Economic Policy Analysis: Lecture 4

Public Goods

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Outline

What's a Public Good?

A pure public good is defined by two attributes:

- Non-rival in consumption: One individual's consumption of a good does not affect another's opportunity to consume the good
  Ex: TV= If I watch TV, it does not prevent my neighbor from watching TV
- Non-excludable: Individuals cannot deny each other the opportunity to consume a good
  Ex: National Radio=impossible to exclude listeners.
  Teaching= possible to exclude students from the class; Cable TV=possible to exclude viewers

Public goods suffer from the free rider problem $\Rightarrow$ Inefficient private provision

Figure 1: Public Good: Definitions

Defining Pure and Impure Public Goods

		Is the good rival in consumption?	
		Yes	**No**
Is the good excludable?	Yes	Private good (ice cream)	Impure public good (cable TV)
	No	Impure public good (crowded city sidewalk)	Pure public good (national defense)

Figure 2: Private good

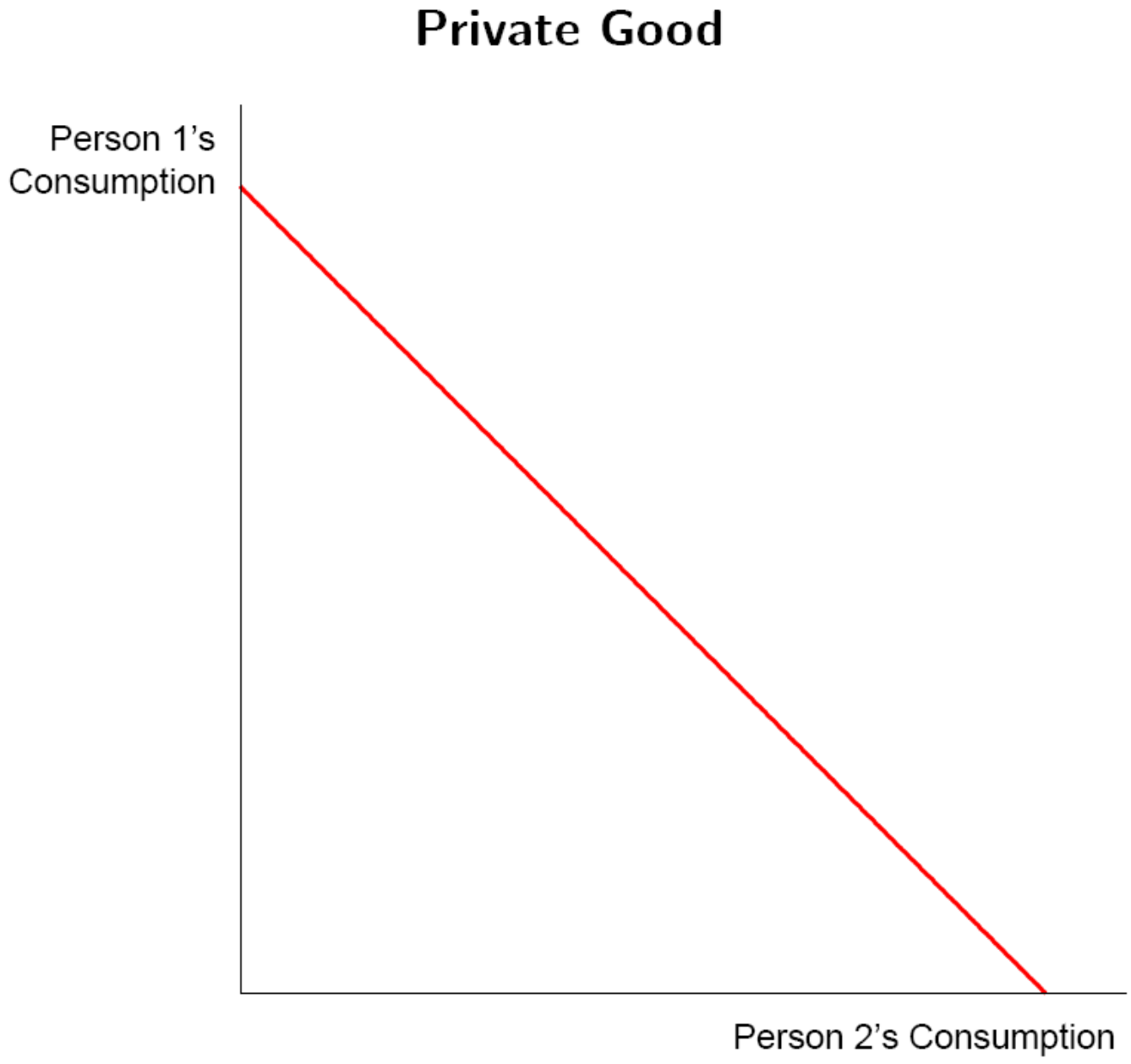
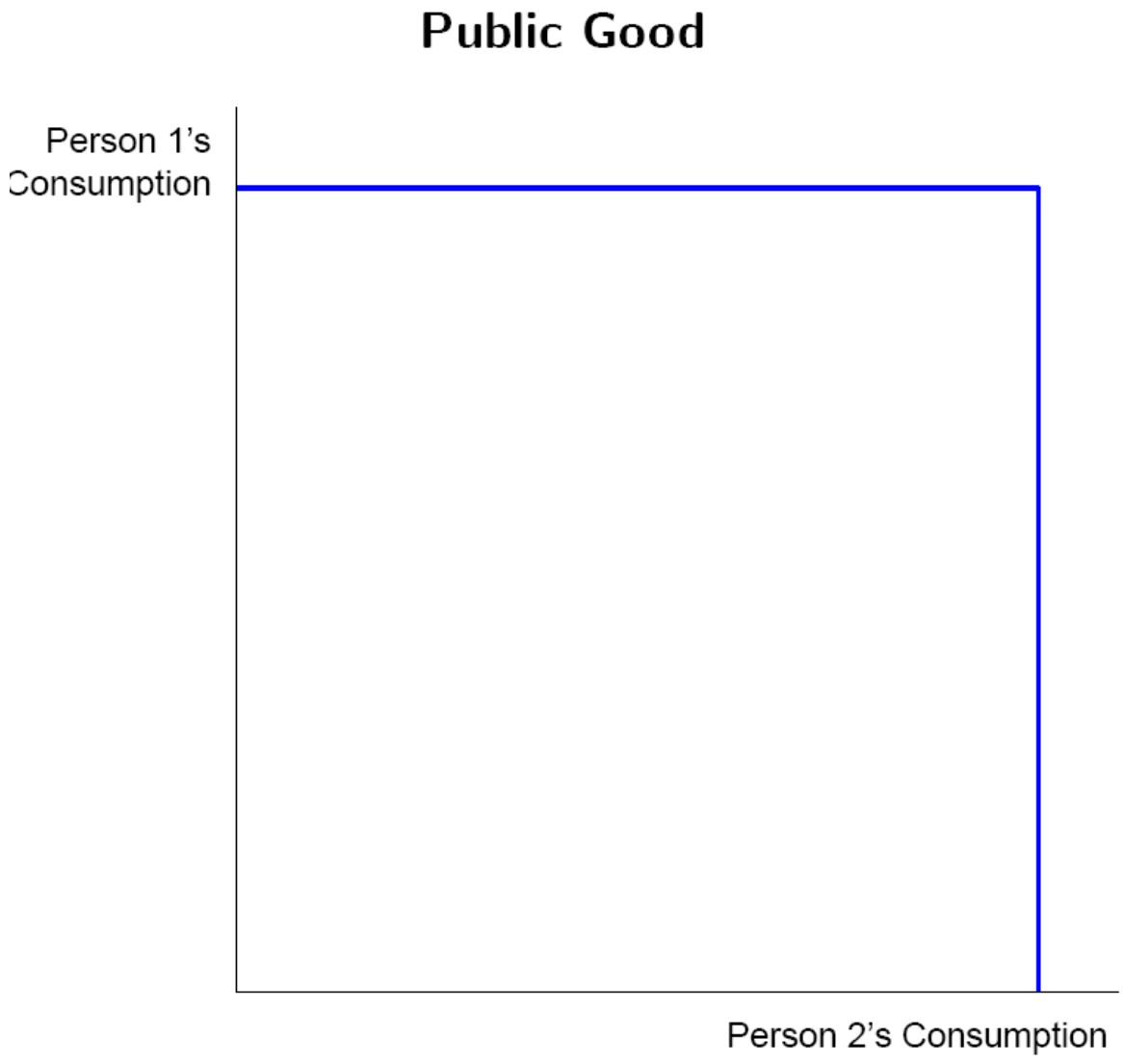


Figure 3: Public Good



Outline

A simple intuition of the Samuelson rule

- Two goods: X, private good, G public good
- G financed by contributions g_i
- Two individuals, with endowment w_i and utility: $u_i = u_i(G, x_i)$ and $w_i = g_i + x_i$
- Discrete provision of a public good, with cost c:

$$\begin{cases} G = 1 \text{ if } g_1 + g_2 \geq c \\ G = 0 \text{ if } g_1 + g_2 < c \end{cases}$$

A simple intuition of the Samuelson rule (2)

- Let's define **reservation price** (or WTP) for public good r_i:

$$u_i(1, w_i - r_i) = u_i(0, w_i) \quad \forall i$$

- Production of public good is pareto-improving (compared to non-provision) if:

$$\begin{cases} g_1 + g_2 \geq c \\ u_i(1, w_i - g_i) > u_i(0, w_i) \quad \text{for both } i \end{cases}$$

- Since u_i is monotonically increasing in x_i, this is equivalent to: $w_i - g_i > w_i - r_i$ for both i
- Production of public good is pareto-improving thus if:

$$r_1 + r_2 > g_1 + g_2 \geq c$$

$\Rightarrow$ At the optimum in the continuous provision case, sum of willingness-to-pay for public good equals marginal cost of producing public good

Figure 4: Aggregate Demand for Private Good: Horizontal Summation

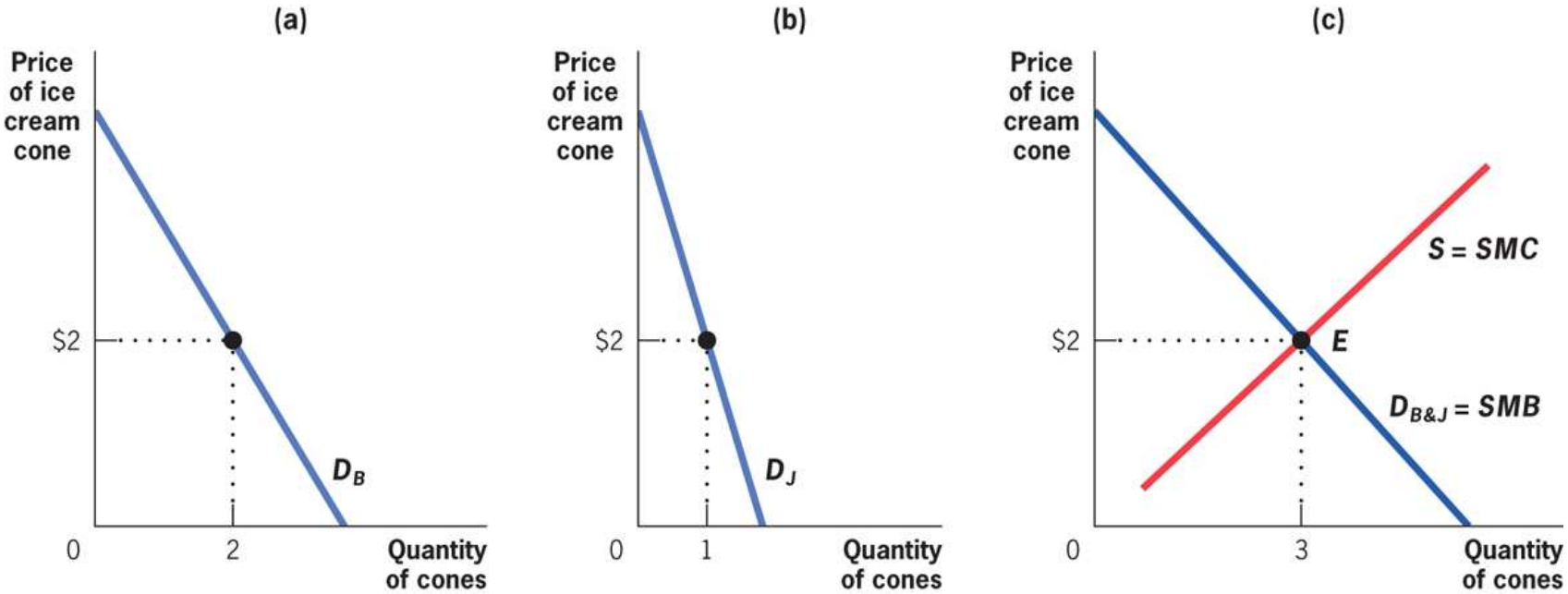
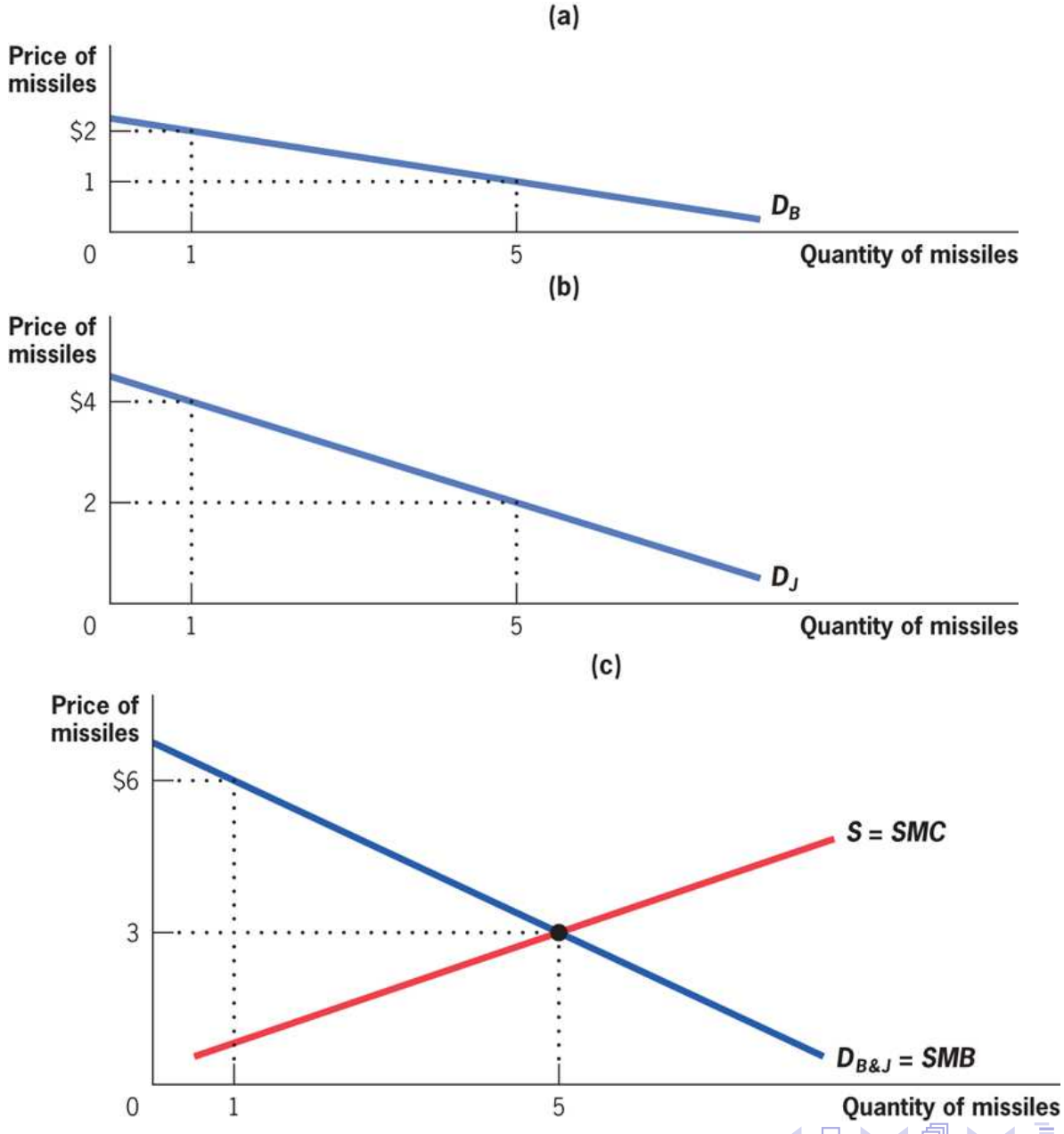


Figure 5: Aggregate Demand for Public Good: Vertical Summation



Samuelson Rule

- In the competitive market for a private good (y), individuals consume different quantities, but have the same *MRS*

$$\frac{\frac{\partial u^i}{\partial y}}{\frac{\partial u^i}{\partial x}} = MRS^i_{yx} = MRT_{yx} \quad \forall i$$

- In the case of a public good, individuals may have different *MRS*, but consume the same amount of the good
- For a given quantity of public good (g), the social marginal benefit is the sum of individual marginal rates of substitution
- Thus, the optimal allocation of the public good satisfies:

$$\sum_i \frac{\frac{\partial u^i}{\partial g}}{\frac{\partial u^i}{\partial x}} = \sum_i MRS^i_{gx} = MRT_{gx}$$

Free Riding

When an investment has a personal cost but a common benefit, individuals will underinvest

$\Rightarrow$ Because of free riding, market underprovision of public goods compared to Samuelson formula

Examples of free riding in action

- A 2005 study of the file-sharing software Gnutella showed that 85% of users were only downloading files from others and never uploading new files
- The file-sharing software Kazaa now assigns users ratings based on their ratio of uploads to downloads and then gives download priority to users according to their ratings, thus discouraging free riders.

Samuelson Rule: Limitations

Free riding legitimates public intervention to reach Samuelson rule. More easily said than done!

Difficult to implement in practice.

- Govt needs to know preferences or to have a mechanism to reveal preferences
- Issue of how to finance the public good if only distortionary taxes available
- Samuelson analysis is a first-best benchmark
- How can optimal level of public good be implemented with available policy tools?

Lindhal Pricing

How to achieve Pareto efficiency through a decentralized mechanism?

Lindhal Pricing

- Suppose individual has to pay a price t for the public good and consume G
- Set for each individual the price at his willingness to pay:

$$t = \frac{\frac{\partial u^i}{\partial g}}{\frac{\partial u^i}{\partial x}} = MRS^i_{gx}$$

- With identical individuals, simply set same level of tax for everybody
- With heterogeneity, efficient outcome can be attained with public goods through prices that are individual-specific

Lindhal Pricing: Constraints

- Must be able to exclude a consumer from using the public good.
  - Does not work with non-excludable public good
- Must know individual preferences to set personalized prices
  - Agents have no incentives to reveal their preferences
- Difference between Lindahl equilibria and standard equilibria:
  - No decentralized mechanism for deriving prices; no market forces that will generate the right price vector

Private Provision of Public Goods

- In some cases, the private sector may yet provide a public good, albeit less than the optimal amount
- Examples of private solutions include:
  1. In the UK, the BBC charges a licensing fee of about $200 to anyone operating a TV, with hefty penalties if you are caught viewing a TV without a license ($1,500)
  2. The software Kazaa rates users based on their uploading-to-downloading ratio and assigns priority for downloading to better rated users
  3. The sanitation and additional security of Times Square NYC is collectively funded by a group of businesses in the neighborhood called a Business Improvement District (BID)

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Private Provision of Public Goods

- The private sector has a a better chance of overcoming the free rider problem in the following cases:
  1. **heterogeneity**: if some individuals care more about the public good than others, they may still provide a significant amount of the good
  2. **altruism**: when individuals privately value the benefits and costs of others, they will tend to provide public goods
  3. **warm glow**: when individuals gain utility from providing the public good, above and beyond the total amount of the public good

$\Rightarrow$ In case of private provision, interaction between public and private provision becomes critical: **Crowd-out**

Private vs Public Provision of Public Goods

- Interest in crowd-out began with Roberts (1984)
- Expansion of govt services for poor since Great Depression accompanied by comparable decline in charitable giving for the poor.
- Conclusion: government has grown tremendously without having any net impact on poverty or welfare
- Evidence mainly based on time series impressions.
- But theory underlying this claim very sensible,

Private or public production?

Public good even if it is publicly funded (public provision) can be either privately or publicly produced.

- Provision and production may not be separable, due to incompleteness of contracts
- Privately-produced product may be of inferior quality, for same reason
- Public production may be inefficient because there is no residual claimant

Outline

Empirical Issues

What are the key parameters to understand optimal public policy towards provision of public goods?

1. Extent of free riding depends on preferences
   - Altruism
   - Warm-glow
2. Extent of free riding depends on contextual setting:
   - Social Pressure
   - Heterogeneity
3. Policy-relevant parameters:
   - Crowding-out
   - Price elasticity of private contributions to public good

Early experiments on free riding

- Early lab experiments testing free-rider behavior=example Marwell & Ames 1981
- Groups of 5 subjects, each given 10 tokens.
- Can invest tokens in either an individual or group account. Individual: 1 token = \$1 for me; Group: 1 token = 50 cents for everyone
- Nash equilibrium is 100% individual but Pareto efficient outcome is 100% group.
- Compute fraction invested in group account under various treatments

Figure 6: Marwell & Ames 1981

Table 2

Summary of results: Experiments 1–11.

Experiment	Mean % of resources invested
1. Basic experiment	42%
2. Skewed resources and/or interest	53%
Experiments 1 and 2, combined	51%
3. Provision point	51%
4. Small groups with provision point (except those with sufficient interest to provide the good themselves)	60%
5. Experienced subjects	47%
6. High stakes	
Experienced interviewers	35%
All interviews	28%
7. Feedback, no changing initial investment	46%
8. Feedback, could change investment in individual account	50%
9. Feedback, could change investment in individual account — college students	49%
10. Manipulated feedback	
Low	43%
Medium	50%
High	44%
11. Non-divisibility	
Divisible (control)	43%
Non-divisible	84%
12. Economics graduate students	20%

Source: Maxwell and Ames 1981

Evidence on Free Riding:

Andreoni JPubEc 1988 and Dawes & Thaler 1988: even though free-riding is a commonly observed behavior, we observe much less free riding in laboratory experiments that theory would predict This suggest that:

- Strategies and learning matter in public good provision
  - Reputation & coordination in repeated games
  - However, if finite horizon, everyone should free ride in the last period
- Utility functions of agents exhibit either altruism or warm-glow
  - People contribute in the last period of repeated games and this is deliberate (Andreoni & Miller 1993)

Context Matters

A wide number of studies show that even in the field, context matters a lot:

- Heterogeneity of the social group reduces contributions to public goods (Alesina & Ferrara QJE 2000)
- Social Pressure (DellaVigna & al. 2010)

Figure 7: Alesina & Ferrara 2000

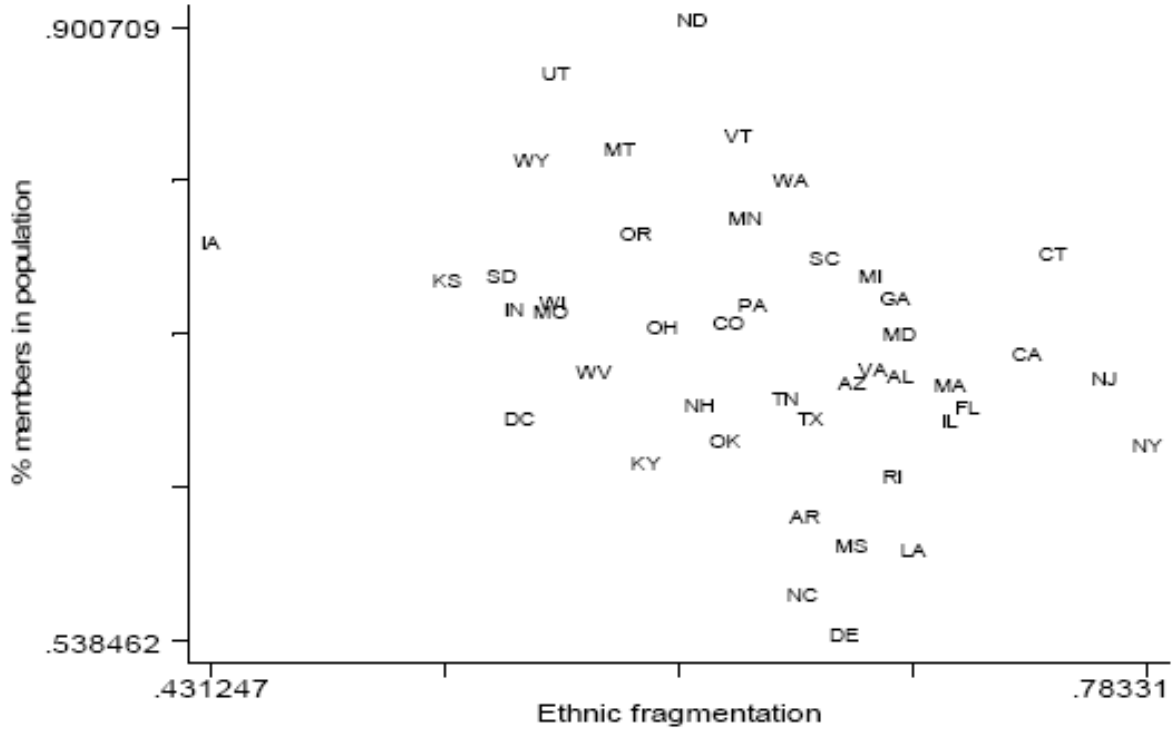

Figure 7: Heterogeneity and participation in groups

Optimal Subsidies to Private Contributions

Saez 2004: Optimal subsidy towards private contributions to public good in a setting with direct public provision of public good and distortionary taxes depends on a small set of parameters

At the optimum

$$\varepsilon_{g^T} = -(1 - \beta(\bar{G^T}))$$

- Crowding-out ($\beta(\bar{G^T})$)
- Price elasticity of private contributions (ε_{g^T})
- These two parameters are embedding all the preference parameters and the contextual parameters of interest (sufficient statistic approach)

Crowd out

- Kingma 1989
- Gruber & Hungerman 2005: analyze effect of New Deal poverty relief policies on poverty relief expenditures of 6 big church congregation
- Overall, results suggest that crowding-out is clearly less than 1 in all contexts: warm-glow motive necessary to explain patterns of contributions to public goods.
- Andreoni & Payne 2003: crowding-out of giving or of fund-raising?

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Price subsidies

Fack & Landais 2010:
Exploit long term history of tax subsidies for charitable contributions to estimate how govt incentives affect private contributions to public goods

- Identification relies on numerous legislated tax changes
- Control for other confounding factors such as differential trends across income groups and time shifting
- Find price elasticities that are small overall but larger for high income groups
- Cheating seems to be a key aspect of these discrepancies in elasticities across groups
- Price elasticity a lot smaller when tax enforcement increases

Figure 8: Charitable contributions as a percentage of total income for top income groups United States, 1917 to 2005

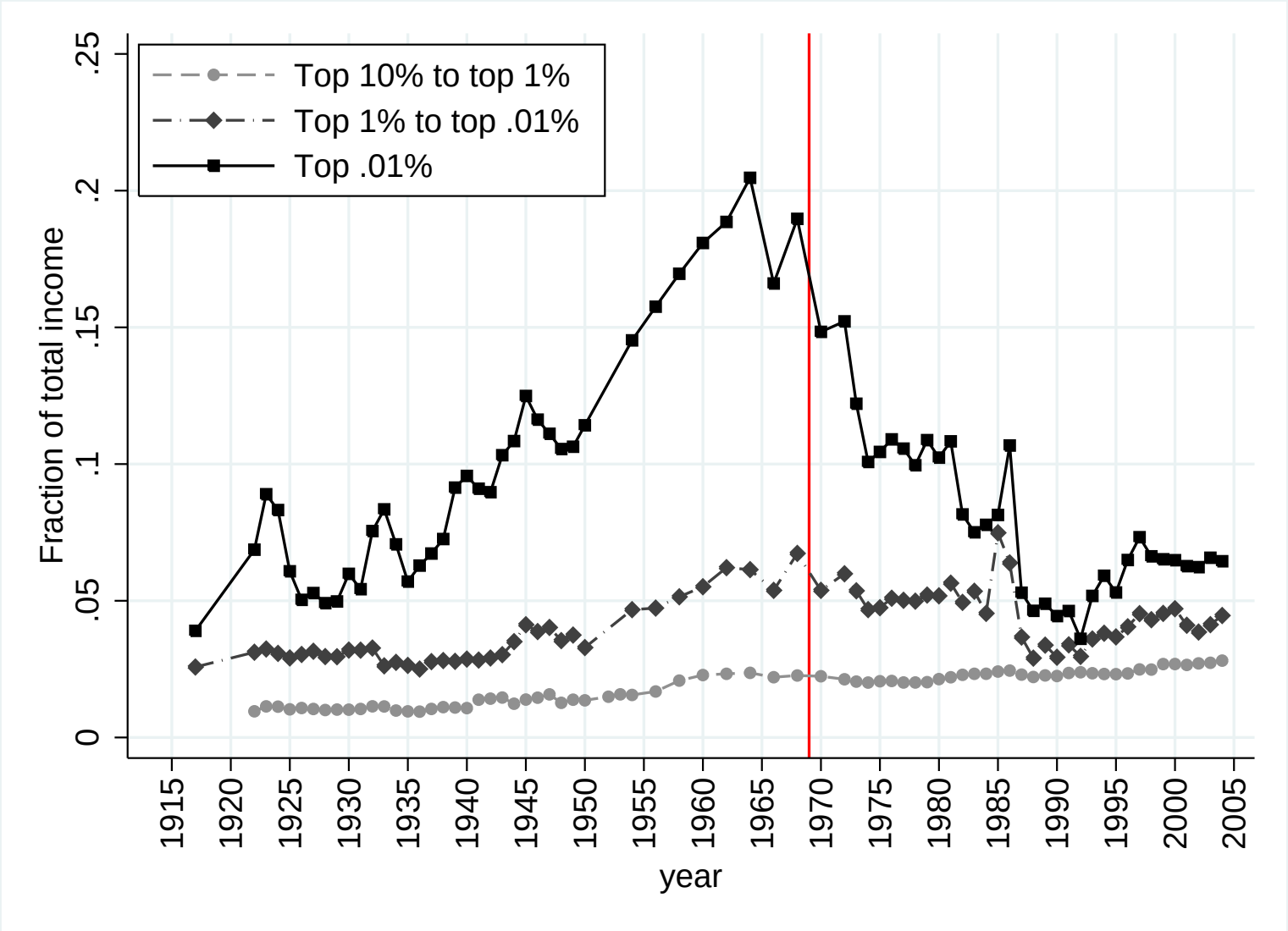

Figure 9: Effective MTR on earned income and contributions as percentage of total income. Top .01% defined excluding K gains

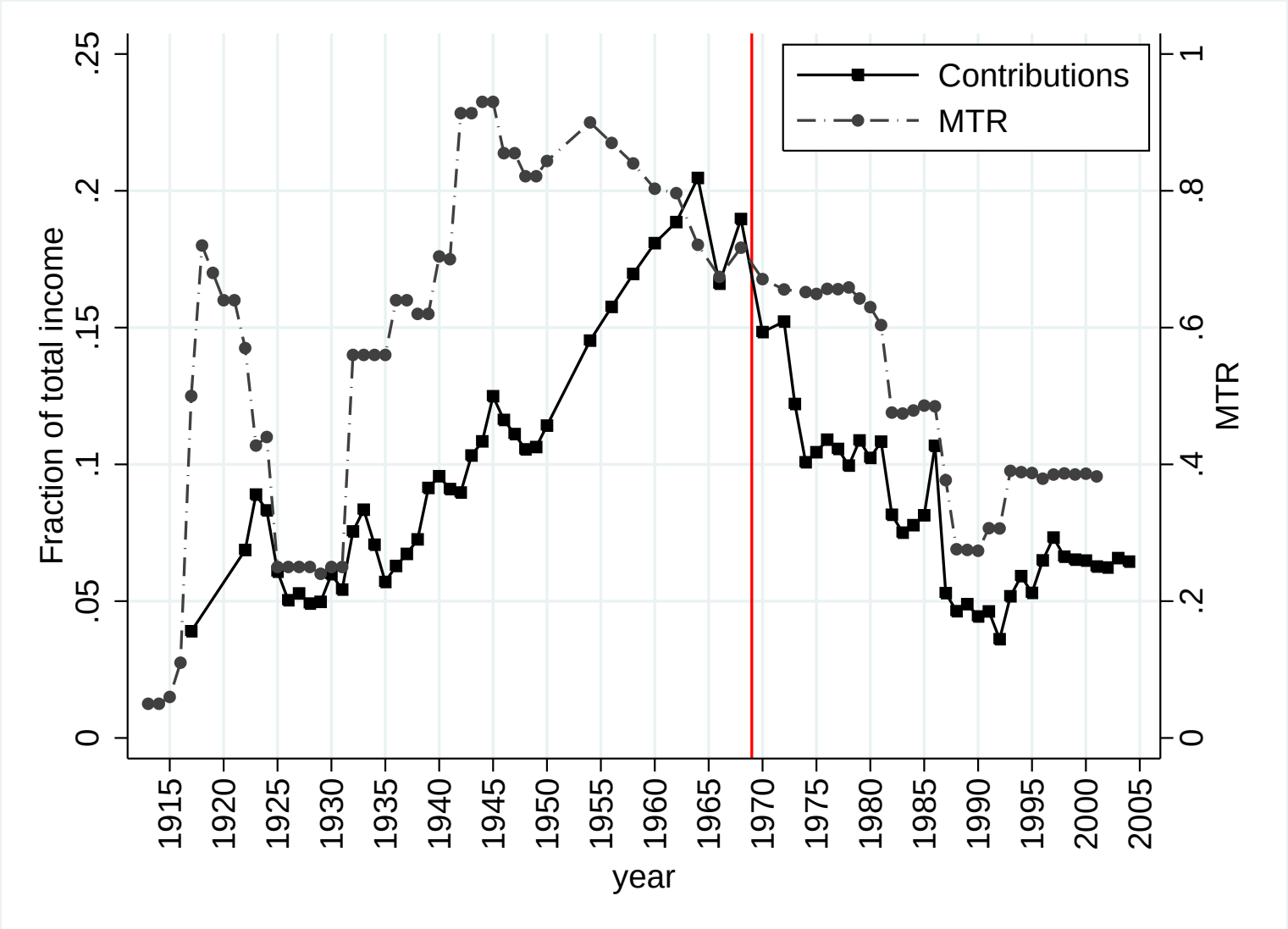

Table 1: Price elasticity estimates, P90-100 (1917 to 2004)

	(1) OLS fe	(2) OLS weighted	(3) IV fe	(4) IV fe	(5) IV fe
logprice	-0.649***	-0.683***	-0.595***	-0.620**	-0.658***
	(0.0941)	(0.0764)	(0.0975)	(0.219)	(0.0826)
logincome	0.965**	1.024**	0.914***	0.938***	1.032***
	(0.178)	(0.150)	(0.212)	(0.251)	(0.180)
Year fixed effects	YES	YES	YES	YES	YES
N	407	407	407	407	407

col. (2) OLS f.e. weighted by share of the group in total contrib.
col. (3) logprice instrumented by logprice at a * (average income). a = long-term ratio of mean income of the group divided by mean income of the pop.
col. (4) logprice instrumented by logprice at inflated income of year n-1
col. (5) logincome instrumented by inflated reported income of year n-1.

Table 2: Price elasticity estimates by income groups, (1960-2004)

	(1) IV fe	(2) IV fe	(3) IV fe	(4) IV fe
	P0-100	P90-99	P99-100	P99.9-100
logprice	-0.420	-0.658*	-0.752***	-0.808*
	(1.301)	(0.328)	(0.124)	(0.380)
logincome	0.608	0.637	0.654***	0.442
	(1.433)	(0.375)	(0.0953)	(0.276)
Year fixed effects	YES	YES	YES	YES
N	495	70	140	70

logprice instrumented by logprice at inflated income of year n-1
logincome instrumented by inflated reported income of year n-1

Clustered robust s.e. in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
15 income groups: 9 deciles from P0 to P90 and the previous 6

Figure 10: Number of new foundations created and foundations terminated, United States (1960 to 1972)