Public Goods

131 Undergraduate Public Economics

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OUTLINE

Chapter 7

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7.2 Private Provision of Public Goods

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PUBLIC GOODS: INTRODUCTION

Private trash collection, financed by a voluntary fee paid by neighborhood residents, faces the classic **free rider problem**.

Goods that suffer from this free rider problem are known in economics as **public goods**.

PUBLIC GOODS: DEFINITONS

Pure public goods: Goods that are perfectly **non-rival in consumption** and are **non-excludable**

Non-rival in consumption: One individual's consumption of a good does not affect another's opportunity to consume the good.

Non-excludable: Individuals cannot deny each other the opportunity to consume a good.

Impure public goods: Goods that satisfy the two public good conditions (non-rival in consumption and non-excludable) to some extent, but not fully.

Optimal Provision of Public Goods

■ TABLE 7-1

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)

Whether a good is private or public depends on whether it is rival and excludable. Pure private goods such as ice cream are both rival and excludable. Pure public goods such as national defense are neither rival nor excludable. Goods that are rival but not excludable, and vice versa, are impure public goods.

Optimal Provision of Public Goods

Optimal Provision of Private Goods

■ FIGURE 7-1
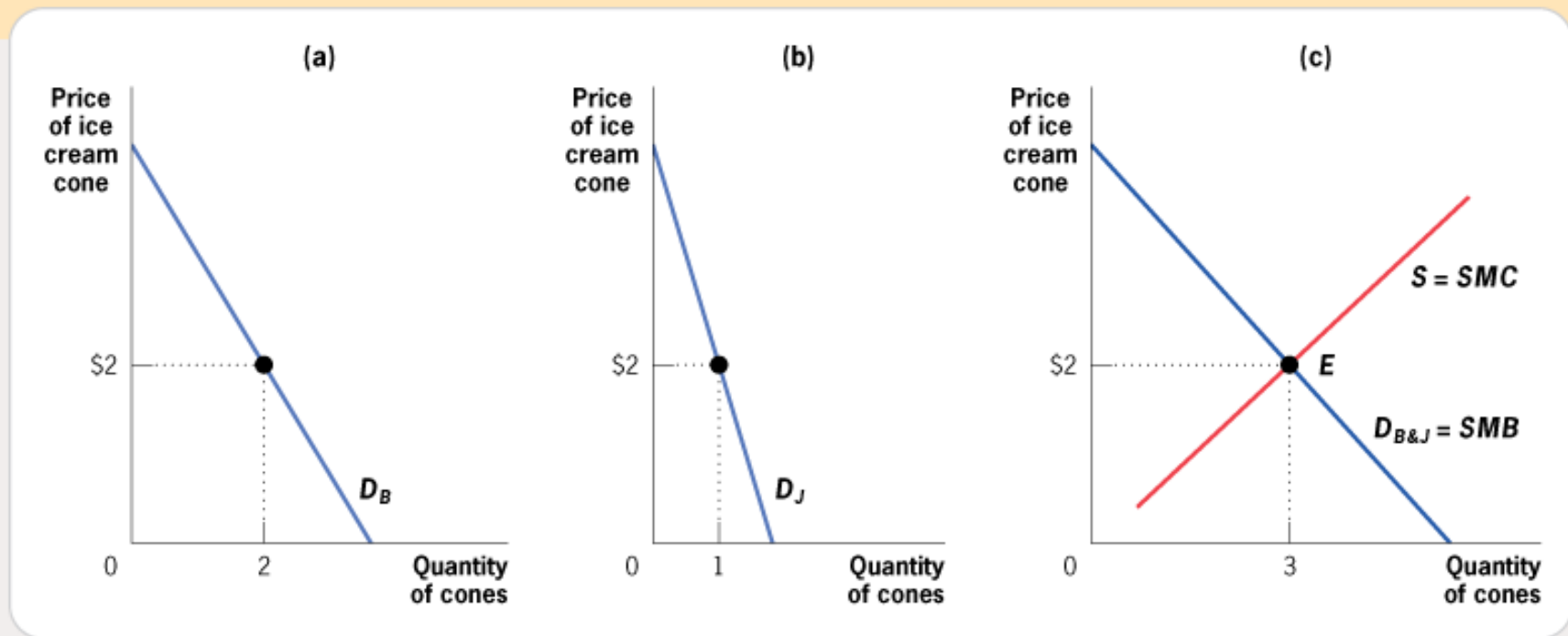
Horizontal Summation in Private Goods Markets • In private goods markets, we horizontally sum the demands of Ben and Jerry to get market demand for ice cream cones. If Ben demands 2 ice cream cones at $2, and Jerry demands 1 ice cream cone at $2, then at a market price of $2 the quantity demanded in the market is 3 ice cream cones.

OPTIMAL PROVISION OF PRIVATE GOODS

Two goods: ic (ice-cream) and c (cookies) with prices P_{ic}, P_c

$P_c = 1$ is normalized to one (numéraire good):

Two individuals B and J

Consumers demand different quantities of the good at the same market price.

The optimality condition for the consumption of private goods is written as: $MU_{ic}^B/MU_c^B = MRS_{ic,c}^B = MRS_{ic,c}^J = P_{ic}/P_c = P_{ic}$

Equilibrium on the supply side requires: $MC_{ic} = P_{ic}$

In equilibrium, therefore: $MRS_{ic,c}^B = MRS_{ic,c}^J = MC$

OPTIMAL PROVISION OF PUBLIC GOODS

Replace private good ice-cream ic by a public good missiles m

$MRS_{m,c}^{B} = \#$ cookies B is willing to give up for 1 missile

$MRS_{m,c}^{J} = \#$ cookies J is willing to give up for 1 missile

In net, society is willing to give up $MRS_{m,c}^{B} + MRS_{m,c}^{J}$ cookies for 1 missile

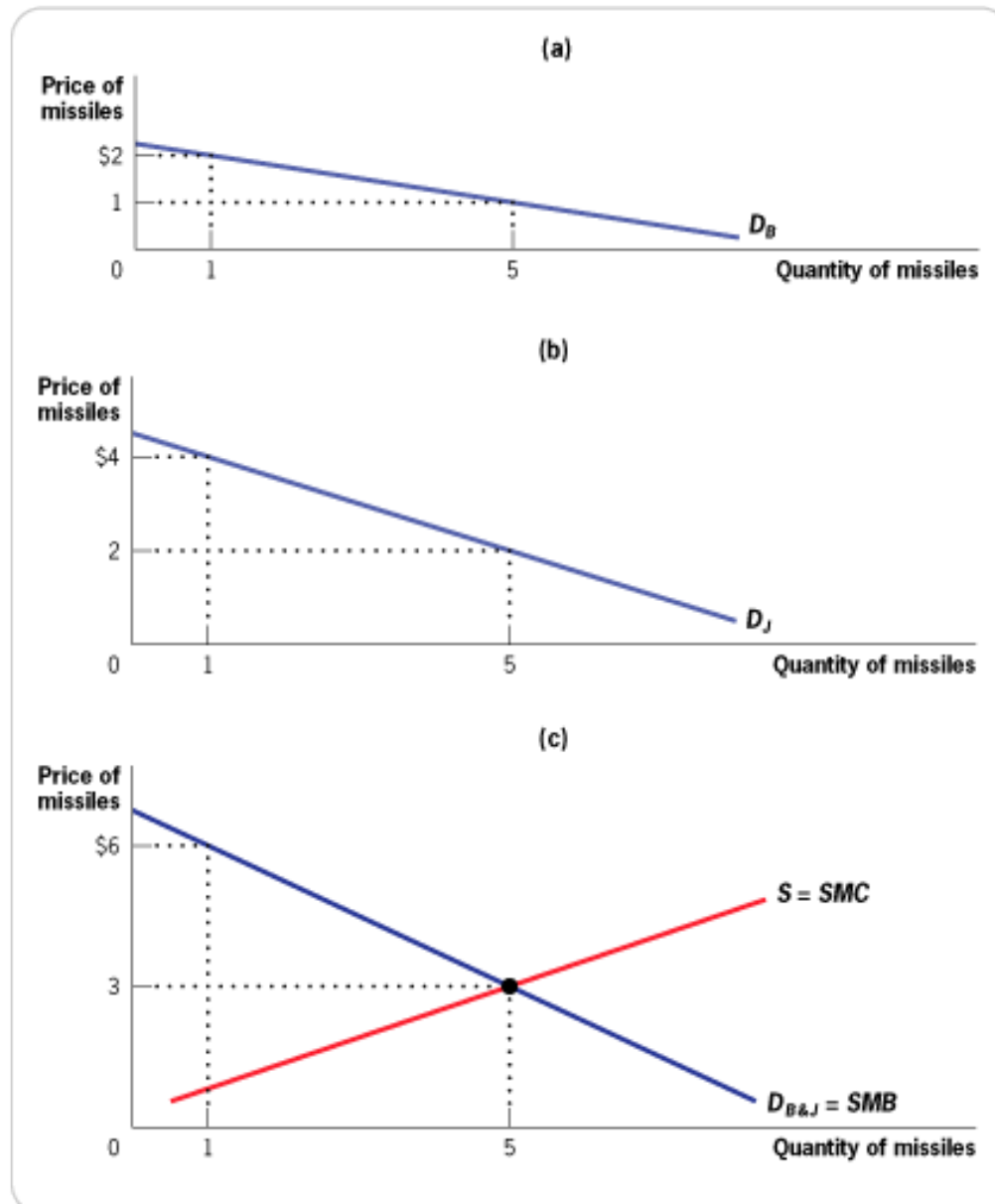Social-efficiency-maximizing condition for the public good is:

$$MRS_{m,c}^{B} + MRS_{m,c}^{J} = MC$$

Social efficiency is maximized when the marginal cost is set equal to the *sum of the MRSs, rather than being set equal to each individuals MRS*.

This is called the **Samuelson rule** (Samuelson, 1954)

7.1

Optimal Provision of Public Goods

(a)

Price of missiles

$2

1

0   1   5   Quantity of missiles

D_B

(b)

Price of missiles

$4

2

0   1   5   Quantity of missiles

D_J

(c)

Price of missiles

$6

3

0   1   5   Quantity of missiles

S = SMC

$D_{B\&J} = SMB$

Vertical Summation in Public Goods Markets • For public goods, we vertically sum the demands of Ben and Jerry to get the social value of the public good. If Ben is willing to pay $1 for the fifth missile, and Jerry is willing to pay $2 for the fifth missile, then society values that fifth missile at $3. Given the private supply curve for missiles, the optimal number of missiles to produce is five, where social marginal benefit ($3) equals social marginal cost ($3).

PRIVATE-SECTOR UNDERPROVISION

Private sector provision such that $MRS_{mc} = MC_m$ for each individual so that $\sum MRS_{mc} > MC_m \Rightarrow$ Outcome is not efficient, could improve the welfare of everybody by having more missiles (and less cones)

Free rider problem: When an investment has a personal cost but a common benefit, individuals will underinvest.

Because of the **free rider** problem, the private market under-supplies public goods

Another way to see it: private provision of a public good creates a positive externality (as everybody else benefits) $\Rightarrow$ Goods with positive externalities are under-supplied by the market

PRIVATE PROVISION OF PUBLIC GOOD

2 individuals with identical utility functions defined on X private good (cookies) and F public good (fireworks)

$F = F_1 + F_2$ where F_i is contribution of individual i

Utility of individual i is $U_i = 2\log(X_i) + \log(F_1 + F_2)$ with budget $X_i + F_i = 100$

Individual 1 chooses F_1 to maximize $2\log(100 - F_1) + \log(F_1 + F_2)$ taking F_2 as given

First order condition: $-2/(100 - F_1) + 1/(F_1 + F_2) = 0 \Rightarrow F_1 = (100 - 2F_2)/3$

Note that F_1 goes down with F_2 due to the free rider problem (called the reaction curve, show graph)

Symmetrically, we have $F_2 = (100 - 2F_1)/3$

PRIVATE PROVISION OF PUBLIC GOOD

Nash equilibrium definition: Each agent maximizes his objective taking as given the actions of the other agents

At the Nash equilibrium, the two reaction curves intersect:

$F_1 = (100 - 2F_2)/3$ and $F_2 = (100 - 2F_1)/3$

$\Rightarrow F_1 + F_2 = (200 - 2(F_1 + F_2))/3 \Rightarrow F = F_1 + F_2 = 200/5 = 40 \Rightarrow F_1 = F_2 = 20$

What is the Social Optimum? $\sum MRS = MC = 1$

$MRS^i_{FX} = MU^i_F/MU^i_X = (1/(F_1 + F_2))/(2/X_i) = X_i/(2F)$

$\Rightarrow \sum MRS^i = (X_1 + X_2)/(2F) = (200 - F)/(2F)$

$\Rightarrow \sum MRS^i = 1 \Rightarrow 200 - F = 2F \Rightarrow F = 200/3 = 66.6 > 40$

Public good is under-provided by the market

The Free Rider Problem in Practice

Chapter 7 Public Goods

The free rider problem is one of the most powerful concepts in all of economics. Some everyday examples, and interesting solutions, include the following:

► WNYC has an estimated listening audience of 1 million people, but only 7.5% of their listeners support the station. In the United Kingdom, the BBC charges an annual licensing fee to anyone who owns and operates a TV.

► A 2000 study of the file-sharing software Gnutella showed that 70% of users download files only from others. 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.

► Cambridge, England, tried to provide 350 free green bicycles scattered throughout the city. Users were expected to return each bicycle to one of 15 stands after its use. Within four days, not a single bicycle could be found, most having been likely stolen and repainted.

Can Private Providers Overcome the Free Rider Problem?

The free rider problem does not lead to a complete absence of private provision of public goods.

The private sector can in some cases combat the free rider problem to provide public goods by charging user fees that are proportional to their valuation of the public good.

Business Improvement Districts

It is infeasible to charge pedestrians a fee for using the streets, so cities use tax revenues to provide police, sanitation, and public works departments. Public provision of these services does not always work effectively.

Example: New York City's Times Square

- ► The city government spent ten years attempting to clean up Times Square.

- ► A group of local businessmen decided to start a Business Improvement District (BID), a legal entity that privately provides local services, and funds these services with fees charged to local businesses.

- ► New York law is structured so that if the BID organizers can get over 60% of the local business community to join, then the BID can levy fees on all local businesses.

Results:

- ► Crime has dropped significantly.

- ► The area is cleaner and more attractive.

- ► Business and tourism are booming.

When Is Private Provision Likely to Overcome the Free Rider Problem?

1) Some Individuals Care More than Others:

Private provision is particularly likely to surmount the free rider problem when individuals are not identical, and when some individuals have an especially high demand for the public good.

2) Altruism:

When individuals value the benefits and costs to others in making their consumption choices.

3) Warm Glow:

Model of public goods provision in which individuals care about both the total amount of the public good and their particular contributions as well.

Experimental evidence on free riding

Laboratory experiments are a great device to test econ theories

Subjects (often students) are brought to the lab where they sit through a computer team game and get paid based on the game outcomes

Many public good lab experiments. Example (Marwell and Ames 1981):

- 10 repetitions for each game

- In each game, group of 5 people, each with 10 tokens to allocate between cash and public good.

- If take token in cash, get $1 in cash for yourself. If contribute to common good, get $.5 to each of all five players.

Nash equilibrium: get everything in cash

Socially optimal equilibrium: contribute everything to public good

In the lab, subjects contribute about 50% to public good, but public good contributions fall as game is repeated (Isaac, McCue, and Plott, 1985)

Explanations: people are willing to cooperate but get upset and retaliate if others take advantage of them

Crowding out of private contributions by govt provision

Suppose government forces each individual to provide 5 so that now $F = F_1 + F_2 + 10$ where F_i is voluntary contribution of individual i

Utility of individual i is $U_i = 2\log(X_i) + \log(F_1 + F_2 + 10)$ with budget $X_i + F_i = 95$

You will find that the private optimum is such that $F_1 = F_2 = 15$ so that government forced contribution crowds out one-to-one private contributions

Why? Rename $F'_i = F_i + 5$. Choosing F'_i is equivalent to choosing F_i: $U_i = 2\log(X_i) + \log(F'_1 + F'_2)$ with budget $X_i + F'_i = 100$

$\Rightarrow$ Equivalent to our initial problem with no government provision hence the solution in F'_i must be the same

However, government forced contributions will have an effect as soon as private contributions fall to zero (as individuals cannot contribute negative amounts and undo government provision)

EMPIRICAL EVIDENCE ON CROWD-OUT

Two strands of empirical literature

1) Field evidence (observational studies)

2) Lab experiments (Andreoni, AER'93)

Traditionally, lab experiments have been more influential but recent field studies may change this

Lab experiments may not capture important motives for giving: warm glow, prestige

CHARITABLE GIVING

Charitable giving is one form of private provision of public good (big in the US, 2% of GDP given to charities).

Funds (1) religious activities (close to dues), (2) Education, (3) human services, (4) health, (5) arts, (6) various causes (environment, animals)

Encouraged by government: giving can be deducted from income for income tax purposes, charitable organizations are exempted from tax

People give out of (1) warm-glow (name on building), (2) reciprocity (alumni), (3) social pressure (churches), (4) altruism (poverty relief). Those effects are not captured in basic econ model

Charities have big fund-raising operations to induce people to give based on those psychological effects

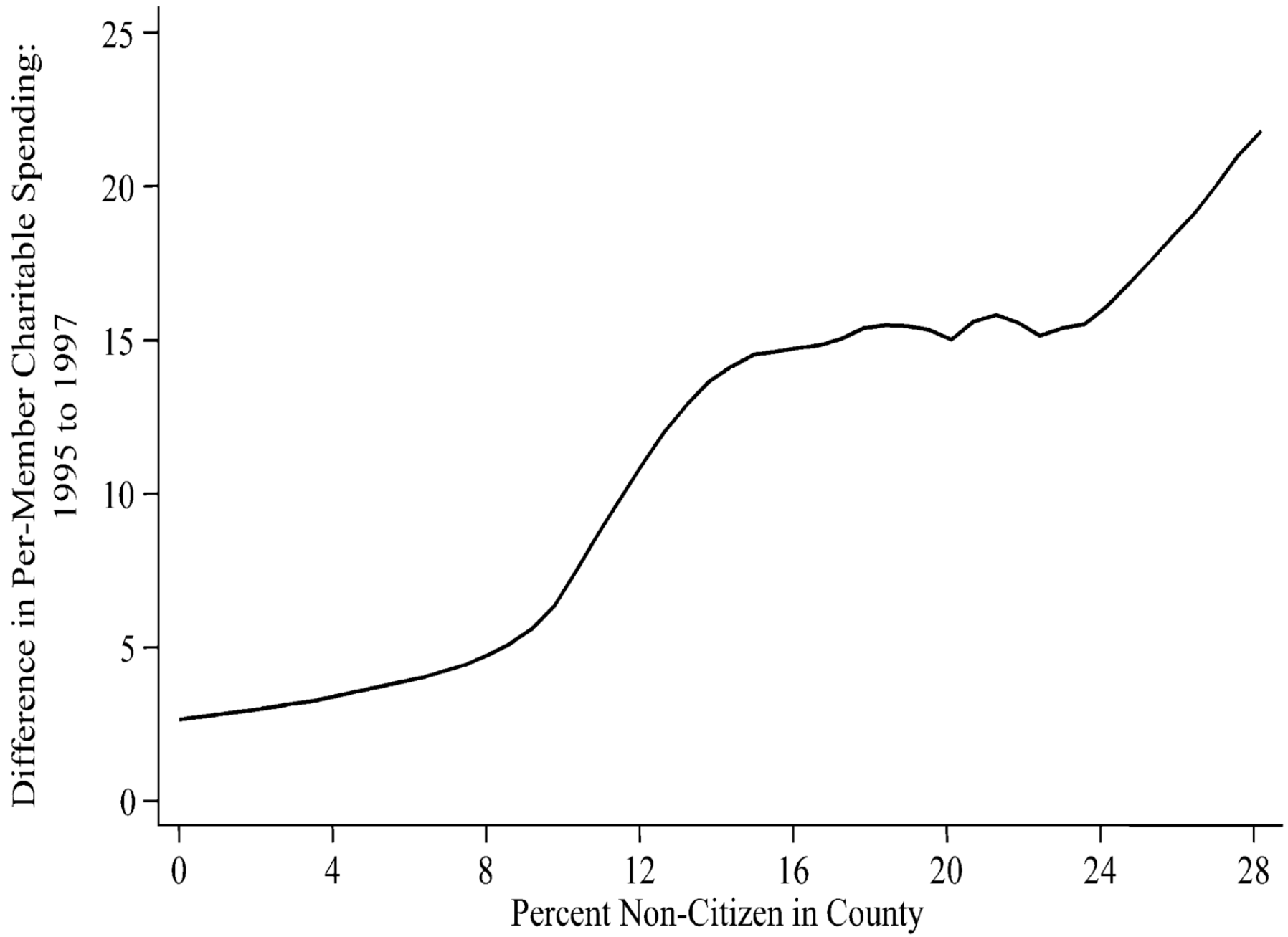# Empirical Evidence on Crowd-Out: Hungerman 2005

Studies crowdout of church-provided welfare (soup kitchens, etc.) by government welfare.

Uses 1996 Clinton welfare reform act as an instrument for welfare spending cuts.

One aspect of reform: reduced/eliminated welfare for non-citizens

Motivates a diff-in-diff strategy: compare churches in high non-citizen areas with churches in low non-citizen areas before/after 1996 reform

Estimates imply that total church expenditures in a state increase by 40 cents when welfare spending is cut by $1

Source: Hungerman 2005

Empirical Evidence on Crowd-Out: Andreoni-Payne '03

Government spending crowds-out private donations through two channels: willingness to donate + fundraising

Use tax return data on arts and social service organizations

Panel study: follows the same organizations overtime

Results: $1000 increase in government grant leads to $250 reduction in private fundraising

Suggests that crowdout could be non-trivial if fundraising is a powerful source of generating private contributions

Subsequent study by Andreoni and Payne confirms this

Find that $1 more of government grant to a charity leads to 56 cents less private contributions

70 percent ($0.40) due to the fundraising channel

Suggests that individuals are relatively passive actors

Reverse Crowd-out

Interesting to also consider opposite channel: crowdout of government programs by individual donations.

"In its 2007 budget proposal, the Bush administration eliminated a \$93.5 million program to underwrite the development of smaller schools, specifically citing the increase in support for those schools from nonfederal funds from the Gates Foundation and the Carnegie Corporation."

Source: New York Times Gates Charity Races to Spend Buffett Billions. (8-13-2006).

Implication: Gates foundation funding military instead of teachers?

Randomized field experiment in charitable giving to test reciprocity

Falk (2007) conducted a field experiment to investigate the relevance of reciprocity in charitable giving

In collaboration with a charitable organization, sent 10,000 Christmas solicitation letters for funding schools for street children in Bengladesh to potential donors (in Switzerland) randomized into 3 groups

1) 1/3 of letters contained no gift (control group)

2) 1/3 contained a small gift: one post-card (children drawings)+one-envelope (treatment 1)

3) 1/3 contained a larger gift: 4 post-cards (children drawings)+4-envelopes (treatment 2)

Likelihood of giving: 12% in control, 14% in treatment 1, 21% in treatment 2

"large gift" was very effective (even relative to cost)

Social Prices as a Policy Instrument

Traditional focus in economics is on changing prices of economic goods

Different set of policy instruments: social "prices"

Suppose people care about social status and policy marker can manipulate status norms

Should make status good one that generates large scale productive externalities.

E.g. have researchers compete on publications rather than size of their houses.

Creates another set of policy instruments to explore

Recent examples from psychology and political science suggest that social price elasticities are large

Example: Gerber, Green, Larimer '08: randomized experiment using social pressure to increase voter turnout

Civic duty mailing

Dear Registered Voter:

DO YOUR CIVIC DUTY AND VOTE!

Why do so many people fail to vote? We've been talking about this problem for years, but it only seems to get worse.

The whole point of democracy is that citizens are active participants in government; that we have a voice in government. Your voice starts with your vote. On August 8, remember your rights and responsibilities as a citizen. Remember to vote.

DO YOUR CIVIC DUTY – VOTE!

Source: Gerber, Green, and Larimer (2008)

Hawthorne mailing

Dear Registered Voter:

YOU ARE BEING STUDIED!

Why do so many people fail to vote? We've been talking about this problem for years, but it only seems to get worse.

This year, we're trying to figure out why people do or do not vote. We'll be studying voter turnout in the August 8 primary election.
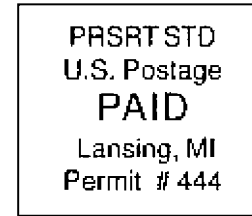
Our analysis will be based on public records, so you will not be contacted again or disturbed in anyway. Anything we learn about your voting or not voting will remain confidential and will not be disclosed to anyone else.

DO YOUR CIVIC DUTY – VOTE!

Source: Gerber, Green, and Larimer (2008)

<u>Self mailing</u>

3 0 4 2 2 - 4 ||| || || | ||

ECRLOT **C050
THE WAYNE FAMILY
9999 OAK ST
FLINT MI 48507

Dear Registered Voter:

WHO VOTES IS PUBLIC INFORMATION!

Why do so many people fail to vote? We've been talking about the problem
for years, but it only seems to get worse.

This year, we're taking a different approach. We are reminding people
that who votes is a matter of public record.

The chart shows your name from the list of registered voters, showing
past votes, as well as an empty box which we will fill in to show whether
you vote in the August 8 primary election. We intend to mail you an
updated chart when we have that information.

We will leave the box blank if you do not vote.

DO YOUR CIVIC DUTY — VOTE!

OAK ST	Aug 04	Nov 04	Aug 06
9999 ROBERT WAYNE		Voted	_____
9999 LAURA WAYNE	Voted	Voted	_____

Neighbors mailing

Dear Registered Voter:

WHAT IF YOUR NEIGHBORS KNEW WHETHER YOU VOTED?

Why do so many people fail to vote? We've been talking about this problem for years, but it only seems to get worse. This year, we're taking a new approach. We're sending this mailing to you and your neighbors to publicize who does and does not vote.

The chart shows the names of some of your neighbors, showing which have votes in the past. After the August 8 election, we intend to mail an updated chart. You and your neighbors will all know who voted and who did not

DO YOUR CIVIC DUTY – VOTE!

MAPLE DR	Aug 04	Nov 04	Aug 06
9995 JOSEPH JAMES SMITH	VOTED	VOTED	_____
9995 JENNIFER KAY SMITH	VOTED		_____
9997 RICHARD B JACKSON	VOTED		_____
9999 KATHY MARIE JACKSON		VOTED	_____
9987 MARIA S. JOHNSON	VOTED	VOTED	_____
9987 TOM JACK JOHNSON	VOTED	VOTED	_____

Source: Gerber, Green, and Larimer (2008)

TABLE 2.   Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%	31.5%	32.2%	34.5%	37.8%
N of Individuals	191,243	38,218	38,204	38,218	38,201

Source: Gerber, Green, and Larimer (2008)

MEASURING THE COSTS AND BENEFITS OF PUBLIC GOODS

Should the government undertake highway improvements?

Measuring costs and benefits can be complicated.

What if, without this highway project, half of the workers on the project would be unemployed? How can the government take into account that it is not only paying wages but also providing a new job opportunity for these workers?

What is the value of the time saved for commuters due to reduced traffic jams? And what is the value to society of the reduced number of deaths if the highway is improved?

We will cover this in the cost-benefit lecture

How Can We Measure Preferences for the Public Good?

Preference revelation: individuals may not be willing to tell the government their true valuation because the government might charge them more for the good if they say that they value it highly.

Preference knowledge: even if individuals are willing to be honest about their valuation of a public good, they may not know what their valuation is, since they have little experience pricing public goods such as highways or national defense.

Preference aggregation: how can the government effectively put together the preferences of millions of citizens in order to decide on the value of a public project?

These difficult problems are addressed by the field of *political economy*, the study of how governments go about making public policy decisions, such as the appropriate level of public goods.

CONCLUSION

A major function of governments at all levels is the provision
of public goods. In some cases, the private sector can provide
public goods, but in general it will not achieve the optimal
level of provision.

When there are problems with private market provision of pub-
lic goods, government intervention can potentially increase ef-
ficiency. Whether that potential will be achieved is a function
of both the ability of the government to appropriately measure
the costs and benefits of public projects and the ability of the
government to carry out the socially efficient decision.