Equality of opportunity:
Theory, evidence and some future directions

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This lecture is largely based on my chapter with Vito Peragine, "Individual Responsibility and Equality of Opportunity" (Ch. 25) in Adler and Fleurbaey (eds.), 2016, *Oxford Handbook of Well-Being and Public Policy.* But Vito is **not** to blame for any errors!

Outline

1. **Equality of opportunity: Motivation and background**
2. Economic models of equality of opportunity
3. Measuring inequality of opportunity
4. Empirical applications
   i. 'Basic' between-types approach
   ii. 'Enhanced' between-types approach
5. Extensions: IGM, poverty, development, causal analysis
6. Conclusions

1. Motivation

"We know that equality of individual ability has never existed and never will, but we do insist that equality of opportunity still must be sought"

(Franklin D. Roosevelt, second inaugural address, 20 January 1937)

"The rise in inequality in the United States over the last three decades has reached the point that inequality in incomes is causing an unhealthy division in opportunities, and is a threat to our economic growth"

(Alan Krueger, Center for American Progress, 12 January 2012)

If these concepts matter for policy, can they be rigorously defined and measured?

1. Philosophical background

Enriching the information basis for the assessment of social justice

- John Rawls (1971): *A Theory of Justice* (Harvard University Press)
- Amartya Sen (1980): "Equality of what?" in McMurrin (ed.), *The Tanner Lectures on Human Values*
- Ronald Dworkin (1981): "What is Equality? Part 1: Equality of Welfare; Part 2: Equality of Resources", *Philos. Public Affairs*, **10**, pp.185-246; 283-345.
- Richard Arneson (1989): "Equality of Opportunity for Welfare", *Philosophical Studies*, **56**, pp.77-93.
- Gerald Cohen (1989): "On the Currency of Egalitarian Justice", *Ethics*, **99**, pp.906-944.

This approach "… performs for egalitarianism the considerable service of incorporating within it the most powerful idea in the arsenal of the anti-egalitarian right: the idea of choice and responsibility" (Cohen, 1989, p.993)

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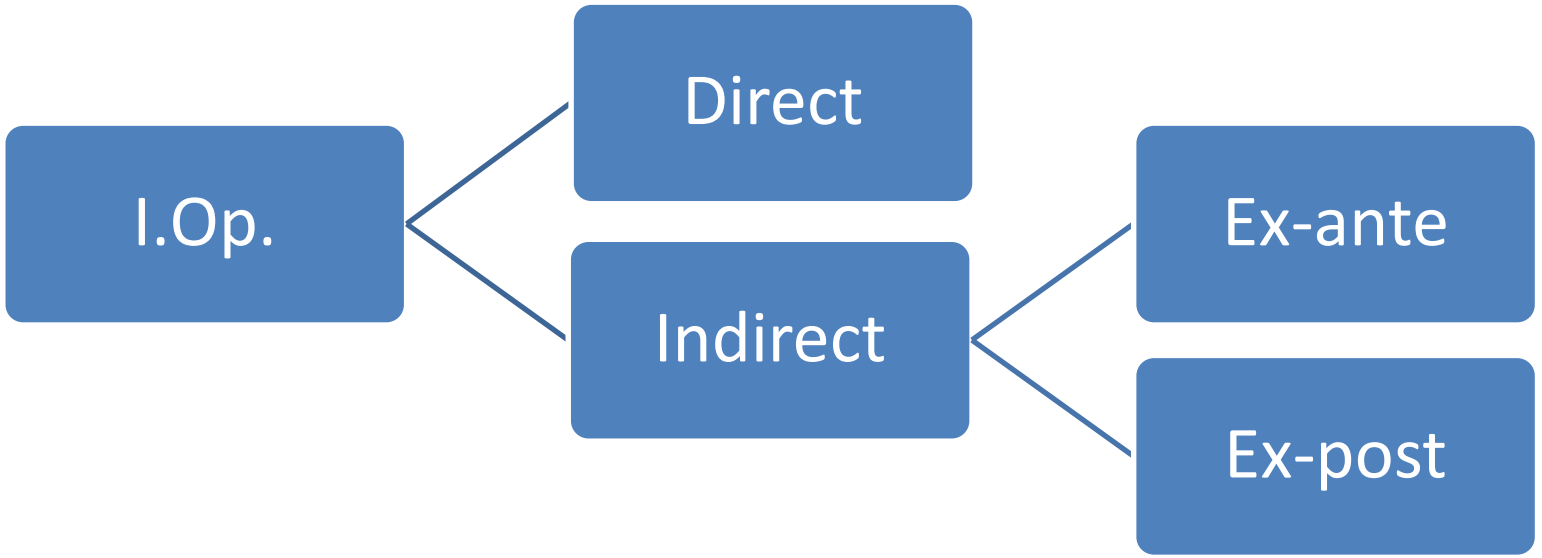
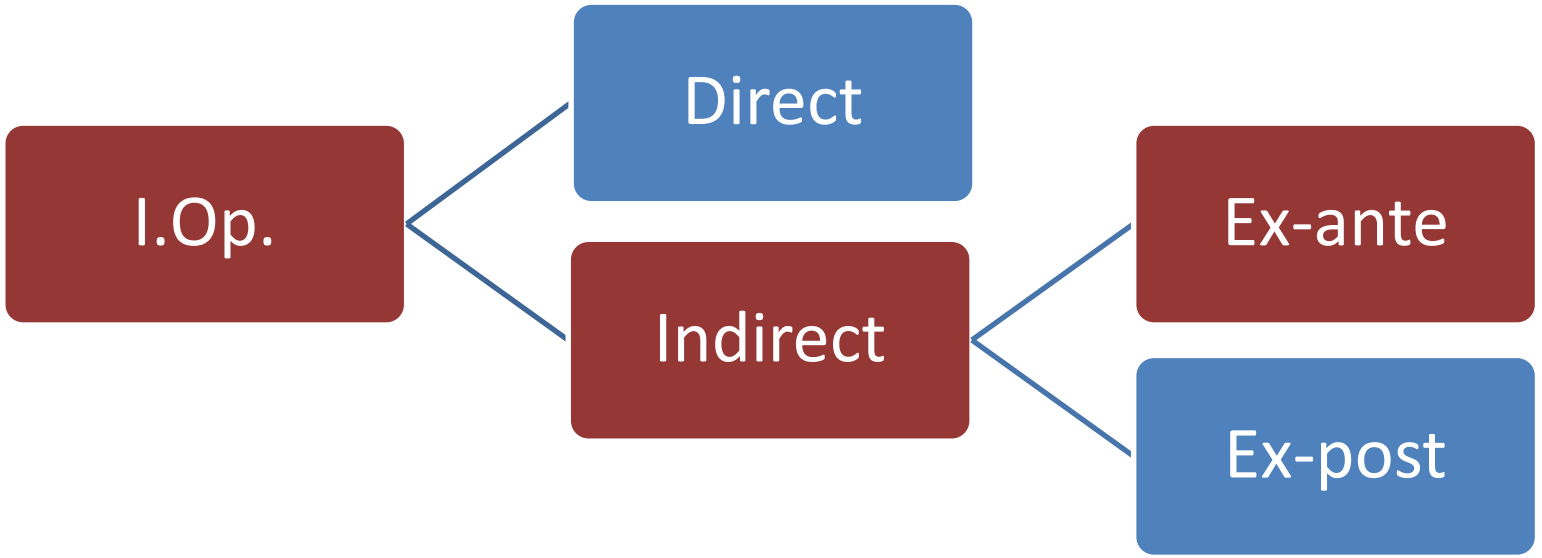
2. Economic models



2. Economic models



2. Economic models

- **Direct approaches**
  - Sought to model opportunity sets explicitly
  - Ranking / ordering opportunity sets
    - Pattanaik and Xu (1990): the cardinality ordering
    - Weymark (2003): the set inclusion ordering
    - Barberà et al. (2004): a survey
  - Ranking / ordering profiles of opportunity sets
    - Kranich (1996) – cardinality difference relation
    - Weymark (2003) – generalized Gini orderings
    - Savaglio and Vannucci (2007)

2. Economic models

- **Indirect approaches**
  - Build primarily on the Arneson / Cohen "control view" of equality of opportunity.
  - Consequentialist and more structural in nature: inferences about equality or inequality of opportunity are made on the basis of (observed) joint distributions of circumstances and outcomes
- Two central principles:
  - Principle of compensation: outcome differences due to factors beyond an individual's responsibility ("circumstances") are unfair, and should be compensated
  - Principle of reward: outcome differences due to individual responsibility factors ("efforts") are ethically legitimate, and should be preserved

2. Economic models

- A simple “canonical” model
- Let each and every individual be fully characterized by the triple *(x, C, e),* and

$$C \in \Omega$$

$$e \in \Theta$$

$$x = g(C, e)$$

$$\boldsymbol{g}: \boldsymbol{\Omega} \times \boldsymbol{\Theta} \Rightarrow \mathbb{R}$$

2. Economic models

- Let all elements of the vector ***C***, as well as *e*, be discrete.
- Let $x_{ij} = g(Ci, ej)$
- Let a *type* consist of all individuals with identical circumstances
- Let a *tranch* consist of all individuals with identical effort levels
- Let there be *n* types and *m* tranches
- Then the population can be represented by the *n x m* matrix $[X_{ij}]$ below.
- To $[X_{ij}]$, let there be associated another *n x m* matrix $[P_{ij}]$, whose elements p_{ij} denote the proportion of the total population with circumstances C_i and effort level e_j.

2. Economic models

Table 1

	e_1	e_2	e_3	…	e_m
C_1	x_{11}	x_{12}	x_{13}	…	x_{1m}
C_2	x_{21}	x_{22}	x_{23}	…	x_{2m}
C_3	x_{31}	x_{32}	x_{33}	…	x_{3m}
…	…	…	…	…	…
C_n	x_{n1}	x_{n2}	x_{n3}	…	x_{nm}

2. Economic models

A tranch

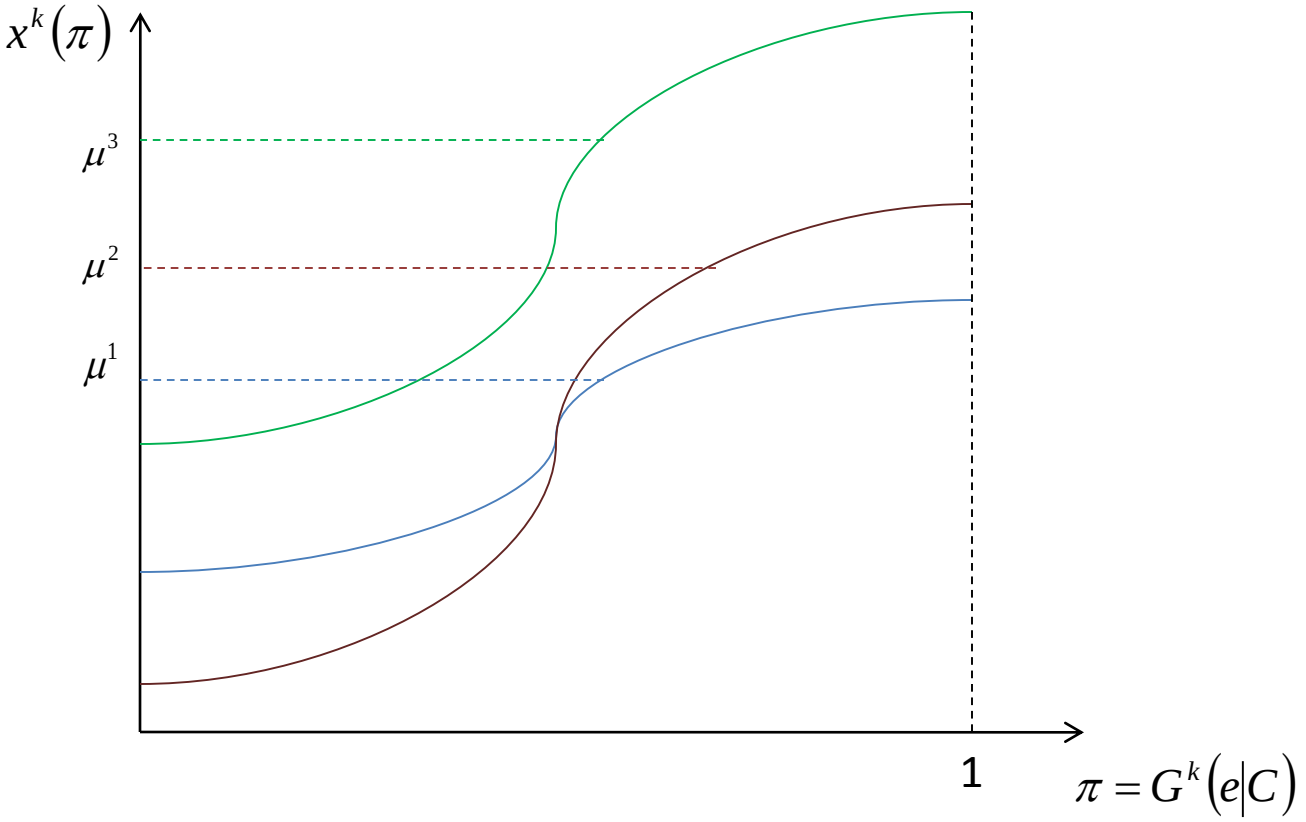
Table 1

A type

	e_1	e_2	e_3	…	e_m
C_1	x_{11}	x_{12}	x_{13}	…	x_{1m}
C_2	x_{21}	x_{22}	x_{23}	…	x_{2m}
C_3	x_{31}	x_{32}	x_{33}	…	x_{3m}
…	…	…	…	…	…
C_n	x_{n1}	x_{n2}	x_{n3}	…	x_{nm}

2. Economic models

When effort is continuous



2. Economic models

- Two central principles:
  - Principle of compensation: outcome differences due to factors beyond an individual's responsibility (circumstances) are unfair, and should be compensated
    - Ex-ante (van de Gaer, 1993): Eliminate inequality across types before effort is realized, by equating values of opportunity sets (defined in terms of the distribution of x conditional on C).
    - Ex-post (Roemer, 1993): Eliminate inequality across types after effort is realized, by eliminating inequality among people exerting the same degree of effort. (i.e. eliminate inequality within tranches).
  - Principle of reward: outcome differences due to the individual choices or responsibility ("efforts") are ethically legitimate, and should be preserved
    - Liberal reward
    - Utilitarian reward
    - Etc.

2. Economic models

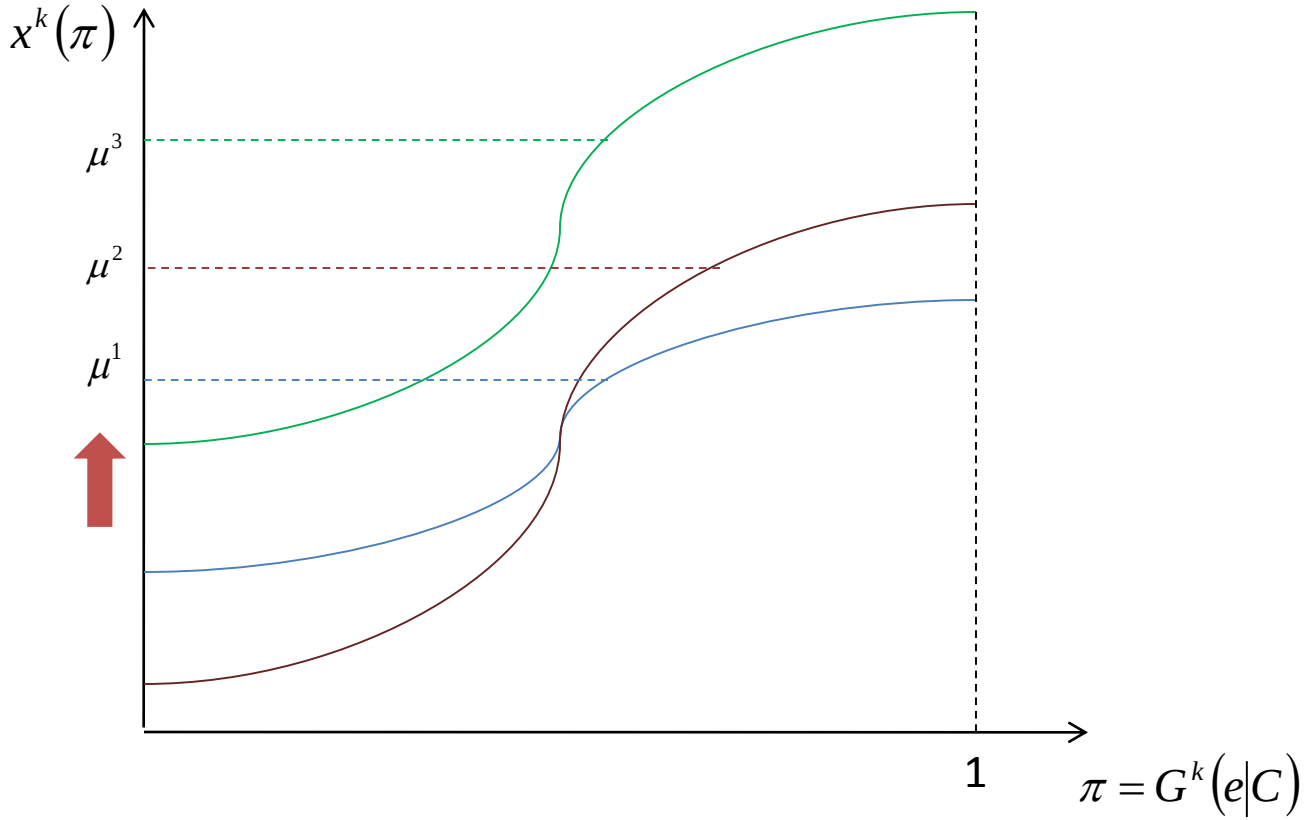
- Variations of this framework have been used to propose:
  i. Social orderings and allocation rules
     - When feasible resource transfers are introduced in the model
  ii. Measures of inequality of opportunity

- Key results (Fleurbaey and Peragine, 2013):

1. In general, the ex-ante and ex-post compensation principles are inconsistent
2. In general, the ex-post compensation principle is inconsistent with reward principles
3. The ex-ante compensation principle and the reward principles are consistent.

2. Economic models

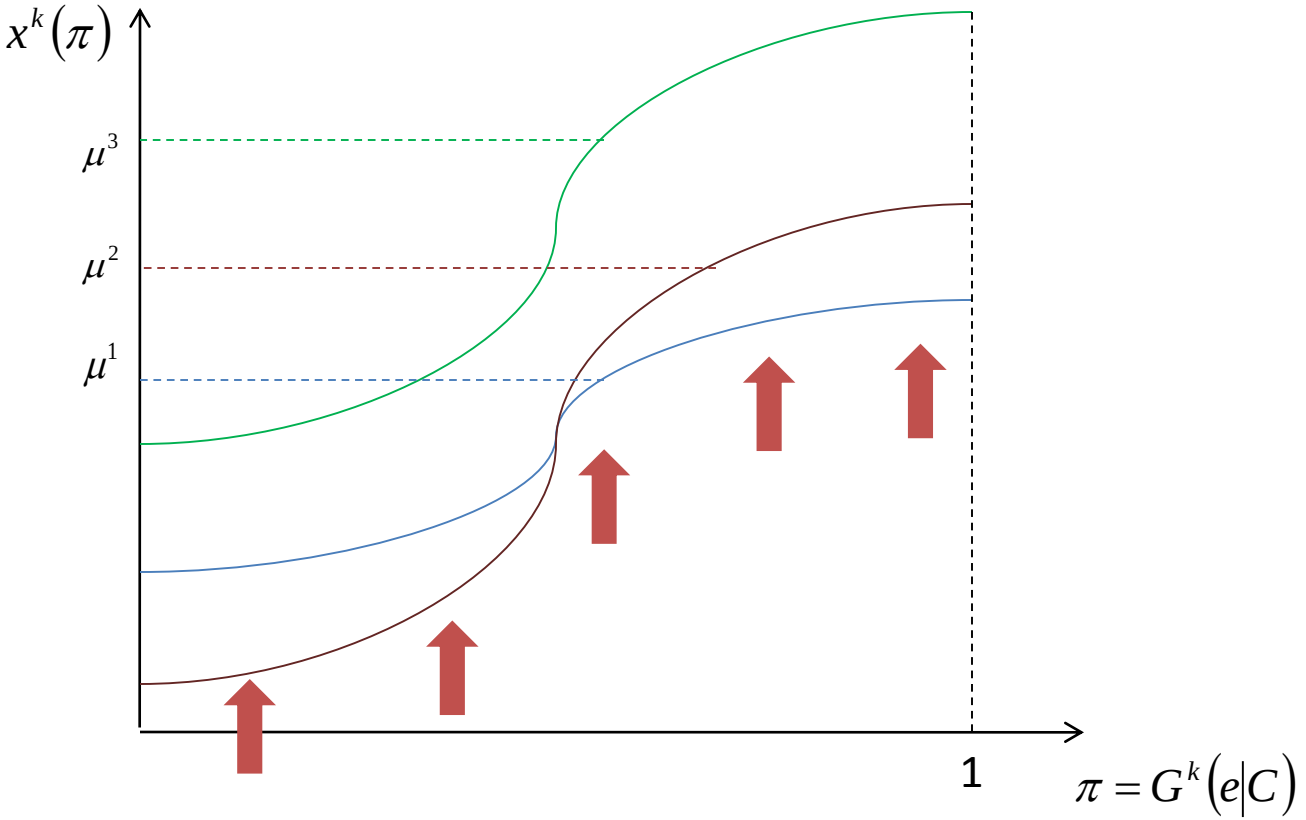
Allocation rules: (i) van de Gaer's "min of means" (satisfies ex-ante compensation and reward)



$$\min_i(\mu_1, \ldots, \mu_n)$$

2. Economic models

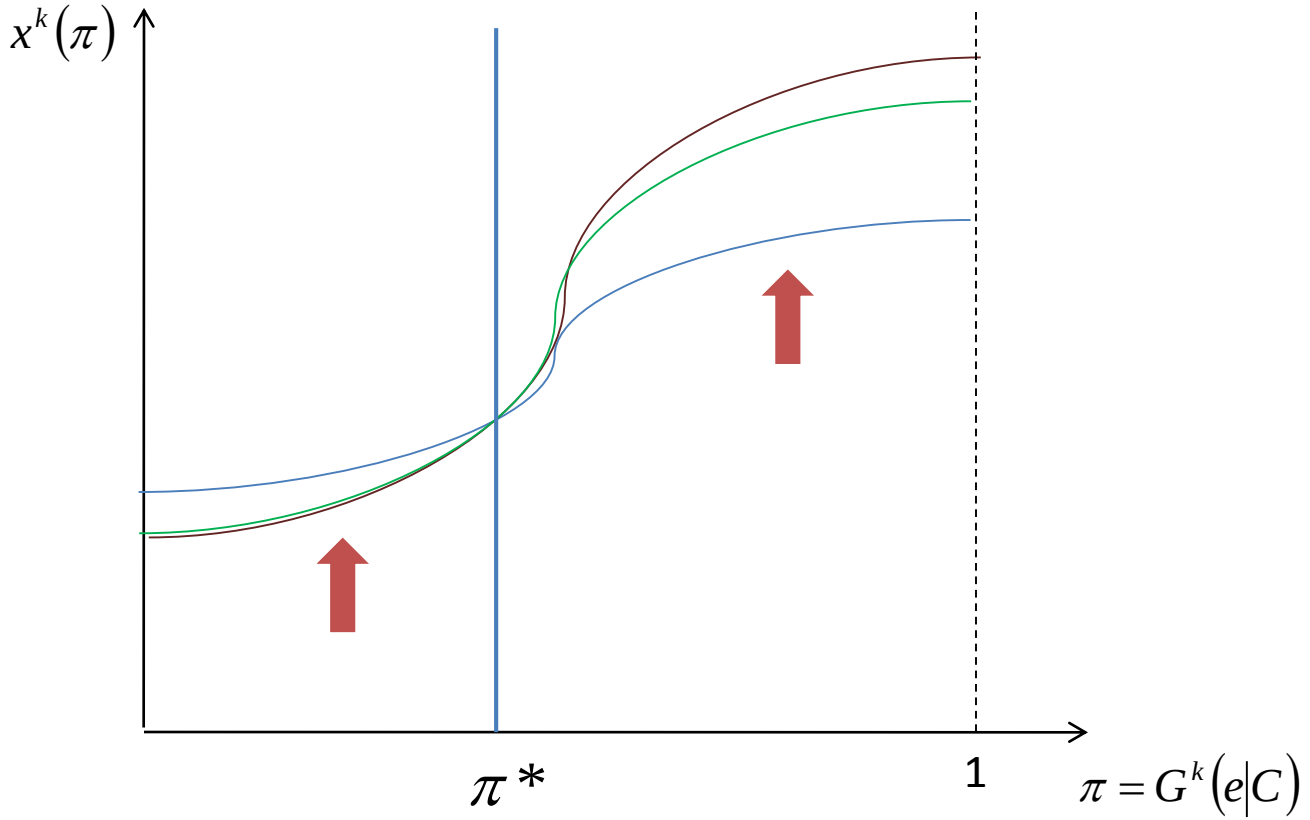
Allocation rules: (ii) Roemer's "mean of mins" (satisfies ex-post compensation)



$$\left(\frac{1}{m}\sum_{j=1}^{m} \min_i (x_{1j}, \ldots, x_{nj})\right)$$

2. Economic models

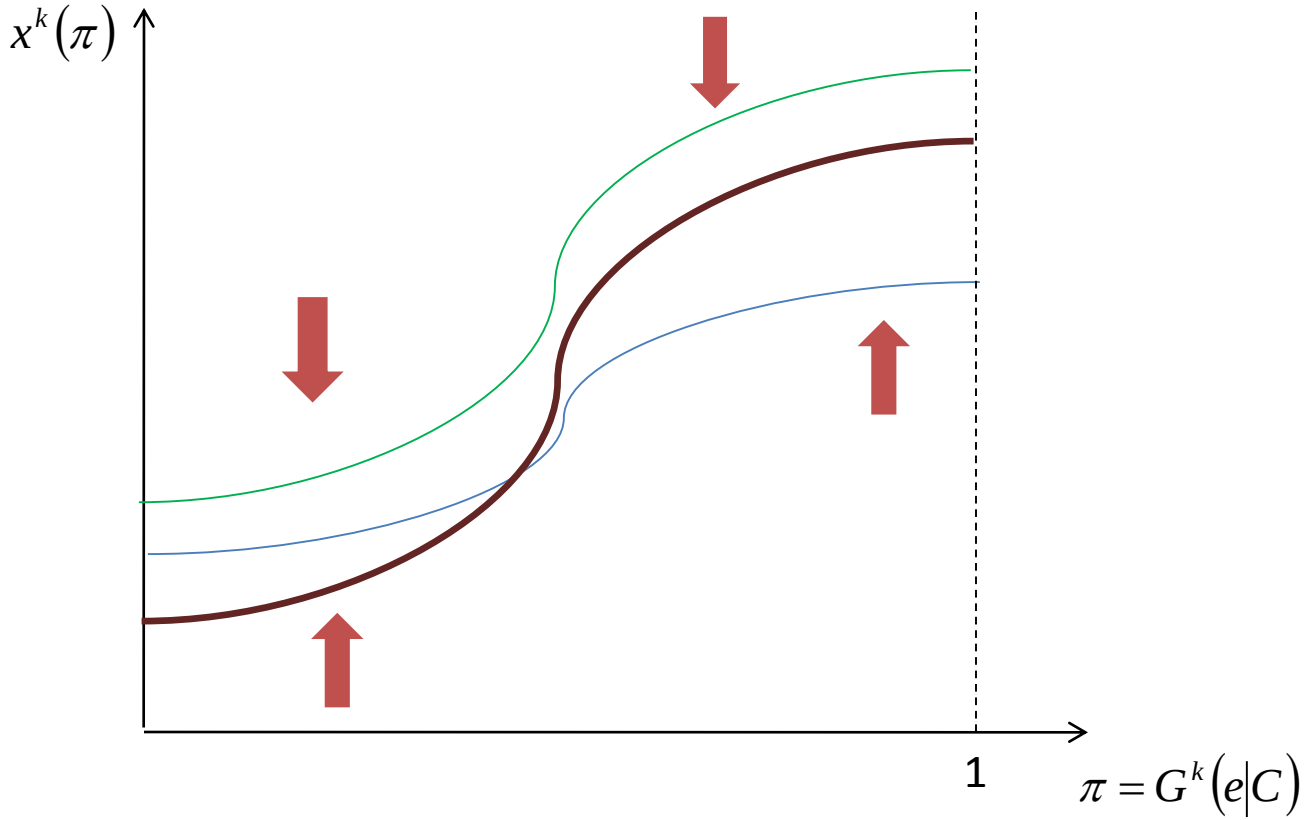
Allocation rules: (iii) Conditional equality (seeks a compromise between ex-post compensation – satisfied only for a reference effort level - and reward.



See Fleurbaey (2008).

2. Economic models

Allocation rules: (iv) Egalitarian equivalence (seeks a compromise between ex-post compensation and reward – satisfied only for a reference type).



See Pazner and Schmeidler (1978), and Fleurbaey (2008).

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3. Measuring inequality of opportunity

In essence, the measurement of inequality of opportunity can be thought of as a two-step procedure: first, the actual distribution $[X_{ij}]$ is transformed into a counterfactual distribution $[\widetilde{\boldsymbol{X}}_{ij}]$ that reflects *only and fully* the unfair inequality in $[X_{ij}]$, while all the fair inequality is removed. In the second step, a measure of inequality is applied to $[\widetilde{\boldsymbol{X}}_{ij}]$.

3. Measuring inequality of opportunity

Between types ***(*** $\tilde{X}_{BT}$ ***)****: For all* $j \in \{1,...,m\}$ *and for all* $i \in \{1,...,n\}$, $\tilde{x}_{ij} = \mu_i$.

Table 2: Between-types inequality *(n=m=3)*

	e1	e2	e3
C1	μ_1	μ_1	μ_1
C2	μ_2	μ_2	μ_2
C3	μ_3	μ_3	μ_3

Draws on the min of means approach. Satisfies ex-ante compensation and reward.

3. Measuring inequality of opportunity

Within tranches ***($\tilde{X}_{WTR}$)***: *For all* $j \in \{1,\ldots,m\}$ *and for all* $i \in \{1,\ldots,n\}$, $\tilde{x}_{i,j} = g(c_i, e_j)/\nu_j$.

Table 4: Within tranches inequality *(n=m=3)*

	e1	e2	e3
C1	$x_{11}/\ \nu_1$	$x_{12}/\ \nu_2$	$x_{13}/\ \nu_3$
C2	$x_{21}/\ \nu_1$	$x_{22}/\ \nu_2$	$x_{23}/\ \nu_3$
C3	$x_{31}/\ \nu_1$	$x_{32}/\ \nu_2$	$x_{33}/\ \nu_3$

Draws on the mean of mins approach. Satisfies ex-post compensation everywhere, but not the reward principle.

3. Measuring inequality of opportunity

Direct unfairness ***($\tilde{X}_{DU}$)****: take* $\tilde{e}$ *as the reference effort. Then* $\tilde{x}_{ij} = g(c_i, \tilde{e})$, $\forall i \in \{1, ..., n\}$ *and* $\forall j \in \{1, ..., m\}$.

Table 3: Direct unfairness (with $\tilde{e}$=1 and n=m=3)

	e1	e2	e3
C1	x_{11}	x_{11}	x_{11}
C2	x_{21}	x_{21}	x_{21}
C3	x_{31}	x_{31}	x_{31}

Draws on the conditional equality compromise. Satisfies ex-ante compensation and reward; and ex-post compensation only for Tranch 1.

3. Measuring inequality of opportunity

Fairness gap ($\tilde{X}_{FG}$): *take* $\tilde{c}$ *as the reference circumstance. Then let* $\tilde{x}_{i,j} = g(c_i, e_j) / g(\tilde{c}, e_j)$, $\forall i \in \{1,...,n\}$ *and* $\forall j \in \{1,...,m\}$.

Table 5: Fairness gap (with $\tilde{c}$=1 and n=m=3)

	e1	e2	e3
C1	1	1	1
C2	x_{21}/ x_{11}	x_{22}/ x_{12}	x_{23}/x_{13}
C3	x_{31}/ x_{11}	x_{32}/ x_{12}	x_{33}/x_{13}

Draws on the egalitarian equivalence compromise. Satisfies ex-post compensation everywhere, but liberal reward only for Type 1.

3. Measuring inequality of opportunity

A summary of the four indirect approaches to measuring I. Op.

Table 6: Welfare criteria, allocation rules and inequality measures

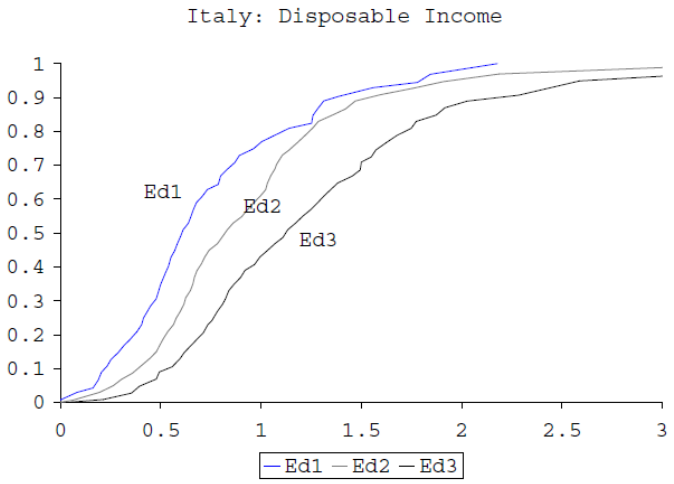
Approaches	Welfare criteria and allocation rules	Inequality measures
Ex ante	*Min of means*	*Between types*
	Conditional equality	*Direct unfairness*
Ex post	*Mean of mins*	*Within tranches*
	Egalitarian equivalence	*Fairness gap*

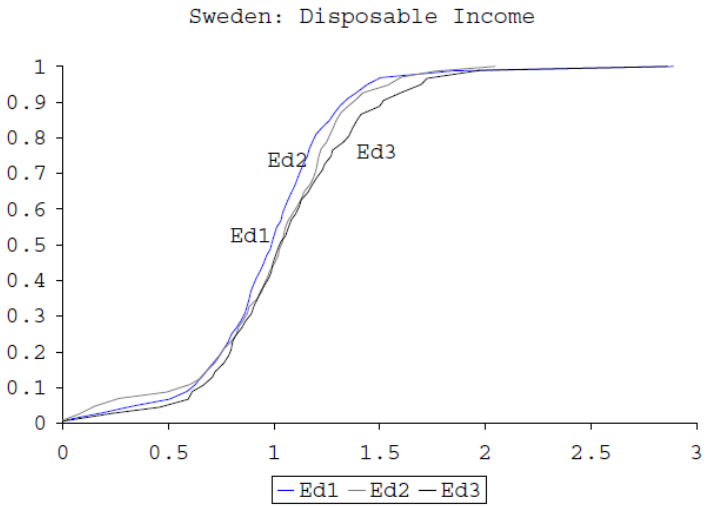
3. Measuring inequality of opportunity

- Partial orderings can be sought instead of complete orderings.

i. To define and test for E.Op. (Lefranc, Pistolesi, Trannoy, RIW, 2008)

- Partition society into types s ($s \in S$). Define E.Op. as a situation where there is no second-order stochastic (SSD) dominance between $\mathrm{F}(x|s)\ and\ \mathrm{F}(x|s'), \forall s, s' \in S$.
- Test for this using Davidson and Duclos (2000) tests for statistically significant SSD, in nine rich countries.





3. Measuring inequality of opportunity

- Partial orderings can be sought instead of complete orderings.

  i. To define and test for E.Op. (Lefranc, Pistolesi, Trannoy, RIW, 2008)

	Italy						**Netherlands**					
	Primary Income			Disposable Income			Primary Income			Disposable Income		
	Ed_1	Ed_2	Ed_3	Ed_1	Ed_2	Ed_3	Ed_1	Ed_2	Ed_3	Ed_1	Ed_2	Ed_3
Ed_1	-	$<_1$	$<_1$	-	$<_1$	$<_1$	-	$<_1$	$<_1$	-	$<_1$	$<_1$
Ed_2	-	-	$<_1$	-	-	$<_1$	-	-	$<_1$	-	-	$<_1$
Ed_3	-	-	-	-	-	-	-	-	-	-	-	-

	Norway						**Sweden**					
	Primary Income			Disposable Income			Primary Income			Disposable Income		
	Ed_1	Ed_2	Ed_3	Ed_1	Ed_2	Ed_3	Ed_1	Ed_2	Ed_3	Ed_1	Ed_2	Ed_3
Ed_1	-	$=$	$<_1$	-	$=$	$<_1$	-	$=$	$=$	-	$=$	$=$
Ed_2	-	-	$=$	-	-	$=$	-	-	$=$	-	-	$=$
Ed_3	-	-	-	-	-	-	-	-	-	-	-	-

But a (between-types) scalar index still used to obtain a (complete) ordering across countries:

$$GO(x) = \frac{1}{\mu} \sum_{i=1}^{k} \sum_{j>i} p_i p_j (\mu_j (1 - G_j) - \mu_i (1 - G_i))$$

3. Measuring inequality of opportunity

- Partial orderings can be sought instead of complete orderings.

  i. To rank 'social states' by I.Op. (Andreoli, Havnes, Lefranc, 2014)

  - Look for dominance not of $F(x|s)$, but of its difference, the gap curve: $\Gamma(F, F', p) = F^{-1}(p) - F'^{-1}(p)$
  - IOp higher in state 0 than in 1 - for all preferences in the Yaari (1987) rank-dependent family of preferences - when $|\Gamma(F_1, F'_1, p)| \leq |\Gamma(F_0, F'_0, p)|, \forall p \in (0,1)$
  - When there is no FSD between types, look for progressively higher-order dominance relations, to obtain rankings for progressively narrower subclasses of the Yaari family of preferences.
  - When there are more than two types, require this for all possible pairwise combinations of types (!) – anonymously or non-anonymously
  - If introduce luck separately, all this must be done for each effort level separately.

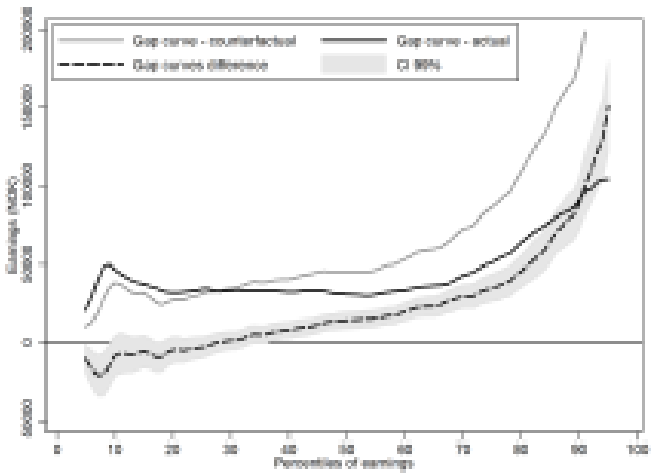
3. Measuring inequality of opportunity

- Partial orderings can be sought instead of complete orderings.

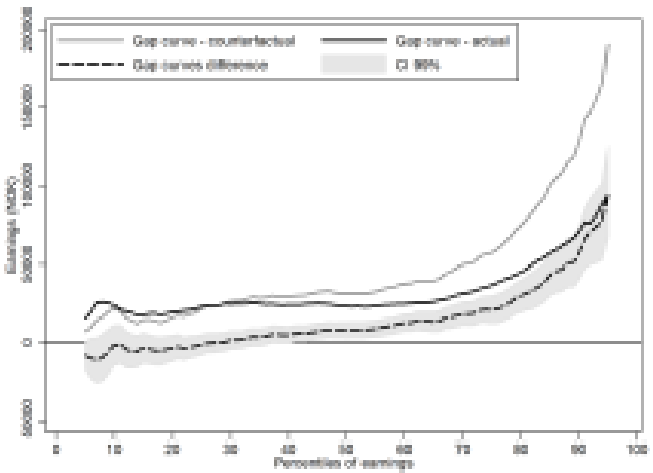
  i. To rank 'social states' by I.Op. (Andreoli, Havnes, Lefranc, 2014)

  - Nice application to evaluation of impact of a child care reform in Norway, using QTEs.

B - Gap curves



(e) Lower vs upper class



(f) Middle vs upper class

  - Results become inconclusive with many types. Revert to scalar indices.

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4. Empirical applications

- We are not aware of any empirical applications of the direct approach.
- Empirical applications exist of all four indirect approaches reviewed above (e.g. Almas et al., 2011; Checchi and Peragine, 2010; Devooght, 2008)
- Only the between-types approach - $I(\tilde{x}_{BT})$ - has been applied sufficiently widely so as to permit international comparisons.
  - 51 countries from 8 papers.
- There are two versions of this index, both of which yield lower-bound measures. Using a slightly different notation:
- IOL: $\theta_a = I(\tilde{x}_{BT})$
- IOR: $\theta_r = \frac{I(\tilde{x}_{BT})}{I(x)}$

4. Empirical applications

- When the information on circumstances is rich enough, the number of types may become too great to estimate either IOL or IOR non-parametrically.
- Bourguignon et al. (2007) and Ferreira and Gignoux (2011) propose a simple model:

$$x = g(C, e, u)$$
$$e = f(C, v)$$

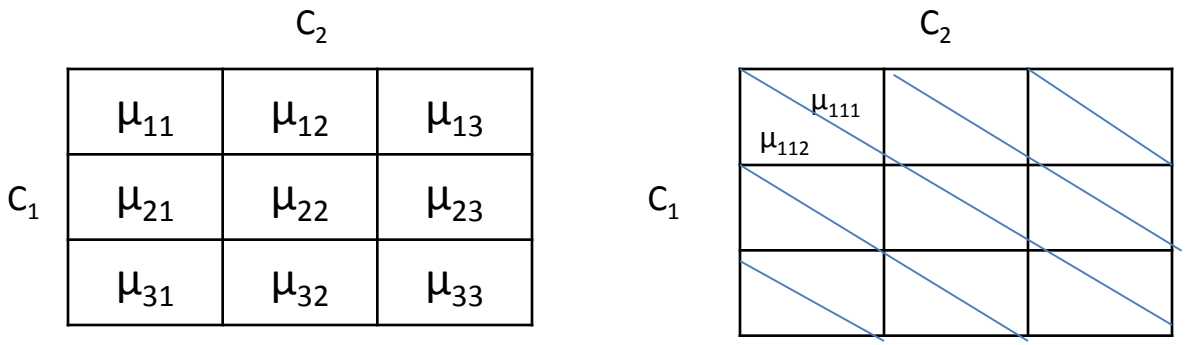
- For the purpose of simply measuring inequality of opportunity, it suffices to estimate the reduced form:

$$x = \phi(C, \varepsilon)$$

- Say, by OLS: $x = C\psi + \varepsilon$
- Can then compute "parametrically smoothed distribution": $\tilde{x}_i = C_i\hat{\psi}$
- Leading to the parametric estimate: $IOL = I(\tilde{x}_i)$

4. Empirical applications

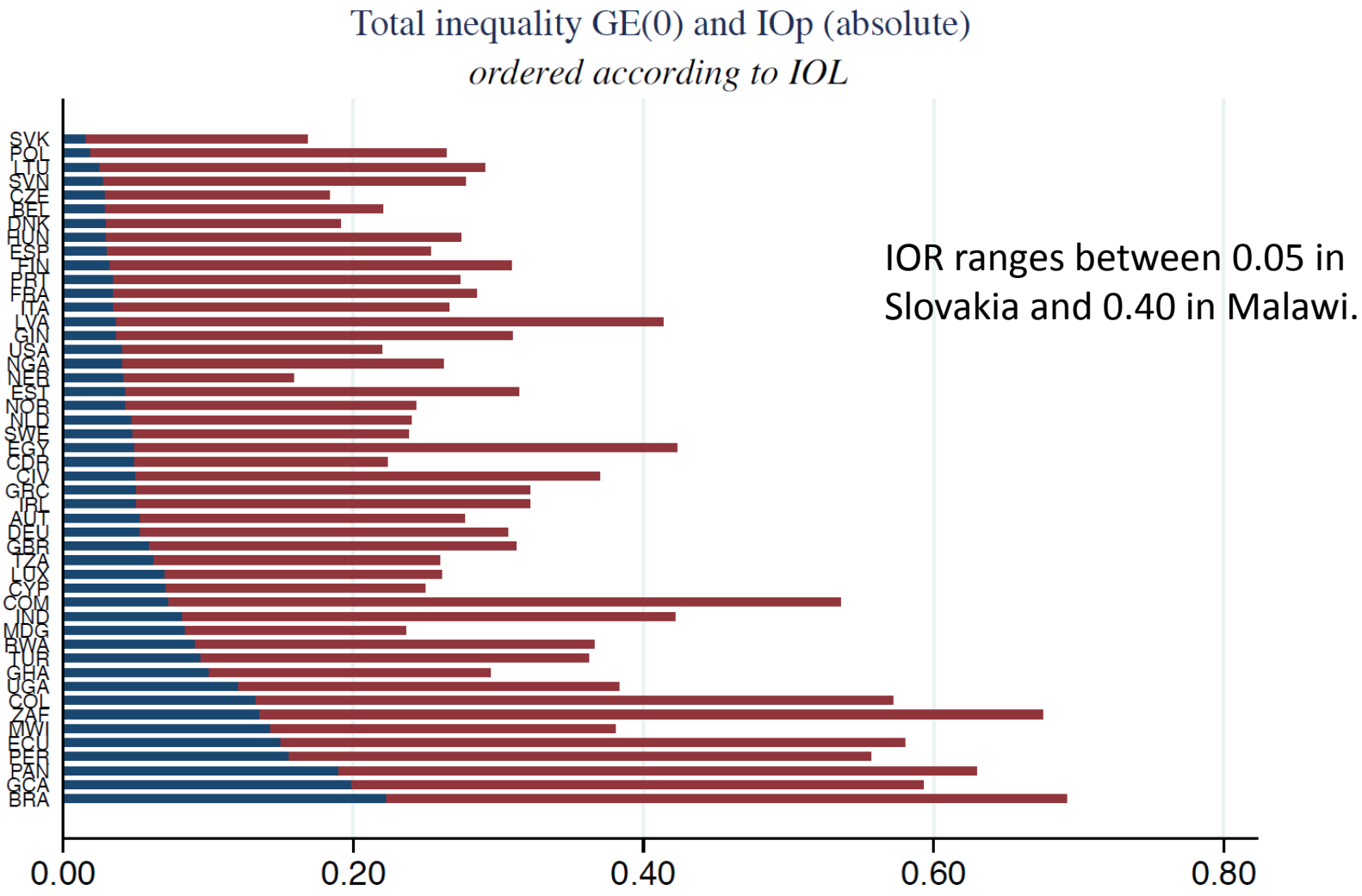
- This leaves two alternative estimation methods for IOL and IOR: non-parametric and parametric.
- Interpretation
  - Omitted circumstances can only lead to a finer partitioning of $\{y_i^k\}$, which can not reduce, but may increase measure.
  - Implication (i): these indices are **lower bound** estimates of inequality of opportunity
  - Implication (ii): causal attribution to specific variables is unwarranted.



  - Formal proof in Ferreira and Gignoux (2011).

	References	Countries	Data sources	Outcome	Method	Circumstances	Number of types
1	Checchi, Peragine, Serlenga (2015)	Austria, Belgium, Cyprus, Czech Republic, Germany, Denmark, Spain, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Lithuania, Luxemburg, Latvia, Netherlands, Norway, Poland, Portugal , Sweden, Slovenia, Slovakia, United Kingdom, Bulgaria, Switzerland, Malta, Romania (Europe: 29)	EU-Silc 2005 and 2011	post-tax individual equivalent incomes	Parametric and non parametric	The same set: parental education, parental occupation, gender, nationality, age	144
2	Brunori, Palmisano, Peragine (2015)	Comoros, Democratic Republic of Congo, Ghana, Guinea, Madagascar, Malawi, Niger, Nigeria, Rwanda, Tanzania, and Uganda (Africa: 11)	Living Standard Measurement Surveys (LSMS), designed by the World Bank , for Malawi, Niger, Nigeria, Tanzania,Uganda. EIM for Comoros, GLSS for Ghana, EIBEP for Guinea, EPM for Madagascar, EICV for Rwanda.	per capita consumption	parametric	Different sets: father's occupation and education, region of birth, ethnicity	From 20 (Nigeria) to 64 (Malawi)
3	Ferreira and Gignoux (2011)	Brazil, Colombia, Ecuador, Guatemala, Panama, Peru	Brazil, PNAD 1996; Colombia, ECV 2003; Ecuador ECV 2006; Guatemala, ENCOVI 2000; Panama, ENV 2003; Peru, ENAHO 2001	household per capita income	parametric	Different sets: gender, ethnicity, parental education, father's occupation, region of birth.	108 (Peru 54)
4	Ferreira, Gignoux, Aran (2011)	Turkey	TDHS 2003-2004 and HBS 2003	imputed per capita consumption	parametric	urban/rural, region of birth, parental education, mother tongue, number of sibling	768
5	Hassine (2012)	Egypt	ELMPS 2006	total monthly earning	non parametric	gender, father's education, mother's education, father's occupation, region of birth.	72
6	Piraino (2012)	South Africa	NIDS 2008-2010	Individual gross income	parametric	race, father's education	24
7	Pistolesi (2009)	US	PSID 2001	individual annual earnings	semiparametric	age, parental education, father's occupation, ethnicity, region of birth	7,680
8	Singh (2011)	India	IHDS 2004–2005	household per capita earnings	parametric	father's education and occupation, caste, religion, location	108

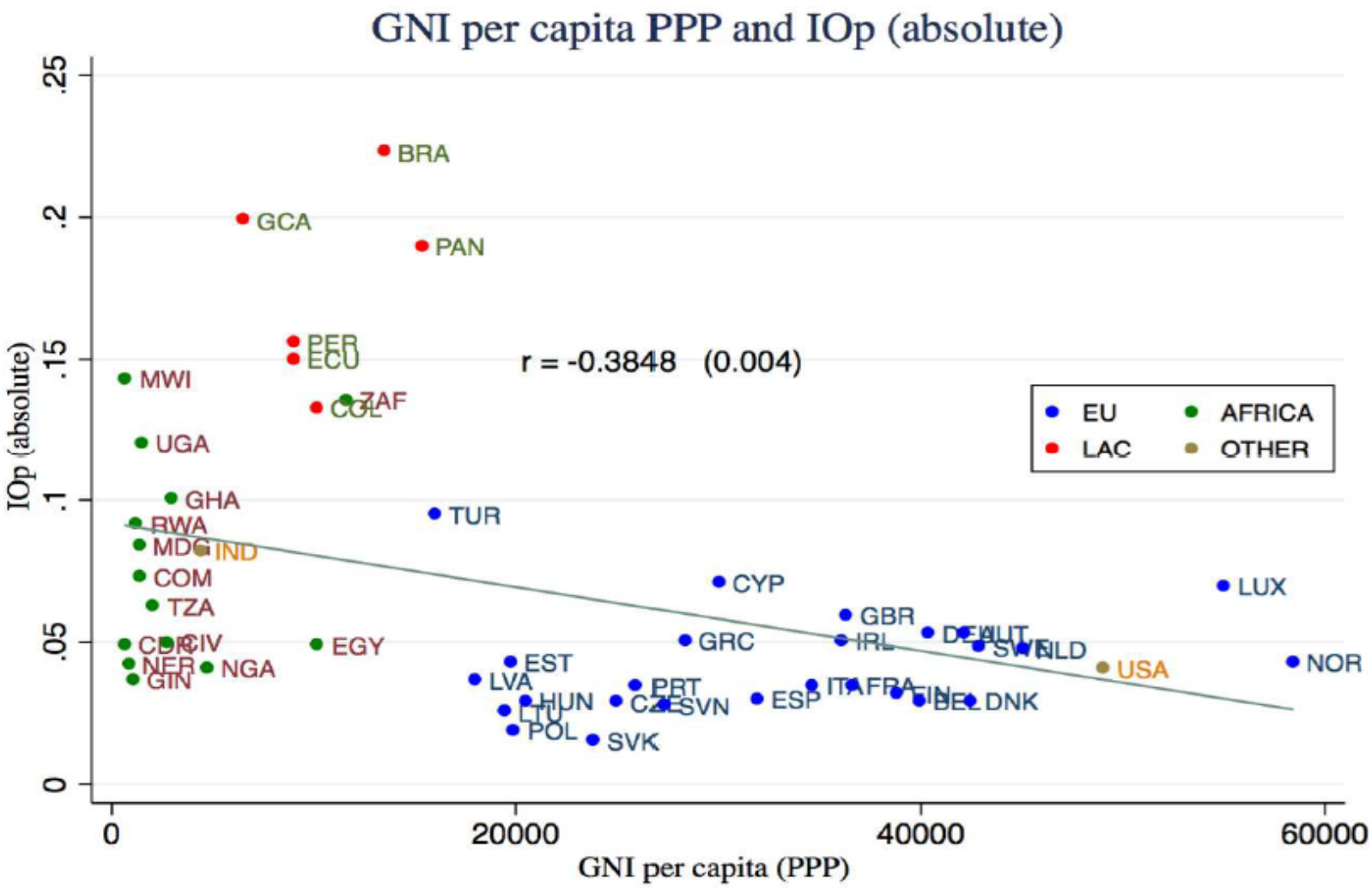
4. Empirical applications



IOR ranges between 0.05 in Slovakia and 0.40 in Malawi.

Note: Estimates come from different studies and are not strictly comparable.
Source: Brunori et al. (2015)

4. Empirical applications



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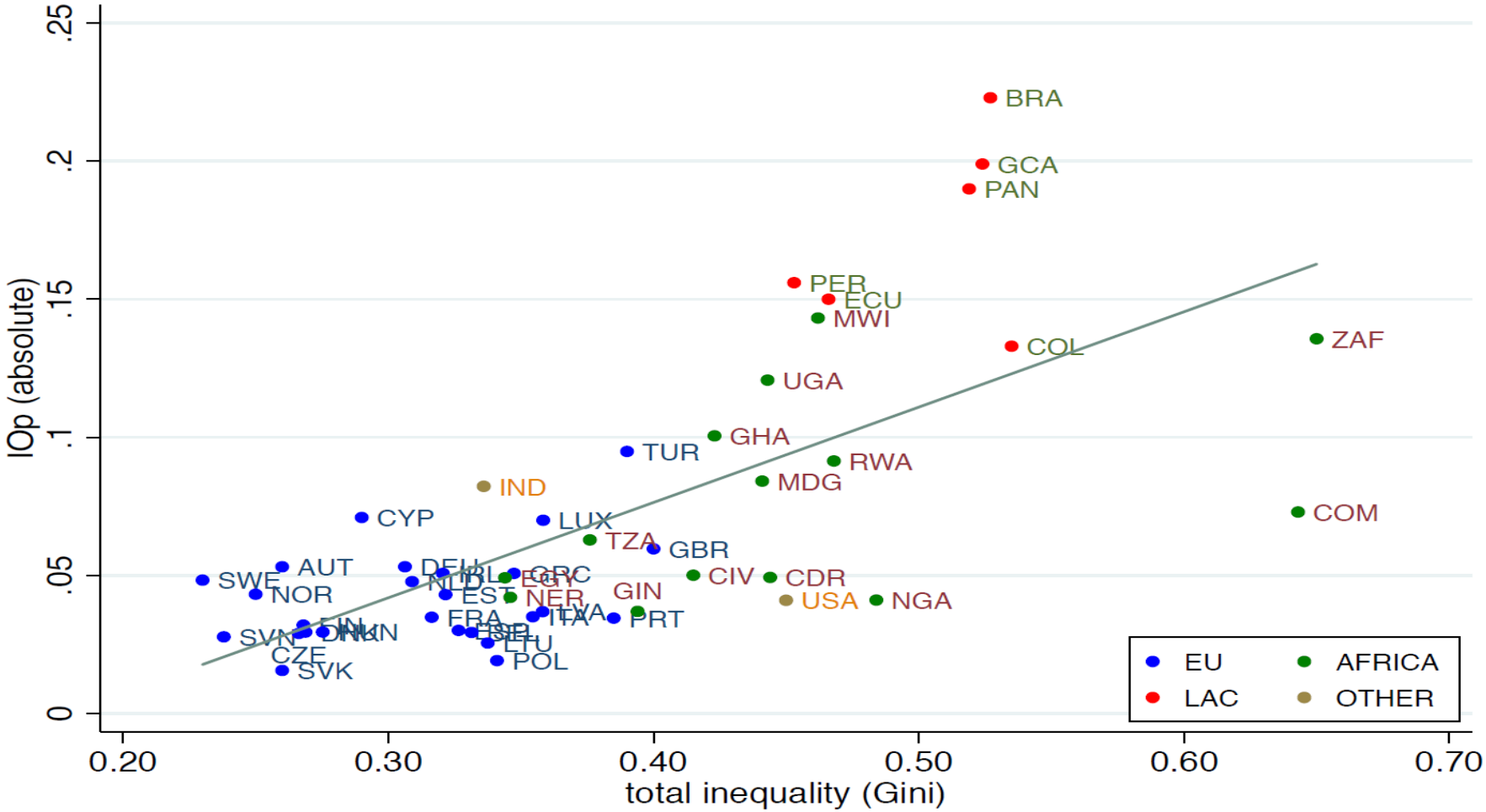
4. Empirical applications

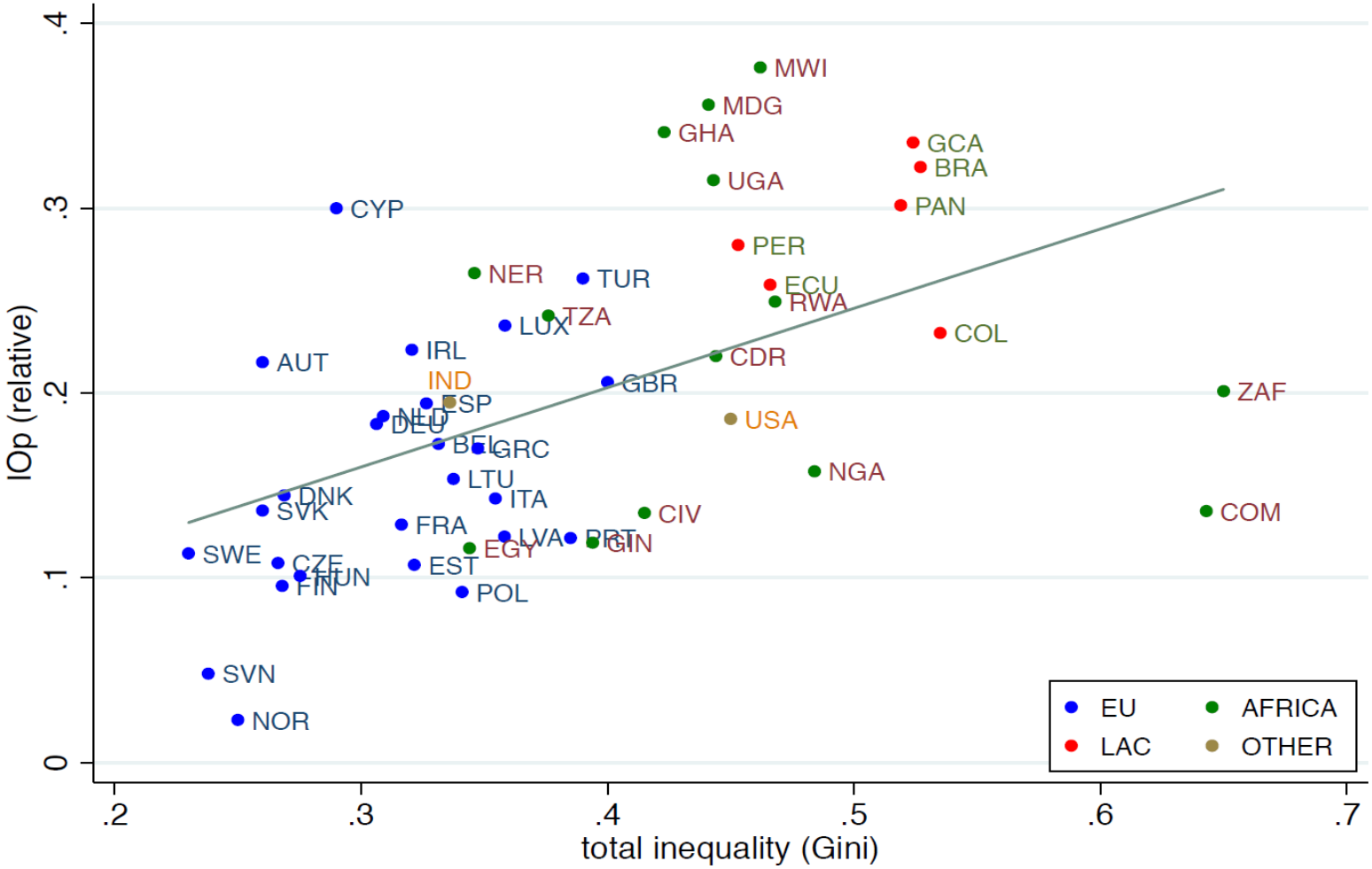
Inequalities of outcome and opportunity: strong correlation



Source: Brunori, Ferreira, Peragine (2015)

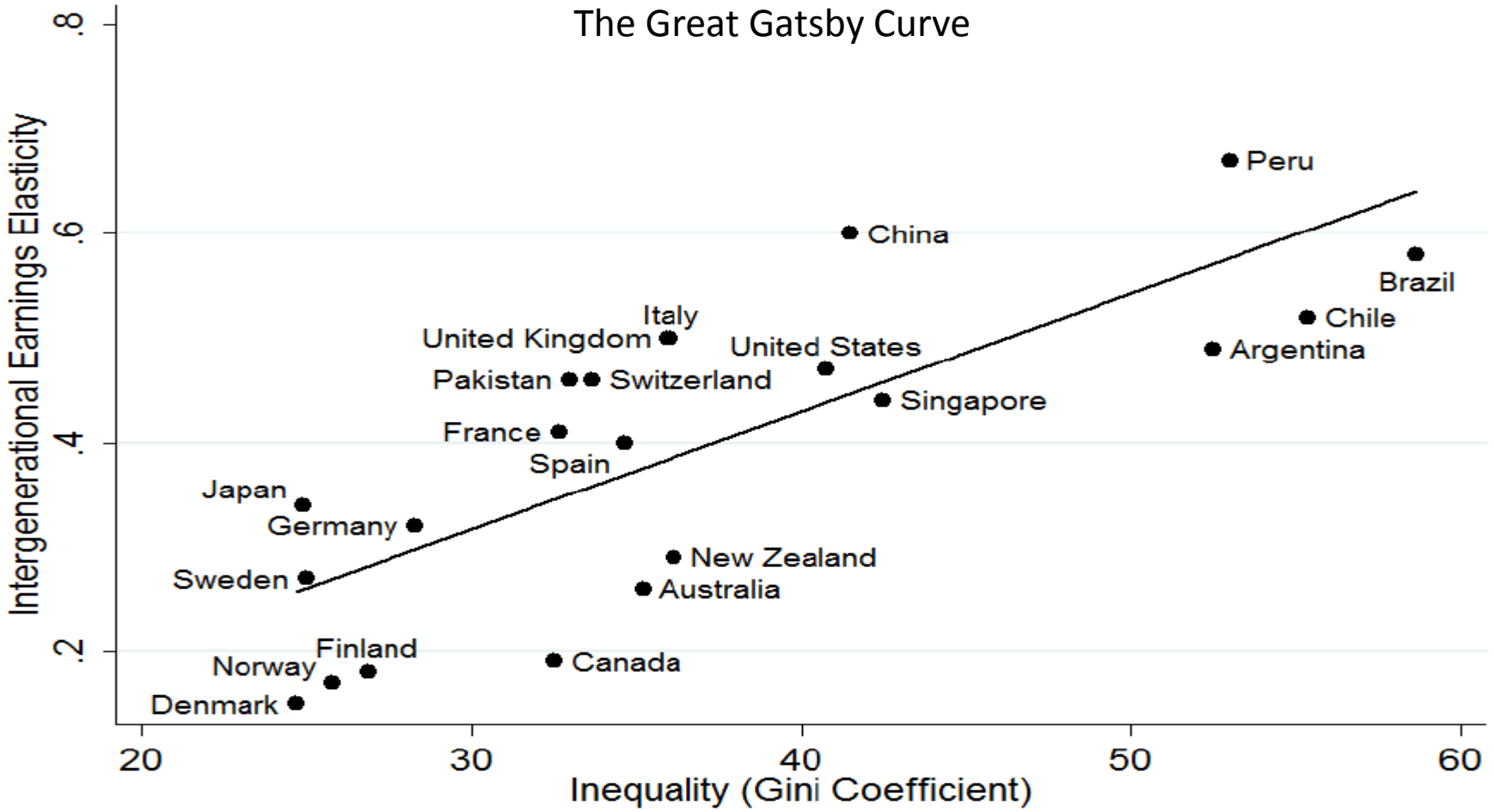
4. Empirical applications

Inequalities of outcome and opportunity: strong correlation



Source : Brunori, Ferreira, Peragine (2015)

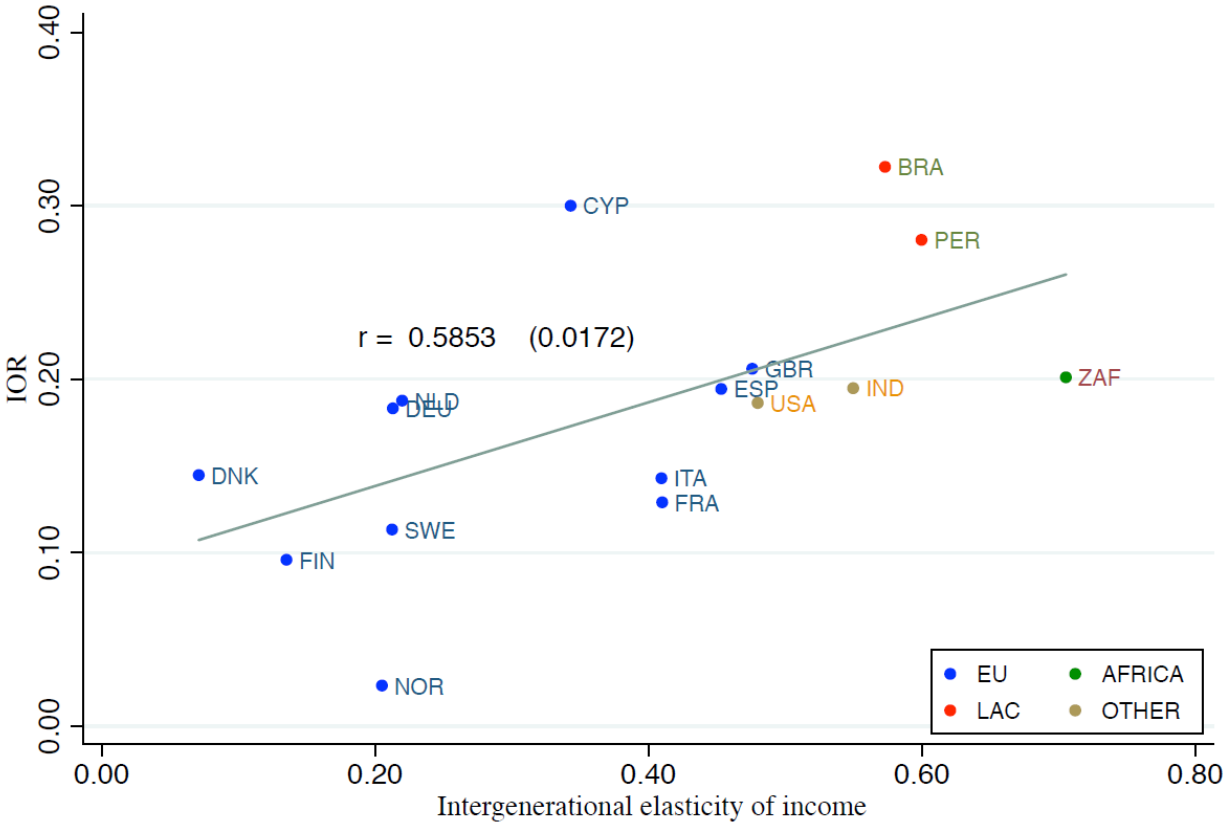
4. Empirical applications



Source: Corak (2012)

4. Empirical applications

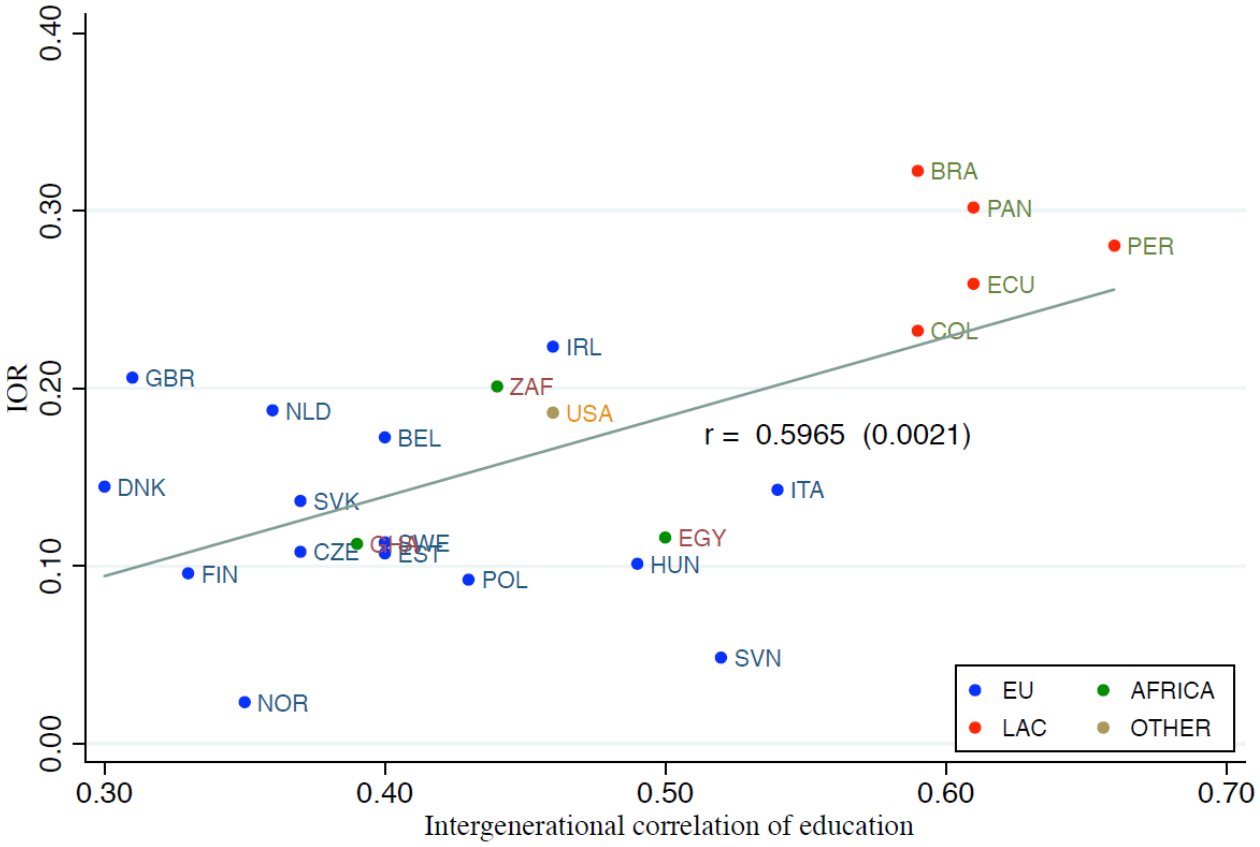
Figure 5: Inequality of opportunity and intergenerational mobility



Note: Estimates come from different studies and are not strictly comparable.
Source: Brunori et al. (2013)

4. Empirical applications

Figure 6: Inequality of opportunity and the intergenerational correlation of education



Note: Estimates come from different studies and are not strictly comparable.
Source: Brunori et al. (2013)

Outline

1. Equality of opportunity: Motivation and background
2. Economic models of equality of opportunity
3. Measuring inequality of opportunity
4. Empirical applications
   i. 'Basic' between-types approach
   ii. 'Enhanced' between-types approach
5. Extensions: IGM, poverty, development, causal analysis
6. Conclusions

4. Empirical applications

1. ‘Enhanced’ between-types approach: looking for upper-bound estimates (Niehues and Peichl, SCW 2014)

- Two-stage estimator using panel data:

  i. Estimate $\ln w_{it} = \beta E_{it} + c_i + u_t + \varepsilon_{it}$

  ii. Back in cross-section, estimate $\ln w_{is} = \varphi \hat{c}_i + v_{it}$

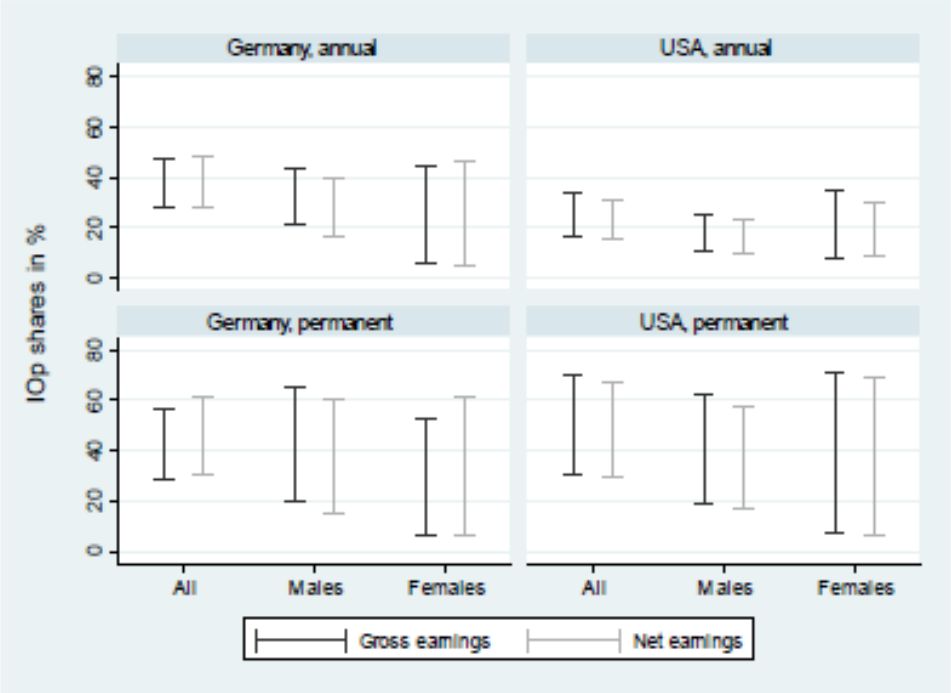
  Construct $\tilde{\mu}^{UB} = \exp(\hat{\varphi}\hat{c}_i + \sigma^2/2)$

  – Application to Germany (SOEP) and the US (PSID), for both current and permanent incomes

4. Empirical applications

1. ‘Enhanced’ between-types approach: looking for upper-bound estimates (Niehues and Peichl, SCW 2014)

Figure 2: IOp shares in outcome inequality



Source: Own calculations based on SOEP and PSID. The two graphs on the top ustrate IOp shares in annual incomes (2009 for Germany, 2007 for the US); the grapl at the bottom IOp shares in permanent incomes.

4. Empirical applications

1. ‘Enhanced’ between-types approach: enlarging the circumstance set through admitting an “age of consent” (Hufe, Peichl, Roemer and Ungerer; 2015)
   - Use National Longitudinal Survey of Youth (NLSY -79) for the US and British Cohort Study (BCS – 70) for the UK

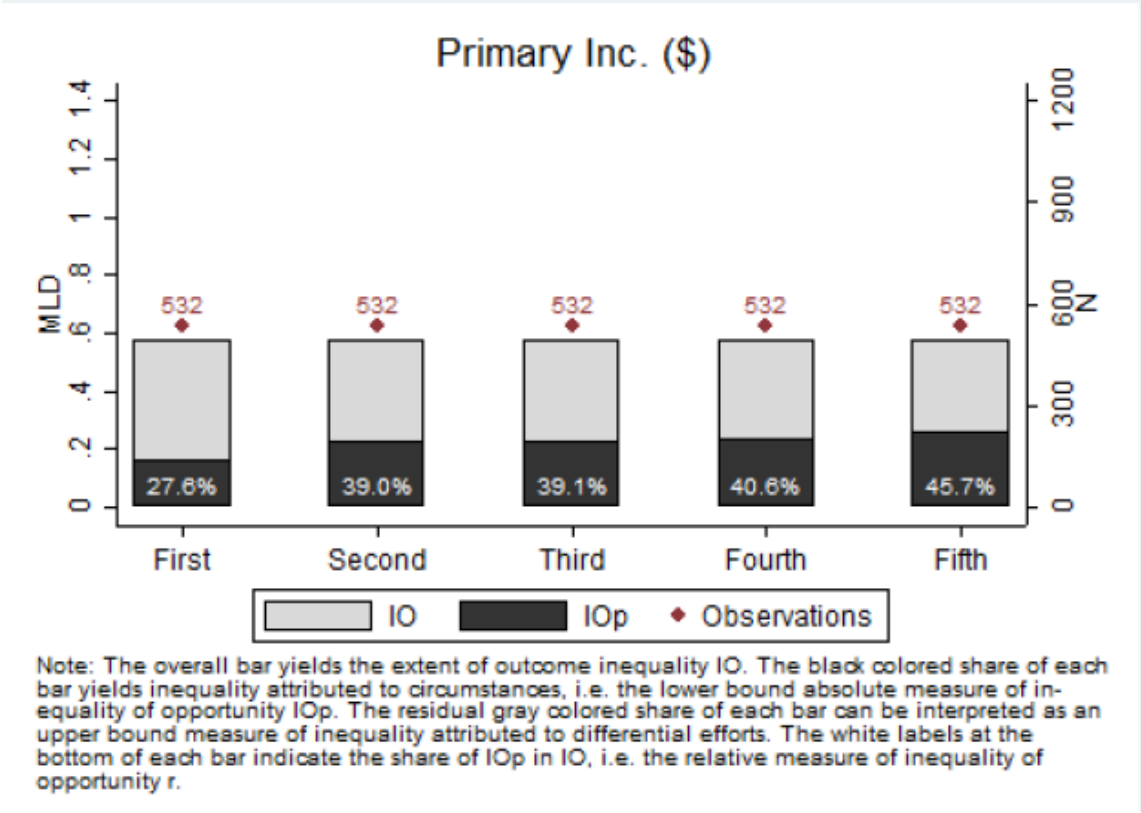
Scenario	Circumstance Set	Circumstance Var.
First	Base	Sex, Country of Birth, Ethnic Affiliation, Cohort, Age, Academic Achievement Mother, Occupation Code Mother, Rural/Urban, Height (16), Family Income
First	Ability	PIAT Math, PIAT Reading
Second	Behavioral Problems	Behavioral Problems Index (BPI)
Third	Child-Parent Relationship	Play/Schoolwork w/ Parents, Perceived Quantity of Time w/ Parents, Parents Split, Parental Income
Fourth	Health-Related Behavior	Smoking Habits Mother, Drinking Habits Mother, Health Restrictions Child
Fifth	Survey Specifics	Specific to NLSY79 and BCS70. See text for more information.
Sixth		

Table 1: Overview of Circumstance Scenarios

4. Empirical applications

1. Hufe, Peichl, Roemer and Ungerer (2015) find that the lower-bound IOR can be as high as 45% in the US and 31% in the UK when using this extended circumstance set.

Figure 2: IOp with varying circumstance sets (NLSY79), comparable sample, average income



Note: The overall bar yields the extent of outcome inequality IO. The black colored share of each bar yields inequality attributed to circumstances, i.e. the lower bound absolute measure of inequality of opportunity IOp. The residual gray colored share of each bar can be interpreted as an upper bound measure of inequality attributed to differential efforts. The white labels at the bottom of each bar indicate the share of IOp in IO, i.e. the relative measure of inequality of opportunity r.

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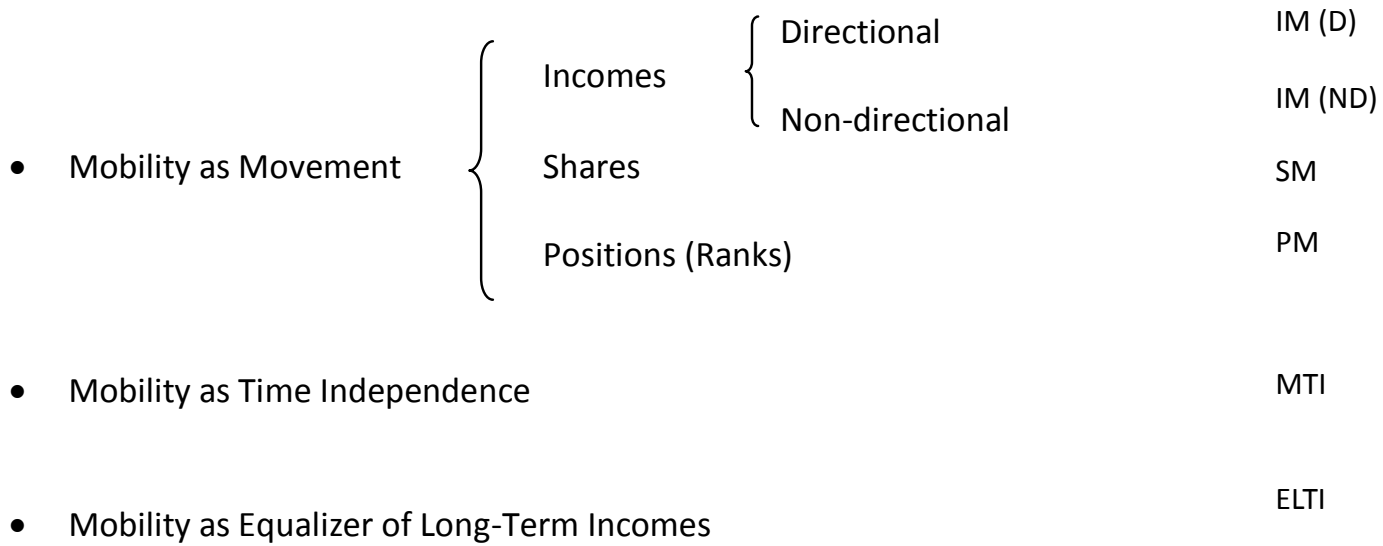
5. Extensions: IOp and mobility

- Economic mobility refers to the transformation of an initial income vector into one or more subsequent vectors, while keeping track of the identity of recipient units.

- Fields (2001) distinguishes between six different concepts of mobility:

Figure 3: Mobility Concepts



5. Extensions: IOp and mobility

- IGM is typically measured by origin-independence measures, such as the complement of the correlation coefficient.

$$M(Y_0, Y_1) = 1 - \rho_{y_0 y_1}$$

- Which is the complement to the square root of the R^2 in the old Galtonian regression:

$$y_t = \beta y_{t-1} + \varepsilon_t$$

- β itself is often used as an inverse measure of mobility. If incomes are in logs, β is the IGE.

5. Notice the isomorphism

- IGM: $y_t = \beta y_{t-1} + \varepsilon_t$ R^2
- IOp: $y = C\psi + \varepsilon$ $IOR = \frac{I(\tilde{\mu}_i)}{I(y)}$

- Inequality of opportunity (at least in the between-types approach) is very close to origin-independent measures of IGM.
  - Difference: more circumstances
    - E.g. Mikkel Gandil's presentation on Monday
  - Omitted variables: IOp is explicitly a lower-bound measure. And explicitly not a causal estimate for any individual circumstance

5. Extensions: Poverty in opportunities...

Poverty in the counterfactual unfair distribution $[\tilde{X}_{ij}]$:

"The rate of economic development should be taken to be the rate at which the mean advantage level of the worst-off types grows over time. […] I look forward to a future number of the WDR that carries out the computation, across countries, of this new definition of economic development" (p.243).

Roemer, John E. (2006): "Review Essay, 'The 2006 world development report: Equity and development", *Journal of Economic Inequality* (**4**): 233-244

- Define an opportunity profile:

$$\Pi^* = \left\{T_1, T_2, ..., T_K\right\} \middle| \, \mu^1 \leq \mu^2 \leq ... \leq \mu^K$$

- And an opportunity-deprivation profile:

$$\Pi^*_\pi = \left\{T_1, T_2, ..., T_j, ..., T_J\right\} \middle| \, \mu^1 \leq \mu^2 \leq ... \leq \mu^J \; ; \; \mu^J < \mu^k, \forall k > J \; ; \text{ and } \sum_{j=1}^{J-1} N_j \leq \pi N \leq \sum_{j=1}^{J} N_j$$

5. Extensions: Poverty in opportunities...

The Brazilian profile, by income per capita

Brazil's "opportunity-deprivation profile" in 1996: six poorest "social types" (adding up to 10% of the population), defined by pre-determined background characteristics.

Ethnicity	Father's occupation	Father's education	Mother's education	Place of birth	Estimated population	Share of national population	Mean advantage (HPCY)	Ratio of overall mean
black and mix-raced	agricultural worker	none or unknown	none or unknown	Nordeste or North	2,276,662	0.06776	105.9	0.261
black and mix-raced	agricultural worker	Upper primary (5) or more	none or unknown	Sao Paulo or Federal District	1,417	0.00004	116.5	0.287
black and mix-raced	agricultural worker	none or unknown	lower primary	Nordeste or North	313,664	0.00934	136.6	0.337
black and mix-raced	agricultural worker	Lower primary	none or unknown	Nordeste or North	352,729	0.01050	136.9	0.338
black and mix-raced	agricultural worker	Upper primary (5) or more	none or unknown	Nordeste or North	7,564	0.00023	144.2	0.355
black and mix-raced	Other	none or unknown	none or unknown	Nordeste or North	2,063,415	0.06141	144.5	0.356

Source: Ferreira and Gignoux (2011)

5. Extensions: ...or opportunity-sensitive poverty?

The purpose of (outcome) inequality-sensitive poverty measures is to distinguish between poverty in distributions such as B and C.

(z=5)	A	B	C	D
I	9	9	9	9
II	8	8	8	8
III	7	7	7	7
IV	6	7	7	7
V	4	3	4	4
VI	3	3	3	3
VII	2	2	1	1
VIII	1	1	1	1
FGT (0)	0.5	0.5	0.5	0.5
FGT (1)	0.25	0.275	0.275	0.275
FGT (2)	0.15	0.165	0.185	0.185

5. Extensions: ...or opportunity-sensitive poverty?

The purpose of (opportunity) inequality-sensitive poverty measures would be to distinguish between poverty in distributions such as C and D.

(z=5)	A	B	C	D
I	9	9	9	9
II	8	8	8	8
III	7	7	7	7
IV	6	7	7	7
V	4	3	4	4
VI	3	3	3	3
VII	2	2	1	1
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5. Extensions: ...or opportunity-sensitive poverty?

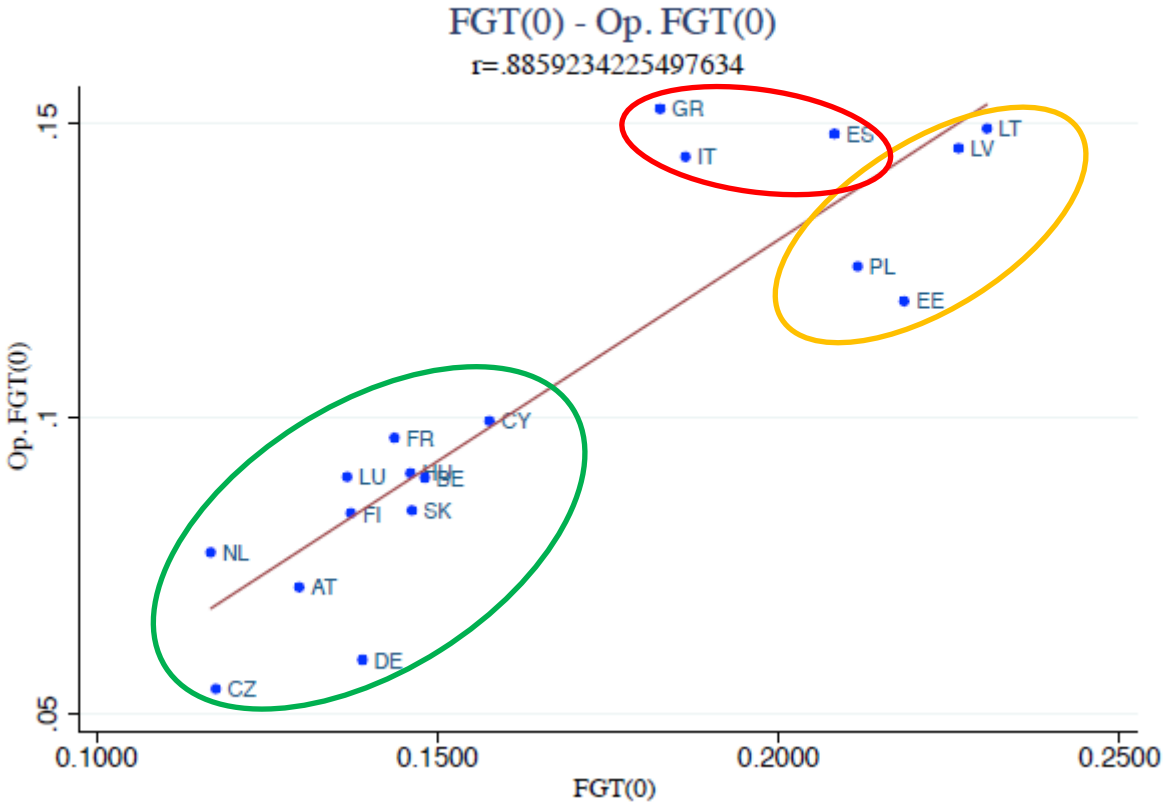
- Should there be a poverty measure that is sensitive to I. Op., in the same way as FGT(2) or the Sen Index are sensitive to outcome inequality?
  - Brunori, Ferreira, Lugo and Peragine (in progress)
  - Anonymity axiom restricted to within types
  - Transfer axiom replaced by separate inequality aversion axioms within and across types.
  - Tension between IOA and IAW is resolved by introducing a hierarchy:

$$P_{FGT}(F, z, \mathcal{T}) = \frac{1}{n} \sum_{i=1}^{n} q_i^F \left(n + 1 - rk(i)\right) \int_0^z \left(\frac{z - x}{z}\right)^{\alpha} f_i(x)\, dx$$

5. Extensions: ...or opportunity-sensitive poverty?

- Poverty levels across eighteen European countries: standard headcount against opportunity-sensitive headcount

Figure 3: Ranking of $FGT(0)$ and $OpFGT(0)$



5. Extensions: Development objectives

- What is the policy objective for opportunity egalitarians?

$$Max_{\phi \in \Phi} min_i \int_t^{\infty} e^{\delta(t-s)} \mu_{i,s} ds$$

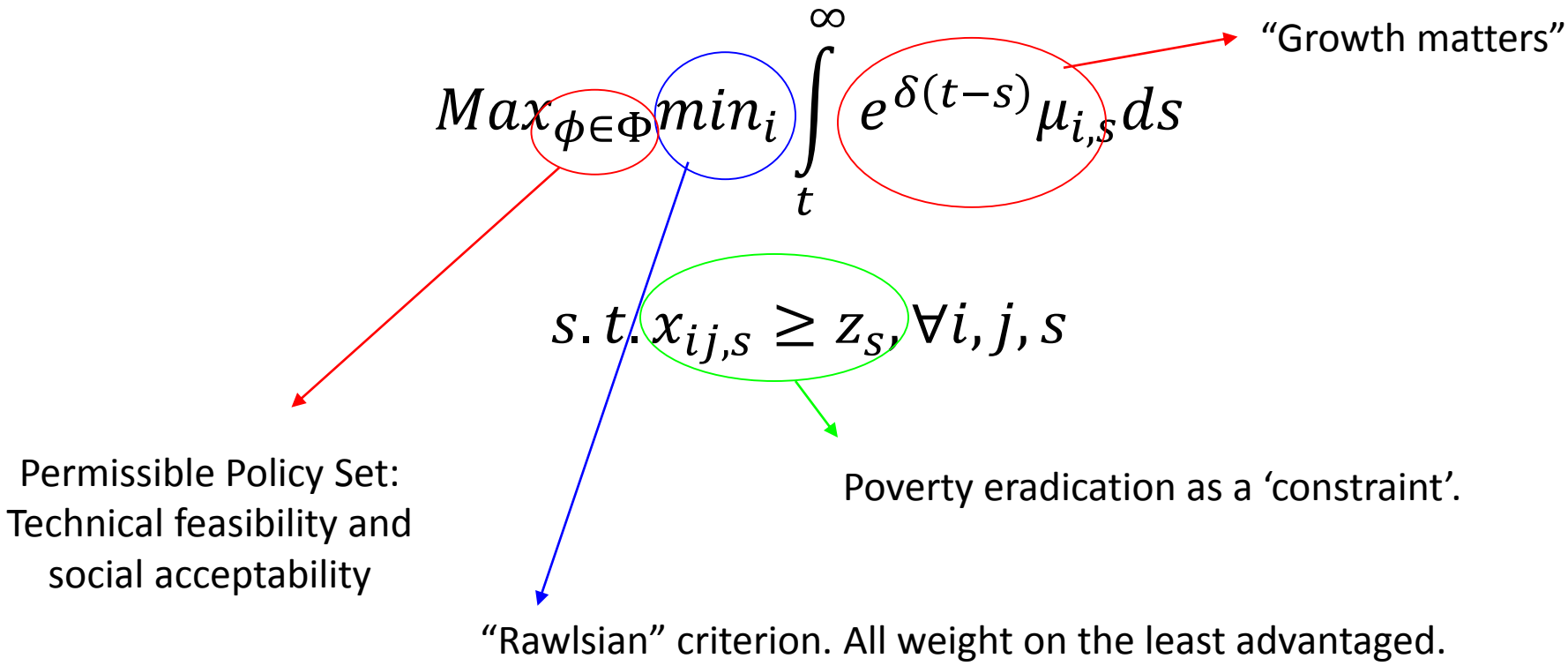
$$s.t. x_{ij,s} \geq z_s, \forall i, j, s$$

- The choice of policies from a feasible set so as to maximize the future stream of 'advantage' for the most disadvantaged type, subject to a no-deprivation constraint and to a policy acceptability constraint.

Source: Bourguignon, Ferreira and Walton, JEI 2007.

5. Extensions: Development objectives

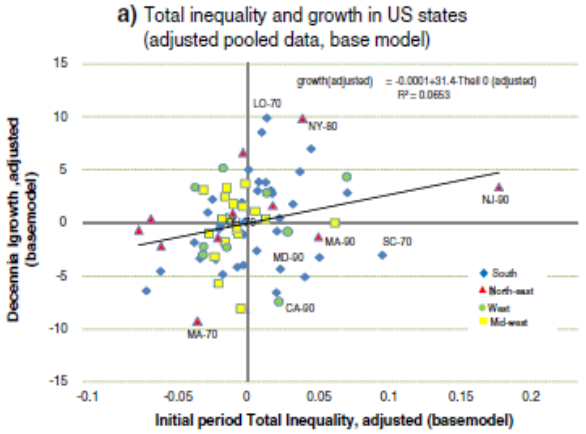
- 'Deconstructing' the equitable development policy problem:

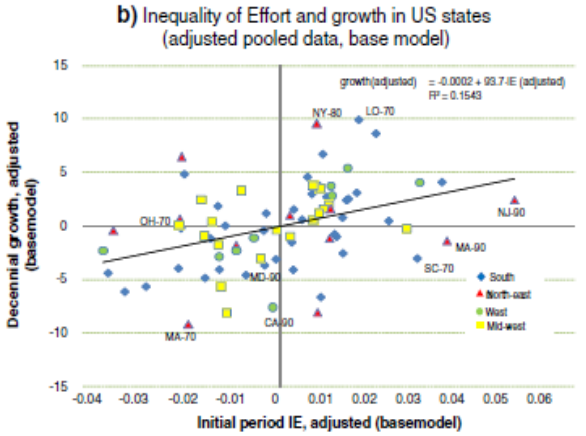


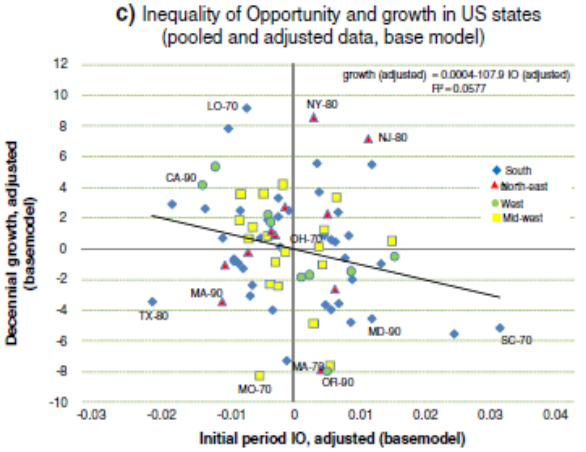
Source: Bourguignon, Ferreira and Walton, JEI 2007.

5. Extensions

- Causal analysis:
- I.Op. as both independent and dependent variable:
  - the relationship between I.Op and economic growth (e.g. Marrero and Rodriguez, 2013; FLLO, 2014)
  - The impact of a CCT (Progresa) on I.Op. (van de Gaer et al. 2014)
- Key challenge: comparable data on advantages and circumstances







6. Conclusions

- Achievements:
  - Changing the space in which fairness judgments are made
  - Incorporating respect for individual responsibility into an egalitarian framework
- Limitations
  - Robustness
    - Too many alternative approaches?
      - Build on Andreoli et al.'s gap curve approach?
  - Accuracy
    - Narrowing the range between lower and upper bounds
      - Building on Niehues and Peichl's approach? Better measures of effort?
  - Dimensionality
    - Is x_{ij} a vector? Things get more complicated…