i(z,q)}{X_i(q)} - 1\right] f(z) & \text{for } s = 1 \\ \int_0^z CD_i^{A:s-1}(y)\,dy & \text{for } s \geq 2. \end{cases}$$

Theorem 1

Theorem

A marginal decrease in the tax on good i is η-pro-poor ($\eta \in \{A, R\}$) for all indices $P(z) \in \Pi^s(z)$ and for all poverty lines $z \in [0, z^+]$ if and only if

$$CD_i^{\eta:s}(z) \geq 0, \ \forall z \in \left[0, z^+\right].$$

Definitions

Definition

A good i is said to be an inferior good if $\varepsilon_i^y < 0$ and a normal good if $\varepsilon_i^y > 0$, for all y.

Definition

A normal good is said to be a necessary good if $\varepsilon_i^y < 1$ and a luxury good if $\varepsilon_i^y > 1$, for all y.

Corollary

Corollary

Regardless of the value of s and z^+:

- *a reduction (an increase) in the tax of good i is never (always) A-pro-poor if the good is a normal good;*
- *a reduction (an increase) in the tax of good i is always (never) A-pro-poor if the good is an inferior good;*
- *a reduction (an increase) in the tax of good i is never (always) R-pro-poor if the good is a luxury good;*
- *a reduction (an increase) in the tax of good i is always (never) R-pro-poor if the good is a necessary good.*

Theorem 2

Theorem

A marginal tax reduction for good i financed by a marginal increase in the tax on good j is η-pro-poor ($\eta \in \{A, R\}$) for all indices $P(z) \in \Pi^s(z)$ and for all poverty lines $z \in [0, z^+]$ if and only if

$$CD_i^{\eta:s}(z) - \gamma CD_j^{\eta:s}(z) \geq 0, \ \forall z \in \left[0, z^+\right].$$

Illustration Using ENIGH 2004

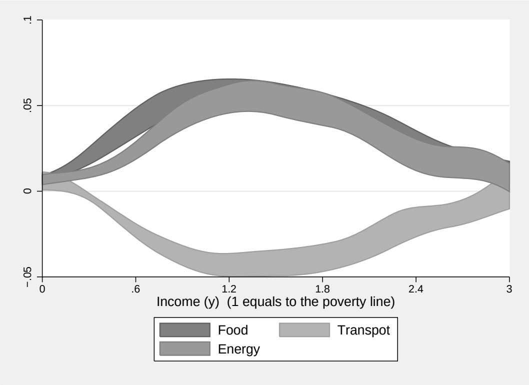
- Household-level data from Mexico's 2004 ENIGH, a nationally representative survey with detailed income and consumption modules.
- We use *per capita* income as the measure of living standards.
- To correct for spatial variation in prices, we assess all incomes in reference to rural prices and multiply urban household incomes by the ratio of rural to urban poverty lines.
- 2004 rural poverty line: 550 pesos per month *per capita*.
- We normalize income by that rural poverty line.

Illustration Using ENIGH 2004

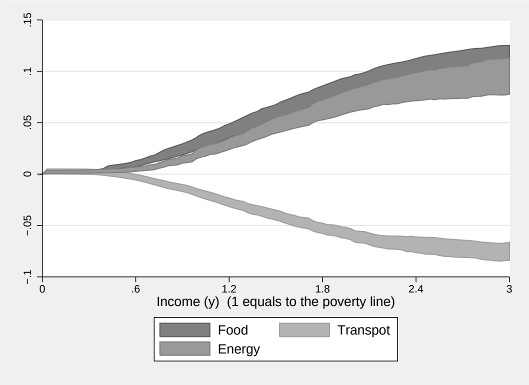
Table: Shares of total expenditures on goods by population quantiles

	Expenditure shares in (%)				
	Poorest	*2*	*3*	*4*	*Richest*
Goods and services					
Food	42.99	28.88	22.61	17.20	8.04
Energy	6.13	5.09	4.45	3.87	2.64
Transport	11.74	11.90	12.09	13.32	12.42
Other goods	39.14	54.13	60.85	65.61	76.9
Food items					
Cereals	25.88	23.91	21.20	18.95	15.90
Milk, meat and fish	28.66	37.92	41.90	45.61	46.44
Vegetables	19.30	18.30	17.63	17.86	17.66
Other food items	26.16	19.87	19.27	17.58	20.00

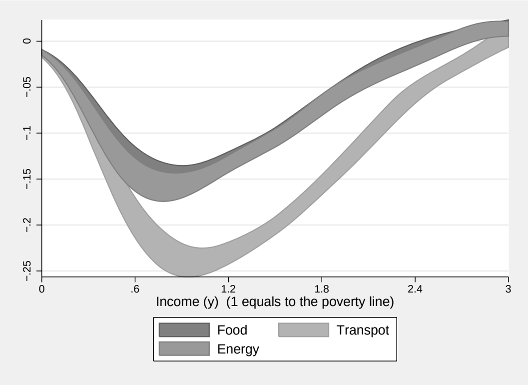
Confident interval (90 %) of relative pro-poor consumption dominance curves ($s = 1$)



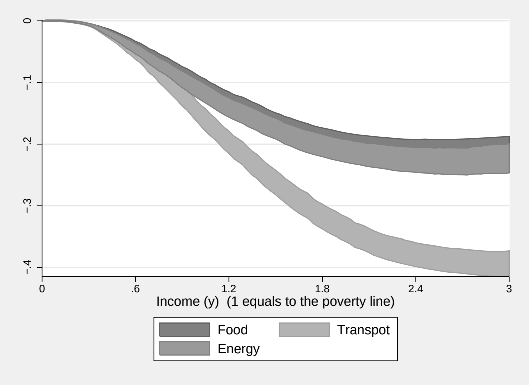
Confident interval (90 %) of relative pro-poor consumption dominance curves ($s = 2$)



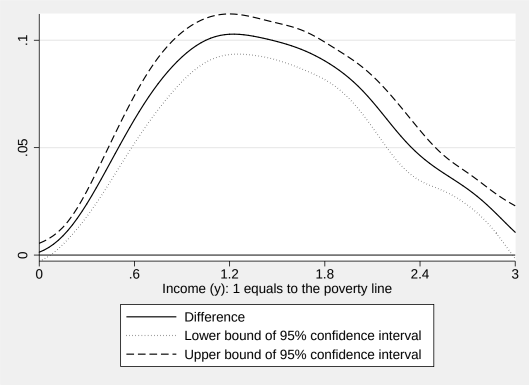
Confident interval (90 %) of absolute pro-poor consumption dominance curves ($s = 1$)



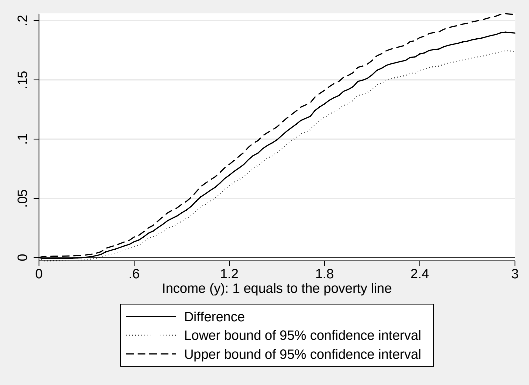
Confident interval (90 %) of absolute pro-poor consumption dominance curves ($s = 2$)



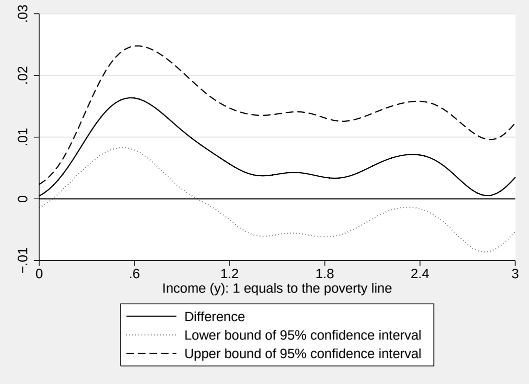
$CD_{Food}^{A:s=1} - CD_{Transport}^{A:s=1}$



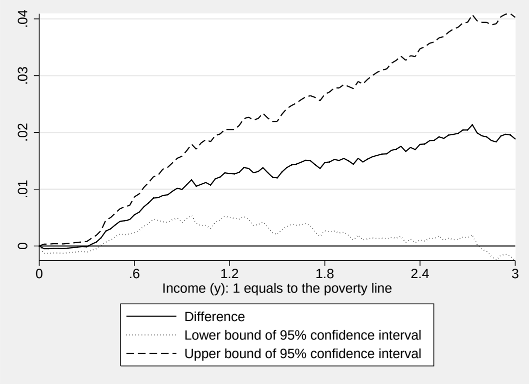
$CD^{A:s=2}_{Food} - CD^{A:s=2}_{Transport}$



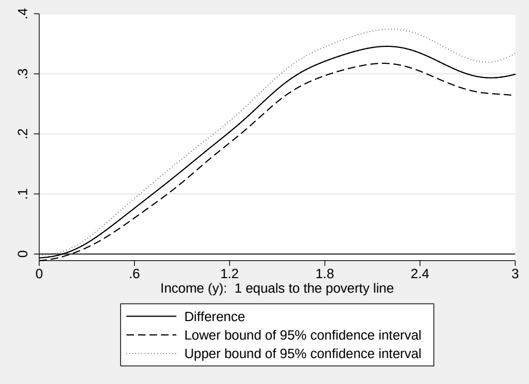
$CD^{A:s=1}_{Food} - CD^{A:s=1}_{Energy}$



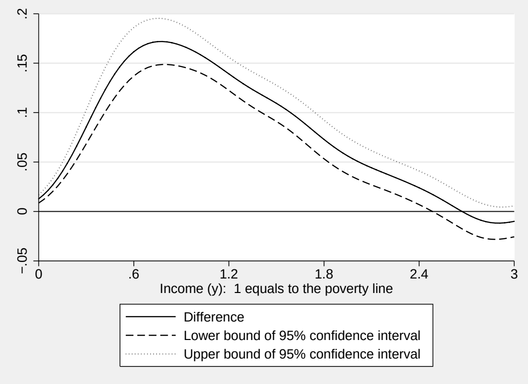
$CD^{A:s=2}_{Food} - CD^{A:s=2}_{Energy}$



$CD^{R:s=1}_{Food} - CD^{R:s=1}_{Energy}$



$CD^{R:s=2}_{Food} - CD^{R:s=2}_{Energy}$



Notation and definitions

- y: equivalent income
- $F(y)$: cumulative distribution of equivalent income
- $f(y) = F'(y)$: density of income
- $t_k(y)$: average transfer from program k per beneficiary of income y
- $\tau_k(y)$: proportion of the population at income y that benefits from program k
- $\phi_k(y) = \tau_k(y) \cdot f(y)$: targeting function
- $\Phi_k = \int_0^a \phi_k(y)\, dy \leq 1$: overall share of the population that benefits from the program.

Notation and definitions

- $G_k(y) = \frac{\int_0^y \phi_k(x)dx}{\Phi_k}$: cumulative distribution function of benefit recipients
- $g_k(y) = \frac{dG_k(y)}{dy} = \frac{\phi_k(y)}{\Phi_k}$: density of recipients
- $T_k = \int_0^a t_k(y)\,\phi_k(y)\,dy$: program k's mean transfer across the population
- $\bar{t}_k = \frac{T_k}{\Phi_k} = \int_0^a t_k(y)\,g_k(y)\,dy$: average transfer *among* program k's beneficiaries

Measuring poverty

- We follow the custom and focus for simplicity on classes of additive poverty indices

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

- z: poverty line in real income space
- $p(y,z) = 0$ for all $y > z$

Measuring poverty

- Consider classes $P(z) \in \Pi^s$ with

$$\Pi^s(z) = \left\{ P(z) \left| \begin{array}{c} p(y,z) \in \widehat{C}^s(z), \\ (-1)^i p^{(i)}(y,z) \geq 0 \text{ for } i = 0, 1, ..., s, \\ p^{(t)}(z,z) = 0 \text{ for } t = 0, 1, ..., s-2 \end{array} \right. \right\}$$

- $\widehat{C}^s(z)$: set of functions that are s-time piecewise differentiable

Transfer reforms

- We will consider (marginal) proportional changes in the initial transfer schedules.
- An agent at income y who is already in receipt of a transfer $t_k(y)$ will thus see his income increase by $t_k(y)\Delta t_k$ following the reform
- Those not already in receipt of the transfer will not be affected by this marginal reform.

Transfer reforms

- The impact of such a reform can then be decomposed into targeting and allocation components as follows:

$$t_k(y)\,\Delta t_k = \underbrace{\bar{t}_k \Delta t_k}_{\text{Targeting}} + \underbrace{\left(t_k(y) - \bar{t}_k\right)\,\Delta t_k}_{\text{Allocation}}.$$

- The reform $t_k(y)\,\Delta t_k$ has the effect of keeping unchanged the relative distribution of benefits $t_k(y)$, since everyone's benefit is increased by the same proportion.
- The targeting component assigns the *same absolute* marginal benefit to all existing recipients.
- The allocation component adds marginally to benefits among recipients in proportion to the difference between existing individual and mean allocation.

Dominance curves

- Program dominance curves (PD)

$$PD_k^s(z) = \begin{cases} \frac{t_k(z)}{\bar{t}_k} g_k(z) & \text{if } s = 1 \\ (s-1)z^{1-s} \int_0^z (z-y)^{s-2} \frac{t_k(y)}{\bar{t}_k} g_k(y)\, dy & \text{if } s > 1. \end{cases}$$

- Targeting dominance curves (TD)

$$TD_k^s(z) = \begin{cases} g_k(z) & \text{if } s = 1 \\ (s-1)z^{1-s} \int_0^z (z-y)^{s-2} g_k(y)\, dy & \text{if } s > 1. \end{cases}$$

- Allocation dominance curves (AD)

$$AD_k^s(z) = \begin{cases} \frac{t_k(z)-\bar{t}_k}{\bar{t}_k} g_k(z) & \text{if } s = 1 \\ (s-1)z^{1-s} \int_0^z \frac{t_k(y)-\bar{t}_k}{\bar{t}_k} (z-y)^{s-2} g_k(y)\, dy & \text{if } s > 1. \end{cases}$$

Theorem 1

Theorem

A revenue-neutral marginal policy reform that increases proportionately all transfers under program k and reduces proportionately all those under program l will reduce poverty for all poverty indices $P(z) \in \Pi^s(z)$ and for all poverty lines $z \in [0, z^+]$ if and only if

$$PD_k^s(y) - \gamma PD_l^s(y) \geq 0 \text{ for all } y \in [0, z^+].$$

Theorem 2

Theorem

A revenue-neutral "lump-sum" marginal policy reform that increases by the same amount the income of all recipients of program k and decreases by the same amount the income of all recipients of program l will decrease poverty for all poverty indices $P(z) \in \Pi^s(z)$ and for all poverty lines $z \in [0, z^+]$ if and only if

$$TD_k^s(y) - \gamma TD_l^s(y) \geq 0 \text{ for all } y \in \left[0, z^+\right].$$

Theorem 3 and 4

Theorem

A marginal reform of program k that increases proportionately the spread of all transfers from their mean value will decrease poverty for all poverty indices $P(z) \in \Pi^s(z)$ and for all poverty lines $z \in [0, z^+]$ if and only if

$$AD_k^s(y) \geq 0 \text{ for all } y \in \left[0, z^+\right].$$

Theorem

A revenue-neutral marginal policy reform that increases proportionately all transfers under program k and reduces proportionately all transfers under program l will improve allocation for all poverty indices $P(z) \in \Pi^s(z)$ and for all poverty lines $z \in [0, z^+]$ if and only if

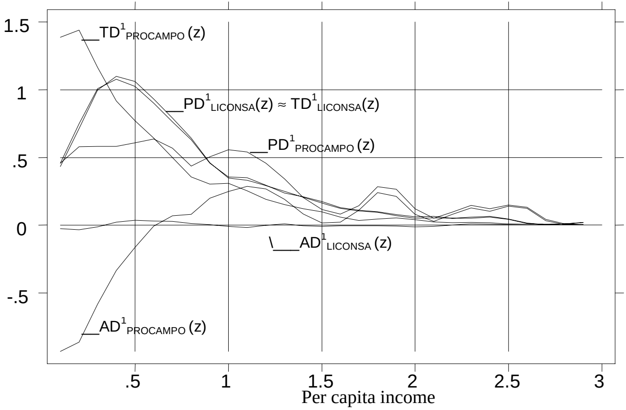
$$AD_k^s(y) - \gamma AD_l^s(y) \geq 0 \text{ for all } y \in \left[0, z^+\right].$$

Mexican programs and data

- We use the Encuesta de Características Socioeconómicas de los Hogares, ENCASEH survey for 1997.
- The survey covers most areas of the countries and it has detailed information on program participation.
- The "Program of Direct Payments to the Countryside" (PROCAMPO), is an income-support program for agricultural producers started in 1993/94.
- It provides agricultural producers with a fixed payment per hectare that is not linked to current production trends.
- The Liconsa (Leche Industrializada Conasupo) provides means tested milk subsidies.
- Qualifying families can purchase from 8 to 24 liters of milk per week at a discount of roughly 25% off the market price. The ration of milk is determined by the number of children under the age of 12.

First order dominance

Figure 1: Procampo vs Liconsa, Poverty Dominance, s=1



Second order dominance

Figure 2: Procampo versus Liconsa, Poverty Dominance, s=2