Public Goods

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[1]Adapted from material by Stefanie Stantcheva at Harvard with assistance from ChatGPT and Cursor for formatting/code generation.

Midterm bonus question

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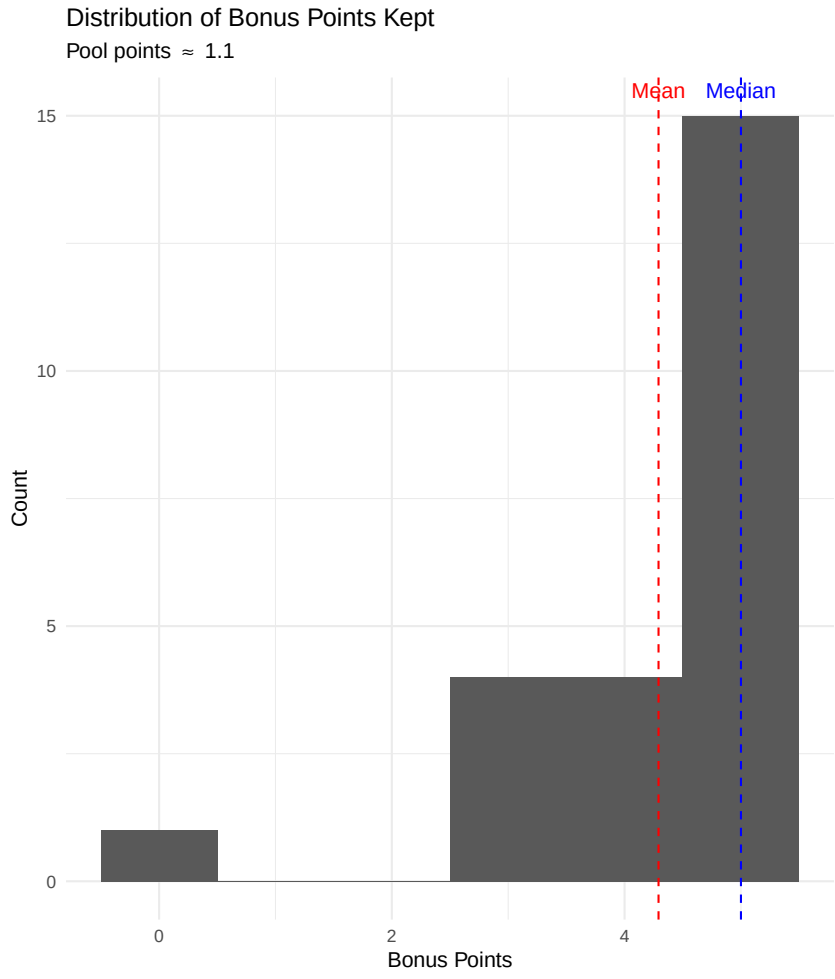
Choose a whole number B between 0 and 5. You will receive that many bonus points. The remaining $5 - B$ points will be put into a common pool. The community fund will be multiplied by 1.5 and distributed evenly among all students taking this exam.

What do you expect the distribution of points kept to look like? Why?



Let's play again for the final!

Learning goals

- Define a "market failure"
- Classify public goods as nonrivalrous and nonexcludable
- Contrast the provision of private goods in a competitive market with the optimal provision of public goods (free rider problem)
- Discuss the role of government in providing public goods and the potential for crowding out

Market failures

- The standard model of competitive markets is a powerful tool for understanding the allocation of resources
- However, sometimes (okay, often) the real world violates a key assumption of the welfare theorems

Market failure (Stefanie Stantcheva EC1410 Lecture 7)

A problem that violates an assumption of the 1st welfare theorem and causes the market economy to allocate resources Pareto inefficiently

- Note: market failures are about efficiency, not equity
- The next part of the course will work through various market failures

Public Goods

- Public goods are one type of market failure
- A public good is nonrivalrous and nonexcludable
- **Nonrival good:** The marginal cost of providing this good to another consumer is zero
- **Nonexcludable good:** It is impossible to keep someone from consuming the good
- Leads to free-rider problems
- How does this relate to life on campus?

Rivalrous and excludable public goods

Let's classify! Food, grazing land, national defense, cable TV, lunar eclipse, museum, clothes, Sunset over Hudson

	Rivalrous	Non-rivalrous
Exclud	Private goods: food, clothes, houses	"club goods": Cable TV, museum
Non-excl	"common pool" resources: grazing land, hiking trails	Public goods: An eclipse, radio signals, national defense

Matrix of rivalrous and excludable goods

From Private to Public Goods

- Let's take a trip to Brooklyn from Poughkeepsie
- Let's classify parts of the trip:
  - Hire Uber X to train: car cost, not shared
    $\Rightarrow$ private good
  - Metro North train to Grand Central: ticket cost
    $\Rightarrow$ "club" good
  - Brooklyn Bridge: free to walk, crowded
    $\Rightarrow$ common resource good
  - Sunset over Hudson: view is free and available to all
    $\Rightarrow$ public good

Review: Optimal Provision of Private Goods

- Jo and Bob buy ice cream (q_i) and cookies (q_c) with prices p_i and $p_c = 1$. How do we find the Pareto optimal allocation?

$$MRS^k_{i,c} = \frac{p_i}{p_c} \quad \text{for all } k \in \{B, J\} \Rightarrow \underbrace{MRS^B_{i,c} = MRS^J_{i,c}}_{\text{Pareto efficient allocation}}$$

- "Willing to pay" $MRS_{i,c}$ cookies for an ice cream, so rewrite $MRS_{i,c}$ as WTP_i and MRS_c as WTP_c
- In a competitive market $p_i = MC_i$, so:

$$WTP^B_i = WTP^J_i = MC_i$$

Optimal Provision of Public Goods

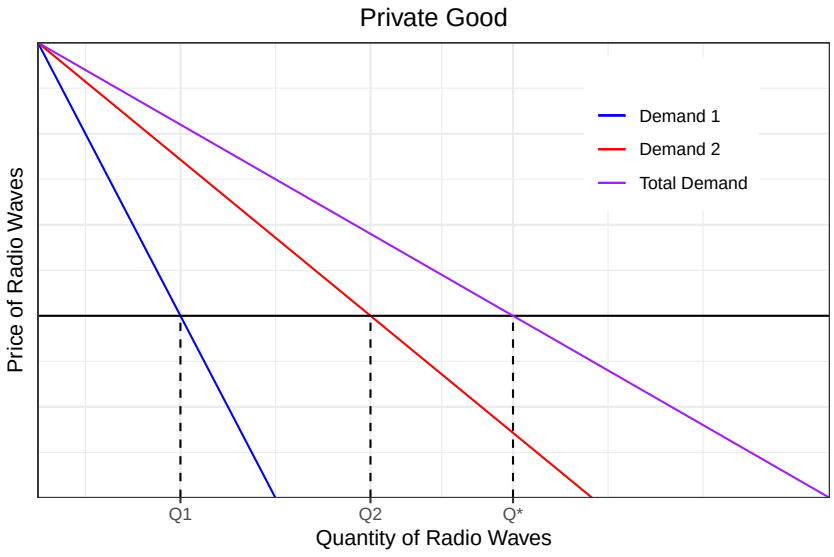
- Switch ice cream for radio waves, a pulic good
- Society's $WTP_r = WTP_r^B + WTP_r^J$ cookies for radio waves
- Which condition is Pareto optimal?

$$\underbrace{WTP_r = MC_r}_{\text{total WTP equals MC}\checkmark} \quad \textbf{OR} \quad \underbrace{WTP_r^B = WTP_r^J = MC_r}_{\text{each person's WTP equals MC}\times}$$

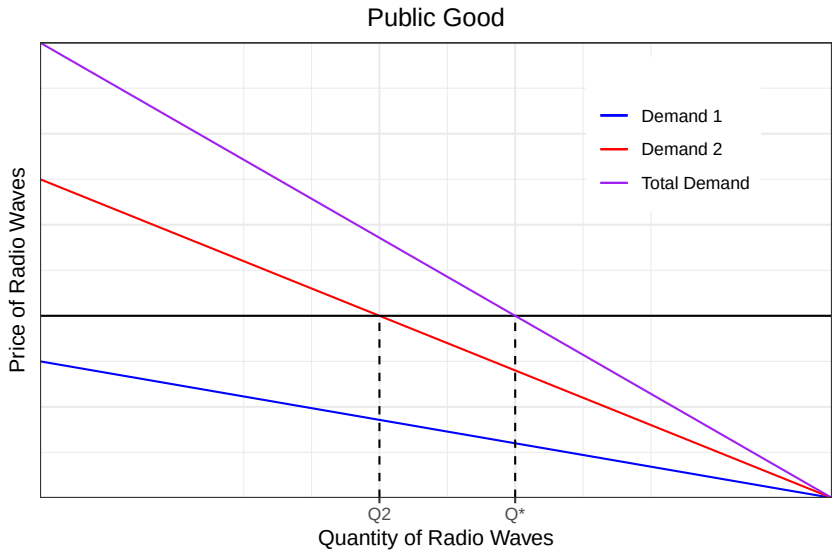
Samuelson Rule (1954) (Stefanie Stantcheva EC1410 Lecture 8)

Social efficiency is maximized when sum of WTPs equals MC **not** individual WTPs

Public versus private



(a) Private good: sum q for each p



(b) Public good: sum p for each q

The total demand is the same, but the allocation is different

Group work

- You are working on a group policy brief and presentation
- I grade the collective work
- What problems can arise here?
- The group project and grade are a "public" good – room to free ride!
- Any solutions?

Private Sector Under-provision & Free Rider problem

- In a private market, $WTP_k = MC$ for all k, so $\sum WTP_k \geq MC$
- Is q_r too low or too high? Increase q_r to reduce $\sum WTP$
- This under-provision is called the free-rider problem

Free Rider Problem (Stefanie Stantcheva EC1410 Lecture 8)

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

$\Rightarrow$ Only those with the highest WTP pay for a public good in a private market

$\Rightarrow$ Less public good provided than the Pareto optimum

Aside on game theory

- Game theory is a classic part of economics with applications to strategic interaction and coordination problems
- A central concept is the **Nash equilibrium**

Nash equilibrium

Each agent maximizes their utility taking as given that others agents are acting to maximize their utility

- Agents maximize utility, but know others do too[2]
- How could this lead to free rider problems?
- Agents only pay for public goods beyond what others pay

[2] See slides by Stefanie Stantcheva for a full mathematical example

Experimental evidence on free riding

- Marwell and Ames 1981 (Lab experiment):
  - 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: take all the cash
- Socially optimal: contribute everything to public good
- Lab: average contribution is 50% to public good, but fall as game repeats (Isaac, McCue, and Plott, 1985)
- Explanation: people are willing to cooperate, but retaliate if others take advantage (hard to sustain a public good)

Class activity: buying potential final exam questions

You each have **7.5** bonus points for the final. You can keep them or use them to unlock **potential exam questions**.

Each question costs **S bonus points**, where S is the number of students attending. Each question is worth 10 points. The chance that a question appears on the final is $\frac{1}{Q}$, where Q is the total number of potential questions.

1. Secretly choose $B_i \in \{0, \ldots, 7.5\}$ to contribute.
2. The class "buys" $\sum_i B_i/24$ (rounded down) potential questions.
3. There will be multiple rounds with points rolled over across rounds.
4. Any excess points at the end, will be refunded proportionally to points donated.

- What is the public good here? The **exam question(s)**.
- Why is it a public good? Once revealed, everyone benefits—**nonrivalrous** and **nonexcludable**.

How does a common point pool differ from a question purchase game?

- **Common point pool:** Quasi-rival "club" good; marginal private payoff is changed by class size.
- **Question purchase game:** *Non-rival* add-on; decision rule is $\sum \text{WTP} \geq \text{MC}$ (Samuelson).
- **Prediction:** More shaving/free-riding in common pool than question purchase game.

Can private provision overcome free rider problems?

- Some value/demand a public good more than others $\Rightarrow$ $\sum_i WTP_i - MC \to 0$ (e.g. patrons of the arts)
  - Spectrum Auction: The Federal Communications Commission (FCC) auctions off rights to broadcast on certain frequencies
  - Re-privatize the public good so the free rider problem is no longer an issue
- Altruism: if people care about others, it can *close the gap* between $\sum_i WTP$ and MC
  - Can lead to overprovision if people overestimate others' benefits from a public good
- Warm glow: People feel good about their individual gift, beyond the utility they get from the total public good

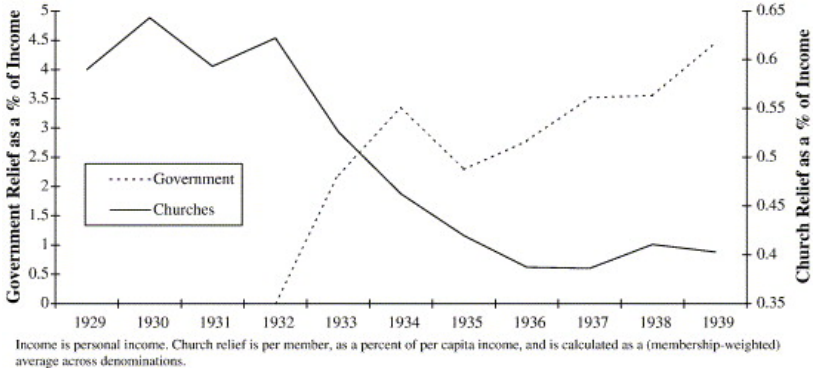
Government provision of public goods

- Governments can provide public goods
- **Note:** Publicly provided goods $\neq$ public goods
  - Publicly provided goods could be rivalrous or excludable (bus)
- What happens to private giving if the government provides a public good?
  - Model: government provision will "crowd out" private provision 1:1 (Andreoni 1988)
  - However, other factors can lead to partial crowd-out:
    - Warm-glow: people feel good giving (Andreoni 1990)
    - Reciprocity: people give more if they know others give
    - Social pressure: people give more if there is an expectation
    - Signalling: show your status by giving
    - Altruism: people value others' utility
    - Leadership: government can lead by example
    - Fundraising:Form 990 tax data show \$1 in gov't grants $\Rightarrow$ $\Downarrow$ \$0.25 in private fundraising (Andreoni-Payne 2003)

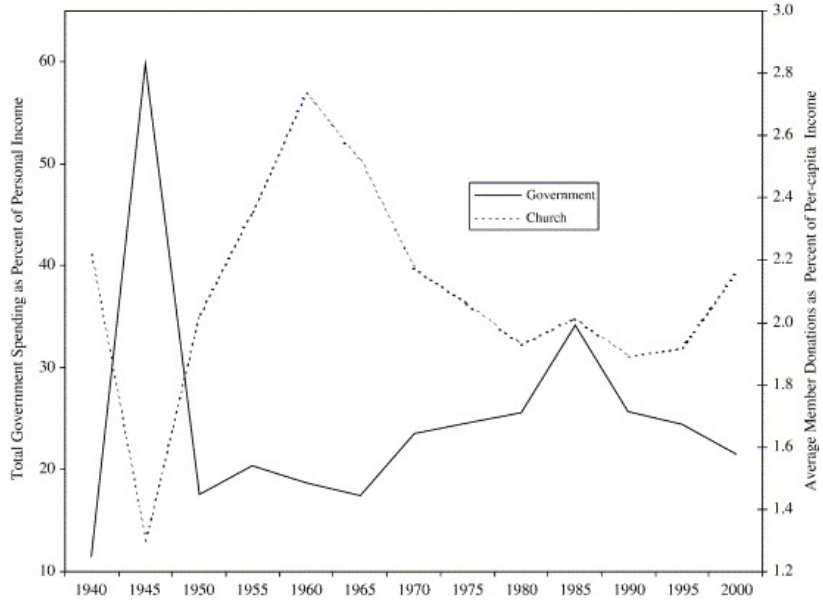
Crowd-out: Are churches and the state substitutes?

- Hungerman (2005) and Hungerman and Gruber (2007) ask if churches step in when the state cuts spending
- Hungerman (2005): 1996 Welfare Reform responses
  - Leverages plausibly exogenous variation in immigration share + 1996 Welfare Reform that limited welfare eligibility for immigrants
  - Incomplete "crowd-out:" \$1 $\Downarrow$ in gov't $\Rightarrow$ \$0.20-0.38 $\Uparrow$ in church spending
- Hungerman and Gruber (2007): Great Depression responses to New Deal spending
  - Plausibly exogenous variation in New Deal spending due to political constraints
  - Incomplete "crowd-out:" \$1 $\Uparrow$ in gov't $\Rightarrow$ \$0.30 $\Downarrow$ in church spending (3% of total New Deal spending)

Macro spending trends



(a) 1929-1939 (Gruber and Hungerman 2007)



(b) 1940-2000 (Hungerman 2005)

Government spending and church giving. Hungerman (2005)

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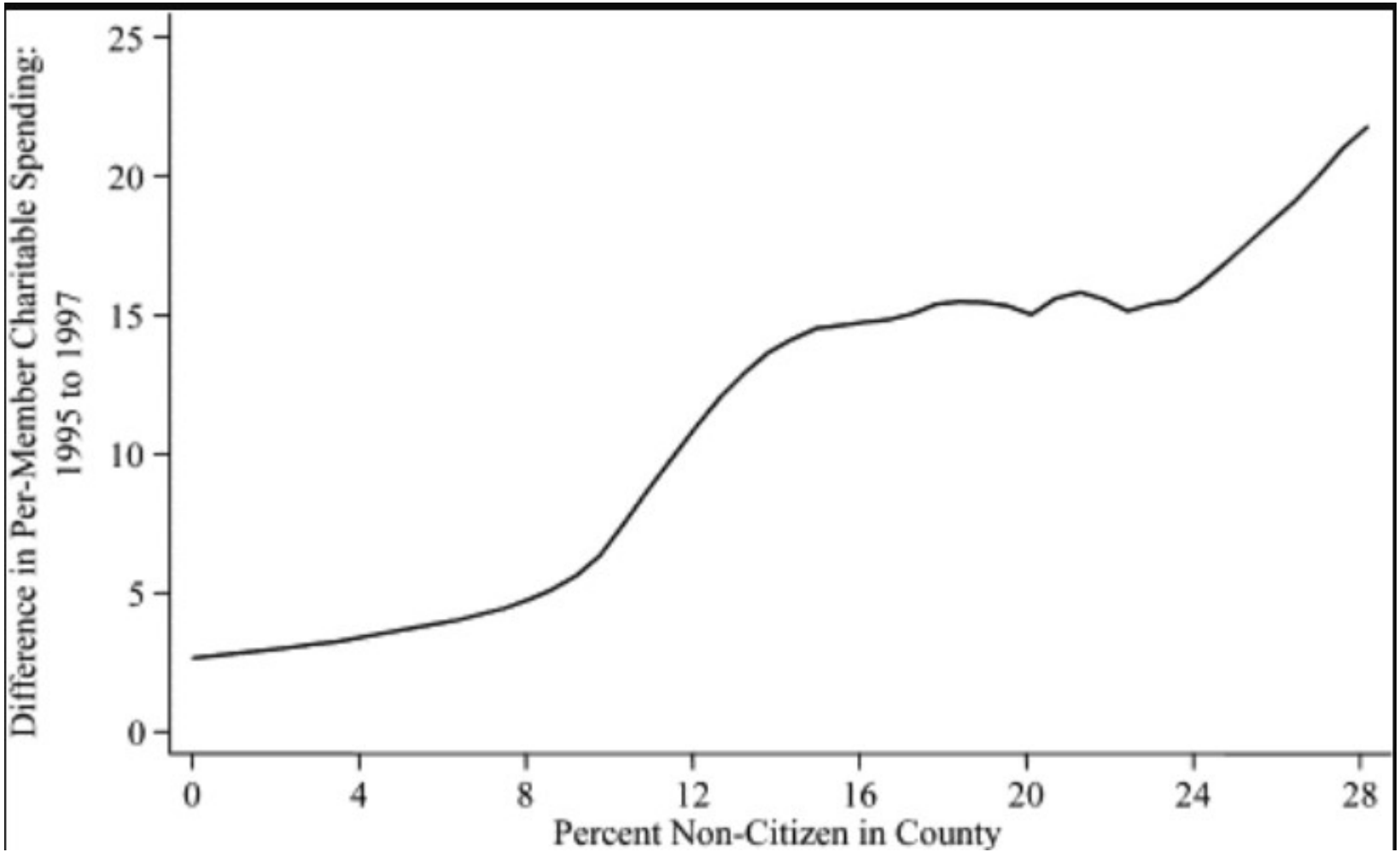
PC(USA) giving increases in immigrant share



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Tiebout choice: local choice + government = market?

- People "vote with their feet" across **many jurisdictions**, each offering a tax–public good bundle.
- Similar to the add/drop period at the start of a semester, students avoid courses with a high workload and low benefit.
- If *mobility is easy*, *preferences/info are known*, *finance is lump-sum*, and *no spillovers*:
  - Sorting can make local public goods **closer to efficient**: MWTP (summed within a town) aligns with MC.
- Reality check: can you always switch classes? No! There are enrollment caps, schedules, and other constraints.
- Towns may differ on tax-public good bundles, but:
  - Equity: Rents respond to demand, creating mobility friction
  - Efficiency: Taxes aren't lump-sum and there are spillovers across towns
  - Stratification: Preferences/means align with demographics creating stratification
- Takeaway: Tiebout pushes toward efficient *local* bundles under strong conditions; equity/stratification concerns remain.

Tiebout sorting in school districts (Urquiola 2005)

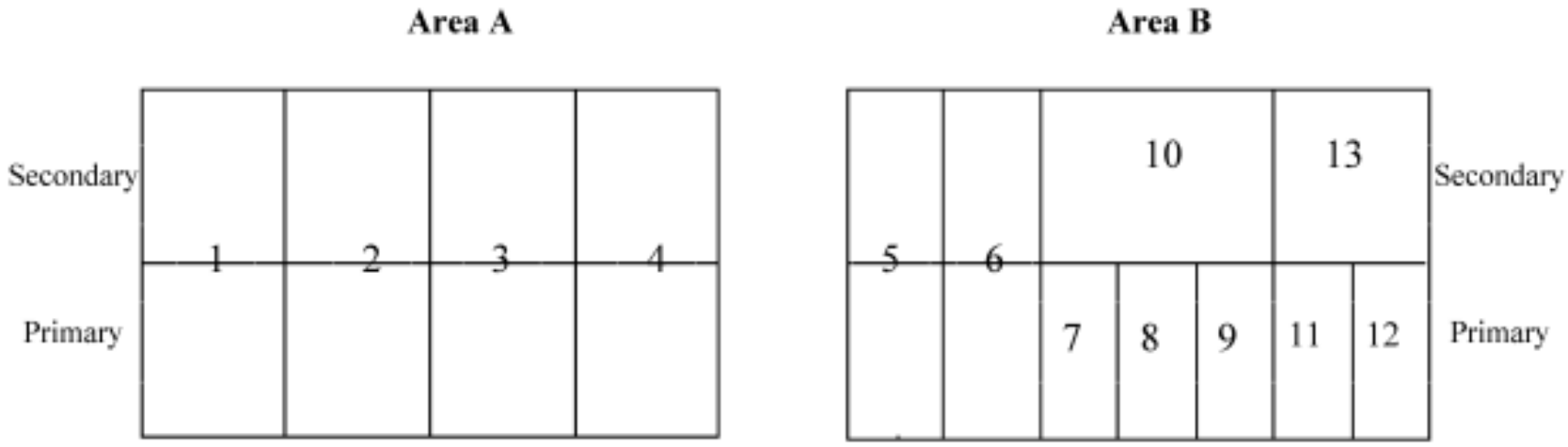

FIGURE 2. HYPOTHETICAL SCHOOL DISTRICT STRUCTURE

Figure 3: School districts vary in size and coverage of primary versus secondary schools across Metropolitan areas (Urquiola 2005)

Tiebout sorting in school districts (Urquiola 2005)

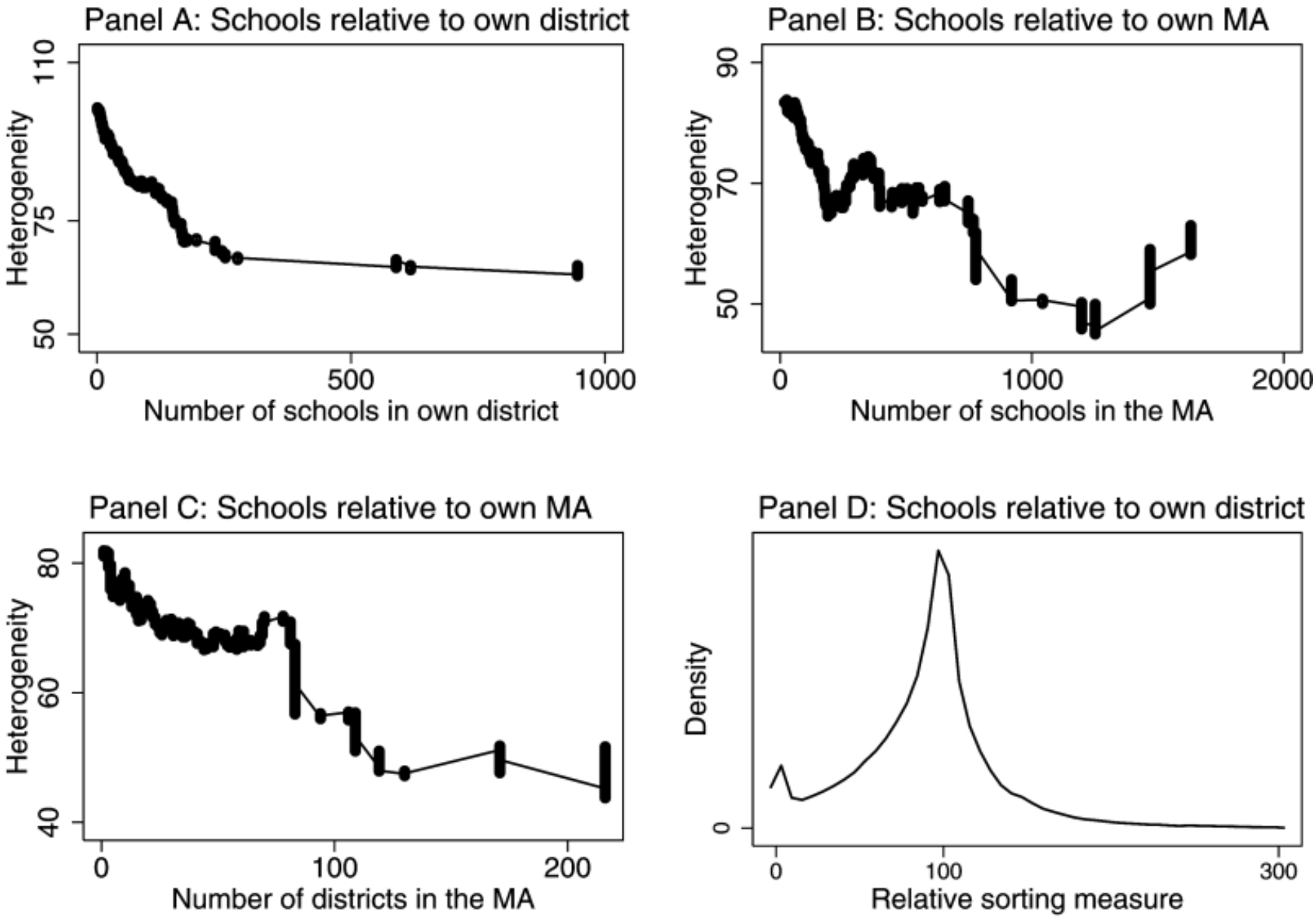

Figure 4: Tiebout choice leads to "sorting" of school districts by observable characteristics – decline in heterogeneity at all levels of aggregation (MA, district

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Other topics

- **Reciprocity**: Falk 2007 found donors in Switzerland give more to help Bangladeshi children when receiving more children's drawings
- **Social Pressure**: Dellavigna et al. (2012): inform treatment group when fundraiser will visit, let treatment group 2 opt out
  - People 9-25% less likely to open door for fundraisers relative to control
  - 28-42% more likely to opt out if given option
- All of these complicate the narrative about public goods and gov't role in increasing their provision

Conclusion

- Public goods are nonrivalrous and nonexcludable
- As a result, they are often subject to free rider problem and under-provided
- Government can step in to provide public goods, but this can crowd out private provision
- Motivations for private provision go beyond a simple economic model leading to incomplete crowd-out
- Government role likely varies by the type of public good