Equality of Opportunity
and School Financing Structure

Juan Rios

January 4, 2017
Motivation (I)

1. **Normative Principles:**
   - **Compensation Principle:** “Allocation is intended to compensate individuals for their disadvantageous circumstances” (Roemer, 2012)
   - **Liberal Reward Principle:** “Particular Inequalities due to responsibilities should be left untouched” (Fleurbaey, 2008)
Motivation (I)

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2. **Crucial distinction**
   - Circumstances:
   - Responsibility:
Motivation (I)

1. Normative Principles:
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2. Crucial distinction
   - Circumstances: Affect opportunity sets
   - Responsibility: Affect preferences
“It is, of course, a deep philosophical question, with psychological and neurophysiological components, to determine exactly what constitutes the complete set of circumstances for any given social problem. In practice, we choose some circumstances for the purpose of the computation, and define the partition of types with respect to those. We then arbitrarily attribute the variation in the acquisition of the objective among those within a type entirely to differential effort.” (Roemer, 2003)
Motivation (III)

- Equality of Opportunity: force to equalize school investment
- Transfers from Central Government
- Property Taxes are efficient to finance local public schools (Tiebout)
Motivation (III)

- Equality of Opportunity: force to equalize school investment
- Transfers from Central Government
- Property Taxes are efficient to finance local public schools (Tiebout)
- Efficiency vs Equality of Opportunity
- Property Taxes vs Central Transfers
The Research Question

- What is the optimal public school financing structure?
  - Equality of Opportunity vs Efficiency
  - Central Government Transfers vs Property Taxes
The Research Question

- What is the optimal public school financing structure?
  - Equality of Opportunity vs Efficiency
  - Central Government Transfers vs Property Taxes

- Optimal Policy depends on
  - Elasticities of house prices wrt to school investments
  - House price distribution
  - Elasticity of children wages wrt public sch. inv.
Related Literature

   - Consider EOp in Education
Related Literature

   - Consider EOp in Education

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2 **Local Public Economics**: Tiebout (1956), Benabou (1996).
   - Take EOp into account
Related Literature

   - Consider EOp in Education

   - Take EOp into account

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   - Take EOp into account

   - EOp vs Efficiency of Local Taxes
   - Optimality as function of elasticities
Outline

1. Normative Criteria
1 Normative Criteria

2 Model
Outline

1. Normative Criteria
2. Model
3. Optimal Policy
Outline

1. Normative Criteria
2. Model
3. Optimal Policy
4. Future Directions
Equality of Opportunity Function

\[ u(\alpha, \gamma, x) \]

- \( \alpha \): Circumstances
- \( \gamma \): Responsibility
- \( x \): Policy
Equality of Opportunity Function

$$u(\alpha, \gamma, x)$$

- $\alpha$: Circumstances
- $\gamma$: Responsibility
- $x$: Policy

$$EOp(x) = \int \min_{\alpha} u(\alpha, \gamma, x) dF(\gamma)$$
### Example

**Table: Economy with 4 Types**

<table>
<thead>
<tr>
<th>Circumstances</th>
<th>Responsibility $\gamma$</th>
<th>$\int \min_{\alpha} u(\alpha, \gamma) dF(\gamma)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selfish Parents</td>
<td>0</td>
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If all heterogeneity is $\alpha$:

$$EOp = \min_{\alpha} u(\alpha, x)$$

If all heterogeneity is $\gamma$:

$$EOp = \int u(\gamma, x) dF(\gamma)$$

Link to Optimal Tax Results

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Equality of Opportunity

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Example

Table: Economy with 4 Types

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<td>Low</td>
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\[\min_{\alpha} u(\alpha, \gamma)\]

- 0 4

\[4 \times \text{Prob}(\gamma = \text{High})\]

EOp reconciled with Welfarism

- If all heterogeneity is \(\alpha\): \(EOp = \min\ u(\alpha, x)\)
- If all heterogeneity is \(\gamma\): \(EOp = \int u(\gamma, x)dF(\gamma)\)
EOp: Planner observes parents altruism

- $u(\alpha, \gamma) = u(\gamma), \forall \alpha$
- No equality of outcome even in the first best
First Best

1. **EOp:** Planner observes parents altruism
   - \( u(\alpha, \gamma) = u(\gamma), \forall \alpha \)
   - No equality of outcome even in the first best

2. **Mirrlees:** Planner observes ability
   - \( u(\theta) = u \ \forall \theta \)
   - Equality of outcome
Assumptions

1. 2 generations
2. Parents are heterogeneous only on altruism
3. Planner observes house prices
4. Uniform property tax rate across districts
5. Uniform house quality within district
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Tractability

1. Housing supply totally inelastic
2. Single crossing of parents’ consumption and school investments with respect to their altruism parameter.
Assumptions

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Tractability

1. Housing supply totally inelastic
2. Single crossing of parents’ consumption and school investments with respect to their altruism parameter.

What is in the model

Focus on trade off between the efficiency of property taxes and redistribution of central transfers.
Children’s Problem

\[ v^k(\alpha, \gamma, x) \equiv \max_{c,e} u^k(c, e; \gamma) \text{ s.t.} \]
\[ c \leq w^k(e, \alpha, x) \]

- \( u^k(\cdot) \): Kids’ utility
- \( \alpha \): Parents’ Preferences
- \( \gamma \): Responsibility
- \( x \): School District investment
- \( c \): Consumption
- \( e \): Effort in education
- \( w^k(\cdot) \): Endogenous children income
Parents’ Problem

\[ v^P(\alpha) \equiv \max_{h,l} \left\{ u^P(x_h, l; \alpha) \text{ s.t.} \right. \]
\[ (1 + t)P(x_h) \leq l \left\} \right. \]

- \( u^P(\cdot) \): Parents’ utility
- \( h \): District index
- \( t \): Property tax rate
- \( P(x_h) \): Price of a house in \( h \) with \( x_h \)
- \( l \): Parents labor supply (\( w^p \equiv 1 \))
- \( u^P_l(\alpha) \equiv 1 \ \forall \alpha \)

No need to redistribute across parents:

\[ \Rightarrow u^P_x(\alpha) = (1 + t)P'(x_h(\alpha)) \]
Parents’ Problem: Reduced Form

\[ \tilde{u}(x, P; \alpha) = u^P(x, (1 + t)P; \alpha) \]
Parents’ Problem: Reduced Form

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Parents’ Problem: Reduced Form

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Decreasing \(-\frac{\tilde{u}_p}{\tilde{u}_x}(\alpha) \Rightarrow\) Sorted Equilibrium
Planner’s Problem

\[
\max_{x(\cdot)} \left\{ \int_{\alpha} v^p(\alpha) dF(\alpha) + \beta \int_{\alpha} \min_{\gamma} v^k(\alpha, \gamma, x) dF(\gamma) \text{ s.t.} \right. \\
\left. \int_{0}^{\infty} x(p) - tpdH(p) \leq R \right\}
\]

- \(\beta\): Discount factor
- \(P \sim H(\cdot)\)
- \(R\): Exogenous Revenue
Elasticities

\[ P(\xi, I) = \arg \max_P \tilde{u}\left(x(P) + \xi P + I, P; \alpha\right) \]
Elasticities

\[ P(\xi, I) = \arg \max_P \tilde{u}(x(P) + \xi P + I, P; \alpha) \]

1. \( \varepsilon(P) = \frac{x'(P)}{P} \frac{\partial P(\xi, I)}{\partial \xi} \bigg|_{\xi=I=0} \) : Elasticity of house prices with respect to the marginal public school resources

2. \( \eta(P) = x'(P) \frac{\partial P(\xi, I)}{\partial I} \bigg|_{\xi=I=0} \) : Level Effect Parameter

3. \( \varepsilon^c(P) = \varepsilon(P) + \eta(P) \) : Slutsky Equation
Optimal Policy

\[
\frac{x'_\text{opt}(P)}{t - x'_\text{opt}(P)} = \varepsilon^c(P)h(P)P \left( \int_P^\infty \left( 1 - g(p) - \beta eop(p) - \frac{t - x'_\text{opt}(p)}{x'_\text{opt}(p)} \eta(p) dH(p) \right) \right)^{-1}
\]

and \[
\int_0^\infty x_{\text{opt}}(p) - tpdH(p) = R \text{ for } P \leq P_t
\]

Observations

- Larger \( x'_\text{opt}(P) \) implies less redistribution.
\[ \frac{d^2x}{dx^2} \left( P^* \right) = \frac{dP^*}{dx} \]
optimal policy
\[ \frac{dx}{dP}(P^*) dP + \frac{dx'}(P^*) dx' \]
Optimal Policy

\[ x(P) \]

\[ dx'(P^*) dP^* \]

\[ x(P^*) \]

\[ P^* \]
Consider a perturbation $dx'(P^*)$ at $P^*$
Intuition

Consider a perturbation $dx'(P^*)$ at $P^*$

$$BE: [t - x'(P^*)]e^{c(P^*)} \frac{P^*}{x'(P^*)} h(P^*) dP^* dx'(P^*)$$
Consider a perturbation $dx'(P^*)$ at $P^*$

1. **BE:** $[t - x'(P^*)] \varepsilon^c(P^*) \frac{P^*}{x'(P^*)} h(P^*) dP^* dx'(P^*)$

2. **ME:** $- \int_{P^*}^\infty dH(p) dx'(P^*) dP^*$

3. **EopE:** $\int_{P^*}^\infty g(p) + \beta eop(p) dH(p) dx'(P^*) dP^*$

4. **LE:** $\int_{P^*}^\infty \frac{t - x'(p)}{x'(p)} \eta(p) dH(p) dx'(P^*) dP^*$
Consider a perturbation $dx'(P^*)$ at $P^*$

1. **BE:** 
   $$\left[ t - x'(P^*) \right] \varepsilon^c(P^*) \frac{P^*}{x'(P^*)} h(P^*) dP^* dx'(P^*)$$

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   $$\int_{P^*}^{\infty} \frac{t - x'(p)}{x'(p)} \eta(p) dH(p) dx'(P^*) dP^*$$

At the optimum the sum of these effects is zero.
Planner’s weights

\[ g(p) = \frac{1}{\lambda} \tilde{u}_x(\alpha(p)) \]

- Lump-sum transfers if this is the only concern (Tiebout)
Planner’s weights

1. \( g(p) = \frac{1}{\lambda} \tilde{u}_x(\alpha(p)) \)
   - Lump-sum transfers if this is the only concern (Tiebout)

2. \( eop(p) = \begin{cases} 
\frac{1}{\lambda} \int u^k_c \frac{\partial w^k}{\partial x} dF_{\gamma|\alpha(\gamma|0)} & \text{if } p = P(\alpha = 0) \\
0 & \text{otherwise} 
\end{cases} \)
   - All weight on \( \alpha = 0 \) under equality of opportunity
Planner’s weights

1. \[ g(p) = \frac{1}{\lambda} \int u^p u^k_c \frac{\partial w^k}{\partial x} \, dF_{\gamma|\alpha}(\gamma|\alpha(p)) - u^p_c \frac{\partial p}{\partial x} \]
   - Lump-sum transfers if this is the only concern (Tiebout)

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Observations

- \( \frac{\partial w^k}{\partial x}(p) \) is relevant to compute parents’ weights
Planner’s weights

1. \( g(p) = \frac{1}{\lambda} \int u^p u^p_c \frac{\partial w_c^k}{\partial x} \ dF_{\gamma|\alpha}(\gamma|\alpha(p)) - u^p_c \frac{\partial p}{\partial x} \)

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Planner’s weights

1. \( g(p) = \frac{1}{\lambda} \int u_v^p u_c^k \frac{\partial w^k}{\partial x} \ dF_{\gamma|\alpha}(\gamma|\alpha(p)) - u_c^p \frac{\partial p}{\partial x} \)
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2. \( \text{eop}(p) = \begin{cases} \frac{1}{\lambda} \int u_c^k \frac{\partial w^k}{\partial x} d_{\gamma|\alpha}(\gamma|0) & \text{if } p = P(\alpha = 0) \\ 0 & \text{otherwise} \end{cases} \)
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Observations

- \( \frac{\partial w^k}{\partial x}(p) \) is relevant to compute parents’ weights
- \( \frac{\partial w^k}{\partial x}(P(\alpha = 0)) \) is relevant to compute children’s weights
- Overlapping Generations + income tax \( \Rightarrow \) fiscal externality on wages
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2. \[ eop(p) = \begin{cases} \frac{1}{\lambda} \int u^k_c \frac{\partial w^k}{\partial x} \, d\tilde{F}_{\gamma|\alpha}(\gamma|0) & \text{if } p = P(\alpha = 0) \\ 0 & \text{otherwise} \end{cases} \]
   - All weight on \( \alpha = 0 \) under equality of opportunity

Observations

- \( \frac{\partial w^k}{\partial x}(p) \) is relevant to compute parents’ weights
- \( \frac{\partial w^k}{\partial x}(P(\alpha = 0)) \) is relevant to compute children’s weights
- Overlapping Generations + income tax \( \Rightarrow \) fiscal externality on wages
- If \( \gamma \) is partially circumstances \( \Rightarrow \) \( F \) becomes \( \tilde{F} \)
Where to go?

- Endogenous human capital formation
- Bequests and access to credit
- Endogenous local taxes
- Overlapping generations + Endogenous $R$
- Heterogeneity of preferences for district quality
- Private schools and externalities
Generalized EOp

- \( m(\gamma, x) = \min_{\alpha} u(\alpha, \gamma, x) \in M \)
- \( EOp : M \rightarrow \mathcal{R}_+ \): Increasing Operator.
- \( EOp \left( m(\gamma, x) \right) \): Equality of Opportunity Function

<table>
<thead>
<tr>
<th>Circumstances ( \alpha )</th>
<th>Responsibility ( \gamma )</th>
<th>Social Criteria</th>
<th>( EOP )</th>
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\[ m(\gamma) \]

\[ 0 \quad 4 \]

\[ 0 \quad 4 \times \text{Prob}(\gamma = \text{High}) \]
Income Taxation

- All weight on lower circumstances and equal weights over responsibilities justifies larger tax rates (Saez and Stancheva)
- All weight on circumstances with enough weight on high responsibility justifies EITC (Jacquet et al)
- Arbitrary weights on circumstances and equal weights on responsibilities optimal tax less progressive (Lockwood and Weinzierl)
- If planner can observe circumstances he could use “tagging”
Competitive Equilibrium

A CE is an allocation for the parents \( \{ c(\alpha), h(\alpha) \} \), for the children \( \{ c(h, \gamma), e(h, \gamma) \} \) a price schedule \( P(h, x) \), a wage production function \( w(e, x, h) \) and a policy schedule \( x(P) \) such that.

1. \( \{ c(\alpha), h(\alpha) \} \) solves the parents problem given \( P() \) and \( x() \)
2. \( \{ c(h, \gamma), e(h, \gamma) \} \) solves the children problem given \( w(\cdot, x, h) \).
3. Good markets clear \( \int c(\alpha) + (1 + t)P(h(\alpha), x)dF(\alpha) = W \)
4. Housing markets clear \( F(\alpha) = H(h(\alpha)) \)

Back to Reduced Form
Case without EOp concerns

- If $eop(p) = 0 \Rightarrow \tilde{u}_x(\alpha) = \tilde{u}_x \equiv \lambda \ \forall \alpha$
- Property taxes $x'(P) = t \ \forall P$ ensure that $LHS = 0 = RHS$
- “Tiebout Result”