Centro de Estudios®
Espinosa Yglesias
PROMOVEMOS LA IGUALDAD DE OPORTUNIDADES

The 'Great Gatsby' Curve In 3D: Inequality of Outcomes, Inequality of Opportunities and Social Mobility across Countries

Autores:

Thomas Staley
University of Leeds

Gaston Yalonetzky
University of Leeds

Documento de trabajo no.

01/2016

Centro auspiciado por: ESRU Fundación Espinosa Rugarcía

The 'Great Gatsby' Curve In 3D: Inequality of Outcomes, Inequality of Opportunities and Social Mobility across Countries

Thomas Staley ♠
Gaston Yalonetzky ♣

August 2016

Abstract

We revisit and update the international evidence on father-to-son income mobility originally produced by Andrews and Leigh (2009), with a more recent dataset spanning a broader array of countries. This is the broadest assessment to date, in terms of the number of countries covered by the same dataset. Secondly, we dig deeper and ask whether the intergenerational income correlations mainly owe to "rigidities at the bottom" (i.e. high intergenerational persistence of outcomes among the relatively poorest) or "rigidities at the top" (i.e. high intergenerational persistence among the relatively richest). Thirdly, we reconstruct the Great-Gatsby curve in "3-D" plotting their estimates of intergenerational income correlations against measures of inequality of opportunity in childhood, alongside Gini income inequality.

Keywords: income mobility, income inequality, Great-Gatsby curve.

♠ University of Leeds.
♣ University of Leeds. Email: G.Yalonetzky@leeds.ac.uk.

1. Introduction

Concerns for rising levels of income and wealth inequality globally and within countries have soared during the last decade, particularly in the aftermath of the 2008 global financial crisis. This is clearly reflected, *inter alia*, in the plethora of books appearing on the matter (e.g. Stiglitz, 2013; Picketty, 2014; Atkinson, 2015; Bourguignon and Scott-Railton, 2015). Even though inequality between countries has decreased during the last fifteen years (Rodrik, 2011), researchers have been pointing out the rise in inequality within many countries, especially developed ones, for the last thirty years (e.g. Atkinson et al., 2011; Alvaredo et al., 2013; Milanovic, 2015). Several factors, including the dismantling of the welfare state in developed countries, skill-biased technological innovation, and increased globalization, have been held responsible for these trends (see Picketty, 2014).

But why should we care about economic inequality? The reason is that high economic inequality is seemingly bad for societies. Empirical evidence shows that, even though the relationship between income inequality and income growth is not straightforward (e.g. Marrero and Rodriguez, 2013), more unequal societies exhibit worse development outcomes in general; chiefly health indicators (Wilkinson and Picket, 2010). Likewise initial asset or income inequality, combined with credit-market constraints may render many poorer people unable to invest in productive activities and human capital (e.g. Galor and Zeira, 1993; Banerjee and Newman, 1993) thereby preventing societies from developing to their fullest potential. Higher income inequality may also undermine social stability through the concentration of power in the hands of few, leading in turn to violent political change and populist regimes (e.g. Acemoglu and Robinson, 2009) as well as to entrenched elites bent on stifling any innovation threatening their power base (Acemoglu and Robinson, 2013). Finally, high economic inequality has the potential to break apart social insurance mechanisms (Fafchamps, 2003).

Social scientists and political philosophers have long advocated unpacking inequality in order to understand its causes and effects; an analysis considered necessary to gauge the legitimacy of inequality. For example, Marrero and Rodriguez (2013) have shown that only so-called inequality of opportunity is detrimental to income growth, whereas inequality of individual efforts does not affect GDP growth negatively. The emerging literature on inequality of opportunity seeks to distinguish between legitimate and illegitimate sources of inequality. The former stem from the responsible efforts of individuals, whereas the latter result from circumstances beyond an individual’s control (Roemer, 2000). The moral liberal-egalitarian prescription says that inequalities due to responsible efforts should be respected, whereas inequalities due to uncontrollable circumstances should be compensated for (Fleurbaey, 2012). The last fifteen years have witnessed a huge growth in both the theoretical and empirical literature on inequality of opportunity (see Roemer and Trannoy, 2014, for a state-of-the-art review; also Putnam, 2015, for an example of the recent surge of interest in the US).

Two categorisations, out of all possible circumstances considered beyond an individual's control, have elicited the most attention. Individual characteristics, such as gender and ethnic group, which have underpinned the large literature on socioeconomic discrimination; and parental characteristics (particularly income, education and occupation) which have driven the long and old literature on intergenerational social mobility, often independently from the more recent inequality of opportunity research agenda.

While the inequality of opportunity literature reminds us that we should distinguish between different forms of inequality for both intrinsically moral and instrumental reasons, the social mobility literature emerged partly as a concern for the interaction between social mobility and existing levels of inequality (see Bjorklund and Jantti, 2012, for a review). The argument was that the same level of inequality should be more tolerable in societies considered more mobile, i.e. where families do not appear in the same rank-position every year (e.g. Friedman, 2002; Formby et al, 2004). We can extend this idea to mobility across generations, and posit that the same level of inequality should be deemed worse in societies where the offspring is more likely to reproduce the wellbeing outcomes of their parents. Furthermore, from an inequality of opportunity perspective, offspring's wellbeing should not depend on parental background as the latter is beyond the children's control.

So is it the case that more unequal societies are perhaps "compensated" by higher levels of social mobility? And how do measures of inequality and social mobility relate to broader measures of inequality of opportunity? This is an empirical question, since in theory it is easy to show that many combinations of inequality with intergenerational mobility could hold (e.g. societies with high inequality and high social mobility, low inequality and high social mobility, and so on.).[1] However, the current empirical answers (e.g. Andrews and Leigh, 2009; Corak, 2013; Brunori et al., 2013) all seem to indicate that, on average, more unequal societies tend to be also more *immobile*; where the latter is usually measured by the intergenerational correlation of income, or some other wellbeing attribute. The upward-sloping scatter-plot of the Gini coefficient of incomes against the intergenerational correlations of income across countries, coming to be termed the "Great Gatsby Curve" (Krueger, 2012).

In this chapter, firstly, we revisit and update the evidence originally produced by Andrews and Leigh (2009), with a more recent dataset spanning a broader array of countries. To the best of our knowledge, this is the broadest assessment to date, in terms of the number of countries covered. Secondly, we dig deeper and ask whether the intergenerational income correlations mainly owe to "rigidities at the bottom" (i.e. high intergenerational persistence of outcomes among the relatively poorest) or "rigidities at the top" (i.e. high intergenerational persistence among the relatively richest). Thirdly, we reconstruct the Great-Gatsby curve in "3-D" plotting our estimates of intergenerational income correlations against measures of inequality of opportunity in childhood, alongside Gini income inequality.

[1] The terms "social mobility" and "intergenerational mobility" are used interchangeably in this chapter.

Our main findings can be summarized as follows: (1) With the more up-to-date dataset we corroborate the findings of Andrews and Leigh (2009), namely that there is indeed a positive relationship between Gini-measured inequality in 1985 and the intergenerational correlation of income, but it is only both statistically and practically significant when former Warsaw pact countries are excluded from the sample; (2) countries with similar levels of intergenerational income mobility differ in the drivers behind these levels, so that "rigidities at the bottom" (or lack thereof) may be more important than "rigidities at the top" for some countries, while the reverse is true for others (we provide a full taxonomy with country examples); (3) for countries with available data, we find evidence of "Great Gatsby" curves involving our measure of intergenerational income mobility (the correlation) and four measures of inequality of opportunity in different dimensions of wellbeing for children. Hence we link up not only past income inequality with present intergenerational mobility, but also the latter with current inequality of opportunity; highlighting the potential for an amplification of inequality in the future.

The rest of the chapter proceeds as follows. Section two contains our methodology, in which we explain how we measured intergenerational income mobility, income inequality, "rigidities" at both the "top" and the "bottom", and the four indices of inequality of opportunity. This section also discusses the data sources that underpin our analysis. Section three then presents and discusses our findings, with our concluding remarks contained in section four.

2. Methodology

In this section we explain the methods behind our results, together with data sources and related aspects. We first provide a detailed discussion of how we obtain our measures of intergenerational mobility. Then we discuss our measures of income inequality, followed by how we measured top and bottom "rigidities" using percentile transition matrices. Finally, we explain the four selected measures of inequality of opportunity.

2.1. Measure of Intergenerational Mobility

We compute two commonly used measures of intergenerational income mobility: the Intergenerational Elasticity (IGE) and the Intergenerational Correlation (IGC). The IGE is the coefficient corresponding to parental income stemming from a linear regression of adult children's income on parental income, including covariates like age. The IGC is a measure of the correlation between parental and offspring's income; following the literature, we construct it by multiplying the IGE by the ratio of parental income's standard deviation to offspring income's standard deviation.

For our application, we connect the incomes of adult men against fathers. Both measures are scale-invariant, meaning that their values are not affected, for instance, by changes in the currency. We report both measures, but we conduct the rest of the analysis connecting intergenerational mobility to measures of inequality focusing on the IGC, since the latter is bounded between -1 and 1, thereby having an easier interpretation.

These measures provide an estimate of the degree of intergenerational re-ranking within a society; therefore reflecting on a child's ability to obtain outcomes markedly different from that of their parents. A high IGE or IGC indicates a strong association of socio-economic status across generations and as such a low level of intergenerational mobility (Blanden et al., 2007).

For the mobility assessment we rely on the 2009 Social Inequality IV module of the International Social Survey Program (ISSP Research Group, 2012). In our dataset we kept only those countries for which sons' income was available. Sons were then only included in the study if they were aged between 25 and 54. Such age restriction is necessary to avoid the variation in elasticities observed across different age groups (Grawe, 2006). Subsequently, sons' and fathers' occupations were divided into nine distinct occupational categories: (1) Legislators; (2) Senior Officials and Managers; (3) Professionals, Technicians and Associate Professionals; (4) Clerks; (5) Service Workers and Shop and Market Sales Workers; (6) Skilled Agricultural and Fishery Workers; (7) Craft and related Trades Workers; (8) Plant and Machine Operators and Assemblers; (9) Elementary Occupations.

An important limitation in the ISSP dataset (common in other data sources used for similar purposes) is that fathers' income is not provided. Predicted parental earnings are therefore used as a proxy for actual parental earnings; a method adopted by a number of other studies (see Bjorklund and Jantti, 1997; Grawe, 2001; Leigh, 2007). We follow the method used by Andrews and Leigh (2009) in order to produce a prediction of father's income, before computing the mobility measures.

Firstly, for each of the 38 countries with available data, log annual earnings y_i of individual *i*, is regressed on a vector of dummies for each occupational category *j*, X_{ij}, and on the individual's age, A_i, which is entered with both a linear and a quadratic term.

$$y_i = \alpha + \sum_{j=1}^{8} \theta_j X_{ij} + \delta A_i + \lambda A_i^2 + \varepsilon_i \qquad (1)$$

where:
y_i = Son's log annual earnings,
α=constant term
θ_j = Coefficient for occupation *j*,
X_{ij} = j occupation dummy for individual *i*,
δ = Coefficient of linear age term,
A_i = Age of individual *i*,

λ = Coefficient of age squared term,
A_i^2 = Age squared of individual *i*,
ε_i= Error term.

The earnings of fathers in occupation *j* are subsequently predicted using the following formula:

$$\widehat{y_{fi}} = \hat{\alpha} + \sum_{j=1}^{8} \widehat{\theta_j} X_{fij} \ + \ \hat{\delta}40 + \hat{\lambda}1600 \quad (2)$$

where: $\widehat{y_{fi}}$ is the predicted income of the father of individual *i*; X_{fij} is the *j* occupational dummy for the father of individual *i*; and the coefficients with a caret on top are predicted coefficients (from estimating equation (1)). Note that we replace the age variables with $A_{fi} = 40$. This specific age is selected as it provides a good proxy for lifetime earnings; avoiding both attenuation bias and amplification bias (Haider and Solon, 2006).

Once fathers' predicted earnings have been calculated, we compute the IGE in equation 3 by regressing sons' actual log annual earnings against fathers' predicted log annual earnings, again controlling for sons' age using both linear and quadratic terms.

Equation 3 can actually be deemed an empirical extension of the Becker-Tomes theoretical model of intergenerational transmission, where the extension itself is the inclusion of the parameters A_i and A_i^2, which account for the lifetime profile of fathers and sons (d'Addio, 2007):

$$y_i = \eta + \ \beta \hat{y}_{fi} + \gamma A_i + \kappa A_i^2 + \mu_i \quad (3)$$

where;
y_i = Log annual earnings of individual *i*,
η= Constant,
β = Intergenerational Elasticity (IGE),
$\hat{y}_{fi}$ = Father's predicted log annual earnings,
γ = Coefficient of linear term for Age,
A_i = Age of individual *i*,
κ = Coefficient of quadratic term for Age,
A_i^2 = Age squared of individual i,
μ_i = Error term.

The coefficient β is the IGE, representing the fraction of relative income differences that are transmitted between generations. The elasticity can be higher in one society than another simply due to differences in the variance of log earnings among sons, or among fathers. For the same reason, the IGE could be greater than one; if there were an increased differential in individual earnings between the paternal generation zero and that of their offspring (Black and Deveraux, 2011).

The IGC is based upon regression (3); however it is adjusted by the dispersion of earnings between the two periods in order to account for changes in inequality (Aaronson and Mazumder, 2008). The IGC is therefore expressed as a function of the ratio of the standard deviation of log earnings between fathers and sons (Black and Devereux, 2011):

$$\rho = \beta \frac{\sigma_f}{\sigma_s} \qquad (4)$$

where;
ρ = Intergenerational Correlation (IGC),
β = Intergenerational Elasticity (IGE),
σ_f = Standard deviation of fathers' log earnings,
σ_s = Standard deviation of sons' log earnings.

As with other correlation coefficients, in theory: $-1 \leq \rho \leq 1$, whereby $\rho = 1$ indicates complete intergenerational immobility, whereas $\rho = 0$ indicates complete intergenerational mobility. At a state of complete intergenerational immobility, differences in parental earnings are wholly absorbed by their children in the sense that children's income distributions are just the parent's up to a multiplicative rescaling (e.g. a common growth factor) and without any dynastic re-ranking (i.e. each son occupies the same rank as their parents did). Conversely, at a state of complete mobility, the incomes of parents and their children's are unrelated (Blanden, 2013): one cannot be predicted from the other.[2]

2.2. Measure Of Income Inequality

For our cross-country comparisons of income inequality versus intergenerational mobility, we follow most of the literature in relying on the Gini coefficient as a measure of inequality (see Aaberge et al., 2002; Causa and Johansson, 2010; Corak, 2013). Yet we are aware of its limitations, including not only its asymptotic normalization, but also its inability to differentiate between varying types of inequalities, and its higher sensitivity to inequalities in the middle of the income distribution (De Maio, 2007).

Estimates for the Gini coefficient for those countries for which they are available, among the 38 contained in our ISSP-2009, are presented in Table 2.1. These have been obtained from the World Income Inequality Database (WIID) V3.0B (UNU-WIDER, 2014). The WIID collates data provided by independent national bodies and agencies; including the Luxembourg Income Study (LIS) and the Deininger and Squire database. As mentioned above, the age of participants included in the analysis ranges from between 25 and 54. Following the reasoning of Andrews and Leigh (2009), we used the Gini coefficient assigned the highest quality rating by the WIID in 1985. Participants from the ISSP dataset would be aged between 1 and 30 in

[2] Whilst negative values for the IGC are possible, they are unusual in practice. They require and reflect a very high degree of re-ranking, whereby the offspring of the richest end up among the poorest, and vice versa.

1985, thus representing the time period in which parents would be making decisions about investment in their children's' human capital. Where a value for 1985 was unavailable, the highest quality estimate for the year closest to 1985 was used.

Table 2.1: Gini Coefficients for selected countries

Country	Gini	Source	Year
Argentina	0.398	WIID3b_1	1985
Austria	0.225	WIID3b_1	1987
Australia	0.302	WIID3b_1	1985
Belgium	0.225	WIID3b_1	1985
Bulgaria	0.234	WIID3b_1	1985
Switzerland	0.323	WIID3b_1	1982
Chile	0.549	WIID3b_1	1985
China	0.314	WIID3b_1	1985
Cyprus	No historical data available		
Czech Republic	0.198	WIID3b_1	1987
Germany	0.26	WIID3b_1	1985
Denmark	0.221	WIID3b_1	1985
Estonia	0.267	WIID3b_1	1986
Spain	0.252	WIID3b_1	1985
Finland	0.2	WIID3b_1	1985
France	0.372	WIID3b_1	1984
Croatia	0.211	WIID3b_1	1987
Hungary	0.221	WIID3b_1	1986
Israel	0.326	WIID3b_1	1985
Iceland	No historical data available		
Italy	0.287	WIID3b_1	1984
Japan	0.304	WIID3b_1	1985
South Korea	0.297	WIID3b_1	1985
Latvia	0.252	WIID3b_1	1986
Norway	0.224	WIID3b_1	1985
Philippines	0.452	WIID3b_1	1985
Poland	0.253	WIID3b_1	1985
Portugal*	0.368	WIID3b_1	1980
Russia	0.261	WIID3b_1	1986
Sweden	0.207	WIID3b_1	1985
Slovenia	0.215	WIID3b_1	1987
Slovak Republic	0.194	WIID3b_1	1987
Turkey	0.47	WIID3b_1	1987
Taiwan	0.29	WIID3b_1	1985

Ukraine	0.322	WIID3b_1	1985
United States	0.34	WIID3b_1	1985
Venezuela	0.453	WIID3b_1	1985
South Africa	0.47	WIID3b_1	1985

Source: UNU-WIDER (2014).

2.3. Mobility Matrices

The statistics ρ and β summarize changes in dispersion and re-ranking across different parts of the paired (father-son) income distributions. Hence, for example, two countries with similar IGC values, could still exhibit different bivariate income distributions. For example, in one country there may be relatively high immobility at the bottom of the distribution coexisting with high mobility at the top, whereas in the other country it could be the case that there is high mobility at the bottom, but not so much in other parts of the distribution.

We can unpack many of these situations, embedded in the IGC, using mobility matrices. Several studies have used these matrices in order to represent the offspring's probability of attaining a certain income category conditioned on their parents having achieved a particular income category. While different ways of constructing the matrix are possible (Formby et al., 2004), most studies work with percentile matrices, in which income categories are defined by percentile groups (e.g. Blanden and Machin, 2008; Dearden et al., 1997; Peters, 1992).

In our analysis we are interested in gauging the relative contributions to the IGC of two transition probabilities in particular: (1) The sons' probability of replicating the situation of fathers in the poorest income quartile; and (2) the sons' probability of replicating the situation of fathers in the richest income quartile. We denote the first probability, $p(1|1)$, and the second one, $p(4|4)$, so that "1" represents the poorest quartile, and "4" represents the richest quartile. $p(1|1)$ is therefore a measure of "rigidities at the bottom", whereas $p(4|4)$ quantifies "rigidities at the top". We compute both probabilities for all 38 countries whose intergenerational mobility was calculated after dividing fathers' and sons' income distributions into quartiles.

2.4. Measures Of Inequality Of Opportunity

We use four measures of inequality of opportunity among children in 2010, all taken from Molinas et al. (2010). The four measures are: (1) The dissimilarity index "D" for reading using the Programme for International Student Assessment (PISA) reading test; (2) the dissimilarity index "D" for mathematics using the PISA mathematics test; (3) the Human Opportunity Index (HOI) for sanitation; and (4) the HOI for overcrowding.

The two types of indices (D and HOI) are computed as follows: Firstly, the outcome of interest is dichotomized, e.g. there is a dummy variable capturing whether the child has access to proper sanitation or not. Then the binary outcome is modelled with a logistic regression involving a vector of child's circumstances (e.g. education of parents, household income) as explanatory variables. The predicted probability of child *i* attaining good sanitation is then computed, p_i. Secondly, the average predicted probability is computed for the whole population sample: $p = \frac{1}{N}\sum_{i=1}^{N} p_i$, where N is the sample (or population) size. Finally, each index is computed according to the following formulas:

$$D = \frac{1}{2N}\sum_{i=1}^{N}\left|\frac{p_i - p}{p}\right| \qquad (5)$$

$$HOI = p(1 - D) \qquad (6)$$

D captures inequality in attainment or access to the desirable outcome (e.g. a desirable school achievement, or access to a proper sanitation service). If the probability of success were independent of the circumstances "explaining" it in the logistic models, then $D = 0$. Hence D indirectly measures inequality between groups of children defined by their combined set of household circumstances. Meanwhile, HOI is a measure akin to the UNDP's inequality-adjusted Human Development Index in the sense that it rewards countries for increases in the average attainment (by being proportional to p), but penalizes them for any inequality in the distribution of average attainment across groups (as measured by D).

For further details pertaining to the definitions of the binary attainments in the four indices, as well as to the choice of circumstance variables across countries, the reader is referred to Molinas et al. (2010).

The available values of these four indices, for those countries among the 38 in our ISSP-2009, are presented in Table 2.2:

Table 2.2: Inequality of opportunity indices in childhood for selected countries*

Country	D-reading	D-maths	HOI-sanitation	HOI-overcrowding
Hungary			44	44
Poland				
South Africa			19	46
China				
Argentina	22.2	25.5	47	32
Chile	12.2	23.2	74	84
Taiwan				
Belgium				
Cyprus				
Slovenia				58
Portugal	9.1	10.2	45	80
Slovakia				
Bulgaria				

France	7.3	7.4	69	90
Spain	8.1	7.2	92	92
Venezuela			81	33
Czech				
Croatia				
Sweden	4.7	5.4		
Denmark				
Germany	6.6	6.2		
Turkey				
Israel				
Iceland				
Latvia				
Estonia				
Norway	6.6	5.5		
US		8.4	70	88
Switzerland				
Austria				91
Russia				
Australia				
Finland				
South Korea				
Japan				
Philipines				
Italy	8	8.8		72
Ukraine				

*All values range between 0 and 100.
Source: Molinas et al. (2010).

3. Results

In this section we present our main results. First, we show our updated mobility estimates using the ISSP-2009 dataset. Then we present our "Great Gatsby" curves plotting our IGC estimates against the Gini index in 1985. Thirdly, we explore the relative importance of both "rigidities at the bottom" and "rigidities at the top" in explaining variations in the IGC. Finally, we present alternative "Great Gasby" curves in which we plot our IGC estimates against the four measures of inequality of opportunity.

3.1. Intergenerational Mobility Estimates

Table 3.1 ranks the 38 countries included in the ISSP-2009 survey according to their estimated IGC (ρ). For completeness, the table also shows the values for IGE (β), the standard deviation of log fathers earnings (σ_f) and the standard deviation of log sons earnings (σ_s).

Table 3.1: IGE and IGC for ISSP-2009 countries*

Country	β	σ_f	σ_s	ρ
Hungary	7.802951 (5.72)	0.0283821	0.6096691	**0.363253**
Poland	6.43532 (5.30)	0.0330225	0.6253512	**0.339826**
South Africa	6.077417 (6.44)	0.0684588	1.250447	**0.332723**
China	4.72285 (9.05)	0.0726886	1.106591	**0.31023**
Argentina	7.013312 (4.29)	0.0275179	0.6902725	**0.279588**
Chile	4.704028 (4.06)	0.0545808	0.9883903	**0.259765**
Taiwan	4.122992 (5.99)	0.0389018	0.6269816	**0.255816**
Belgium	6.319842 (3.60)	0.0179393	0.4434282	**0.255675**
Cyprus	6.229713 (3.90)	0.015917	0.4214624	**0.235272**
Slovenia	5.105763 (2.88)	0.0256249	0.5573486	**0.234745**
Portugal	5.169765 (2.43)	0.0236546	0.5293055	**0.231036**
Slovak Republic	5.177748 (2.97)	0.0270566	0.617407	**0.226904**
Bulgaria	5.233005 (2.28)	0.0331758	0.77079	**0.225235**
France	4.591292 (4.59)	0.0266029	0.5566953	**0.219405**
Spain	5.107292 (2.58)	0.0210492	0.4987823	**0.215534**
Venezuela	4.803244 (2.85)	0.0215596	0.4809061	**0.215335**
Czech Republic	3.848951 (2.54)	0.028783	0.5229603	**0.211841**
Croatia	3.855258 (2.54)	0.0243863	0.4524613	**0.207787**
Sweden	3.455817 (3.16)	0.0275178	0.4654497	**0.204311**
Denmark	4.545209 (3.67)	0.0201764	0.4533708	**0.202276**

Country	β	σ_f	σ_s	ρ
Germany	3.606628 (3.20)	0.0300418	0.5534357	**0.195776**
Turkey	5.124084 (2.44)	0.0268833	0.7064576	**0.19499**
Israel	4.940643 (2.66)	0.0204184	0.5355095	**0.188381**
Iceland	1.349326 (0.84)	0.0275058	0.6069747	**0.061146**
Latvia	4.254073 (2.22)	0.0339405	0.7691928	**0.18771**
Estonia	2.795021 (1.35)	0.0286523	0.5400398	**0.148292**
Norway	4.664978 (2.21)	0.0192382	0.684937	**0.131028**
United States	2.828447 (1.80)	0.0346245	0.8982965	**0.109021**
Switzerland	2.568211 (1.54)	0.0241497	0.5987549	**0.103584**
Austria	2.310998 (1.11)	0.0158012	0.4423081	**0.082559**
Russia	2.353425 (0.97)	0.0204651	0.5892076	**0.081742**
Australia	1.722546 (1.14)	0.0279062	0.623207	**0.077133**
Finland	2.297069 (0.95)	0.0213152	0.6398956	**0.076516**
South Korea	0.0253666 (0.11)	0.5270092	2.498084	**0.005351**
Japan	0.0606762 (0.03)	0.0331334	0.6166326	**0.00326**
Philippines	-0.065864 (-0.07)	0.0552995	0.9022304	**-0.00404**
Italy	-0.1535373 (-0.08)	0.0260498	0.5479774	**-0.0073**
Ukraine	-0.3272638 (-0.19)	0.0317599	0.6901673	**-0.01506**

*(t-statistics in parenthesis)

As Table 3.1 shows, there are four countries with an IGC greater than 0.3: Hungary, Poland, South Africa and China. Interestingly, these include three former socialist countries, and South Africa, known for its recent Apartheid past. In these societies, parental earnings are considered a strong indicator of children’s future earnings, with at least 30% of the relative differential in parental earnings transmitted to children; thus implying a limited degree of intergenerational re-ranking.

Meanwhile six countries feature an IGC of less than 0.1: Austria, Russia, Australia, Finland, South Korea and Japan. These are the countries in our sample with the highest levels of intergenerational mobility in the sense that children's income prospects are more difficult to predict using their parent's earnings; with less than 10% of the relative differential in parental earnings being transmitted to children.

It is also apparent that there are three countries with a negative IGC: Italy, Ukraine and the Philippines. Such negative coefficients are indicative of an extremely high level of re-ranking, i.e. children from richer parents are more likely to end up among the poorest of their generation (and children from poorer parents are more likely to end up among the richest of their generation) than in other societies (that report a non-negative IGC).

Whilst this could be considered an even higher level of intergenerational mobility (due to the re-ranking component), paradoxically, the further they are away from zero, the greater the level of predictability entailed by both negative and positive IGC values. In other words, our conception of mobility gets blurred when we face negative IGC values, since, in these cases, a higher degree of re-ranking implies *greater* predictability, i.e. the opposite of the case with positive IGC values (where a higher degree of re-ranking means less predictability and higher mobility). Yet none of the estimated IGEs for these three countries are statistically significant at the 10% level of significance.

3.2. Gini Income Inequality And Intergenerational Mobility: Our Update

Going back to some of the questions posed in the introduction: Is it the case that higher income inequality in some societies may be at least partially "compensated" by higher degrees of intergenerational mobility? Or is it the case that societies with higher inequality tend to be also more immobile across generations?

Despite methodological and sample differences, all recent studies uncover a negative relationship between inequality and mobility, i.e. higher inequality is associated with lower mobility. The OECD (2008) finds this relationship for 12 member countries. Andrews and Leigh (2009) confirm these results with 16 countries. Their estimated IGC is statistically significant at the 1% level of statistical significance, when former Warsaw Pact countries are excluded from the analysis. Corak (2013) reaches similar conclusions with 13 countries.

We update and provide further validation for these results by plotting Gini indices from 1985 against our estimated IGC for 36 countries (the Gini coefficients for Cyprus and Iceland were not available for the required period).

Figure 3.1: The "Great Gatsby" curve for 36 countries

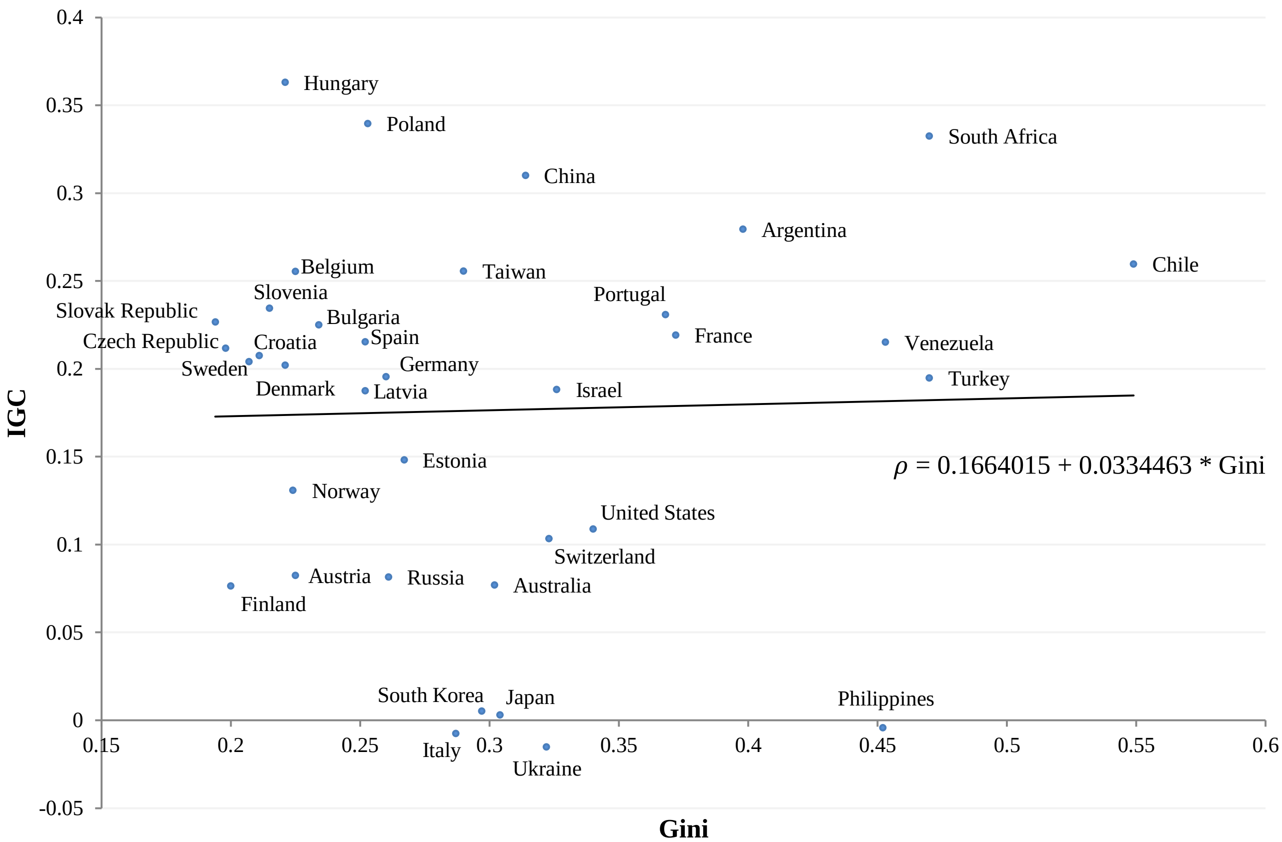
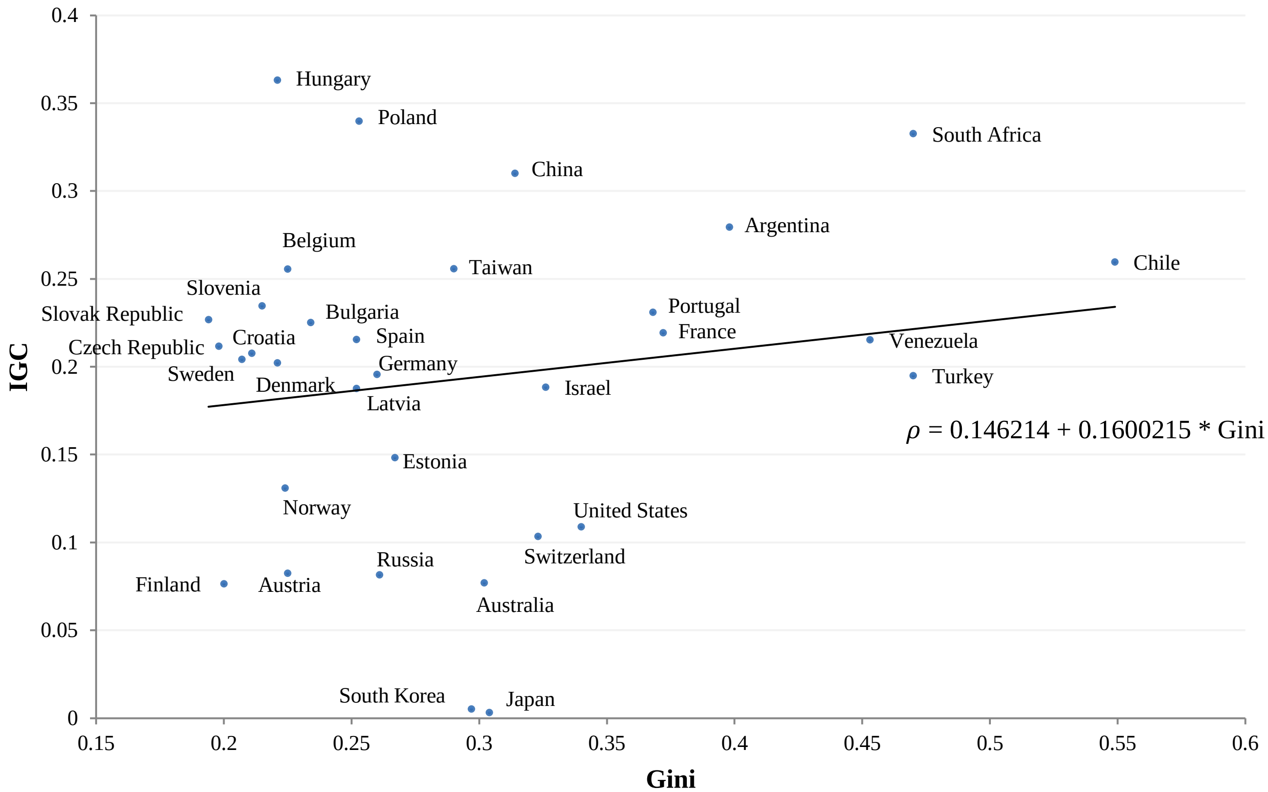


Figure 3.1 shows our scatter plot for 36 countries. The best linear fit is also shown, featuring a positive but small correlation coefficient between the IGC and the Gini of 0.0334463. The coefficient is not statistically significant at the 10% level of significance.

Figure 3.2 shows the relationship between IGC and the Gini excluding the three countries that report a negative IGC: Italy, Ukraine and the Philippines. As shown in Figure 3.2, the correlation increases to 0.1600215, although this correlation is once again found to be insignificant at the 10% level of statistical significance.

Figure 3.3 shows the relationship between the IGC and the Gini, excluding the three countries that report a negative IGC, and those countries from the sample which previously belonged to the Warsaw Pact (Bulgaria, Czech Republic, Slovakia, Hungary, Poland and Russia). These countries are omitted because they were not market economies until the 1990s, and, following Andrews and Leigh (2009), it is deemed inappropriate to draw comparisons considering their levels of inequality during the 1980s.

Figure 3.2: The "Great Gatsby" curve for 33 countries

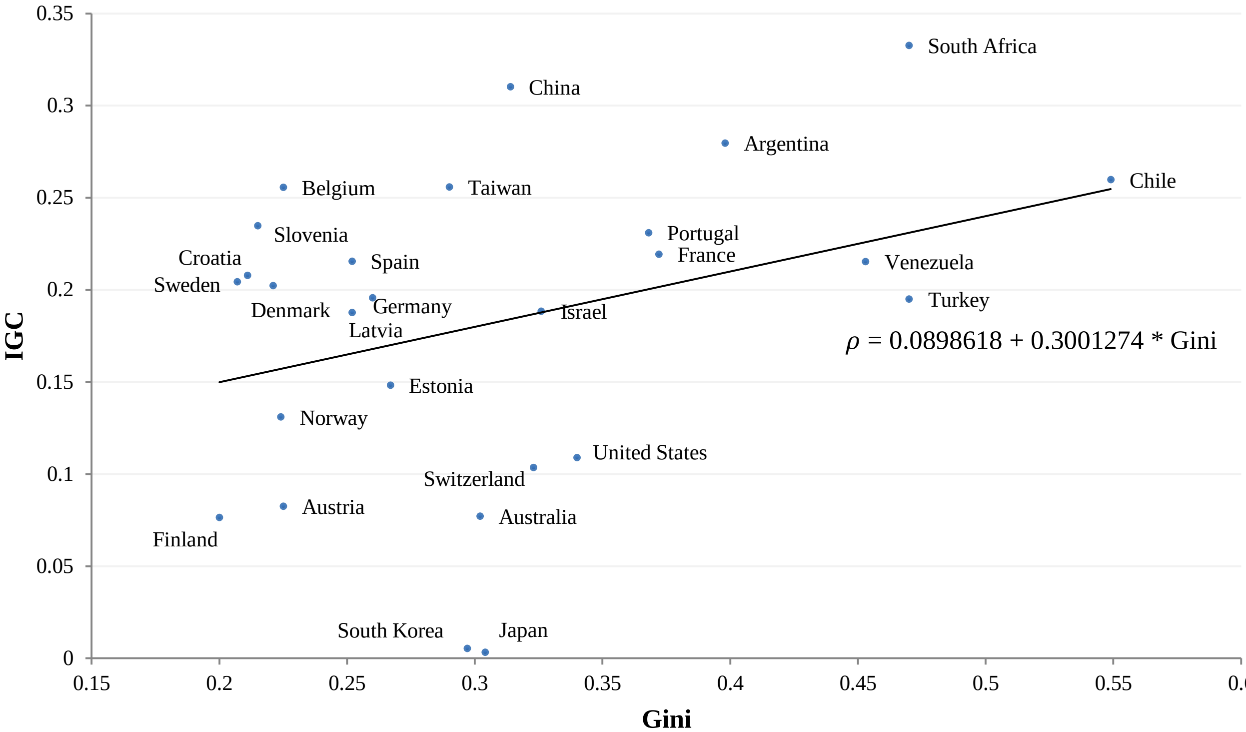


As is evident from Figure 3.3, there is a marked increase in the correlation between the IGC and the Gini when the six former Warsaw pact countries in the sample are omitted (alongside the other three with negative IGC values). The correlation coefficient increases to 0.3001274 and is found to be statistically significant at the 10% level of statistical significance.

Using the regression line as a reference, Figure 3.3 shows that some countries achieve a higher than expected level of mobility relative to their level of inequality. For example, South Korea and Japan both combine moderate inequality with high levels of intergenerational mobility. Conversely, a number of countries feature IGC values significantly above the trend line. For example, despite having only a marginally higher level of inequality than both South Korea and Japan, China has a much lower level of intergenerational mobility, and even much lower than would be "expected" for its level of inequality.

In summary, we are able to validate the "Great Gatsby" curve, and conclude that male children who grew up in societies classified as more unequal in 1985 were less likely to experience high levels of intergenerational mobility by 2009.

Figure 3.3: The "Great Gatsby" curve for 27 countries



3.3. Intergenerational Mobility, "Rigidities At The Bottom" And "Rigidities At The Top"

Now we explore the relative importance of both "rigidities at the bottom" and "rigidities at the top" in explaining variations in the IGC. Surely, rigidities (or lack thereof) in different parts of the joint distribution of parental and offspring incomes (e.g. "at the middle") also explain variations in the IGC. But we focus on those at the extremes of the distributions, representing the degree of persistence of wellbeing status among the poorest and the richest in society, respectively.

Already this narrower view illustrates how different combinations of "rigidities" can yield similar IGC values, and how in some countries "rigidities at the bottom" seems to be a more important driver of intergenerational persistence than at the top, or vice versa. Take the cases of Portugal and Slovakia. According to Table 3.1, the former has an IGC of 0.23, while the latter has an IGC of 0.22. As these figures are very similar, should we expect that these two countries reveal similar probabilities for sons' situations replicating those of their fathers; in every income quartile respectively, including the poorest and the richest? The IGC is a summary measure, therefore, most of the time, the answer is "no". In fact, in Portugal $p(1|1) = 0.66$, whereas in Slovakia $p(1|1) = 0.34$. Meanwhile, in Portugal $p(4|4)$=0.15, whilst in Slovakia $p(4|4) = 0.27$. Hence, even though both countries have very similar IGC values, in Portugal the main driver of relative immobility vis-à-vis Slovakia seems to be “rigidities at the bottom”, whereas “rigidities at the top” is comparatively more significant in Slovakia.

Of course, we should expect that countries with higher overall immobility should exhibit higher levels of all sorts of rigidities (i.e. higher probability mass in the diagonal, in terms of mobility matrix representations), and vice versa with highly mobile countries. However, in general for most intermediate values of the IGC, different combinations of “rigidities” can yield similar values, as illustrated in the Portugal-Slovakia example.

Figure 3.4 lists our 38 countries in ascending order of $p(1|1)$. Interestingly, Hungary is the least “rigid at the bottom”, notwithstanding featuring the highest IGC value. This suggests that, in countries like Hungary, barriers at the top of the income distribution, preventing children whose parents are at the top from sliding down the income ladder, may be more salient than barriers at the bottom; preventing children from disadvantaged families climbing up. Meanwhile, Israel has one of the highest “bottom rigidities”, despite having a relatively low IGC. This suggests an alternative reality; whereby relatively low barriers at the top of the income distribution, preventing children whose parents are at the top of the income distribution from falling down the income ladder, are more salient than the aforementioned barriers at the bottom in explaining the summary measure of intergenerational mobility.

Figure 3.5 lists our 38 countries in ascending order of $p(4|4)$. Owing to the fact that Hungary reports the highest $p(4|4)$, i.e. the greatest degree of immobility at the top of the income distribution, our view that the main driver of Hungary’s high IGC is “rigidity at the top” is confirmed. However, we note that Latvia also exhibits a high $p(4|4)$, despite having a relatively low IGC. This once again implies the alternate reality, that relatively low barriers at the bottom of the income distribution, preventing children whose parents are at the bottom from climbing up the income ladder, may be more salient than barriers at the top; preventing children from privileged families falling down. Hence high focalized rigidities will not drive the IGC upward on their own if a society exhibits enough flux in other parts of the transition matrix.

From this very simple unpacking exercise we can therefore classify countries into three groups: (1) countries where the IGC is roughly equally driven by either both high top and bottom “rigidities” or both low top and bottom “rigidities” (e.g. South Africa and South Korea); (2) countries where the IGC value seems to be more influenced by the “bottom rigidity” (e.g. Latvia and Portugal); (3) countries where the IGC value seems to be more influenced by the “top rigidity” (e.g. Hungary and Austria).[3]

[3] To further illustrate the classification of countries contained within this section, consider the case of Austria. Austria features a relatively low IGC whilst having a high $p(1|1)$ and a low $p(4|4)$. We therefore conclude that there is a higher influence of “top rigidities” (or lack thereof) on the overall mobility observed in Austria; otherwise Austria would be expected to have a high IGC value owing to its “bottom rigidities”. We therefore deduce our conclusions from a comparison of the calculated “average” level of mobility (the IGC) and the two extremes: “bottom rigidities” and “top rigidities”.

Figure 3.4: Sons' probability of replicating the situation of fathers in the poorest income quartile ("rigidities at the bottom")

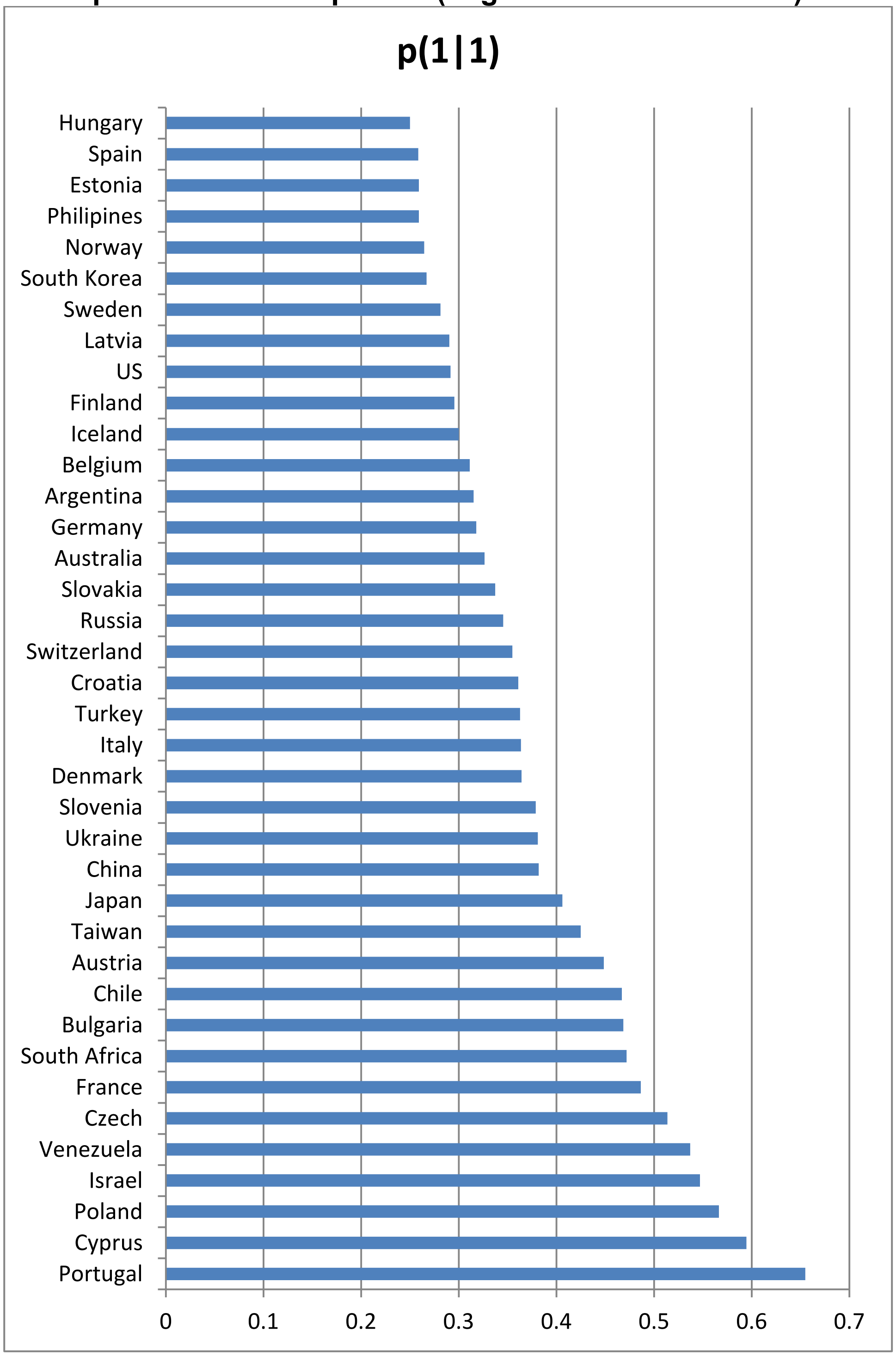
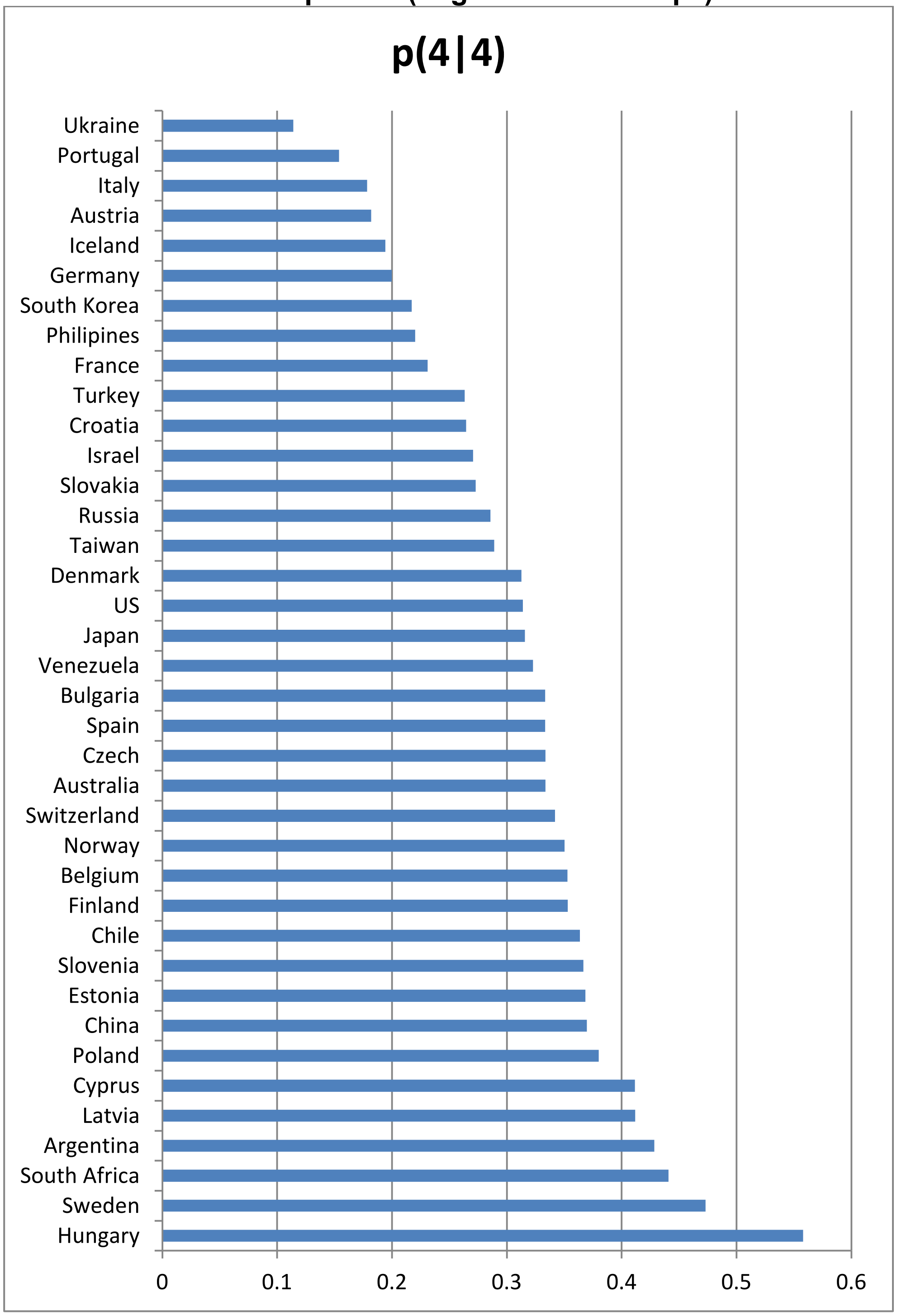


Figure 3.5: Sons' probability of replicating the situation of fathers in the richest income quartile ("rigidities at the top")



3.4. Intergenerational Mobility And Measures Of Inequality Of Opportunity For Children

In this subsection we present alternative "Great Gatsby" curves in which we plot our IGC estimates against the four measures of inequality of opportunity.

Figure 3.6 plots the calculated IGC against the "D" index of the PISA reading test, for the nine countries for which data are readily available. The scatter plot suggests that a parabolic relationship between the two variables provides a better fit to the data than a line. The blue line represents the parabola that best fits the data, with its equation written inside the figure (where "RD" represents the "D" index for reading). The figure suggests a positive and convex relationship between our measure of intergenerational income mobility and the selected measure of inequality of opportunity in reading for children in 2010, for most of the range of the IGC. In other words, on average, countries with recent experiences of low intergenerational mobility exhibit higher levels of inequality of opportunity with respect to reading for their children.

Figure 3.6. PISA reading "D" versus IGC

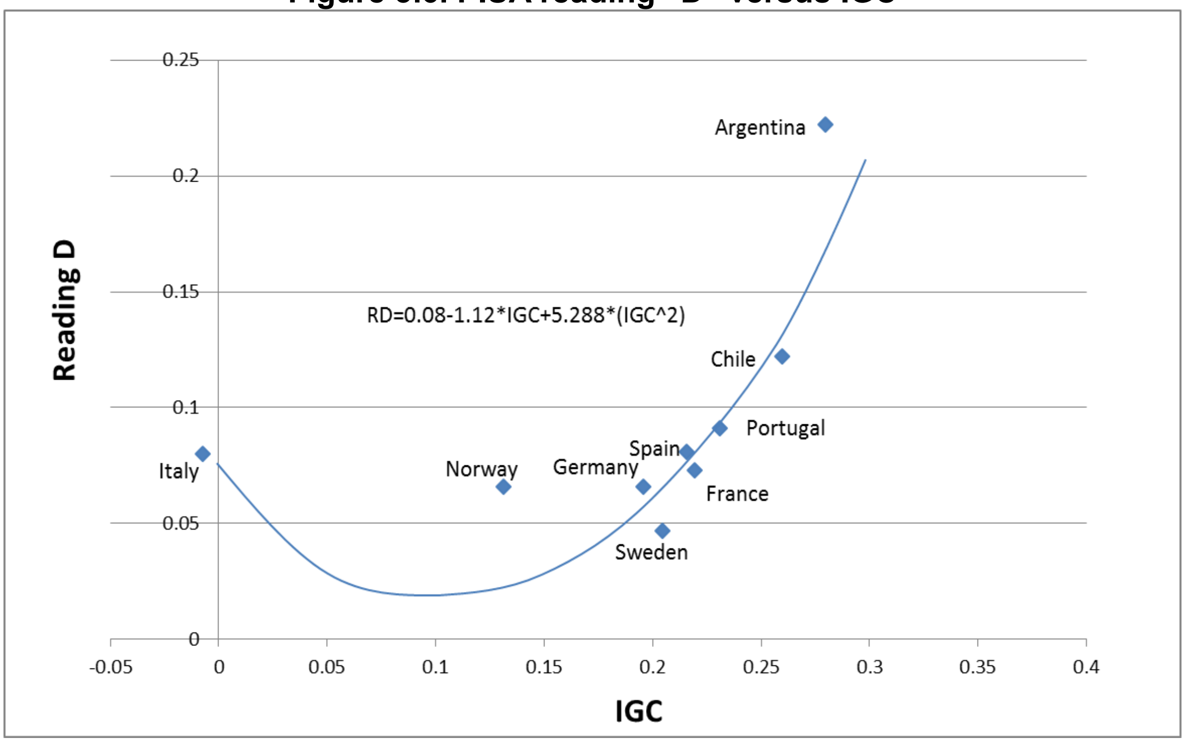


Figure 3.7 plots the IGC against the "D" index of the PISA mathematics test, for the ten countries for which data are readily available. As in figure 3.6, the scatter plot suggests that a parabolic relationship between the two variables is worth fitting. The equation for the parabola (drawn with the blue line) is written inside the figure (where

"MD" represents the "D" index for maths). The figure suggests, again, a positive and convex relationship between our measure of intergenerational income mobility and our measure of inequality of opportunity in mathematics for children in 2010, for a significant part of IGC's range. In other words, as before, on average, countries with recent experiences of low intergenerational mobility also feature greater levels of inequality of opportunity in mathematics for their children.

Figure 3.7. Maths reading "D" versus IGC

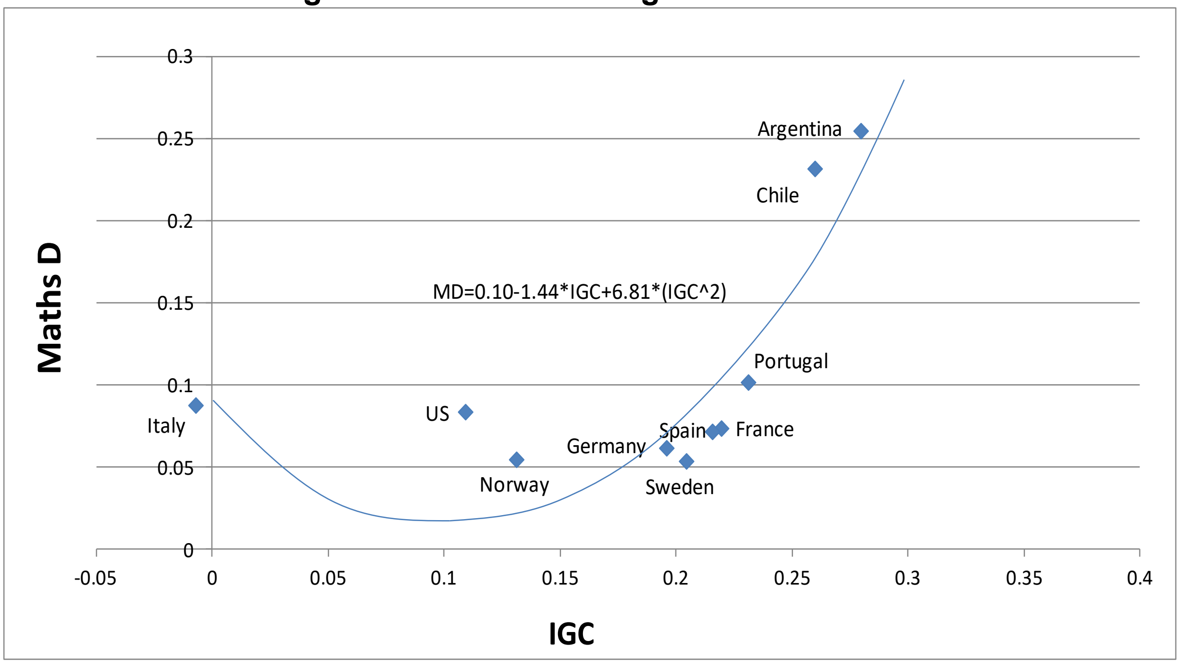


Figure 3.8 plots the IGC against the Human Opportunity Index (HOI) of sanitation, for the nine countries for which data are readily available. By contrast to the previous figures, the scatter plot now suggests fitting a linear relationship (drawn with the blue line) whose equation is written inside the figure (where "HOI S" represents the HOI for sanitation). We observe a negative relationship between our measure of intergenerational income mobility and our measure of inequality of opportunity in sanitation for children in 2010. Hence, on average, countries with recent experiences of low intergenerational mobility feature greater levels of inequality of opportunity in sanitation for children.

Finally, figure 3.9 plots the IGC against the Human Opportunity Index (HOI) of overcrowding, for the twelve countries for which data are readily available. As with figure 3.8, the scatter plot suggests fitting a linear relationship (drawn with the blue line) whose equation is written inside the figure (where "HOI O" represents the HOI for overcrowding). Again, a negative relationship between our measure of intergenerational income mobility and our measure of inequality of opportunity in overcrowding for children in 2010 emerges. Hence, on average, countries with recent experiences of low intergenerational mobility also feature greater levels of inequality of opportunity in overcrowding for children.

Figure 3.8. HOI sanitation versus IGC

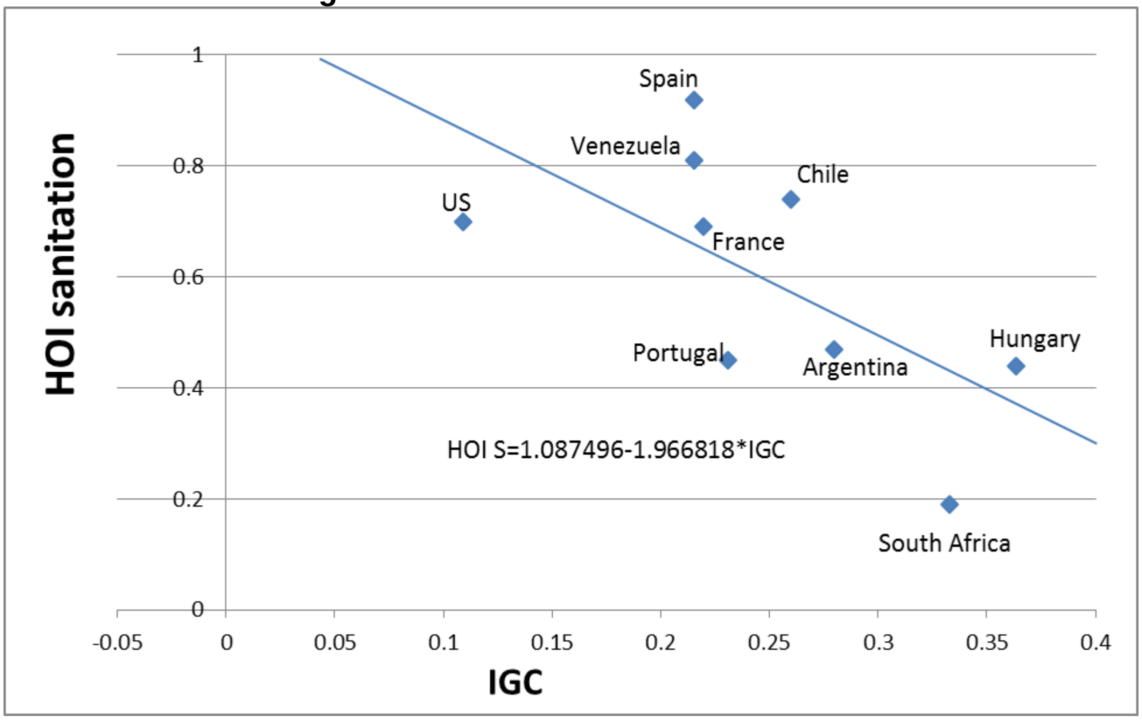
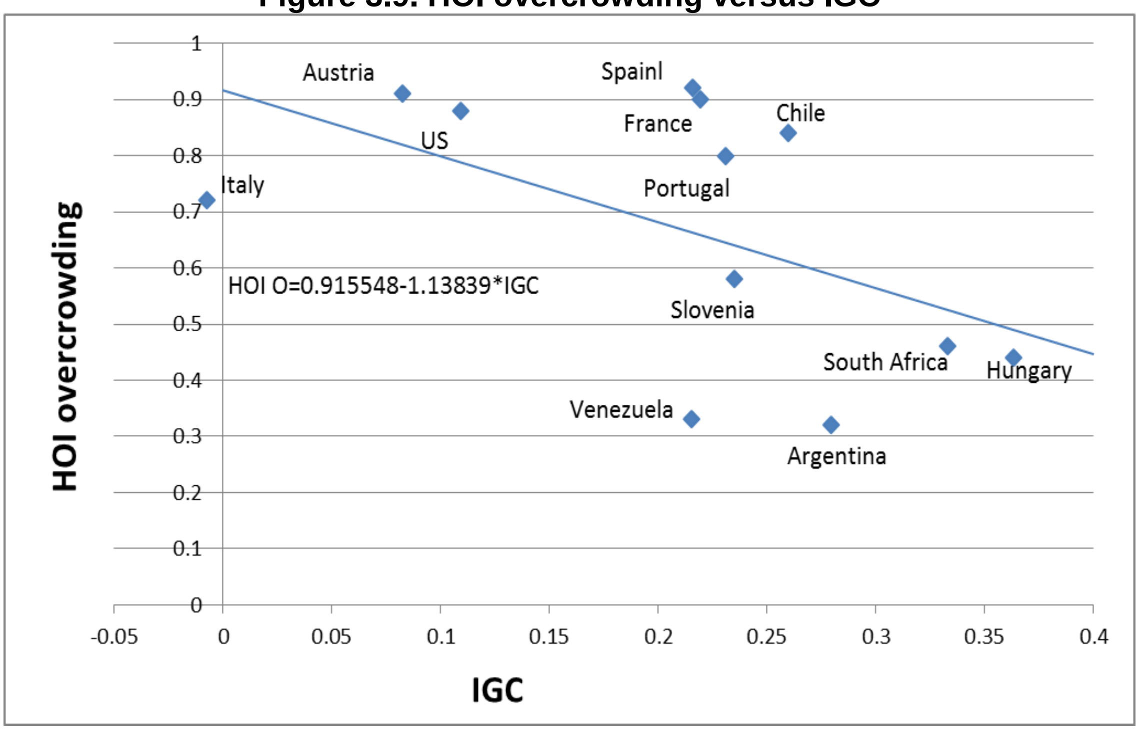


Figure 3.9. HOI overcrowding versus IGC



4. Conclusion

Our main findings in this chapter can be summarized threefold. Firstly, with a more recent dataset that covers a greater number of countries, we are able to corroborate the results of Andrews and Leigh (2009), namely that there exists a positive relationship between Gini-measured income inequality in 1985 and the intergenerational correlation of income in 2009. It is important to note however that this relationship is only found to be statistically significant when both countries that report a negative IGC, and those that belonged to the former Warsaw pact, are excluded from the sample.

Secondly, countries with similar levels of intergenerational income mobility differ in the drivers behind these levels. In general, it is worth unpacking the IGC value in order to probe the different levels of intergenerational persistence in different parts of the income distribution. For example, in some countries, like South Africa (high IGC) and South Korea (low IGC), the IGC is roughly equally driven by "bottom" and "top rigidities" (or lack thereof). Meanwhile, in some countries, like Latvia (relatively low IGC) and Portugal (relatively high IGC), the IGC is more influenced by "bottom rigidity". Finally, in other countries, like Hungary (high IGC) and Austria (low IGC), the IGC is more influenced by "top rigidities".

Thirdly, for countries with available data, we find evidence of "Great Gatsby" curves involving our measure of intergenerational income mobility (the correlation) and four measures of inequality of opportunity in different dimensions of wellbeing for children. In the case of the "D" indices for reading and maths, the curves appear to be parabolic, whereas for the two HOI indices (sanitation and overcrowding) we find a relatively linear relationship between each of them and the IGC. Hence we link up not only past income inequality with present intergenerational mobility, but also the latter with current inequality of opportunity, potentially signalling future further inequalities.

Our findings therefore indicate that, on average, countries with higher past income inequality tend to exhibit higher current intergenerational immobility, as well as higher current inequality of opportunity for children across several dimensions of wellbeing; the latter implying amplified income inequality prospects in the future.

While our results are fairly consistent with those found earlier by Andrews and Leigh (2009), there are some interesting differences with the findings of other recent studies which are worth highlighting. Corak (2006, 2013) provides the main alternative computation of intergenerational income mobility indices, reporting the intergenerational income elasticity. In Corak's (2013) "Great Gatsby" curve, using only developed countries, the three countries populating the top-right corner of high elasticity and high inequality are Italy, the United Kingdom, and the United States. Even though his Gini values are similar to ours (despite different data sources), his mobility estimates are different from ours. We do not have the UK in our sample, but our estimates of both the IGE and the IGC for Italy and the US are lower than those for countries like France, Germany, Finland, Sweden, Norway, and Denmark; whereas Corak (2013) finds all these countries' values below those of Italy and the United States. The strength of the calculated mobility index therefore varies according to the data source and empirical methodology applied. This is apparent from comparing our methodological section to the note accompanying Figure 1 in Corak (2013, p. 82).

The previous comparison exemplifies the importance of data and methodological choices in these cross-country comparisons. Additionally, the use of complementary and more informative measures of intergenerational mobility relying on alternative wellbeing dimensions, e.g. those based on family income, social status, occupational status or education (Blanden, 2013), should be encouraged despite current data limitations and conceptual challenges. Likewise other family relationships, such as father-daughter, mother-son and mother-daughter should also be considered toward these "Great Gatsby" assessments, for they may contain key information pertaining to the persistence of parental and childhood outcomes (d'Addio, 2007).

To summarize, whilst we have extended the research in this field, we believe that future research exploring "Great Gatsby" relationships should consider additional concepts and measurements of intergenerational mobility and different concepts and measurements of inequality (e.g. of outcomes, of opportunity, etc.), involving several indicators of wellbeing and social status, such as those aforementioned. Finally, we believe that the pervasiveness of the already confirmed relationships between different forms of inequality and mobility, including this paper's findings, warrants further research into the underlying causes behind their existence. It is only then that relevant policy prescriptions can be formulated to alleviate a problem that threatens to undermine both economic and social prosperity.

References

Aaberge, Rolf, Anders Bjorklund, Markus Jantti, Marten Palme, Peder Pedersen, Nina Smith, and Tom Wennemo (2002), "Income inequality and income mobility in the Scandinavian countries compared to the United States", *Review of Income and Wealth*, 48: 443-69.

Aaronson, Daniel, and Bhashkar Mazumder (2008) "Intergenerational economic mobility in the US, 1940 to 2000", *Journal of Human Resources*, 43(1): 139-72.

Acemoglu, Daron, and James Robinson (2009) *Economic origins of dictatorship and democracy*, Cambridge University Press.

Acemoglu, Daron, and James Robinson (2013) *Why nations fail: The origins of power, prosperity and poverty*, Profile Books.

Alvaredo, Facundo, Anthony B. Atkinson, Thomas Piketty, and Emmanuel Saez. (2013) "The Top 1 Percent in International and Historical Perspective." *Journal of Economic Perspectives*, 27(3): 3-20.

Andrews, Dan, and Andrew Leigh (2009) "More inequality, less social mobility", *Applied Economic Letters*, 16: 1489-92.

Atkinson, Anthony, Thomas Piketty, and Emmanuel Saez (2011) "Top incomes in the long run of history", *Journal of Economic Literature*, 49(1): 3-71.

Atkinson, Anthony (2015) *Inequality*, Harvard University Press.

Banerjee, Abhijit, and Andrew Newman (1993) "Occupational choice and the process of development", *Journal of Political Economy*, 101(2): 274-298.

Bjorklund, Anders, and Markus Jantti (2012) "Intergenerational income mobility and the role of family background", chapter in Nolan, Brian, Wiemer Saavedra and Timothy Smeeding (editors) *The Oxford Handbook of Economic Inequality*, Oxford University Press.

Bjorklund, Anders, and Markus Jantti (1997) "Intergenerational income mobility in Sweden compared to the United States", *American Economic Review*, 87(5): 1009-18.

Black, Sandra, and Paul Deveraux (2011) "Recent developments in intergenerational mobility", chapter 16 in Card, David, and Orley Ashenfelter (editors), *Handbook of Labor Economics*, Volume 4, Part B, North-Holland.

Blanden, Jo, Paul Gregg, and Lindsey Macmillan (2007) "Accounting for intergenerational income persistence: noncognitive skills, ability and education", *Economic Journal*, 117(519): C43-60.

Blanden, Jo, and Stephen Machin (2008) "Up and down the generational income ladder in Britain: past changes and future prospects", *National Institute Economic Review*, 205(1): 101-16.

Blanden, Jo (2013) "Cross-country rankings in intergenerational mobility: a comparison of approaches from Economics and Sociology", *Journal of Economic Surveys*, 27(1): 38-73.

Bourguignon, Francois, and Thomas Scott-Railton (2015) *The globalization of inequality*, Princeton University Press.

Brunori, Paolo, Francisco Ferreira, and Vito Peragine (2013) "Inequality of opportunity, income inequality and economic mobility: some international comparisons", IZA DP 7155.

Causa, Orsetta, and Asa Johansson (2010) “Intergenerational social mobility in OECD countries”, *OECD Journal: Economic Studies*, 2010: 1-44.

Corak, Miles (2006) “Do Poor Children Become Poor Adults? Lessons from a Cross-Country Comparison of Generational Earnings Mobility”, in John Creedy, Guyonne Kalb (editors) *Dynamics of Inequality and Poverty (Research on Economic Inequality, Volume 13)* Emerald Group Publishing Limited, pp.143 – 188.

Corak, Miles. 2013. "Income Inequality, Equality of Opportunity, and Intergenerational Mobility." *Journal of Economic Perspectives*, 27(3): 79-102.

d’Addio, Anna C. (2007) “Intergenerational transmission of disadvantage: Mobility or immobility across generations? A review of the evidence for OECD countries”, OECD Social, Employment, and Migration Working Papers 52.

Dearden, Lorraine, Stephen Machin, and Howard Reed (1997) “Intergenerational mobility in Britain”, *The Economic Journal*, 107: 47-66.

De Maio, Fernando (2007) “Income inequality measures”, *Journal of Epidemiology & Community Health*, 6(10): 849-52.

Fafchamps, Marcel (2003) *Rural poverty, risk and development*, Edward Elgar.

Fleurbaey, Marc (2012) *Fairness, responsibility, and welfare*, Oxford University Press.

Formby, John, James Smith, and Buhong Zheng (2004) “Mobility measurement, transition matrices and statistical inference”, *Journal of Econometrics*, 120: 181-205.

Friedman, Milton (2002) *Capitalism and freedom: fortieth anniversary edition*, University of Chicago Press.

Galor, Oded, and Joseph Zeira (1993) “Income distribution and macroeconomics”, *The Review of Economic Studies*, 60(1): 35-52.

Grawe, Nathan (2001) “Quantile regression measures of mobility in the US and abroad”, mimeograph.

Grawe, Nathan (2006) “Life cycle bias in estimates of of intergenerational earnings persistence”, *Labour Economics*, 13(5): 551-70.

Haider, Steven, and Gary Solon (2006) “Life-cycle variation in the association between current and lifetime earnings”, *American Economic Review*, 96(4): 1308-20.

ISSP Research Group (2012): *International Social Survey Programme: Social Inequality IV - ISSP 2009*. GESIS Data Archive, Cologne. ZA5400 Data file Version 3.0.0, doi:10.4232/1.11506

Krueger, Alan (2012) “The Rise and Consequences of Inequality in the United States”, Remarks delivered at the Center for American Progress, Washington D.C.

Leigh, Andrew (2007) “Intergenerational mobility in Australia”, *The B.E. Journal of Economic Analysis & Policy*, 7(2).

Marrero, Gustavo, and Juan G. Rodriguez (2013) “Inequality of opportunity and growth”, *Journal of Development Economics*, 104: 107-122.

Milanovic, Branko (2015) “Trends in global income inequality and their political implications”, keynote lecture delivered at the sixth meeting of the Society for the Study of Economic Inequality, ECINEQ, Luxembourg.

Molinas, Jose, Ricardo Paes de Barros, Jaime Saavedra, and Marcelo Giugale (2010) *Do our children have a chance? The 2010 Human Opportunity Report for Latin America and the Caribbean*, The World Bank.

OECD (2008) *Growing unequal? Income distribution and poverty in OECD countries*, OECD Publishing.

Peters, Elizabeth (1992) "Patterns of intergenerational mobility in income and earnings", *The Review of Economics and Statistics*, 74(3): 456-66.

Picketty, Thomas (2014) *Capital in the twenty-first century*, Harvard University Press.

Putnam, Robert (2015) *Our kids: The American Dream in crisis*, Simon & Schuster.

Rodrik, Dani (2011) "The future of economic convergence", NBER Working Paper 17400.

Roemer, John (2000) *Equality of opportunity*, 2nd Edition, Harvard University Press.

Roemer, John, and Alain Trannoy (2014) "Equality of opportunity", chapter 4 in Aktinson, Anthony, and Francois Bourguignon (editors) *Handbook of Income Distribution* 2A-B, North-Holland.

Stiglitz, Joseph (2013) *The price of inequality*, Penguin.

UNU-WIDER (2014) "World Income Inequality Database (WIID3.0b)"

Wilkinson, Richard, and Kate Pickett (2010) *The spirit level: Why equality is better for everyone*, Penguin.