Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Approach

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Outline

1. Introduction

Research Question

- Which level of government should provide public goods?

Motivating Examples

- MTA: Should state or cities run and operate buses and subway?
- Highways: Should federal government or states pay for highways?
- Other goods: How much should cities spend on parks and libraries?

Important Concepts

- Federalism: Centralized and decentralized govts. share jurisdiction
- Public Goods: Nonexcludable and Nonrivalrous
- Externality: + (-) spillovers result in under (over) production
- Fiscal Federalism: The study of a public sector that taxes and produces public goods at different levels of government.

1. Introduction: Public Goods and Fiscal Federalism

- Decentralization: Theory of Local Public Goods, Tiebout (1956)
  - City competition for residents leads to optimal public good provision
  - Residents sort according to preferred combination of public goods
  - Requires several assumptions including no externalities

- Fiscal Federalism: Standard Approach, Oates (1972)
  - Analyzes centralized and decentralized provision with (+) externalities
  - Decentralization: Fails to internalize spillovers (*coordination failure)*
  - Centralization: Uniform provision (*preference matching failure*)

- Fiscal Federalism: PE Approach, Besley & Coate (2003)
  - Adds legislature and relaxes uniformity assumption under centralization
  - Uncertainty: Districts unsure about amount of public good provision
  - Misallocation: Spending skews toward those in winning coalition
  - Strategic Delegation: Median differ from elected legislator's preferences

2. Framework

Economy

- Districts
  - Two geographic districts $i \in \{1, 2\}$,
  - Each with a unit mass of non-mobile citizens with complete information
  - Each produces a local public good (e.g. parks, roads & libraries)
- Goods
  - One private: citizens endowed with $X \in \mathbb{R}^{>0}$ and consume $x \geq 0$
  - Two public: produces $g_i \geq 0$ units at cost of p units of X
- Taxes
  - Uniform head tax: τ_i
  - Decentralized Govts: produce one good and tax $\tau_i = pg_i$
  - Centralized Govt: produces two goods and taxes $\tau_i = p(g_1 + g_2)/2$
- Externalities
  - Public goods exhibit (+) spillovers indexed by $k \in [0, \frac{1}{2}]$
  - $k = 0$ citizens care about goods in own district only
  - $k = \frac{1}{2}$ citizens care about goods in both districts equally

2. Framework, cont

Citizens

- Types
  - Taste preference parameter for public goods $\lambda \sim [0, \bar{\lambda}]$
  - In each district i median $m_i = \mathbb{E}[\lambda]$
  - Preferences over $[0, \bar{\lambda}]$ are single peaked
  - Assumptions: $m_1 \geq m_2$ and $2m_1 < \bar{\lambda}$

- Quasi-linear Utility

$$x + \lambda[(1-k)\ \ln g_i + k\ \ln g_{-i}]$$

- Budget Constraint

$$X \geq x + \tau_i$$

3. Standard Approach

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Government chooses public good level(s) according to median voter(s)

- Three Systems
  1. First Best: Social Planner
     - Internalizes spillovers
     - Differentially sets public good levels
  2. Second Best: Two Decentralized Governments
     - Does not internalize spillovers (*Coordination Failure*)
     - Matches local production to local preferences
  3. Second Best: One Centralized Government
     - Uniform allocation imperfectly internalizes spillovers
     - Allocation does not vary with spillovers (*Preference Matching Failure*)

3. Standard Approach: First Best

Social Planner

- Internalizes Individual Maximization Problems

$$
\begin{aligned}
u_1(x_1, g_1, g_2) &= x_1 + m_1[(1-k)\ \ln g_1 + k\ \ln g_2] + \mu_1[X_1 - x_1 - \tau_1] \\
u_2(x_2, g_1, g_2) &= x_2 + m_2[(1-k)\ \ln g_2 + k\ \ln g_1] + \mu_2[X_2 - x_2 - \tau_2]
\end{aligned}
$$

  - Sum the utility functions
  - Can restrict choice variables to g_i (u_i is linear in $x_i \Rightarrow \mu_i = 1$)
  - Regardless of underlying political system, $\tau_1 + \tau_2 = p(g_1 + g_2)$

- Aggregate Public Good Surplus Problem

$$
\begin{aligned}
g_i^s = \underset{g_i}{\arg\max}\ & [m_1(1-k) + m_2 k]\ln g_1 + \\
& [m_2(1-k) + m_1 k]\ln g_2 - p(g_1 + g_2)
\end{aligned}
$$

3. Standard Approach: First Best, continued

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Social Planner chooses public good levels according to m_1 and m_2

$$g_i^s = \arg\max_{g_i} \quad [m_1(1-k) + m_2 k]\ln g_1 + [m_2(1-k) + m_1 k]\ln g_2 - p(g_1 + g_2)$$

$$(g_1^s, g_2^s) = \left(\frac{m_1(1-k) + m_2 k}{p}, \frac{m_2(1-k) + m_1 k}{p}\right)$$

- Result: Optimal Allocation
  - Each district i fully internalizes external benefit to district $-i$
  - Each district allocation matches preferences of local citizens

3. Standard Approach: Second Best with Decentralization

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Each district government i chooses public good level according to m_i

$$g_i^d = \underset{g_i}{\text{argmax}}\ m_i[(1-k)\ln g_i + k\ln g_{-i}^d] - pg_i$$

$$(g_1^d, g_2^d) = \left(\frac{m_1(1-k)}{p}, \frac{m_2(1-k)}{p}\right)$$

- Result: *Coordination Failure*
  - Spillovers $k > 0$ to public goods leads to underproduction of g_i
  - District i fails to account for benefits to district $-i$ citizens

$$g_i^d = \frac{m_i(1-k)}{p} < \frac{m_i(1-k) + m_{-i}k}{p} = g_i^s, \quad \forall k > 0$$

3. Standard Approach: Second Best with Centralization

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Central govt. chooses uniform public good level according to m_1 & m_2

$$g^c = \underset{g}{\text{argmax}}\ [m_1 + m_2]\ln g - 2pg$$

$$(g_1^c, g_2^c) = \left(\frac{m_1 + m_2}{2p}, \frac{m_1 + m_2}{2p}\right)$$

- Result: *Preference Matching Failure*
  - Identical Districts ($m_1 = m_2$): allocation matches social planner
  - Nonidentical Districts ($m_1 > m_2$): $g_i^c \in (g_2^s, g_1^s)\ \forall k < \frac{1}{2}$

$$\frac{m_1 + m_2}{2p} \in \left(\frac{m_2(1-k) + m_1 k}{p}, \frac{m_1(1-k) + m_2 k}{p}\right), \quad k < \frac{1}{2}, \ m_1 > m_2$$

3. Standard Approach: Public Surplus Comparison

Surplus Functions

$$
\begin{aligned}
S^d(k) &= \sum_{i\in\{1,2\}} \left\{[m_i(1-k)+m_{-i}k]\ln\frac{m_i(1-k)}{p} - m_i(1-k)\right\} \\
S^c(k) &= [m_1+m_2]\ln\frac{m_1+m_2}{2p} - m_1 - m_2
\end{aligned}
$$

Proposition 1

- Identical Districts ($m_1 = m_2$)
  - Spillovers ($k > 0$): $S^c(k) > S^d(k)$
  - No Spillovers ($k = 0$): $S^c(k) = S^d(k)$
- Non-identical Districts ($m_1 > m_2$)
  - Small Spillovers ($\forall\ k$ s.t. $k < k'$): $S^c(k) < S^d(k)$
  - Large Spillovers ($\forall\ k$ s.t. $k \geq k'$): $S^c(k) \geq S^d(k)$

    Proof: $\exists k' \in (0, 1/2)$ st $S^c(k) \geq (<) S^d(k)$ for all $k \geq (<) k'$
    - $S^c(0) < S^d(0)$ and $S^c(1/2) > S^d(1/2)$
    - $\partial S^d(k)/\partial k < 0$

4. Political Economy Approach

- Question
  - Is uniformity realistic or necessary for suboptimal centralization?
- Argument
  - Non-identical legislators can produce suboptimal allocations

- New Features
  - Legislatures: Determine public good allocations
  - Simultaneous Elections: Citizen candidates elect legislators
  - Bargaining: Legislators ex-ante bargain over a single period allocation

- New Concepts
  - Uncertainty: Districts unsure about amount of public good provision
  - Misallocation: Spending skews toward those in winning coalition
  - Strategic Delegation: Median differ from elected legislator's preferences

4. Political Economy Approach, continued

Three Systems

1. Two Decentralized Legislators
   - Bargaining: None. Legislator i benevolently sets policy in district i
   - Preference matching with coordination failure

2. One Centralized Non-Cooperative Legislature
   - Bargaining: Baron and Ferejohn (1989) "style" in single period
   - Imperfectly matches preferences and internalizes spillovers
   - Ex-ante, districts unsure about final allocation (*Uncertainty*)
   - Ex-post, allocation skewed toward winning coalition (*Missallocation*)
   - Potential Critique: Do we care about ex-ante or ex-post allocations?

3. One Centralized Cooperative Legislature
   - Bargaining: *Utilitarian Bargaining Solution*
   - Imperfectly matches preferences and internalizes spillovers
   - Median incentivized to support non-median type (*Strategic Delegation*)

4. Political Economy Approach, continued

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Districts simultaneously elect respective legislator λ_i (citizen candidate)
  3. Government chooses public good level(s) as function of legislator type

- Equilibrium
  - Legislator Pair: $(\lambda_1^*, \lambda_2^*)$
  - Policy allocation: (g_1, g_2)

- Backwards Induction
  - Policy Stage
    - Representatives set policy to maximize their public goods surplus
    - Where allocations are functions of legislator type: $g_i = f_i(\lambda_1, \lambda_2)$
  - Election Stage
    - District i voters pick legislator λ_i to maximize their public good surplus

4. PE Approach: Decentralization

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Districts simultaneously elect respective legislator λ_i (citizen candidate)
  3. Legislator λ_i chooses public good level g_i as function of legislator type

- Policy Stage
  - Legislator λ_i solves district i's maximization problem.
  - λ_i takes $g_{-i}(\lambda_{-i})$ as given.

$$g_i(\lambda_i) = \arg\max_{g_i} \lambda_i[(1-k)\ln g_i] + k\ln g_{-i}(\lambda_{-i})] - pg_i$$

$$(g_1(\lambda_1), g_2(\lambda_2)) = \left(\frac{\lambda_1(1-k)}{p}, \frac{\lambda_2(1-k)}{p}\right)$$

4. PE Approach: Decentralization, continued

- Election Stage
  - District i citizens with type $\lambda \in [0, \bar{\lambda}]$ face public good surplus:

$$\lambda\Big[(1-k)\ln\frac{\lambda_i(1-k)}{p} + k\ \ln\frac{\lambda_{-i}(1-k)}{p}\Big] - \lambda_i(1-k)$$

  - Type λ citizens pick λ_i to maximize surplus
  - Median Voter Argument
    - Citizen type λ has single peaked preferences over types $\lambda_i', \lambda_i \in [0, \bar{\lambda}]$
    - If $\lambda_i' > \lambda_i > \lambda$, then type λ prefers λ_i
    - If $\lambda_i' < \lambda_i < \lambda$, then type λ prefers λ_i
    - Thus m_i will be majority preferred to any $\lambda_i \neq m_i$
  - Equilibrium
    - Legislator Pair: $(\lambda_1^*, \lambda_2^*) = (m_1, m_2)$
    - Policy Allocation: Same as decentralization in standard approach

$$(g_1, g_2) = \Big(\frac{m_1(1-k)}{p}, \frac{m_2(1-k)}{p}\Big)$$

4. PE Approach: Centralization, Non-cooperative Leg.

- Extensive Form
  1. Nature chooses distribution of public goods tastes, λ, in each district i
  2. Districts simultaneously elect respective legislator λ_i (citizen candidate)
  3. Via bargaining, λ_i chooses (g_1, g_2) as function of own type with $pr = \frac{1}{2}$

- Policy Stage
  - Legislator λ_i forms a minimum winning coalition with $pr = 1/2$
  - λ_i solves district i's maximization problem, but chooses g_i and g_{-i}

$$(g_1^i(\lambda_i), g_2^i(\lambda_i)) = \underset{g_i, g_{-i}}{\text{argmax}}\ \lambda_i[(1-k)\ln g_i + k\ln g_{-i}(\lambda_{-i})] - \frac{p}{2}(g_i + g_{-i})$$

$$(g_1^i(\lambda_i), g_2^i(\lambda_i)) = \Big(\frac{2\lambda_i(1-k)}{p}, \frac{2\lambda_i k}{p}\Big), \quad i \in \{1, 2\}$$

4. PE Approach: Centralization, Non-coop Leg., cont.

- Election Stage
  - District i citizen of type $\lambda \in [0, \bar{\lambda}]$ receives public good surplus:

$$\frac{1}{2}\left[\lambda\left[(1-k)\ln\frac{2\lambda_i(1-k)}{p} + k\ \ln\frac{2\lambda_i k}{p}\right] - \lambda_i + \lambda\left[(1-k)\ln\frac{2\lambda_{-i}k}{p} + k\ \ln\frac{2\lambda_{-i}(1-k)}{p}\right] - \lambda_{-i}\right]$$

  - Type λ citizens pick λ_i to maximize surplus
  - Median Voter Argument implies majority prefers m_i
  - Equilibrium
    - Legislator Pair: $(\lambda_1^*, \lambda_2^*) = (m_1, m_2)$
    - Policy Allocation:

$$\begin{aligned}(g_1, g_2) &= \left(\frac{2m_1(1-k)}{p}, \frac{2m_1 k}{p}\right) \text{ with prob. } 1/2 \\ &= \left(\frac{2m_2 k}{p}, \frac{2m_2(1-k)}{p}\right) \text{ with prob. } 1/2\end{aligned}$$

4. PE Approach: Centralization, Non-coop Leg., cont.

- Result: *Uncertainty & Misallocation*
  - Identical Districts ($m_1 = m_2$): Equivalent to planner only if $k = \frac{1}{2}$
  - Nonidentical Districts ($m_1 > m_2$): Never equivalent to planner
  - Misallocation: Spending skewed toward those in winning coalition

	Allocation (g_i, g_{-i})	
k	Noncoop	Planner
0	$(\frac{2m_i}{p}, 0)$	$(\frac{m_i}{p}, \frac{m_{-i}}{p})$
$\frac{1}{2}$	$(\frac{m_i}{p}, \frac{m_i}{p})$	$(\frac{m_1+m_2}{2p}, \frac{m_1+m_2}{2p})$

  - Uncertainty: Districts unsure of ex-post allocation
    Critique
    - Why focus on ex-post rather than ex-ante allocations?
    - If interested in long-run, ex-ante allocation may be more appropriate.

PE Approach: Public Surplus Comparison

$$
\begin{aligned}
S_n^c(k) &= \tfrac{1}{2}[m_1(1-k)+m_2k]\left(\ln\tfrac{2m_1(1-k)}{p}+\ln\tfrac{2m_2k}{p}\right) \\
&+\tfrac{1}{2}[m_2(1-k)+m_1k]\left(\ln\tfrac{2m_2(1-k)}{p}+\ln\tfrac{2m_1k}{p}\right)-m_1-m_2
\end{aligned}
$$

Proposition 2

- Identical Districts ($m_1 = m_2$)

  $\exists k'' \in (0, 1/2)$ s.t.
  - Small Spillovers ($\forall$ k s.t. $k \leq k''$): $S_n^c(k) \leq S^d(k)$
  - Large Spillovers ($\forall$ k s.t. $k > k''$): $S_n^c(k) > S^d(k)$

- Non-identical Districts ($m_1 > m_2$)

  $\exists k''' \in (0, 1/2)$ s.t.
  - Small Spillovers ($\forall$ k s.t. $k < k'''$): $S_n^c(k) < S^d(k)$
  - Large Spillovers ($\forall$ k s.t. $k \geq k'''$): $S_n^c(k) \geq S^d(k)$
  - k''' in Non-identical PE Approach $> k'$ Standard Approach

4. PE Approach: Public Surplus Comparison, continued

Proof Sketch

$$
\begin{aligned}
S_n^c(k) &= \tfrac{1}{2}[m_1(1-k)+m_2 k]\left(\ln\tfrac{2m_1(1-k)}{p}+\ln\tfrac{2m_2 k}{p}\right) \\
&\quad +\tfrac{1}{2}[m_2(1-k)+m_1 k]\left(\ln\tfrac{2m_2(1-k)}{p}+\ln\tfrac{2m_1 k}{p}\right)-m_1-m_2
\end{aligned}
$$

- $S_n^c(\cdot)$ is increasing in k, since $\partial S_n^c(k)/\partial k) > 0$
- $S_n^c(0) < s^d(0)$ and $S_n^c(1/2) > s^d(1/2)$
- $S_n^c(K) = S^c(k)$ for $k = 1/2$ and $S_n^c(K) < S^c(k)$ for $k < 1/2$

$$
\begin{aligned}
S_n^C(k) &< \tfrac{m_1+m_2}{2}\left[\ln\tfrac{m_1}{p}+\ln\tfrac{m_2}{p}\right]-(m_1+m_2) = S_n^c(\tfrac{1}{2}) \\
&< [m_1+m_2]\ln\tfrac{m_1+m_2}{2p}-(m_1+m_2) = S^c(k)
\end{aligned}
$$

- The first line follows since $S_n^c(\cdot)$ is increasing
- The second line follows by the strict concavity of $ln(\cdot)$
  - $\ln\left(\frac{m_1}{2p}+\frac{m_2}{2p}\right) > \frac{1}{2}\ln\frac{m_1}{p}+\frac{1}{2}\ln\frac{m_2}{2p}$

5. Conclusions

Presentation Summary

- Standard Approach
  - Identical Districts: centralization preferred for all spillover levels $k > 0$
  - Nonidentical Districts: centralization preferred for k sufficiently large
- PE Approach
  - Identical Districts: centralization preferred for k sufficiently large
  - Nonidentical Districts: centralization preferred for k sufficiently large

Concluding Question

- Across various public goods, are spillovers likely to be high or low?