14.771 Development Economics: Microeconomic issues and Policy Models

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14.771: Public Finance Lecture 2

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Outline

- Basic problem: lack of information about who is really poor.
  - This is a problem everywhere. See US PF literature.
  - But the problem is particularly severe in developing countries: we don't even observe income!
- Two approaches:
  - Broad subsidies (e.g., food subsidies)
  - Try to do targeted transfers anyway

Poverty metrics

- Standard decomposable metric developed by Foster, Greer, and Thorbecke (1984):
  - Define z as the poverty line.
  - Then for $\alpha \geq 0$ define

$$P_\alpha = \int_0^z \left(\frac{z-y}{z} \right)^\alpha f(y)\, dy$$

- Special cases:
  - $P_0 = \int_0^z f(y)\, dy$ is the "headcount" ratio, i.e., number of poor people
  - $P_1 = \int_0^z \left(\frac{z-y}{z} \right) f(y)\, dy$ is the "poverty gap",i.e., the amount of money required to bring all poor people up to the poverty line.
  - $\alpha > 1$ puts more weight on the poverty of very poor.
- Key property is decomposability. Assume i subgroups with population shares λ_i. Then

$$P_\alpha = \sum_i \lambda_i P_{i,\alpha}$$

Thinking about transfers

- Assume for the moment we cannot directly identify poor households (i.e., no targeting)
- Besley and Kanbur (1988): How do we evaluate subsidies in terms of poverty reductions?
  - Infra-marginal subsidies
    - To everyone
    - With geographical targeting
  - Marginal subsidies (i.e., price changes)
    - To everyone
    - When there are both producers and consumers

Notation

- Since we're talking about subsidies we sometimes need two price vectors:
  - p is the undistorted world price vector
  - q is the price vector faced by households
- Indirect utility function: $V(q, y)$
- Define equivalent income as income at world price vector, i.e.

$$y_E(p, q, y),$$

defined by

$$V(p, y_E) = V(q, y)$$

Infra-marginal subsidies

- Typically happen in the form of ration shops, where each household entitled to buy x kg of subsidized food
- Can be thought of as lump-sum transfer of size m, where m is monetary equivalent of subsidy at p prices
- Impact on poverty:

$$P_\alpha = \int_0^z \left[\frac{z_E - y_E\left(p, p, y + m\right)}{z_E} \right]^\alpha f\left(y\right) dy$$

- Taking derivatives with respect to m:

$$\begin{aligned} \frac{\partial P_\alpha}{\partial m} &= \frac{\alpha}{z_E} \int_0^z \left[\frac{z_E - y_E\left(p, p, y + m\right)}{z_E} \right]^{\alpha - 1} \left(-\frac{\partial y_E}{\partial m} \right) f\left(y\right) dy \\ &= -\frac{\alpha}{z_E} P_{\alpha - 1} \end{aligned}$$

- So if we care about poverty gap ($\alpha = 1$), then impact of inframarginal subsidy is proportional to the headcount ratio.

Geographical targeting

- Geographical targeting is much easier than individual targeting, since we can use representative household surveys to figure out the geographical distribution of poverty
- This allows us to improve substantially on lump-sum transfers.
- Suppose i regions, population shares represented by λ_i.
- Increasing budget to region i by b_i gives each person in region i a transfer of $\frac{b_i}{\lambda i}$
- Using the logic from before,

$$\frac{\partial P_\alpha}{\partial b_i} = -\frac{\alpha}{z_E} P_{i,\alpha-1}$$

- So, if objective is to minimize national P_α, give infra-marginal subsidies at the margin to regions with highest $P_{\alpha-1}$. I.e., to reduce poverty gap, put ration shops in areas with high poverty rates, since that is where money most efficiently reaches the poor.

Geographical targeting

- How is geographical targeting done in practice?
- One approach: Poverty maps. Elbers, Lanjouw and Lanjouw (2003)
- Idea:
  - Representative household survey has data on consumption, for small number of people
  - Census has data on every individual (age, education, etc), but doesn't measure consumption
  - So project consumption on census characteristics in household survey, and use census to extrapolate out of sample
  - Standard errors need to be corrected for spatial autocorrelation
- Big savings in cost:
  - In Cambodia, geographic targeting at province level reduces cost of given poverty reduction by 45%; targeting at commune level reduces cost of given poverty reduction by 69%! (Elbers et al 2007)

Price subsidies at the margin

- Price subsidies also affect consumer choices.
- Notation:
  - Post-tax prices: $q_i = p_i + t_i$
  - Effect on poverty of change in subsidy t_i:

$$\frac{\partial P_\alpha}{\partial t_i} = \frac{\alpha}{z_E} \int_0^z \left[\frac{z_E - y_E(p, q, y)}{z_E} \right]^{\alpha - 1} \left(-\frac{\partial y_E}{\partial q_i} \right) f(y)\, dy$$

  - Consumer demand $x_i(q, y)$. Define

$$\overline{x}_i = \int_0^\infty x_i f(y)\, dy \text{ (mean consumption of } i\text{)}$$

$$\overline{x}_i^P = \frac{\int_0^z x_i f(y)\, dy}{\int_0^z f(y)\, dy} \text{ (mean consumption of } i \text{ by poor)}$$

  - Government budget constraint:

$$\int_0^\infty \left[\sum_k t_k x_k(q, y) \right] f(y)\, dy = B$$

Effect of a revenue-neutral change in taxes

- Consider taxes on two commodities, t_1 and t_2.
- Budget balance implies

$$\frac{dt_1}{dt_2} = \frac{\int_0^\infty \left(\sum_k t_k \frac{\partial x_k}{\partial t_2} + x_2 \right) f(y)\, dy}{\int_0^\infty \left(\sum_k t_k \frac{\partial x_k}{\partial t_1} + x_1 \right) f(y)\, dy}$$

- Effect of budget-neutral increase in t_1 is:

$$\frac{\partial P_\alpha}{\partial t_1} = \frac{\alpha}{z_E} \int_0^z \left[\frac{z_E - y_E}{z_E} \right]^{\alpha - 1} \left(-\frac{\partial y_E}{\partial q_1} - \frac{\partial y_E}{\partial q_2} \frac{dt_2}{dt_1} \right) f(y)\, dy$$

- To gain intuition, need to understand how equivalent income affected by subsidies, i.e., $\frac{\partial y_E}{\partial q_i}$.

Effect of a revenue-neutral change in taxes

- Simple case: suppose we start from case of no subsidies, so $t_k = 0$ $\forall k$. Then (recalling 14.121)

$$\left.\frac{\partial y_E}{\partial q_i}\right|_{p=q} = -x_i(q, y)$$

$$\begin{aligned}
\frac{\partial P_\alpha}{\partial t_1} &= \frac{\alpha}{z_E}\int_0^z \left[\frac{z_E - y_E}{z_E}\right]^{\alpha-1}\left(-\frac{\partial y_E}{\partial q_1} - \frac{\partial y_E}{\partial q_2}\frac{dt_2}{dt_1}\right) f(y)\, dy \\
&= \frac{\alpha}{z_E}\int_0^z \left[\frac{z_E - y_E}{z_E}\right]^{\alpha-1}\left(x_1 + x_2\frac{dt_2}{dt_1}\right) f(y)\, dy \\
&= \frac{\alpha}{z_E}\int_0^z \left[\frac{z_E - y_E}{z_E}\right]^{\alpha-1}\left(x_1 - x_2\frac{\overline{x}_1}{\overline{x}_2}\right) f(y)\, dy \\
&= \frac{\alpha}{z_E\overline{x}_1}\int_0^z \left[\frac{z_E - y_E}{z_E}\right]^{\alpha-1}\left(\frac{x_1}{\overline{x}_1} - \frac{x_2}{\overline{x}_2}\right) f(y)\, dy
\end{aligned}$$

- Reduction in P depends on relative consumption of x_1 and x_2 by poor

Effect of a revenue-neutral change in taxes

- Special case of $\alpha = 1$ (poverty gap).
- Define H as headcount ratio (fraction poor). Then:

$$\begin{aligned}\frac{\partial P_\alpha}{\partial t_1} &= \frac{\alpha}{z_E \overline{x}_1} \int_0^z \left(\frac{x_1}{\overline{x}_1} - \frac{x_2}{\overline{x}_2} \right) f(y)\, dy \\ &= \frac{\alpha}{z_E \overline{x}_1} H \left(\frac{\overline{x}_1^P}{\overline{x}_1} - \frac{\overline{x}_2^P}{\overline{x}_2} \right)\end{aligned}$$

- Very intuitive: subsidize the commodity where share of commodity consumed by the poor is highest, if goal is to reduce P_1.
- More generalized versions have similar intuitions with appropriate weights.
- If initial taxes not equal to 0, also need to incorporate effect of tax change on other revenues

Infra-marginal vs. marginal subsidies

- Assume positive Engel curves on all goods, so expenditure on all goods increases with income.
  - Then infra-marginal subsidies are always better than marginal subsidies.
  - Intuition: for marginal subsidies, effect on poverty only from share of expenditure from the poor, $\overline{x}_1^P$

Producers and consumers

- Assume income generated by profit function

$$y = \Pi [q, k]$$

  where k are endowments like land.
- For producers,

$$\left.\frac{\partial y_E}{\partial q_i}\right|_{p=q} = -\left[x_i (q, y) - r_i (q, k)\right]$$

  where r is production of commodity. (envelope theorem).
- Define $n = r - x$.
- Then effect of price change is

$$\begin{aligned}\left.\frac{\partial P_\alpha}{\partial t}\right|_{p=q} = & \lambda_1 \frac{\alpha}{z_E} \int_0^z \left[\frac{z_E - y_E}{z_E}\right]^{\alpha-1} x f_1 (y)\, dy + \\ & \lambda_2 \frac{\alpha}{z_E} \int_0^z \left[\frac{z_E - y_E}{z_E}\right]^{\alpha-1} n f_2 (y)\, dy\end{aligned}$$

Producers and consumers

- If $\alpha = 1$, this simplifies to

$$\left.\frac{\partial P_\alpha}{\partial t}\right|_{p=q} = \frac{\alpha}{z_E}\left(\lambda_1 H_1 \overline{x}_1^P + \lambda_2 H_2 \overline{n}_2^P\right)$$

- This is intuitive: effect on poverty depends on mean net consumption among consumers and mean net consumption among producers.

Summary so far

- Inframarginal subsidies tend to be better than price subsidies, unless there are inferior goods that you can subsidize.
- Why?
  - Higher share goes to the poor
  - Don't hurt producers
  - Can do even better with geographic targeting
  - Also: dead-weight loss from distorted prices
- But inframarginal subsidies are much harder to implement (e.g., corruption, operating shops, etc)
- And, even they are not perfect, because large amounts of transfers still go to non-poor.
- Can we do better with more directly targeted transfers?

Targeting

- Targeting options if income is not observable:
  - Proxy-means tests
  - Self-targeting
  - Community-based targeting

Proxy-Means Tests

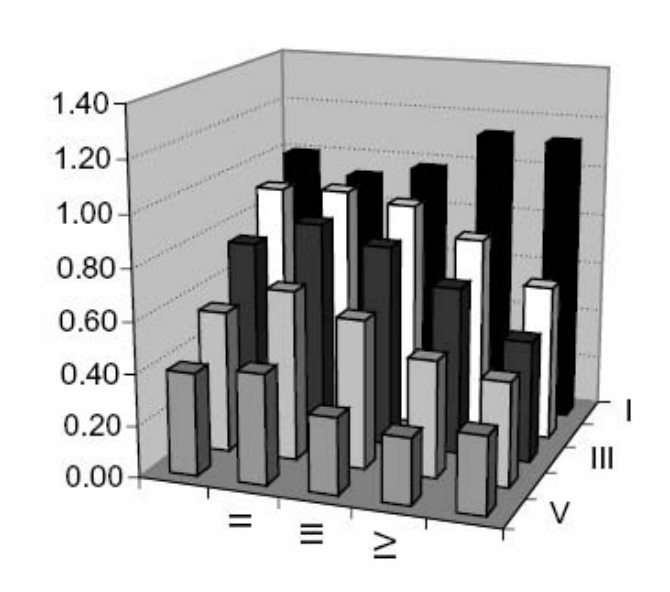
- Similar idea to poverty mapping, but at individual level. This is the main way individual targeting is done in most developing countries. (E.g, Progresa).
- Concept: consumption surveys are expensive, and non-verifiable, so you can't use them to target directly
- Instead: do a survey where you collect data on assets (land, house, motorcycle, etc)
  - Assets capture permanent component of income
  - And they are hard to falsify on a survey
- Use survey data to estimate relationship between consumption and assets, and used predicted consumption for targeting
- Problems
  - R^2 much less than 1, so you don't get poverty exactly right
  - Corruption among surveyors
  - Costly: need to do a census

Self-Targeting

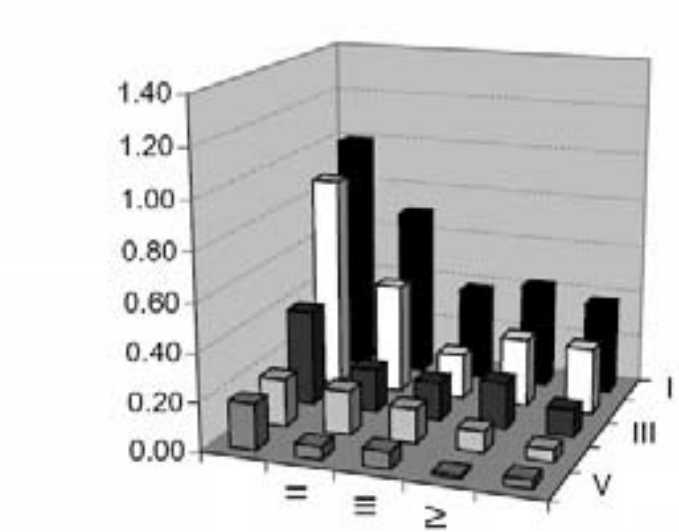
- Nichols and Zeckhauser (1982): "Ordeals" can be used to target the poor
  - Suppose you need to wait in long line to get unemployment benefits
  - Unemployed have low opportunity cost of time, so they are more likely to wait in line
  - Waiting in line therefore serves as a screening device

Self-Targeting In Practice

- Sumarto et al (2003) compares targeting of two programs in Indonesia in 1998
  - Subsidized rice (no self targeting)
  - Public employment scheme (self targeting)



Rice



Employment

Community-Based

- Allow local community to identify poor households
- Idea: local community has much more information than central government
  - This is the premise behind informal insurance, microfinance, etc.
- Problem:
  - If you are using this information to target beneficiaries, this information may not get revealed. Instead, elites may capture the project.
  - Potential tradeoff: better local information vs. more elite capture
- Some existing evidence that communities do know more (Alderman, Galasso and Ravallion)

Current research on targeting

- Alatas, Banerjee, Hanna, Olken, and Tobias (in the field next month!)
- Randomized experiment will compare three targeting methods:
  - Proxy-means test
  - Community ranking
  - Hybrid: community ranking, followed by proxy-means test on bottom 50%.
- Will test corruption in PMT, elite capture of community, and whether hybrid reduces elite capture of ranking process
- To evaluate, we will first conduct household survey to get consumption data, as well as data on family links to village elites and subjective rankings of poverty of other household members
- Stay tuned.

Adding it all up

- Olken (2007) analysis of targeted subsidized rice program in Indonesia
  - In theory, proxy-means test to determine eligibility. Eligible households receive 20kg of subsidized rice per month. Subsidy value about \$4/month, or 9% of HH expenditures for median eligible household.
  - In reality, local officials ignored official criteria and chose beneficiaries.
  - In addition, there was substantial corruption – at least 18% of rice went missing.
- To add this up, calculate social welfare under alternative scenarios:
  - CRRA utility function $u = \frac{c^{1-\rho}}{1-\rho}$
  - Assume all stolen rice goes to richest household in village.
  - Program financed through consumption tax (VAT). Use alternate estimates for marginal cost of public funds (typical developed country estimate: approx 1.3), which measures deadweight loss of taxation
- Normalize social welfare so that complete waste (throw the money in the ocean) = 0% and perfect targeting of transfer = 100%.

Adding it all up

- Local reallocation improved welfare, but corruption may have made program not worthwhile
- Most of the potential gains from redistribution not captured by either PMT or local targeting

Comparing Costs and Benefits

Allocations:		Utilitarian, CRRA utility ρ=1 (% of welfare maximizing utility)	Utilitarian, CRRA utility ρ=2 (% of welfare maximizing utility)
Program	Actual allocation	52.23	35.31
	Actual allocation, no corruption	62.06	42.73
	Official eligibility guidelines	60.90	42.10
No program	Consumption tax, MCF = 1.00	46.90	24.68
	Consumption tax, MCF = 1.20	56.25	29.59
	Consumption tax, MCF = 1.40	65.59	34.48
	Consumption tax, MCF = 1.60	74.91	39.36
Baselines	Pure waste	0.00	0.00
	Welfare maximizing	100.00	100.00

Figure by MIT OpenCourseWare.

Concluding thoughts

- Common theme for taxation and redistribution: lack of information
  - True everywhere, but particularly true in developing countries
  - As a result, tax and redistribution policies look very different
- More broadly, PF and development is a very open area, so lots of room for potential research

Roy's identity details

- Recall

$$V\left(p, y_E\right) = V\left(q, y\right)$$

- Implicit function theorem implies

$$\frac{\partial y_E}{\partial q_i} = \frac{\frac{\partial V(q,y)}{\partial q_i}}{\frac{\partial V(p,y_E)}{\partial y_E}}$$

- Roy's identity implies

$$\frac{\partial y_E}{\partial q_i} = \frac{-\frac{\partial V(q,y)}{\partial y} x_i\left(q, y\right)}{\frac{\partial V(p,y_E)}{\partial y_E}}$$