

Economic theory and practical lessons for measuring equal opportunities

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Introduction and major messages

The use of the word “practical” in the title of this memorandum should not necessarily be interpreted as “feasible.” Some of the suggestions I make for the development of a set of statistics appropriate for the measurement of equality of opportunity certainly are feasible, and while some can be introduced and used almost immediately, others can only be put into practice over a longer horizon and may well require a commitment of human and financial resources. “Practical” lessons are those that can in principle be put into practice, but also those that are grounded in our understanding of the theory of intergenerational mobility and equality of opportunity.

Theory, of course, rarely if ever gives direct guidance to empirical analysis and public policy. I draw two threads from economic theory, and pull them as long as I possibly can to inform specific recommendations for policy makers concerned with the measurement and monitoring of equality of opportunity in the rich countries, without hopefully splitting them from the fabric of logical and well articulated thought. These threads of thought lead to three suggestions:

1. Use data appropriate for the country at hand—and indeed where possible promote the development and use of new data, whether those associated with the administration of the income tax and other government programs, survey data supplemented with retrospective questions, or linked survey and administrative data—to estimate summary measures of intergenerational mobility. These statistics include:
 - (a) the intergenerational earnings elasticity, which can be thought of as a complement to cross-sectional indicators of inequality like the GINI coefficient, and the intergenerational correlation in income ranks

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- (b) intergenerational income transition matrices, which depict the degree and direction of child mobility according to each parental rank
2. Develop measures of absolute mobility, and in particular develop a poverty line based upon the monetary resources associated with discrete changes in the lack of upward mobility for children whose parents are in the lower part of the income distribution. Publish on a regular basis the headcount ratio of children living in families with less than this level of monetary resources.
 3. Make full use of the Programme for International Student Assessment (PISA) and expand its scope to include young children
 - (a) regularly publish a host of appropriate statistics associated with important skills and competencies of the 16 year old children surveyed in these data in a way that is framed by the theory of equality of opportunity
 - (b) move forward in implementing the original vision of a PISA for young children—say those five or six years of age, children at the cusp of starting primary school—by developing appropriate measures of skills and competencies that can be measured across countries, and including them—along with measures of family background—in repeatedly administered cross sectional surveys across all the countries currently included in PISA.

Theory and Measurement

What is intergenerational mobility?

There is no single answer to this question, and certainly there is credibility in many of the different measures used across the various social sciences. Economic analysis is rooted in a perspective that stretches back to Francis Galton, whose work dates to the 1800s, and continues to resonate today through a simple model of “regression to the mean”:

$$\ln Y_{i,t} = \alpha + \beta \ln Y_{i,t-1} + \epsilon_{i,t}$$

where Y is some outcome we are interested in, usually taken to be permanent income by economists, i indexes families, and t generations. The best guess of a child’s adult earnings (generally expressed in natural logarithms) is just the average income of his or her birth cohort—which can be thought as indicated by α —plus two deviations from the average, the first being some fraction of the earnings of his or her parent or parents, as represented by β —and the other representing residual influences not correlated with parental income. The value of β , usually estimated by least squares, is the parameter of interest, the intergenerational income elasticity, indicating to what degree the relative advantages or disadvantages of the parent are transmitted to the child. β expresses this in percentage terms, and is generally found to be positive but less than one: as it approaches 0 mobility is complete (with the best guess of a child’s adult earnings being the cohort average); as it approaches 1 mobility is limited, and in the extreme children occupy the same position in the income distribution as their parents. Negative values would indicate an intergenerational reversal in economic status, and values greater than one would indicate divergence from, rather than regression to, the average.

Figure 1: A sense of upward and downward mobility for children for any set of commonly ranked parents is offered by the intergenerational transition matrix

Child quintile	Parent quintile				
	1	2	3	4	5
1	33.7%	24.2%	17.8%	13.4%	10.9%
2	28.0%	24.2%	19.8%	16.0%	11.9%
3	18.4%	21.7%	22.1%	20.9%	17.0%
4	12.3%	17.6%	22.0%	24.4%	23.6%
5	7.5%	12.3%	18.3%	25.4%	36.5%

Source: Chetty, Hendren, Kline, Saez (2014), "Where is the Land of Opportunity?" *Quarterly Journal of Economics*, Table II, page 1577.

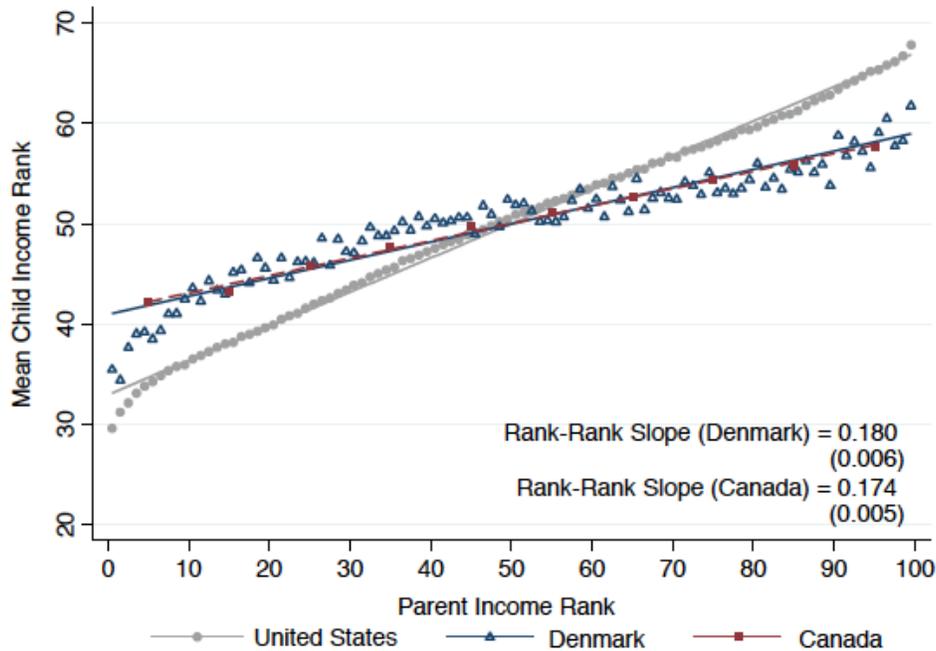
There is now a long list of careful studies suggesting this coefficient varies across the rich countries, lying somewhere between 0.4 and 0.6 for Italy, the United Kingdom and the United States, and as low as 0.2 or less in some Nordic countries. But as an exercise in description, this statistic is no more than what it is, though sometimes it is made it out to be much more, possibly reflecting the fact that what is central to academic analysis may not align perfectly with what is of interest in public policy.

The intergenerational income elasticity refers to percentage differences in child outcomes according to parental origins. It is a measure of relative mobility across the generations referring to percentage deviations from the average. And while this statistic has been estimated for men and women, for a host of different measures of income and earnings—both individual and family, for earnings, total market income, and for income after taxes and transfers—the largest number of estimates that permit comparisons across the largest numbers of countries refer to the market earnings of fathers and sons. Finally, this statistic on its own makes no reference to absolute differences or directional changes: whether a generation is making more or less than the previous generation, whether particular children are making more or less than their parents, or whether mobility in one country is higher or lower than another because of more or less mobility in either an upward direction from the bottom, or a downward direction from the top.

Even so this is a valuable statistic as a backdrop to public policy discussion, and offers a complement to the GINI coefficient and other measures of cross sectional inequality. It indicates the degree to which relative income advantages have been passed on to the current generation of adults from their parents. But if there is confidence that a particular country has the statistical infrastructure in place to accurately produce this statistic, then it would do well to supplement it with a somewhat fuller descriptive account of mobility offered by the transition matrix between parent and child ranks in their respective income distributions. These transition matrices, an example of which is offered in Figure 1, give a sense of both upward and downward mobility, and permit the public policy community to assess the degree of mobility from any set of parents with a common rank in the income distribution. The information in Figure 1 refers to a quintile transition matrix in the United States, and shows that children raised by fathers in the bottom 20% of the income distribution have only a 7.5% chance of rising to the top fifth, while those raised by parents in the top fifth have an almost 37% chance of being in the top fifth of their generation.

Cross country comparisons are just as easily communicated in a transparent way using rank correlations, and by focusing on particular slices of parental ranks. Figure 2 depicts the average percentile rank of children for fathers at each percentile of the income distribution in the United

Figure 2: Cross country differences in the average percentile ranks of children in Denmark, Canada, and the United States according to father's percentile rank



Source: Chetty, Hendren, Kline, Saez (2014), "Where is the Land of Opportunity?" *Quarterly Journal of Economics*, Figure II, page 1576. The Rank-Rank Slope for the US is 0.341.

States, Denmark, and Canada (though the Canadian information is for deciles). The slopes of these relationships are analogous to the intergenerational elasticity when the degree of inequality (the variance of income) has not changed across the generations, and in this study by Chetty *et al.* (2014) are pretty well the same in Denmark and Canada—0.180 and 0.174 respectively—but, at 0.341, significantly greater in the United States. Overall there is more stickiness in the mobility process in the United States, both compared to a country with which it shares a good deal, and one which is very different in demography, geography, and social and labour market institutions. This is of interest in its own right, but leaves important issues for policy unaddressed.

Consider the contrast between the United States and Denmark. The absolute differences in average incomes, both in the father and the child generations, and the variance of incomes must surely be different in these two countries. I don't hazard a guess as to the averages, but the variance is surely greater in the United States, the rungs between the income ladders of both generations most likely being much wider apart. A child moving ten percentiles in the Danish income distribution may well experience a much smaller change in rank with the same amount of income in the United States. A particularly relevant way of appreciating this distinction, relevant not just for between country comparisons but also for within country discussions, concerns the falling away of mobility for children of parents at the very bottom of the income distribution. On the one hand this highlights an advantage of using the transition matrix over a simple summary measure like the intergenerational

elasticity or rank correlation coefficient: any non linearities—differences in the mobility process across the parental income distribution—can be clearly observed. In fact, the variation in β across countries has little to do with differences in mobility of children raised by families in the broad middle of the income distribution, and reflects differences at the extremes. Transition matrices, if they are calculated finely enough with reliable measures of permanent income free of measurement error and life-cycle biases for both the parents and the adult children, have the capacity to highlight this fact. Children raised by families in the bottom decile of the Danish income distribution appear to have less upward mobility, as also appears to be the case for those raised in the bottom vingtile of the US distribution.

Promoting the upward mobility of children raised by bottom income parents is likely to be a policy relevant issue for all countries of the OECD. The intergenerational earnings elasticity and correlation inform this discussion even under the assumption of linearity. A very slow regression to the mean might raise the importance of not letting families fall to far below average income because mobility is so low. But a non linear process heightens the matter even more, and may also give this public policy discussion salience in countries having a high degree of regression to the mean.

What is left unanswered is just what income levels are critical to lowering the risk of an intergenerational stickiness of status at the bottom: in other words where should we draw a poverty line, in domestic currency, if our concern is the risk associated with the loss of potential for upward mobility? Ranks don't answer this question. The regular publication of a poverty line of this sort—a measure of the minimal monetary resources below which the chances of the intergenerational transmission of poverty are distinctly higher—and its associated head count ratio would be a valuable complement to existing poverty lines, even in countries like Denmark, where currently used indicators like 50 or 60% of the median income indicate a very low level of child poverty.

What is Equality of Opportunity?

The degree of regression to the mean in incomes and ranks, and associated transition matrices are central descriptive statistics of intergenerational mobility, and without them we cannot begin a discussion about equality of opportunity. But they are not measures of equality of opportunity. John Roemer has clearly made the case that a transition matrix in which all entries are the same does not reflect a definition of equality of opportunity that most citizens of the OECD would consider acceptable. It would involve public policy levelling all possible playing fields, compensating for all possible circumstances, and by implication significantly curtailing the role of family autonomy in the raising of children.

For Roemer equality of opportunity means that inequities of outcome are not defensible when they are the result of different “circumstances”. To make this distinction we need to know to what degree individuals are responsible for their outcomes in life: in other words, to what extent are these outcomes the result of circumstances beyond an individual's control (for which they should be compensated), and to what extent do they reflect an individual's effort (for which they should be responsible)?

His philosophical analysis of these issues is a central element of the theory of equality of opportunity, and in the end he is asking us to accept that drawing a line between ‘circumstance’ and ‘effort’ requires a value judgement. Values are certainly a part of economic analysis, but at the same time it is fair to suggest that they enter the analysis as a way of ranking the desirability of outcomes. But philosophers, and a good deal of experimental evidence, tell us that most citizens of the OECD care independently about the ways in which outcomes are obtained: process matters.

The derivation of statistics useful for public policy addressed to equality of opportunity cannot escape the need to make an explicit value judgment. Without doing so theory will offer little guidance for the conduct of policy, and no practical suggestions for the development of appropriate statistical indicators beyond the purely descriptive. But this is nothing new. While it is rare for the statistical agencies of the OECD to adopt “official” poverty lines, all these countries, or their supra-national representatives, draw these lines using some value judgment on the degree of relative deprivation that in some sense is not acceptable.

It is not self-evident what “circumstances” policy makers should seek to level in order to promote equality of opportunity, but one way to advance the discussion is to focus measurement on children. Roemer and Trannoy suggest that “where children are concerned, all inequality should be counted as due to circumstances, and none to effort ...” Children should not be held responsible for their “choices” until they reach the age of majority. That may be a value judgment most citizens are willing to accept, particularly when paired with a human rights perspective, informed by the Convention on the Rights of the Child, a UN Convention that almost all rich countries have ratified.

Economic theory makes clear that intergenerational mobility is determined by a host of factors, and that we can’t parse these out by simply looking at the intergenerational income elasticity. Becker and Tomes (1979, 1986) offer a standard and widely used economic model underscoring this point. A simplified version would be based on the following three equations:

$$\ln Y_t = \phi \ln Y_{t-1} + \gamma H_t + \lambda E_t + v_t \quad (1)$$

$$H_t = \delta E_t + \theta \ln Y_{t-1}, \quad \theta \geq 0 \quad (2)$$

$$E_t = \alpha + h E_{t-1} + \nu_t \quad (3)$$

The model is recursive, and this way also links with increasingly accepted notions of child development. Children inherit an endowment associated with their underlying personality, competencies, or perhaps family culture from their parents (E), to the degree given by h . This endowment influences the development of their human capital (H), which may also be influenced by their parent’s status, usually income status, to the degree given by θ . Human capital, in turn, is an important influence on adult outcomes, (Y), but endowments continue to be, as may also be the case for parental status, according to the values of λ and ϕ .

The important message even at this level of abstraction is that β will be a composite of:

- the degree of inheritability of innate endowments or family culture (h)
- the strength of the causal association between family circumstances and a child’s human capital (θ)
- the returns to those components of human capital (γ), a clear marker for the degree of labour market inequality
- and any direct influence parental status may have on earnings outcomes of children in adulthood (ϕ), through networks or nepotism, or through endowments (λ)

The observation that one country has a different β than another, or that there are upward or downward trends in β over time and cohorts within a country is not informative for public policy directed to equality of opportunity because this coefficient does not identify a particular causal force, and because we have not articulated as a public policy objective which—if any—of these factors cut against accepted notions of equality of opportunity.

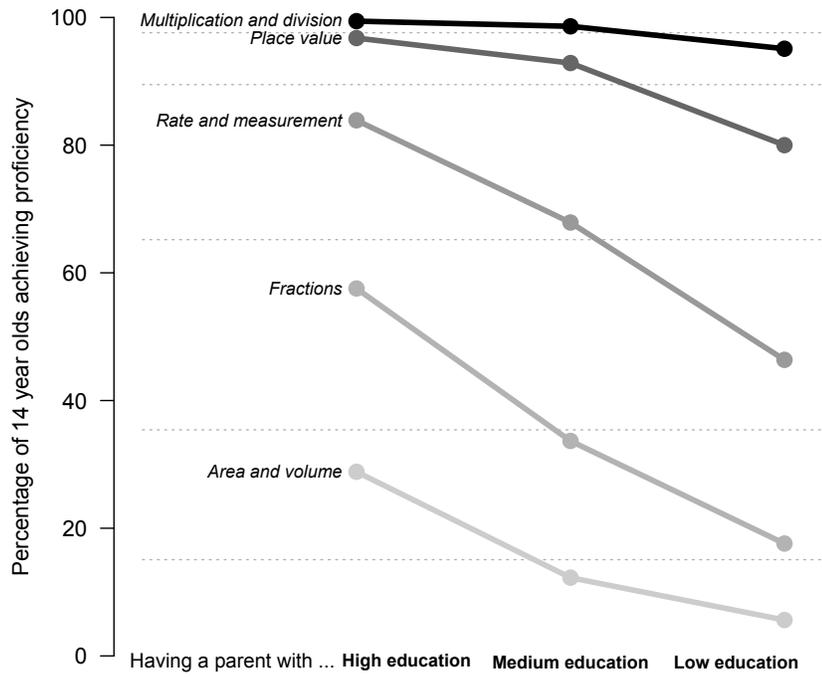
If we focus on equation (1), adult outcomes, most citizens might agree that differences in incomes associated with nepotism in the hiring process, so that the children of relatively well-to-do parents get jobs in relatively better paying firms—and are on this basis earning more than other children who are as highly educated or have the same level of other characteristics influencing earnings—should be eliminated. And most citizens might also agree that differences in outcomes associated with endowments that do not reflect differences in productivity—skin colour, height, beauty—should also be eliminated. But we cannot know whether or not this is the case from observing β , which would also be influenced by the returns to characteristics, whether innate or through the efforts that went into getting more schooling and skills, that are associated with productivity differentials. A statistic derived from an equation like $\ln Y_{i,t} = \alpha + \beta \ln Y_{i,t-1} + \epsilon_{i,t}$ only starts this conversation, and a public policy conversation more closely tied to Roemer’s notion of equality of opportunity, and an emphasis on children, would probably do better to focus on equation (2), the development of human capital, and its association with parental status.

In this respect, this model is a bit too simplified, and we need to appreciate the developments in the economics, psychology, and child development literatures suggesting it might be more appropriately represented as a series of recursive equations, each representing a stage in which children develop specific competencies that then set a stage, and raise or dampen the risks of fully developing through next stage. An important interaction in this process being that between the early years and subsequent development, as summarized by Jim Heckman’s metaphor that “skills beget skills”. We need to also appreciate that the dimensions of human capital relevant for adult earnings may also be multi-dimensional and include not just cognitive skills but also aspects of personality, team work, and other non-cognitive skills. Formal schooling and the associated credentials may only partially indicate or develop these skills.

Statistical markers of equality of opportunity should be informed by the sub-system of recursive equations represented by equation (2). My own view is that parental education is a preferred indicator of socio-economic status for these purposes, reflecting the capacity of parents to make both monetary and non-monetary investments in their children. But even statistics based upon these sorts of relationships, variations in children’s literacy, numeracy, or social skills according to their parent’s education, is an abstraction neglecting variations in parental preferences. Nonetheless we may imagine that regardless of parental preferences, regardless of parental capacities, all children should grow up in a way that develops the capacity to become all that they can be, and to function normally in our societies as they exist. So explicit measurement of these capacities at each important stage of child development is important for informing public policy, and measuring equality of opportunity in a way that is at least one level deeper than just description, even if in some degree it continues to formally remain that.

Figure 3 offers an example of the degree of competency in various dimensions of mathematics by 14 year old children in the United States, according to whether the parent with highest education held a college degree (labelled “High education” in the figure), and had at the other extreme no more than a high school diploma (labelled “Low education”). On average less than 4 in ten young teens on the cusp of high school, have mastered manipulating fractions. This average outcome is something public policy makers may wonder about, and they may even also wonder about the

Figure 3: Proficiency in mathematics among 14 year olds in the United States is much higher for children with more educated parents



Source: Bradbury, Corak, Waldfogel, Washbrook (2015), *Too Many Children Left Behind*. New York: Russell Sage Foundation.

Note: The dashed horizontal lines indicate the average proportion attaining competency in each mathematical skill.

fact that just less than 6 in 10 children from the most advantaged backgrounds have mastered this skill. Overall averages may continue to be a concern as policy makers are likely to have a clearer sense of what is socially acceptable in these sorts of domains, regardless of a child's effort. If this is so then they may also wonder about the falling away of competency among children with less advantaged backgrounds. And this dimension of the discussion opens a natural window onto equality of opportunity.

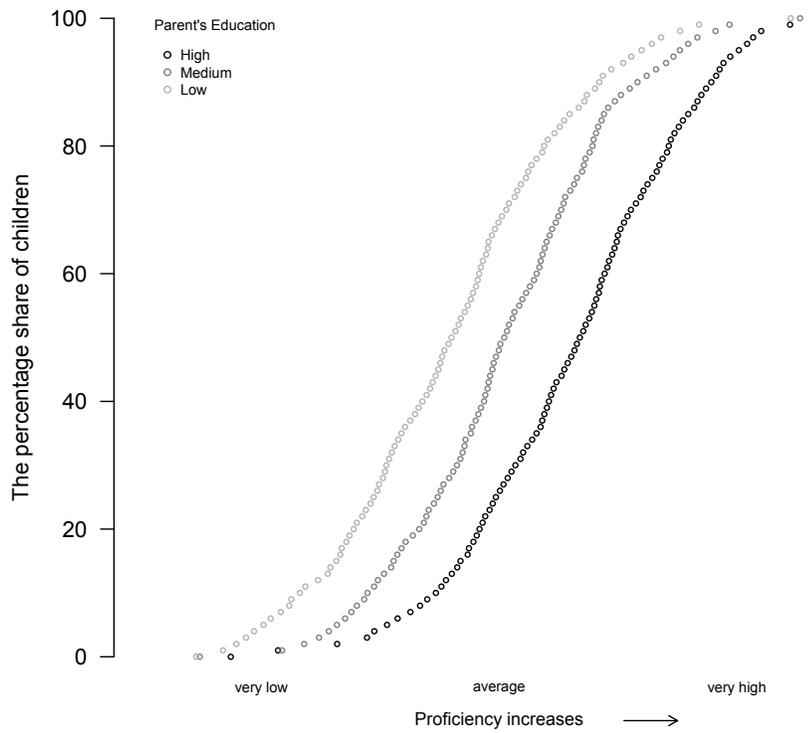
Pictures of this sort have been, and can easily continue to be, provided by the PISA for similarly aged children in many other countries. They should form a part of any dashboard of statistics associated with equality of opportunity. PISA publications tend to focus on a continuous index of competency that certainly has its merits, but loses something as a communication device. These indices can be directly associated with particular levels of competency that are more directly grasped in public policy, and they should be derived and communicated in this form.

But a continuous index reflecting a more finely nuanced notion of skills and competency also has a central place in Roemer's framework. He encourages us to use the empirical cumulative distribution functions categorized by family circumstances, and proposes that equality of opportunity is reflected in the degree to which these functions are the same. If similarly ranked children across family background types attain the same level of competency, then this indicates equality of opportunity. The extent to which this is not the case overall, or even at particular points in the distribution, reflects unequal opportunities.

Figure 4 offers an example, again based on the US and using data that are not PISA based, but refer to a similar aged group. These are the same data used in Figure 3, but now with a continuous indicator of mathematics skill, and displayed in the way Roemer suggests by offering on the vertical axis the cumulative percentage of children that have reached no more than a particular skill level indicated on the horizontal axis: very low referring to two standard deviations below the average, very high to two standard deviations above. The horizontal gaps between the curves indicate inequality of opportunity if we accept that parental education is a circumstance in the sense used by Roemer. These gaps are widest in the broad middle of the distribution: the median ranked child of all children with parents having low education has a competency in mathematics much lower than the average test score, and notably lower than his or her counterpart with high educated parents, who scores well above the average. It would appear that there is equality of opportunity if a child is extremely gifted: the achievement gaps of top percentile children being very small. But even among the top there is a significant gap in achievement. The children scoring in the top decile of the distribution of all children with low education parents close somewhat the achievement gap relative to the top ten percent with medium educated parents. But both groups—in spite of surely having nurtured talent, expending effort, or having innate ability—still score lower than the top decile from parents with college degrees. All of this leaves unquestioned the fact that for the great bulk of the distribution achievement is clearly distinguished by family background.

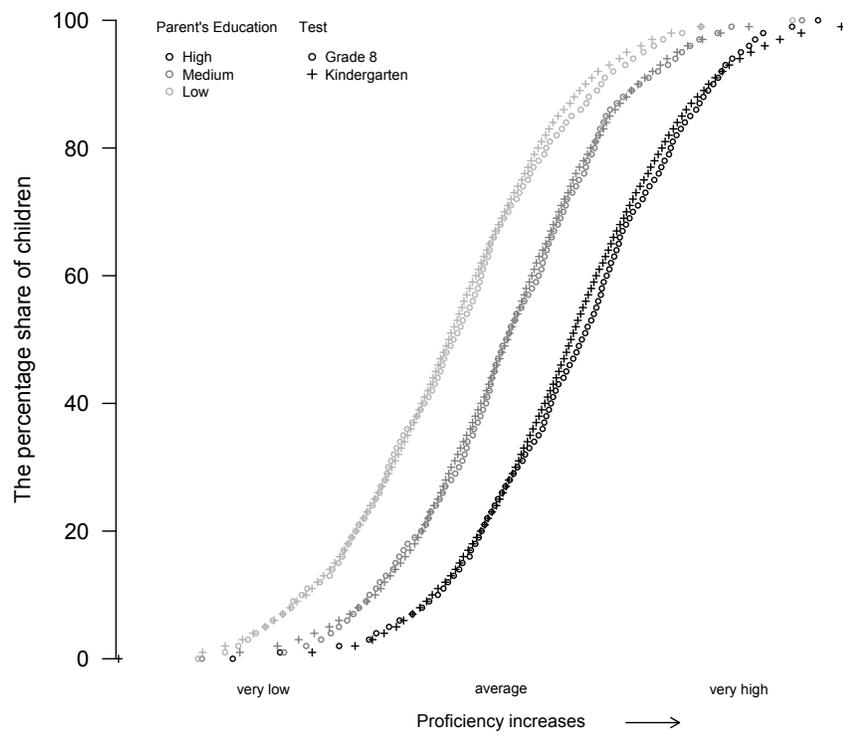
There is no reason, as far as I can tell, why PISA test scores cannot be organized in this way. For all I know this may very well be the case somewhere in the many very influential and well-written PISA reports. And while this would be an easily and virtually costless step forward in developing equality of opportunity indicators, it needs to be supplemented with another important, albeit more costly, step. These results are conditional on children being in their early-mid teens. This has a great deal of power to direct public policy to the high school and adolescent years, but it may be misguided if the theory of child development wrapped up in our discussion of equation (2) is correct. If the early years matter, then inequality of opportunity may be embedded in societal outcomes well before children reach high school. If we are to take the focus on children seriously, then indicators

Figure 4: Roemer's framework suggest organizing test scores as cumulative distribution functions by family background, with achievement differences of similarly ranked students across groups indicating inequality of opportunity



Source: Bradbury, Corak, Waldfogel, Washbrook (2015), *Too Many Children Left Behind*. New York: Russell Sage Foundation.
 Note: very low refers to two standard deviations below the average test score, and very high to two standard deviations above.

Figure 5: Comparing the cumulative distributions for mathematics test by parental education for children of age 5 and 14 suggests inequality of opportunity is present in kindergarten and is not much changed by primary schools



Source: Bradbury, Corak, Waldfogel, Washbrook (2015), *Too Many Children Left Behind*. New York: Russell Sage Foundation.
 Note: very low refers to two standard deviations below the average test score, and very high to two standard deviations above.

of equality of opportunity need to be provided at younger ages, particularly on the cusp of formal schooling so that family versus societal influences can have a hope of being distinguished.

Figure 5 offers an example of the kind of outcome that PISA should be enhanced to produce. The cumulative distribution function of standardized math scores collected at roughly age 5, when these US children were starting kindergarten, are added to the information in Figure 4, and appear to be very similar. The differences in outcomes by parental education is something evident when children first enter the schooling system, and does not change significantly during the years in primary education. The differences in the ranking of children by family circumstance at the cusp of high school are pretty accurately indicated by the differences in ranking during the first months of kindergarten. This cannot be currently done with PISA unless the effort to develop a version of the data for 5 or 6 year olds is given strong support. I should emphasize that does not require a longitudinal survey of children, only a series of repeated cross sections across countries, and at crucial ages in child development that have already been highlighted by the academic literature.

Conclusion and major messages

Equality of opportunity should be an aspect of how we understand economic performance and social progress. It puts a focus on process, not on outcomes, and therefore can't be the only aspect. And it may be very challenging to discern in a rigorous way, relying as it does on an inherent value judgement to distinguish between "circumstance" and "effort." While theorists and philosophers will continue to debate its definition, the notion of equality of opportunity rings true at some basic level for many citizens of the rich countries. For this reason alone practitioners should grasp firmly onto whatever theoretical threads they can in order to offer up practical indicators that are useful both to describe societies, and to guide policy interventions.

There is no measurement without theory, and I suggest three lessons for the development of useful indicators. These involve, firstly, uncovering existing data useful for the calculation of standard summary measures of intergenerational mobility, developing new data for this purpose from administrative sources, and enhancing existing surveys with retrospective information. Second, common descriptive statistics of mobility across generations should be complemented with other measures that speak more directly to policy concerns, including measures of absolute mobility and a poverty line and an associated poverty rate based on the minimal level of resources needed to reasonably lower the risk of the intergenerational transmission of low status. Finally, organize existing information and develop new instruments modeled after the PISA to chart the relationship between family background and child development through the whole series of transitions children make on their way to becoming successful and self-sufficient adults.

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