“Scattered thoughts on EOp”

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Topics

1. Harmonizing IGM and EOp approaches
2. Feudalism versus Capitalism: How much inequality of Opp should we expect?
3. Policy examination: The non-conflict between EOp and ‘efficiency’
4. Is everything a circumstance?
5. Inequality of Opportunity and capitalist institutions
6. A politically salient calculation

1. Harmonizing IGM and EOp

- IGM has a long history. It is the first quantitative approach to measuring inequality of opportunity
- The data: IGM matrix *Q,* whose *i th* row gives the distribution of income of sons of fathers who sit at the *i th quantile* of the distribution of income in their generation
- Thus element q_{ij} is the fraction of sons of quantile *i* fathers who occupy quantile *j* of their income distribution
- The sum of each column and each row is unity

IGM measurement

- Two standard approaches to measuring IOp with IGM:
- Let $\{(x, y)\}$ be the data where each ordered pair is (father's income, son's income). Regress:
- $$\log y = a \log x + b + u$$

Then a is the elasticity of son's income wrt father's income.

Second approach. Let $i = F(x), \quad j = G(y)$.

Regress. $i = \alpha j + \beta + u$.

Then α is the 'rank-rank slope.'

The EOp approach

- Let *t* be a type, where the type partition of the population sorts individuals into equivalence classes with respect to their circumstances
- Let *F* be the distribution of income of the population, F^t be the distribution of income of type *t*, and ν^t the fraction of type *t* in the population, so $F = \sum_1^T \nu^t F^t$.
- Let $\mu^t = mean\ F^t$. Let Φ be a counterfactual distribution in which fraction ν^t of the population has income μ^t.

EOp approach (cont.)

- Let $MLD(H)$ be the mean log deviation of any distribution *H.*
- Then:

$$MLD(F) = MLD(\Phi) + \sum \nu^t MLD(F^t)$$

- This is called decomposability.

In particular, $r = \frac{MLD(\Phi)}{MLD(F)}$ has a natural interpretation as the fraction of income inequality due to circumstances.

Viewing IGM as an EOp problem

- The IGM approach uses exactly one circumstance: The rank of the father in father's income distribution.
- The *i* th row of *Q* is the (discrete) density function of the distribution of income of sons of *i th* ranked fathers. If $n = 100$, for example, the sons are partitioned into 100 types.
- What is the distribution *F*? It is the uniform distribution! Simply add up the rows, multiplying each row by $1/n$. One gets the vector (1/n,1/n,….1/n). But this is the density of the uniform distribution.

Thus, we have:

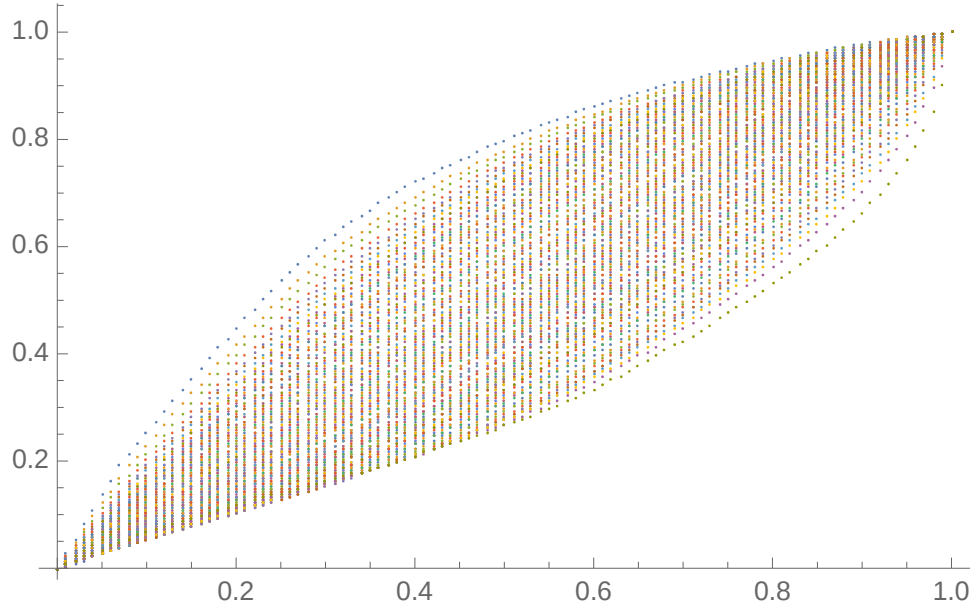
$$r = 1 - \frac{\sum .01 MLD(F^i)}{MLD\ (U)}$$

Where *U* is the uniform distribution on [0,1] and F^i is the distribution function given by the *i* th row of *Q*. Here , I have assumed *n* = 100.

r is thus the fraction of rank inequality among sons attributable to father's rank.

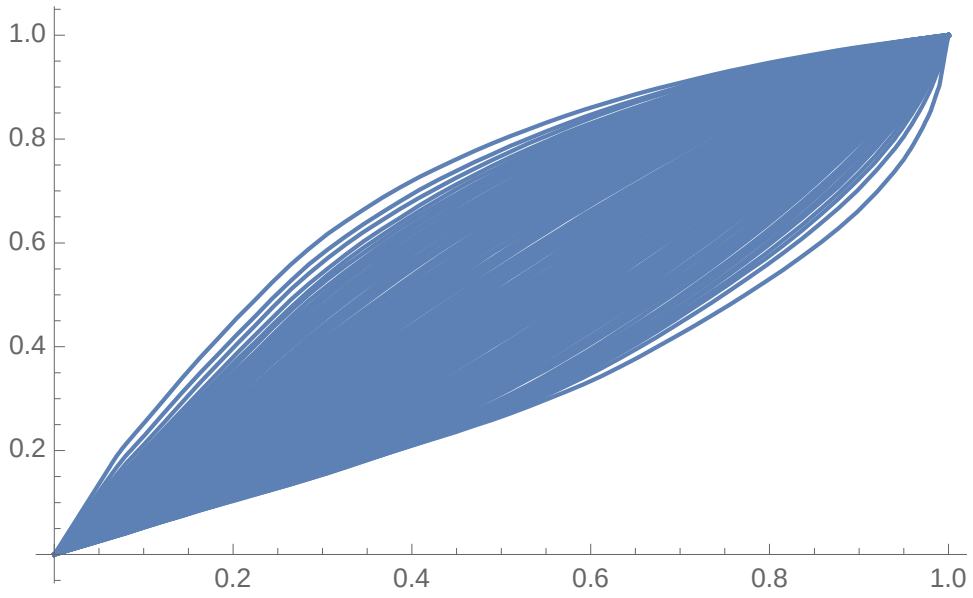
Chetty, Hendren, Kline and Saez (2014), US

- Chetty et al have computed a 100 x 100 IGM matrix for the US.
- Here are the 100 CDFs by rank of father of sons ' *lifetime pre-tax family income:*



Continuous Version

- Here's the continuous version, where I simply interpolate the discrete CDFs linearly:



- You might think a lot of the inequality is due to the rank-of-father circumstance. But the computation yields:

    - $r = 6.71\%$.

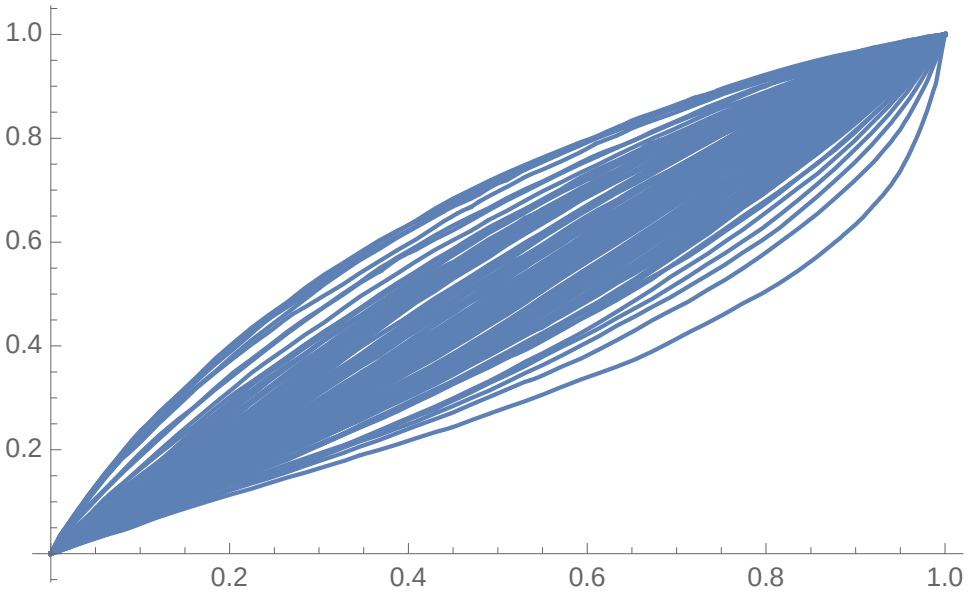
And this is with 100 types! Not much income inequality is due to this circumstance.

Canada's IGM

- Miles Corak has computed a 100 x 100 IGM matrix for Canada. Income concept: Same as Chetty et al. Using the same technique, we compute:

$$r^{Can} = 3.40\%$$

We knew Canada was more egalitarian!

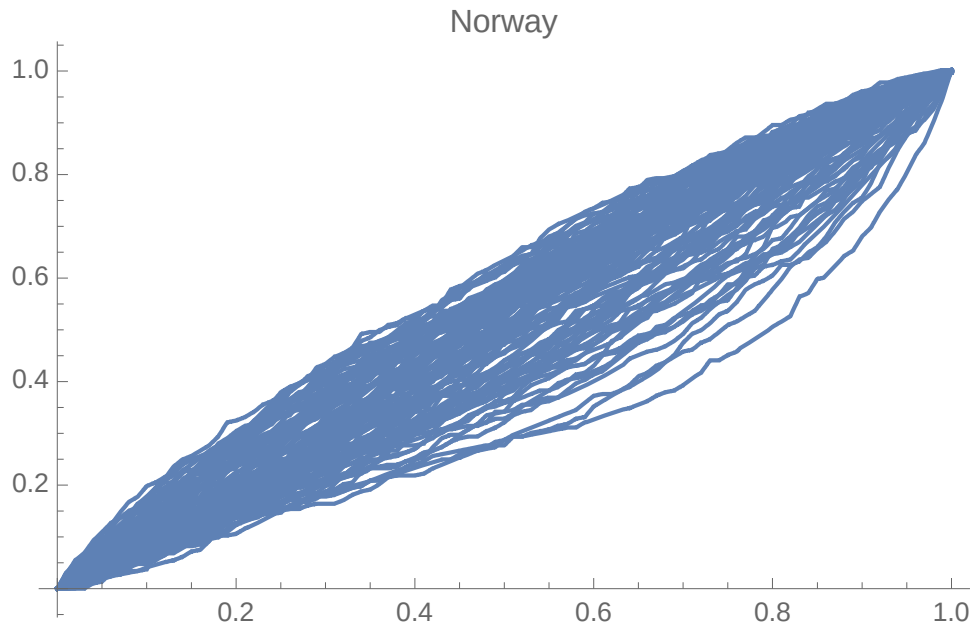


Norway (100 x 100; R. Aaberge). The income concept is ‘wage income’

I have 100 x 100 IGM matrices for only US, Canada & Norway

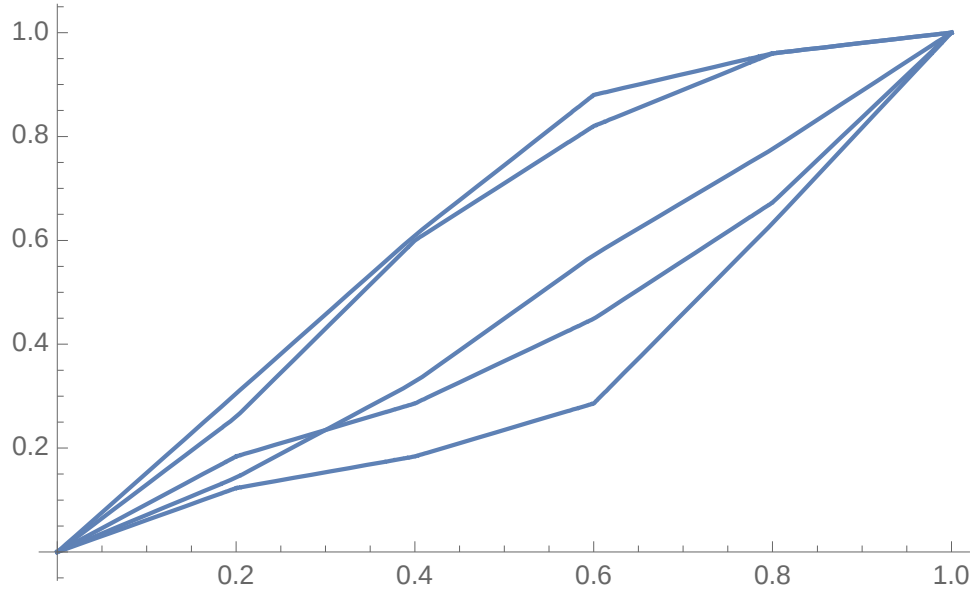
r = 2.2%

We see that sons of the top 1% of fathers pull away from the pack



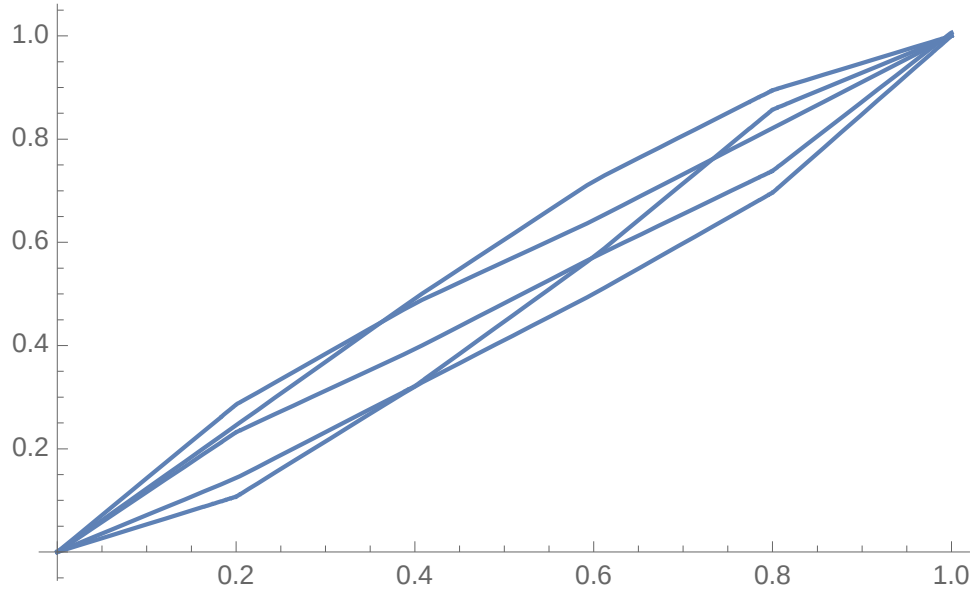
Germany (Kyzyma and Groh-Samberg, 2018)
Income concept: **Gross labor earnings . Quintiles**

r = 8.9%



Germany (2018): **pre-tax household income**

r = 1.2%



Clearly international comparisons are not useful unless we harmonize the income concept

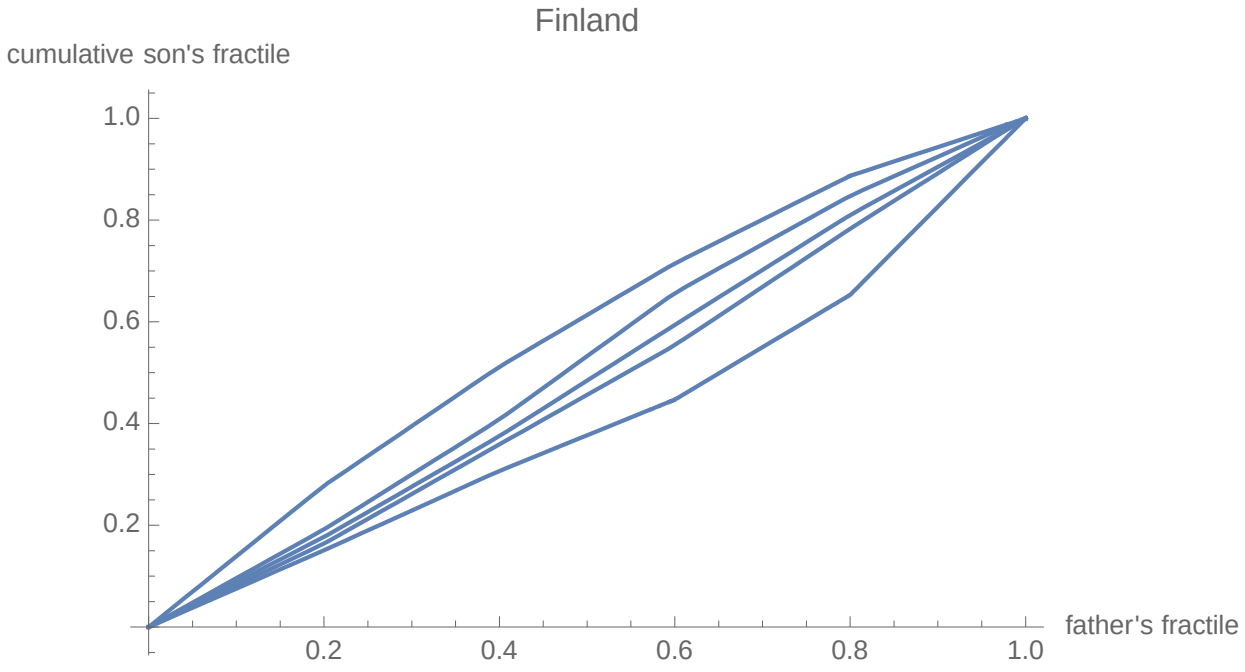
Aggregating Q

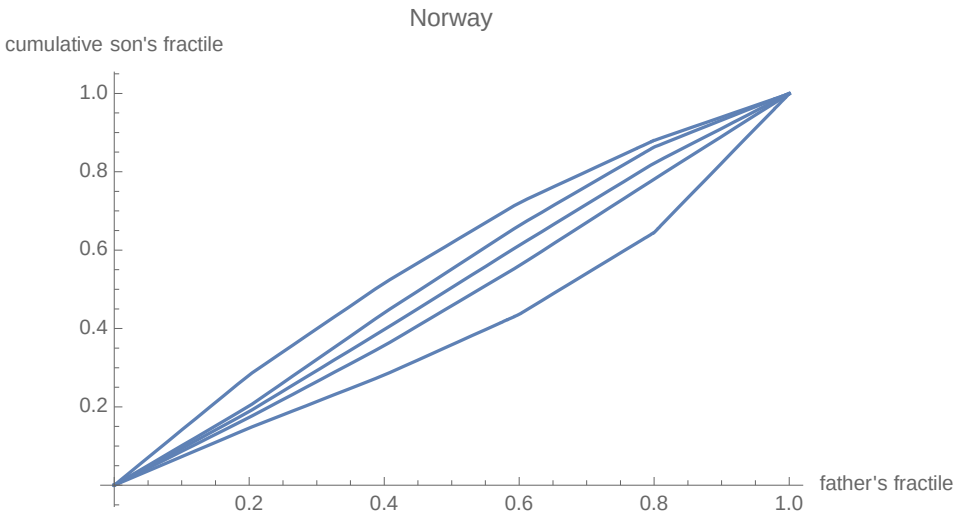
- How much information do we lose if we aggregate Q? Suppose we aggregate to give us 20 types: the sons of fathers by father's ventile. We keep all the information about sons, so we have a CDF for each type with 100 data points on it
- We get $r^{US} = 6.68\%$. In fact:

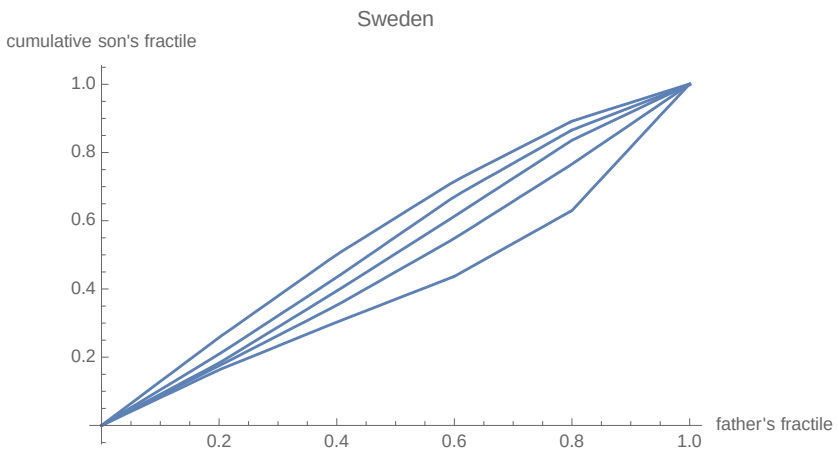
quantile	r
centile	0.0671
ventile	0.0668
quintile	0.0631

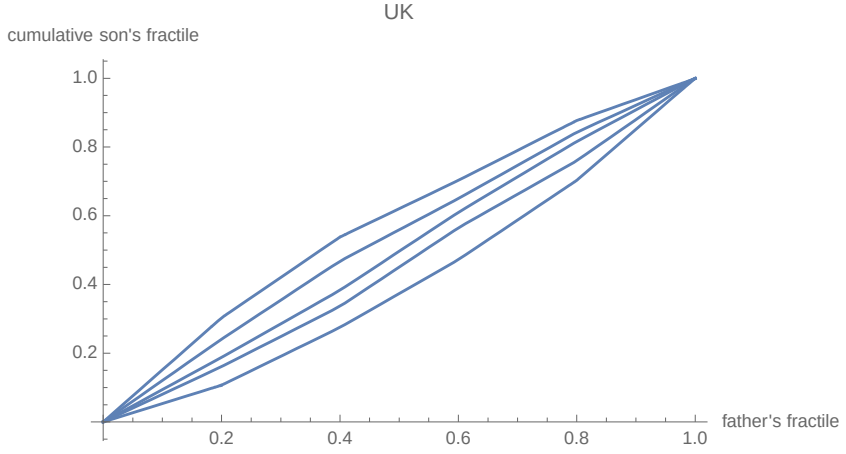
Jantti and seven co-authors (2005)

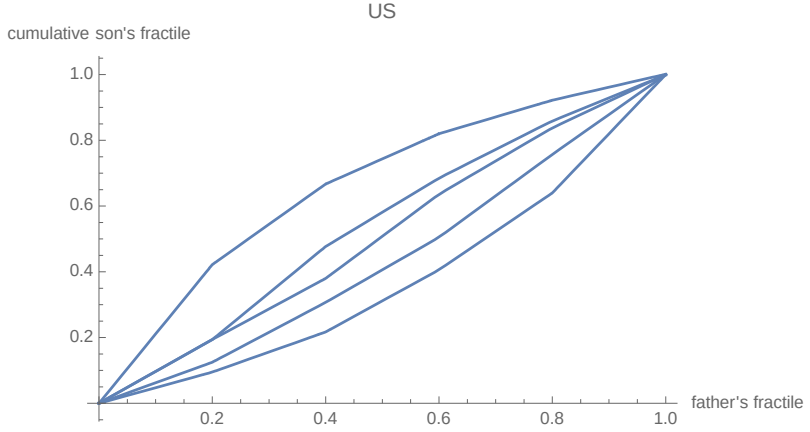
- Compute income IGM matrices for Finland, Denmark, Norway, Sweden, UK and US. For all countries, *n* = 5.

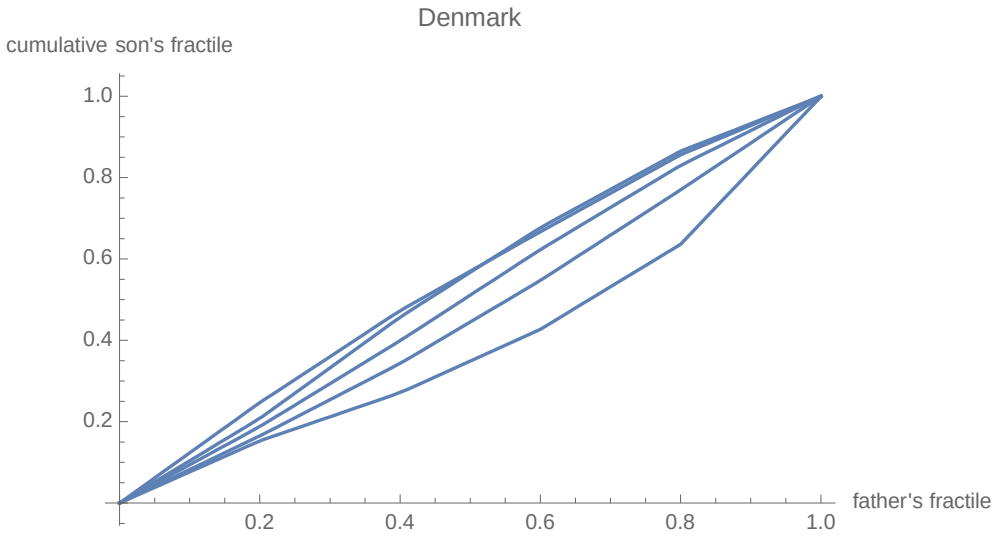



Norway
cumulative son's fractile
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
father's fractile


Sweden
cumulative son's fractile
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
father's fractile

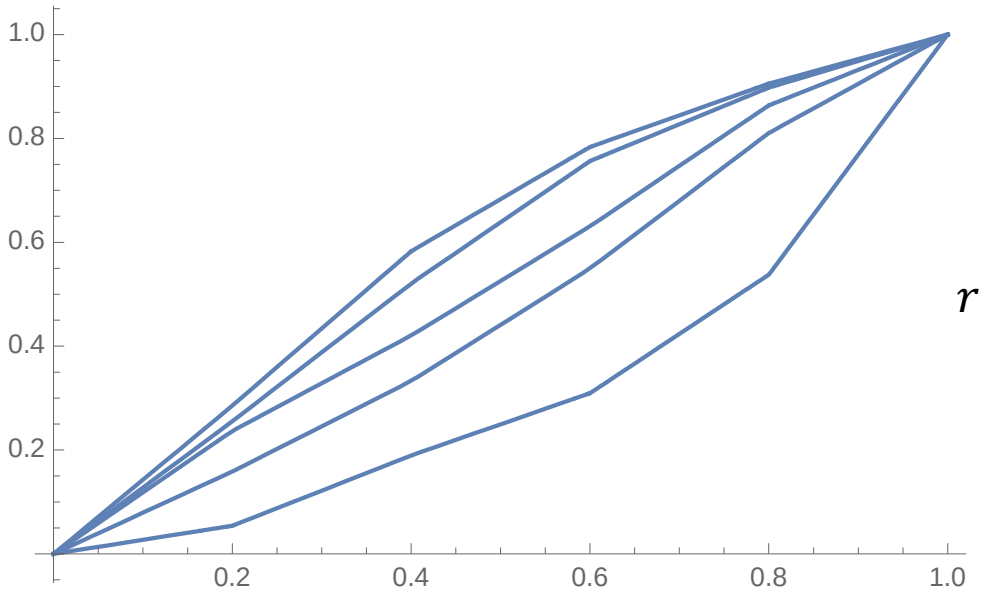

UK
cumulative son's fractile
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
father's fractile


US
cumulative son's fractile
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
father's fractile



country	rr
denmark	0.0427
finland	0.0447
norway	0.0262914
sweden	0.028898
UK	0.0226689
US	0.0530013

Swedish wealth IGM matrix (A. Adermon)



$r = 7.23\%$

Atkinson, Maynard and Trinder (1983), *Parents and children*

Table 2.1 Intergenerational occupational mobility: evidence from the Oxford survey

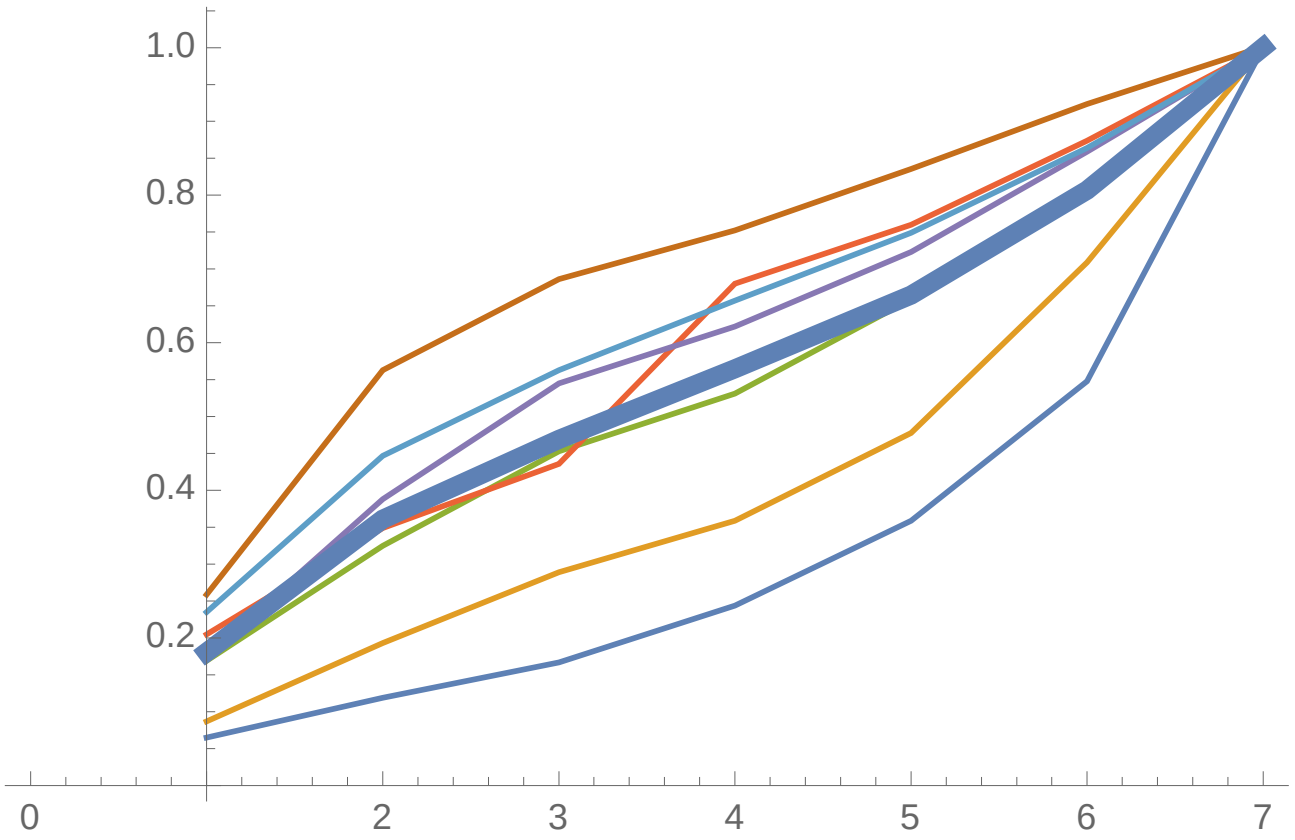
Percentage in father's class	*Percentage in respondent's class* I	II	III	IV	V	VI	VII	*Total (% of sample)*
I	45.2	18.9	11.5	7.7	4.8	5.4	6.5	100.0 (7.3)
II	29.1	23.1	11.9	7.0	9.6	10.6	8.7	100.0 (5.9)
III	18.4	15.7	12.8	7.8	12.8	15.6	16.9	100.0 (7.3)
IV	12.6	11.4	8.0	24.4	8.7	14.4	20.5	100.0 (14.1)
V	14.2	13.6	10.1	7.7	15.7	21.2	17.6	100.0 (11.5)
VI	7.8	8.8	8.3	6.6	12.3	30.4	25.9	100.0 (27.5)
VII	6.5	7.8	8.2	6.6	12.5	23.5	34.9	100.0 (24.6)
Total	13.6	11.5	9.2	9.4	11.6	21.2	23.5	

Note: The results include farmers, small-holders and farm workers, and relate to 9434 men aged between 20 and 64 years.
Source: Goldthorpe (1980), Table 2.2.

Class I	higher-grade professionals, administrators, managers and large proprietors;
Class II	lower-grade professionals, administrators, and managers; higher-grade technicians, and the supervisors of non-manual workers;
Class III	routine clerical workers, sales personnel and other non-manual workers;
Class IV	farmers, small proprietors and self-employed;
Class V	supervisors of manual workers and lower-grade technicians;
Class VI	skilled manual workers;
Class VII	semi-skilled and unskilled manual workers, including agricultural workers.

For each class of fathers, we show the percentage of sons who entered

Here are the 7 cdfs of the types, by father's occupational category and the aggregate



Arbitrary element: I assign a status Value of 1 to the 'lowest' class and '7' to the highest class.

I compute
r = 2.9%.

In contrast, the EOp literature gets much higher values or *r:*

- The standard values of *r* in the EOp literature with a list of circumstances that include parental education, ethnicity, region of the country, etc., are about 20%.
- Hufe et al (2017) used two data sets, US and UK, in which they could append fairly thick description of childhood environment, and compute, using parametric methods,

$$r^{US} = 46\%, \qquad r^{UK} = 36\%.$$

For the usual reasons, these are lower bounds on true *r.*

Comparing the parametric and non-parametric methods

- The non-parametric method is the one described above, where we have actual distribution functions of income for each type.
- Typically, with many circumstances, sample size is not sufficiently large to create income distributions for a variety of types with any statistical precision
- The parametric method uses regression analysis to compute the influence of circumstances on income. One can then carry out the MLD computation.

Replication of parametric method with Chetty et al. *Q*

- I use the 100 density functions from Chetty paper. I generate randomly 50,000 points from these 100 distributions, chosen randomly, and then use the method of Hufe et al (2017) to compute the role of father's rank in son's rank. How close will this be to the non-parametric method?
- Key: I use linear regression, rather than trying to reproduce the centile distribution functions from the data.

- I get $r = 7.80\%$, while the value from the non-parametric analysis is 6.71%. So the parametric method seems to introduce considerable bias. We usually don't have 50,000 observations.

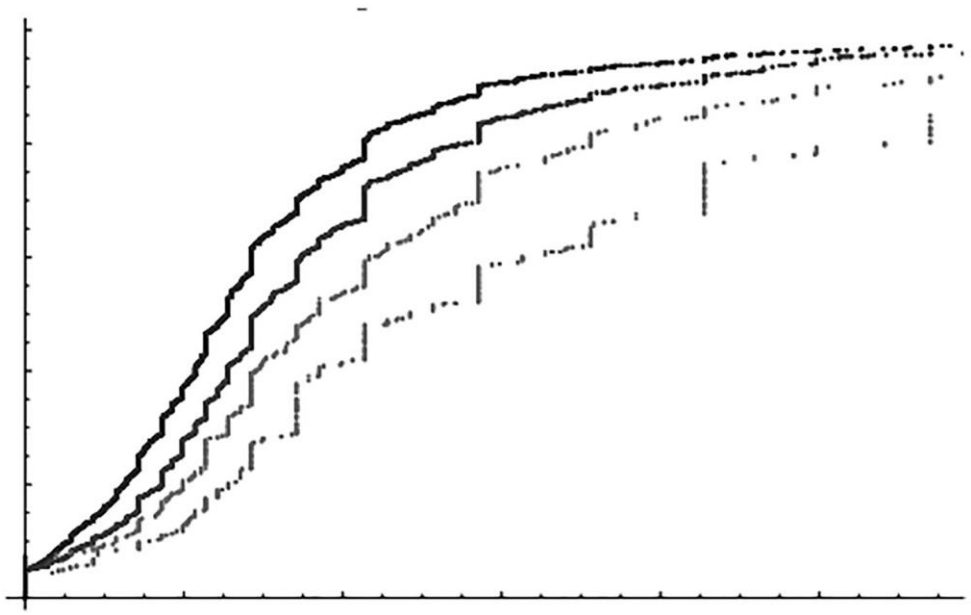
Limitations of IGM analysis

- My conclusion from this comparison: The IGM approach is very limited as a revelation of the impact of circumstances upon income.
- It has cross-sectional and intertemporal value: using IGM, we can certainly see that Sweden is a more just society than the US.
- But it gives a misleading account of the role of autonomous choice on income, and that is a significant defect
- *We must agitate and advocate more actively* for creating the data sets that will reveal the true role of circumstances upon income formation

2. Feudalism versus Capitalism

Here is a typology for income distribution in Egypt, from a survey done in 2012, where the four types are defined by parental education:

Figure 1. *Income distribution functions, four types, Egyptian men*



from Assaad, Krafft et alii, 2017

$r = 10.3\%$

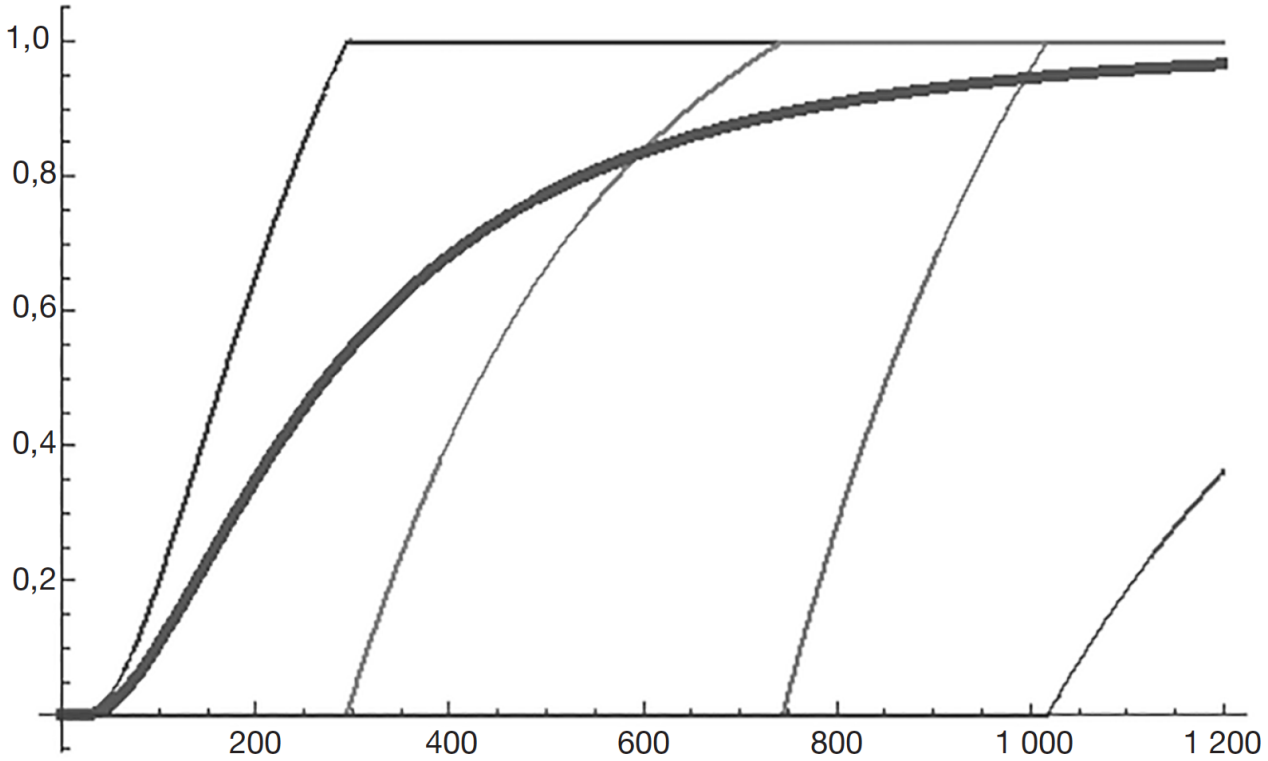
- To gain some insight into why *r* is so low, consider the following optimization problem.
- Given the frequencies of the four types $(\nu^t)$and their mean incomes (μ^t), construct four CDFs with those means, which represent four types with those frequencies, that aggregate to the given aggregate distribution *F* for Egypt, in order to *maximize the value of r*.

This is a solvable optimization problem. The answer is the following:

Heavy curve is Egyptian income CDF

Figure 4. *The decomposition of Egyptian* F *that maximizes the role of circumstances and preserves the order of the means of the actual decomposition*

The key: the supports of the Four component Distributions are Disjoint!



For this decomposition, r = 83.3%.

- This is a picture of a *feudal society*: the supports of the four component distributions are *disjoint*. The richest serf is poorer than the poorest artisan, the richest artisan is poorer than the poorest merchant, the richest merchant is poorer than the poorest….
- In reality, the supports of the four component Egyptian distributions are *virtually the same.* Thus capitalism has *massively equalized* opportunities, compared to feudalism.
- To get high values of *r*, we have to have sufficiently fine-grained types that *the intersection of the supports of the type distributions are small.*

3. The right-wing bugaboo: The cost of equity is inefficiency

- This suggests we show that many policies will both increase opportunity equality *and* increase national income.
- Perhaps this is most important in the US, where right-wing ideology is powerful. I don't know if the ideology has an important hold in Latin America and other developing countries.

Example: Educational Finance

- We have *T* types of child. The policy is educational expenditures on each type of child. We have functions $Y^t(x)$, giving the mean income of a child of type *t* if *x* is spent on the education of children of this type. A simple version of the EOp program is:
-

$$\max \min[Y^1(x^1),\ldots,Y^T(x^t)]$$

subj. to

$$\sum_{t=1}^{T} f^t x^t \leq M$$

- Now suppose we add a constraint saying that the average income of this generation of students should be at least k:

$$\max \min[Y^1(x^1),\ldots,Y^T(x^t)]$$

subj. to

$$\sum_{t=1}^{T} f^t x^t \leq M$$

$$\sum_{1}^{T} f^t Y^t(x^t) \geq k$$

Proposition 1

Proposition 1. *At the solution to program* (1.2), *let* t^* *be any type at which the minimum in the argument of the objective is achieved. Then, either:*

- (1) $Y^i = Y^{t^*}$ for all i *and* (*generically*) $Y^{t^*} > k$, *or*
- (2) *there is at least one index i for which* $Y^{t^*} < Y^i$ *and the productivity constraint binds.*

I.e.: Either we can reach FULL EOP, or there is a conflict between equity and 'efficiency' *at the Optimum policy.*

Not the end of the story…..

Proposition 2. *Let* $x^* = (x^{1*}, \ldots, x^{T^*})$ *be the status-quo policy. Let* $t^* = \arg\min_t Y^t(x^{t^*})$, *and suppose* t^* *is the only type at which the minimum is achieved (surely true at the status quo). Then it is possible to find a feasible direction (not violating the budget* M*) at* x^* *which increases* Y^{t^*} *and GDP per capita if and only if:*

(**) *there exists* $i \neq t^*$ *such that* $(Y^{t^*})'(x^{t^*}) > (Y^i)'(x^i)$. ($Y'$ is the derivative of Y.)

The key is: the status quo is *not the optimal policy*.

Jackson , Johnson and Persico (2016)

Jackson, Johnson and Persico (2016) provide new estimates of the functions $Y^t(x)$. Using a natural experiment they estimate an equation of the form:

$$Y = \delta \ln x + \phi C \qquad (2.1)$$

where Y is income of the adult worker, x is the per capita school expenditure in the secondary schools he attended, and C is a vector of circumstances.

More importantly for our purposes, they estimate the equation:

$$Y^t = \delta^t \ln x^t + \phi C^t \qquad (2.2)$$

for two types – children from low-income and high-income families. From equation (2.2), we have :

$$(Y^t)'(x^t) = \frac{\delta^t}{x^t}. \qquad (2.3)$$

From Table 4 of their paper, we have:

$$(x^{LI}, x^{HI}) = (\$4470., \$4873.), (\delta^{LI}, \delta^{HI}) = (.96, .55), \qquad (2.4)$$

Proposition 2 tells us that there is a redistribution of educational finance that will both raise the income per capita and improve opportunity equality if and only if

$\frac{\delta^{LI}}{x^{LI}} > \frac{\delta^{HI}}{x^{HI}}$ -- see eqn. (2.3) -- which is true.

If we reduced the funding in schools for the high-income children by \$100 per capita, it would reduce the average income of the workers those children become by \$11 per annum on average. This reduction in educational finance for the high-income type, transferred to the schools of low-income children, would raise the funding for those children by $\$100 * \frac{.41}{.59} = \$69.50$ per capita, raising the income of the workers those children become by $69.5 * .24 = \$16.70$ per capita. This generates a global gain in per capita income of $f^{HI}(-11) + f^{LI}(16.70) = \$5.43$.

4 . Is everything a circumstance?

- The ‘causal thesis’ states that every action a person takes has a material (chemical, physical, neurological) antecedent. This view is also known as ‘materialism.’
- ‘Incompatibilism’ is the view *that if the causal thesis is true, then there is no such thing as meaningful responsibility*. Sometimes this is stated “Materialism implies the non-existence of free will.”
- ‘Compatibilism’ is the view that the causal thesis does not destroy the possibility of responsibility. Most philosophers (e.g., Rawls, Scanlon) are compatibilists.

So: How do compatibilists define responsibility?

- A person is responsible for an action if it is pre- meditated, the person was of sound mind when making the decision, contemplated alternatives, and can justify his actions. It would seem a good conception of responsibility is what the law accepts in many legal systems. A killing is not a murder unless it was pre-meditated.
- It is difficult to offer, I think, a non-circular definition of responsibility. But the alternative of denying its existence is worse: it goes against thousands of years of human culture and psychology, and indeed the concept exists in all cultures.
- This is why the ‘problem of free will’ is a perennial philosophical puzzle.

- When writing our paper (Hufe, Peichl, Roemer, Ungerer [2017]) one of the authors proposed including brain scans of individuals as circumstances (there is a data set that apparently we could have exploited to do this).
- I opposed this. Why? Because *even responsible actions* will have antecedent material representations ('causes') in the brain. That is: *it's a mistake to identify physical biological states* as circumstances. Both circumstances and responsible actions will induce brain states that are antecedent to actions. That is, the presence of a brain state associated with an action *does not imply* the person is not responsible for the action. This is the *compatibilist view.*

- When writing our paper (Hufe, Peichl, Roemer, Ungerer [2017]) one of the authors proposed including brain scans of individuals as circumstances (there is a data set that apparently we could have exploited to do this).
- I opposed this. Why? Because *even responsible actions* will have antecedent material representations (‘causes’) in the brain. That is *it’s a mistake to identify physical biological states* as circumstances. Both circumstances and responsible actions will induce brain states that are antecedent to actions.

- This is why I think we must take responsibility to be defined by the culture in question.
- It may be true that, as we learn more about biology and the formation of the brain in childhood, our conception of responsible action will shrink. And this will imply that our EOp theory will come to look more like Equality of Outcomes. But this development must be based on good science, and not on a facile equivalence of material brain states with circumstances.
- See Robert Sapolsky, *Behave: The biology of humans at our best and worst*, for one the biologist's view of this question.

5. Inequality of Opportunity: Micro vs. Macro

- Our empirical studies of IOp are micro. We take *major institutions of the economy* as fixed, and study how tweeking one policy would equalize opportunities to some degree
- The glaring fact is that the concentration of income at the top in at least the US has massively reduced opportunities for most people, not only through depriving them of income in a counterfactual world, but by huge negative externalities the bottom 90% suffer from the political & economic power of those at the top of the pyramid

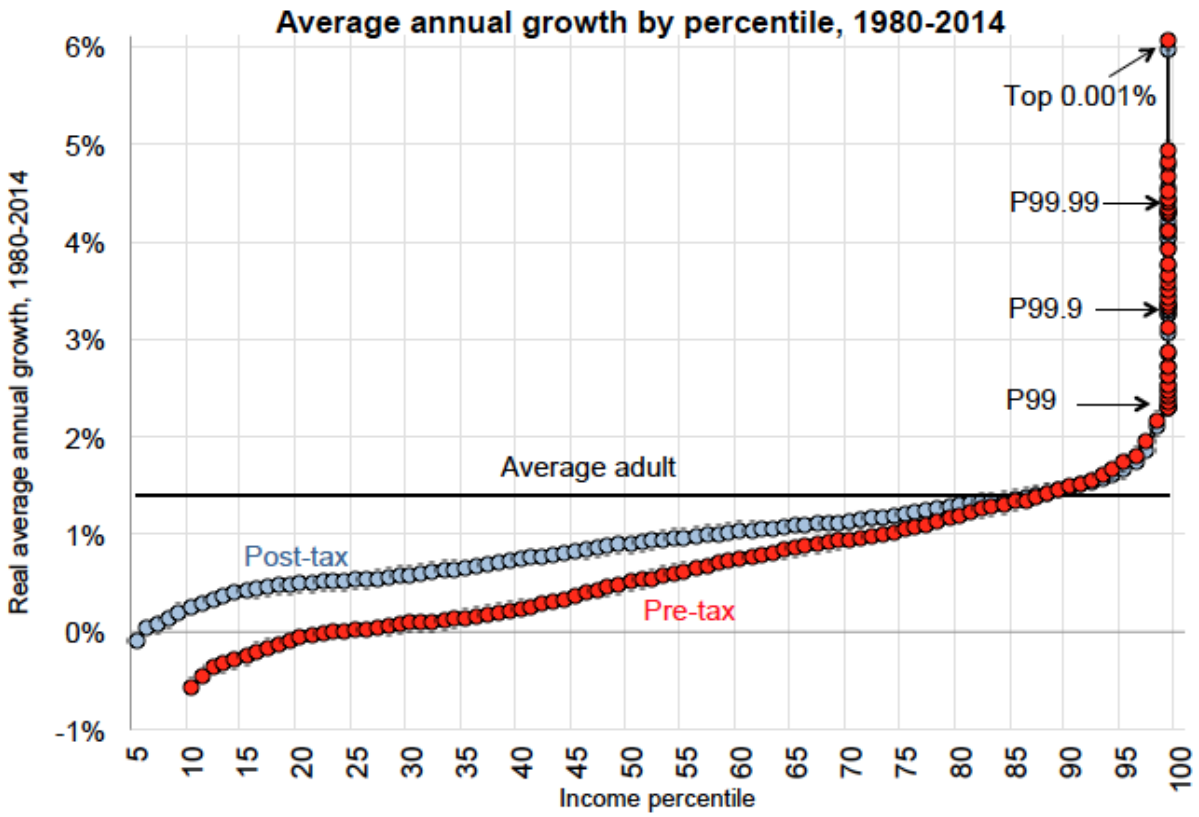
- Ideally, we would like to know: How much do the institutions of modern capitalism induce opportunity inequality, compared with some feasible egalitarian alternative?
- Clearly this is a poorly formulated research question. But I believe we should broaden our vision, and attempt to get a handle on it. Most of the empirical work at present takes too small a field of vision. We are thereby letting capitalism off the hook.
- At the same time, recall that capitalism has vastly improved opportunity equality vis-à-vis feudalism. We must maintain perspective.

6. A politically salient calculation

- I conjecture in the US, political disenchantment has been magnified by voters' seeing that their children's income has stagnated. I will estimate the following:
- **For any number *x*, in the period 1980-2014, what fraction of parents have seen their child's income growing at a rate <= *x* ?**
- I use the IGM matrix of Chetty et al to give the distribution of children of each centile of parents in the income distribution, and I use the estimates of Piketty, Saez & Zucman (2017) to give the growth rate of incomes at each centile in the income dist'n in the period 1980-2014

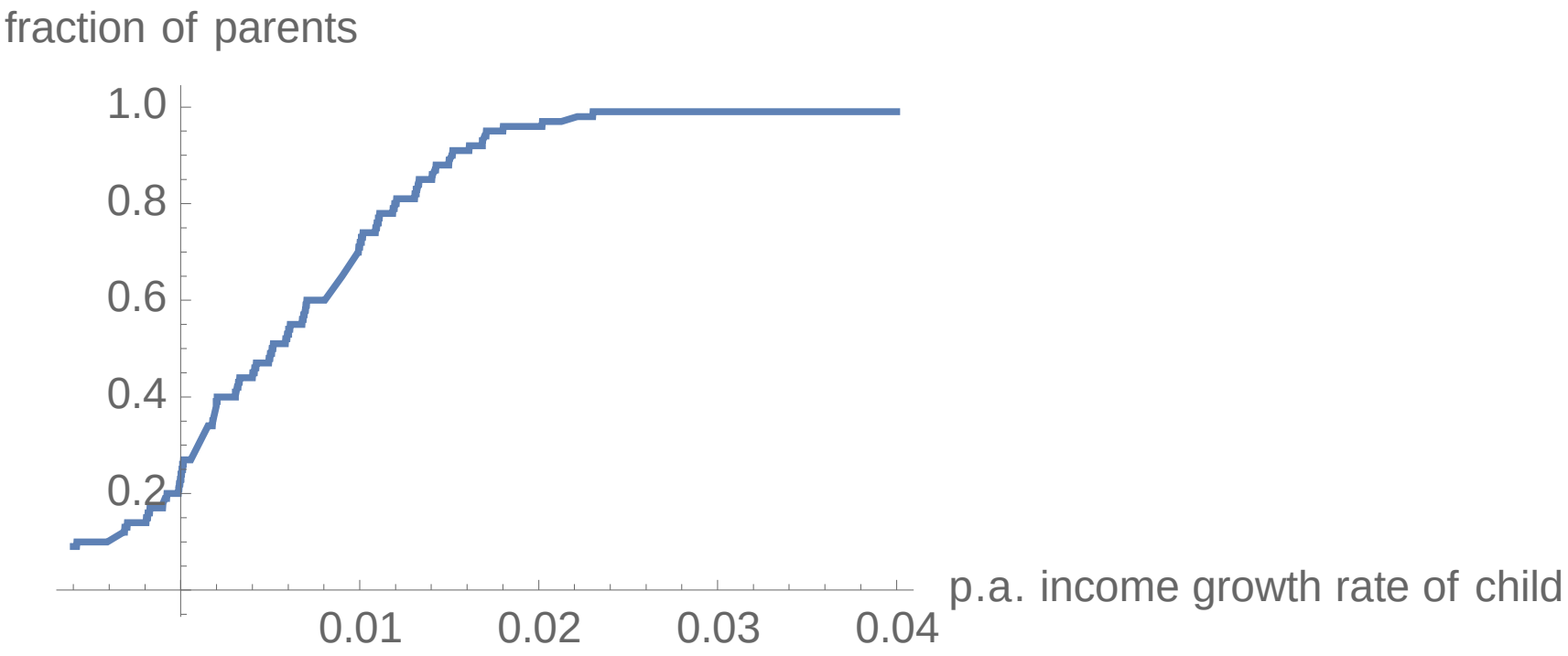
Piketty, Saez & Zucman (2017). Growth rates

Figure 2: The distribution of economic growth in the United States



- Define g[j]=annual growth rate of income at centile *j* of income dist'n in this period
- Then $V[x]=.01*\sum_{i=1}^{100}\sum_{g[j]\leq x} q[i,j]$
- V[x] is the fraction of parents whose child's annual income grew at less than *x* per annum.
- Of course this estimate assumes each child's income growth rate is characterized by the Piketty growth rate for the entire period.

The graph of V[x]



Here’s a table of *V:*

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Fraction of parents whose child's annual income grew at less than:	x%
0.32	0.1
0.39	0.2
0.4	0.3
0.44	0.4
0.48	0.5
0.53	0.6
0.59	0.7
0.6	0.8
0.65	0.9
0.71	1.
0.76	1.1
0.8	1.2
0.81	1.3
0.85	1.4
0.89	1.5
0.91	1.6
0.94	1.7
0.95	1.8
0.96	1.9
0.96	2.
0.97	2.1
0.97	2.2
0.98	2.3
0.99	2.4
0.99	2.5
0.99	2.6
0.99	2.7
0.99	2.8
0.99	2.9
0.99	3.
0.99	3.1
0.99	3.2
0.99	3.3
0.99	3.4
0.99	3.5
0.99	3.6
0.99	3.7
0.99	3.8
0.99	3.9
0.99	4.

About 1/3 of parents saw child’s income grow at less than 0.1%. Half of parents saw child’s income grow at less than 0.5%. About 30% saw child’s inc. grow at greater than 1%.

Average income grew at 1.4% p.a. in this period. Yet 85% of Parents saw child’s income grow at less than 1.4%. Beware the ecological fallacy.

- I contend this was a source of anger and resentment for parents, who would compare their children's experience to their own experience in the earlier period before 1980.
- Trump was able to 'explain' this economic stagnation for the majority by blaming blacks (who take state handouts), Mexicans (who take jobs), and China (which displaces US jobs with imports).
- In the US, blacks, immigrants and China are scape-goats. This is qualitatively different from Europe, where immigrants are a challenge to 'national identity.' Right-wing populism in the US and Europe have different causes.