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# Economic Theory and Practical Lessons for Measuring Equality of Opportunities

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## STATISTICS DIRECTORATE

**ECONOMIC THEORY AND PRACTICAL LESSONS FOR MEASURING EQUALITY OF OPPORTUNITIES****WORKING PAPER No.68**

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**ECONOMIC THEORY AND PRACTICAL LESSONS FOR MEASURING EQUALITY OF OPPORTUNITIES**

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## ABSTRACT

The development of a dashboard of statistics for the monitoring of equality of opportunity should recognize important lessons from economic theory: first, descriptive statistics associated with intergenerational mobility do not speak directly to equality of opportunity without accepting a value judgment that children should not be held responsible for circumstances beyond their control; and, second, the process of child development encourages a focus on different skills and competencies, as well as different stages in a child's life. On the basis of these lessons, the paper offers three practical recommendations for the development of policy relevant indicators. First, use data appropriate for the country at hand to estimate summary measures of inter-generational mobility, including the intergenerational elasticity of earnings between parents and children, and associated transition matrices. Second, develop measures of absolute mobility, and in particular develop a poverty line based upon the minimal level of resources needed to reasonably lower the risk of intergenerational transmission of low status, and that could complement more traditional poverty lines. Finally, make full use of the information on 15 year-olds from the Programme for International Student Assessment (PISA), and expand its scope to include younger children by developing a PISA type instrument for four to five year old children across the OECD countries.

## RÉSUMÉ

L'élaboration d'un tableau de bord des statistiques pour le suivi de l'égalité des chances doit tenir compte des enseignements utiles que nous livre la théorie économique : premièrement, des statistiques descriptives associées à des données sur la mobilité intergénérationnelle ne sauraient rendre compte directement de l'égalité des chances, à moins de souscrire au jugement de valeur selon lequel les enfants ne doivent pas être tenus pour responsables de circonstances qu'ils ne contrôlent pas ; deuxièmement, le processus de développement de l'enfant est propice à l'adoption d'une approche axée sur différentes compétences et connaissances, ainsi que sur différentes étapes de la vie de l'enfant. Le présent document fait fond sur ces enseignements et formule trois recommandations concrètes relatives à l'élaboration d'indicateurs utiles pour l'action publique. Premièrement, des données adaptées à chaque pays devraient être utilisées pour estimer des indicateurs synthétiques, notamment l'élasticité intergénérationnelle des revenus entre parents et enfants, et les matrices de transition qui lui sont associées. Deuxièmement, il convient d'élaborer des mesures de la mobilité absolue, et en particulier de définir un seuil de pauvreté sur la base du niveau minimum de ressources nécessaires pour faire raisonnablement baisser le risque de transmission intergénérationnelle du statut défavorisé, et qui pourrait être utilisé en complément de seuils de pauvreté plus conventionnels. Enfin, il serait judicieux d'exploiter pleinement les informations sur les élèves de 15 ans tirées du Programme international pour le suivi des acquis des élèves (PISA), et d'en étendre le champ d'application afin d'y inclure des enfants plus jeunes, en élaborant un instrument de type PISA permettant de prendre en compte les enfants de quatre à cinq ans de l'ensemble des pays de l'OCDE.

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## 1. Introduction and key messages

1. The use of the word “practical” in the title of this paper 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 are certainly feasible. However, 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.

2. Theory, of course, rarely if ever gives direct guidance to empirical analysis and public policy. I draw upon 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 inter-generational mobility. These measures include:
  - a) the inter-generational earnings elasticity, which can be thought of as a complement to cross-sectional indicators of inequality like the Gini coefficient, and the inter-generational correlation in income ranks; and
  - b) inter-generational 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 minimal level of resources needed to reasonably lower the risk of intergenerational transmission of low status, and that could complement more traditional poverty lines. 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 younger children:
  - a) regularly publish a host of appropriate statistics associated with important skills and competencies of the 15 year old students surveyed by PISA in a way that is framed by the theory of equality of opportunity
  - b) move forward in implementing a PISA-type instrument for young children — say those five or six years of age, i.e. 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.

## 2. Theory and Measurement

### *What is Intergenerational Mobility?*

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

$$\ln Y_{i,t} = \alpha + \beta \ln Y_{i,t-1} + \varepsilon_{i,t-1} \quad (1)$$

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  $\alpha$  — plus two deviations from the average, the first being some fraction of the earnings of his or her parent or parents, as represented by  $\beta$ ; and the second representing residual influences not correlated with parental income.

4. The value of  $\beta$ , usually estimated by least squares, is the parameter of interest, the inter-generational income elasticity, indicating to what degree the relative advantages or disadvantages of the parent are transmitted to the child. The parameter  $\beta$  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 becomes more limited, and in the extreme children occupy the same position in the income distribution as their parents. Negative values of  $\beta$  would indicate an intergenerational reversal in economic status, while values greater than one would indicate divergence from, rather than regression to, the average.

5. There is now a long list of careful studies suggesting that 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 (Corak 2013). 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.

6. 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 both men and women and for a host of different measures of income and earnings — both individual and family earnings, both market and disposable income — most of the 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 does not say anything about *absolute* differences or directional changes, e.g. 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 in another because of more or less mobility in either an upward direction from the bottom or a downward direction from the top.

7. Even so, the intergenerational income elasticity is a valuable statistic as a backdrop to public policy discussion, and offers a useful 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 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 a 36.5% chance of being in the top fifth of their generation.

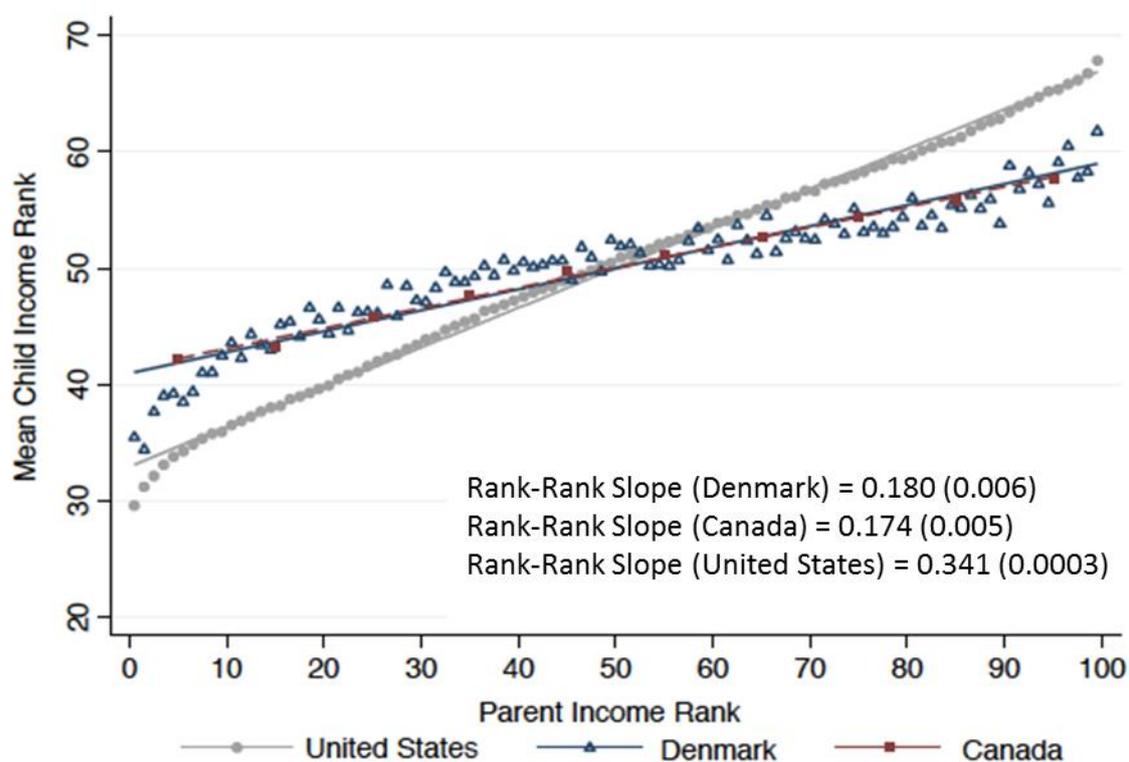
**Figure 1. Intergenerational transition matrix, United States**

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, pp. 1577.

8. Cross-country comparisons are just as easily communicated 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 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. In the estimates shown in Figure 2, drawn from the study by Chetty et al. (2014), these slopes are pretty well the same in the case of Denmark and Canada — 0.180 and 0.174 respectively — but, at 0.341, significantly greater in the United States. Overall, Figure 2 suggests that there is more stickiness in the mobility process in the United States, both compared to a country with which it shares a good deal (Canada), and to one which is very different in terms of demography, geography, and social and labour market institutions (Denmark). This contrast is of interest in its own right, but leaves important issues for policy unaddressed.

Figure 2. Average percentile income ranks of children according to father's percentile rank, Denmark, Canada and the United States



Source: Chetty, Hendren, Kline, Saez (2014), "Where is the Land of Opportunity?", *Quarterly Journal of Economics*, Figure II, pp:1576.

9. 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 do not 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. In these circumstances, 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. Being based upon rankings, transition matrices abstract from inequalities between and within the discrete categories for which they are defined. So while I am suggesting that they should be used to supplement the intergenerational elasticity, we should not lose sight of the need to use both of these measures in conjunction with appropriate indicators of inequality for both the parents at the time they were raising their children, and for the children in adulthood.

10. Another 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 in both countries. 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-linearity — differences in the mobility process across the parental income distribution — can be clearly observed. In fact, the variation in  $\beta$  across countries has little to do with differences in mobility of children raised by families in the broad middle of the income distribution, and mainly reflects differences at the extremes. Transition matrices, if calculated finely enough with reliable measures of permanent income free of measurement error and life-cycle biases for both parents and adult children, have the capacity to highlight this fact. Children raised by families in

the bottom decile of the Danish income distribution have less upward mobility, as also appears to be the case for those raised in roughly the bottom 10% or so of the US distribution.

11. Promoting the upward mobility of children raised by bottom income parents is a policy relevant issue for all OECD countries. The intergenerational earnings elasticity and correlation matrix 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 too 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.

12. What is left unanswered by these measures 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 loss of potential for upward mobility? Ranks do not answer this question. The regular publication of a poverty line of this sort — i.e. a measure of the minimal monetary resources below which the chances of the intergenerational transmission of poverty are distinctly higher—and its associated headcount ratio would be a valuable complement to existing poverty lines even in countries like Denmark, where currently used indicators like poverty headcounts based on thresholds of 50 or 60% of median income indicate a very low level of child poverty.

13. Where to draw the line distinguishing the “poor” from the “not poor” has been a very challenging issue confronted in different ways by many countries. In part this reflects the fact that theory offers less guidance on setting this threshold than it does on other aspects of determining the poverty rate, namely the types of resources to focus upon, and the construction of an index. Setting a threshold and updating it are open to competing interpretations, and reflect value judgements. My recommendation is not intended as a substitute for these concerns and discussions, but rather as advancing them along one dimension for which policy makers have expressed a concern: the upward mobility of the less advantaged. In some measure this could be a less contentious aspect of drawing a poverty line because I imagine it to be data-driven. After all, the categories defining transition matrices are somewhat arbitrary: quartiles, quintiles, vingtiles, and percentiles all appear in the literature. My recommendation for an intergenerational mobility poverty line is simply a suggestion for adding an absolute dimension to this by exploring whether or not there is a level of private income associated with a discrete change in the chances of moving upward inter-generationally. There should be no expectation that this line would be the same across countries, given the very significant differences in the public provision of important resources for a child’s life chances.

### ***What is Equality of Opportunity?***

14. The degree of regression to the mean in both income levels and ranks, and the associated transition matrices, are central descriptive statistics of intergenerational mobility; without them we cannot begin a discussion about equality of opportunity. But they are not measures of equality of opportunity *per se*. John Roemer has 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 (e.g. Roemer, 1998 2004). Such a situation 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.

15. 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)?

16. Roemer’s philosophical analysis of these questions 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. Both philosophers and a good deal of experimental evidence tell us that most citizens of the OECD care about the ways in which outcomes are obtained, i.e. process matters. The derivation of statistics useful for public policy discussions of equality of opportunity cannot avoid making an explicit value judgment. Without doing so, theory would 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 statistical agencies of OECD countries 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.

17. While it is not self-evident what “circumstances” policy makers should seek to level in order to promote equality of opportunity, one way to advance the discussion is to focus on children. Roemer and Trannoy (2015) suggest that “where children are concerned, all inequality should be counted as due to circumstances, and none to effort ...”; in other words, children should not be held responsible for their “choices” until they reach the age of majority. This may well be a value judgment that 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.

18. Economic theory makes clear that intergenerational mobility is determined by a host of factors, and that we cannot parse these out by simply looking at the intergenerational income elasticity. Becker and Tomes (1979, 1986) and Becker *et al.* (2015) offer a standard and widely used economic model underscoring this point. A simplified version would be based on the following three equations:

$$\ln Y_t = \phi \ln Y_{i,t-1} + \gamma H_t + \lambda E_t + v_t \quad (2)$$

$$H_t = \theta \ln Y_{i,t-1} + \delta E_t \quad (3)$$

$$E_t = \alpha + hE_{t-1} + v_t \quad (4)$$

The model is recursive, and links with increasingly accepted notions of child development. From equation 4, children inherit from their parents an endowment associated with their underlying personality, competencies, or perhaps family culture ( $E$ ), 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 proxied by their income), to the degree given by  $\theta$  (equation 3). Human capital, in turn, is an important influence on adult outcomes having a rate of return indicated by  $\gamma$ , but endowments continue to be important, as may also be the case for parental status, according to the values of  $\lambda$  and  $\phi$  (equation 2).

19. The important message from this model, even at this level of abstraction, is that  $\beta$  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 ( $\theta$ );

- the returns to those components of human capital ( $\gamma$ ), a clear marker for the degree of labour market inequality; and
- any direct influence that parental status may have on earnings outcomes of children in adulthood ( $\phi$ ), through networks or nepotism, or through endowments ( $\lambda$ )

20. It follows that the observation that one country has a different  $\beta$  than another, or that there are upward or downward trends in  $\beta$  over time and between cohorts within a country, is not very informative for public policy aimed at increasing 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.

21. If we focus on equation (2), i.e. adult outcomes, most people 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. Most citizens might also agree that differences in outcomes associated with endowments that do not reflect differences in productivity — e.g. gender, skin colour, height, beauty — should also be eliminated. But we cannot know whether or not these are the main factors driving  $\beta$ , which is also 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 the one shown in Section 2 — i.e.  $\ln Y_{i,t} = \alpha + \beta \ln Y_{i,t-1} + \varepsilon_{i,t-1}$  — only starts this conversation; a public policy discussion more closely tied to Roemer's notion of equality of opportunity, and an emphasis on children, would do better to focus on equation (3), i.e. the development of human capital of children, and its association with parental status.

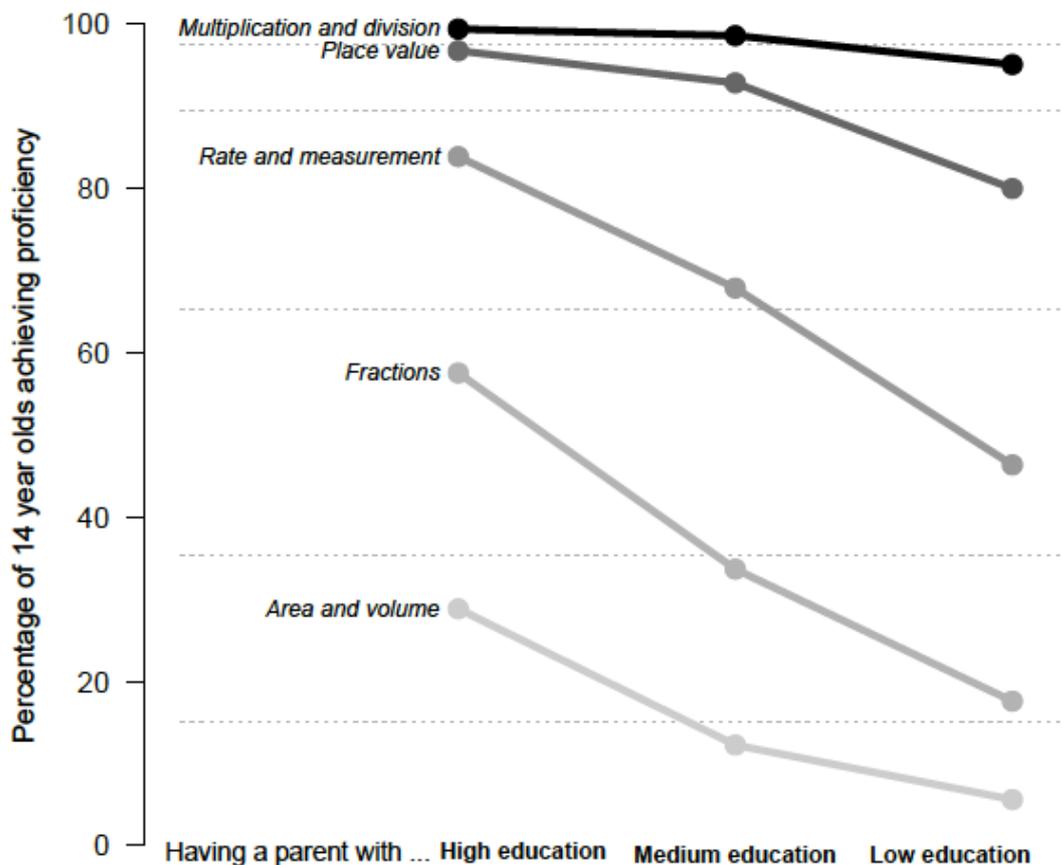
22. In this respect, the Becker and Tomes' model shown above is a bit too simplified. We need to appreciate the developments in the economics, psychology, and child development literatures suggesting it might be more appropriately represented as a series of recursive equations, each representing a stage in which children develop specific competencies, which then determine the scope for future success, raising or dampening the risks of fully developing through the next stage. An important interaction in this process is that between the early childhood years and subsequent development, as summarized by Jim Heckman's metaphor that “skills beget skills” (Heckman, 2008). 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.

23. Statistical markers of equality of opportunity should be informed by the sub-system of recursive equations represented by equation (3). 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, such as variations in children's literacy, numeracy, or social skills according to their parent's education, are an abstraction neglecting variations in parental preferences. Nonetheless we may imagine that regardless of parental preferences and 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. 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 one level deeper than just description, even if in some degree it continues to remain that.

24. 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) or no more than a high school diploma (labelled “Low education”). On average, less than 4 in 10 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 also wonder about the 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. But 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.

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



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

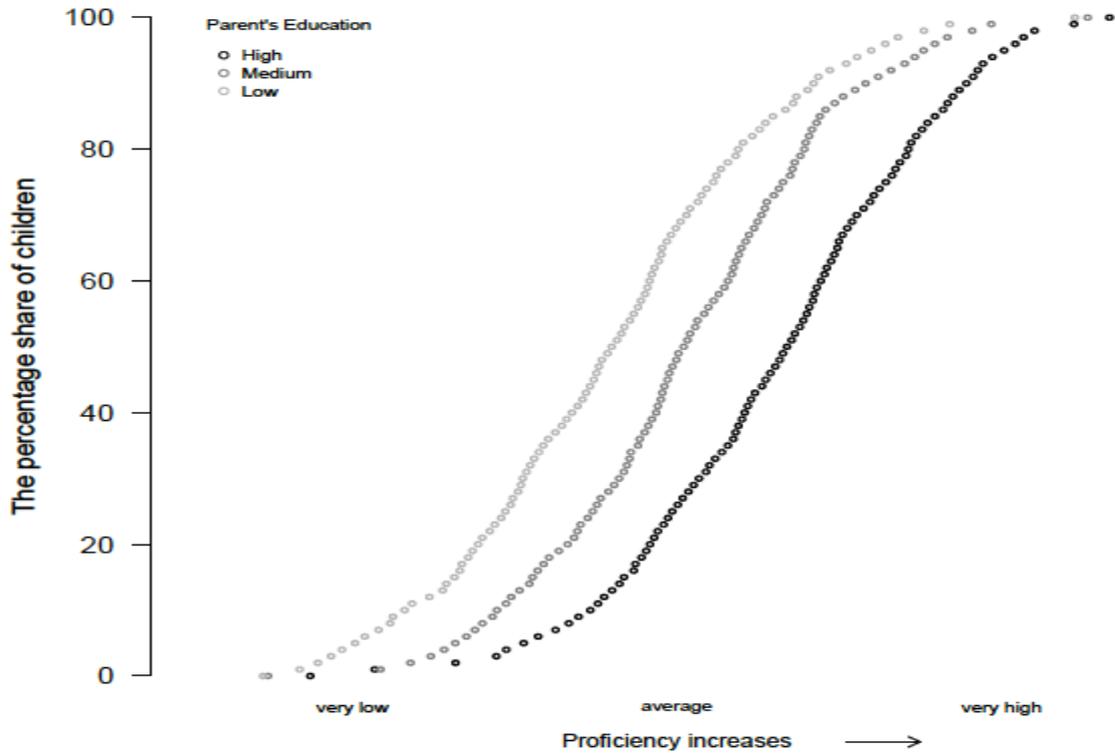
Source: Bradbury, Corak, Waldfogel, Washbrook (2015), *Too Many Children Left Behind*, New York, Russell Sage Foundation.

25. Pictures of this sort have been, and can easily continue to be, provided by the PISA instrument for similarly aged children in many other countries. They should form a part of any dashboard of statistics to monitor equality of opportunity. PISA publications tend to focus on a continuous index of competency that certainly has its merits, but this 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.

26. A continuous index reflecting a more finely nuanced notion of skills and competencies also has a central place in Roemer's framework. Roemer 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 across children with different characteristics. 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.

27. Figure 4 offers an example, again referred to the United States 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 suggested by Roemer: the vertical axis shows the cumulative percentage of children with skills below the particular level indicated on the horizontal axis ('very low', referring to two standard deviations below the average; and 'very high', referring to two standard deviations above the average). 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 among those with low-educated parents 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. Summary measures could be easily derived from pictures of this sort, taken either as the gap at a particular point, like the median, or more appropriately by integrating under the cumulative distribution functions. But the pictures are interesting in their own right as they show where difference are greatest, or how large they are at particular points in the distribution. For example, equality of opportunity among extremely gifted children would show up if the achievement gaps of top percentile of children was very small. But Figure 4 shows that, even among the top-achieving students, there is a significant gap in achievement. The children scoring in the top decile of the distribution of all children with low-educated parents close somewhat the achievement gap relative to the top 10% with medium-educated parents. But both groups –despite having nurtured talent, expending effort, or innate ability – still score lower than the top decile of students 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.

**Figure 4. Cumulative distribution of math test scores for children aged 14 by family background, United States**



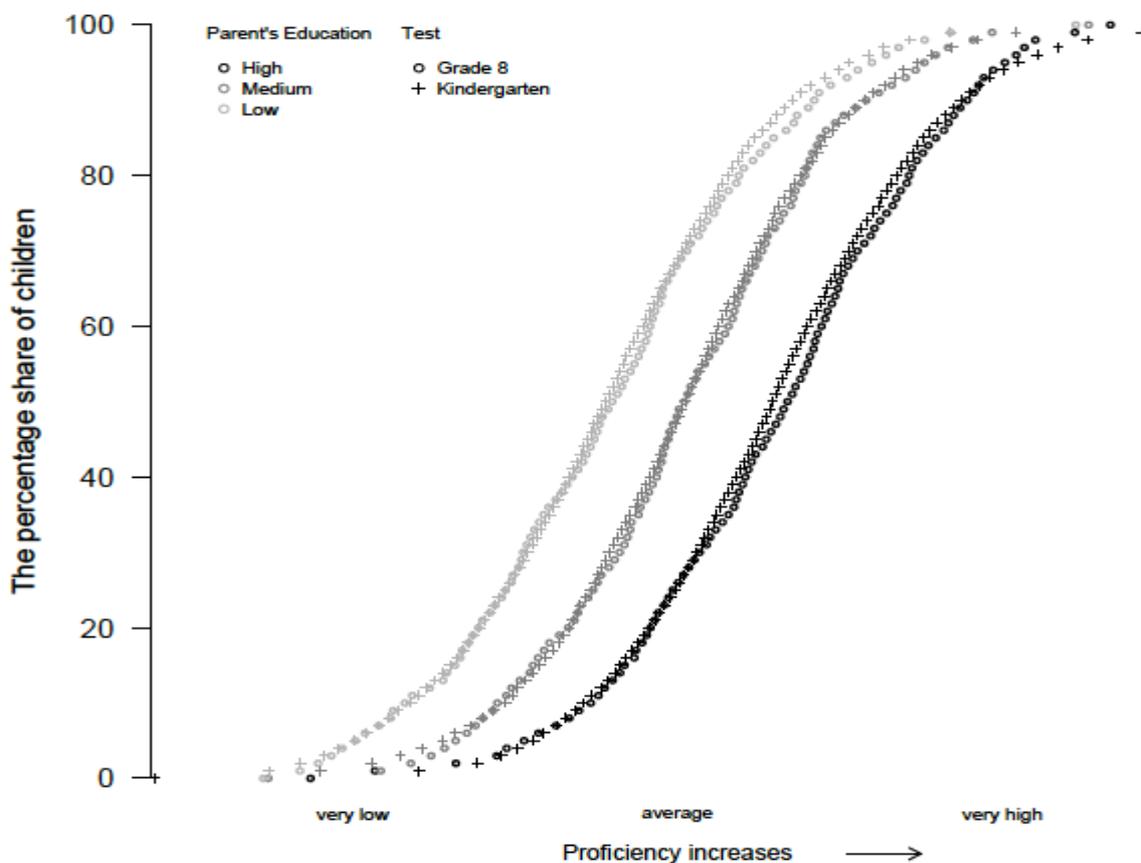
Note: Differences in achievement among similarly ranked students across groups indicate inequality of opportunity. 'Very low' scores refers to students with achievements two standard deviations below the average test score; 'very high' scores refers students with achievements two standard deviations above the average test score.

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

28. There is no reason, as far as I can tell, why PISA test scores cannot be organized in this way. Such information may very well be already shown somewhere in the many well-written PISA reports, and the topic and related issues have certainly been addressed in a number of specific studies by OECD staff, including for example Causa and Johansson (2011a,b). 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. PISA scores refer to students in their early- to mid-teens. This has a great deal of power in terms of directing 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 equations 2 to 4 is correct. If the early years matter, then inequality of opportunity may be embedded in outcomes gained well before children reach high school. If we are to take the focus on children seriously, then indicators of equality of opportunity would 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.

29. Figure 5 offers an example of the kind of outcome that PISA should be encouraged to produce. The cumulative distribution function of standardized math scores collected at roughly age 5, when these US children are starting kindergarten, is added to the information in Figure 4. The functions at the two ages appear to be very similar. Differences in outcomes by parental education are already evident when children first enter the schooling system, and do not change significantly during the years in primary and lower-secondary education. Also, differences in the ranking of children by family circumstances at the cusp of high school are pretty accurately captured by the differences in ranking during the first months of kindergarten. Comparative evidence of this type cannot currently be produced unless the effort to develop a PISA-type instrument for 5 or 6 years-old children is given strong support. I should emphasize that developing this type of instrument does not require a longitudinal survey of children but just a series of repeated cross-sections across countries at those crucial ages in child development that have already been highlighted by the academic literature.

Figure 5. Cumulative distributions for math test scores for children aged 5 and 14 by parental education, United States



Note: Differences in achievement among similarly ranked students across groups indicate inequality of opportunity. 'Very low' scores refers to students with achievements two standard deviations below the average test score; 'very high' scores refers students with achievements two standard deviations above the average test score.

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

### 3. Conclusions

30. Equality of opportunity is a critical aspect for how we understand economic performance and social progress. The concept focuses on processes, rather than outcomes, and therefore cannot be the only aspect. And it may be very challenging to measure 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 most people in 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.

31. There is no measurement without theory, and I suggest three theoretically-grounded lessons for the development of useful indicators of equality of opportunity. These involve:

- First, 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, complementing common descriptive statistics of mobility across generations with other measures that speak more directly to policy concerns, including measures of absolute mobility as well as a poverty line and an associated poverty rate based on the minimal level of resources needed to reasonably lower the risk of intergenerational transmission of low status.
- Finally, better organizing existing information and developing new instruments modelled after PISA to chart the relationship between family background and child development through the whole series of transitions that children make on their way to becoming successful and self-sufficient adults.

## REFERENCES

- Becker G.S., S.D. Kominsers, K.M. Murphy and J.L. Spenkuch (2015), “A Theory of Intergenerational Mobility”, MPRA Paper, August, <https://mpra.ub.uni-muenchen.de/66334/>
- Becker G.S. and N. Tomes (1986), “Human Capital and the Rise and Fall of Families”, *Journal of Labor Economics* 4 (3): S1-39.
- Becker G.S. and N. Tomes (1979), “An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility”, *Journal of Political Economy* 87 (6), pp. 1153-89.
- Bradbury B., M. Corak, J. Waldfogel and E. Washbrook (2015), *Too Many Children Left Behind*, New York: Russell Sage Foundation.
- Causa, O. and A. Johansson (2011a), “Intergenerational Social Mobility in OECD Countries”, *OECD Economic Studies*, Vol. 2010/1.
- Causa, O. and A. Johansson (2011b), “Equity in Student Achievement Across OECD Countries: An Investigation of the Role of Policies”, *OECD Economic Studies*, Vol. 2010/1.
- Chetty R., N. Hendren, P. Kline and E. Saez (2014), “Where Is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States”, *Quarterly Journal of Economics*, 129 (4): 1553.
- Corak M. (2013), “Income Inequality, Equality of Opportunity, and Intergenerational Mobility”, *Journal of Economic Perspectives* 27 (3), pp: 79-102, <https://www.aeaweb.org/articles.php?doi=10.1257/jep.27.3.79>
- Fishkin J. (2014), *Bottlenecks: A New Theory of Equal Opportunity*, Oxford: Oxford University Press.
- Heckman J.J. and S. Mosso (2014), *The Economics of Human Development and Social Mobility*, NBER Working Paper Series 19925, Cambridge, Mass.
- Heckman J.J. (2008), “Schools, Skills, and Synapses”, *Economic Inquiry*, 46 (3), pp: 289-324.
- Nybom M. and J. Stuhler (2015), “Biases in Standard Measures of Intergenerational Dependence”, July, Unpublished, <https://mileskorak.files.wordpress.com/2015/10/nybom-and-stuhler-standard-measures-of-intergenerational-income-dependence-july-2015.pdf>
- Roemer J.E. (1998), *Equality of Opportunity*, Harvard University Press, Cambridge.
- Roemer J.E. (2004). “Equality of opportunity and intergenerational mobility: going beyond intergenerational income transition matrices”, in M. Corak (ed.), *Generational income mobility in North America and Europe*, Cambridge University Press, Cambridge.
- Roemer J.E. and A. Trannoy (2015), “Equality of opportunity: Theory and measurement”, *Journal of Economic Literature*, forthcoming, <https://mileskorak.files.wordpress.com/2015/10/roemer-trannoy-equality-of-opportunity-theory-and-measurement-journal-of-economic-literature-forthcoming.pdf>