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Working Paper No. 14-18
October 2014

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Income mobility, intergenerational mobility and the Great Gatsby Curve: is education the key?

John Jerrim[1] and Lindsey Macmillan[2]

Abstract

It is widely believed that countries with greater levels of income inequality also have lower levels of intergenerational mobility. This relationship, known as the Great Gatsby Curve (GGC), has been prominently cited by high-ranking public policy makers, best-selling authors and Nobel Prize winning academics. Yet relatively little cross-national work has empirically examined the mechanisms thought to underpin the GGC – particularly with regards to the role of educational attainment. This paper uses the cross-nationally comparable Programme for International Assessment of Adult Competencies (PIAAC) dataset to shed new light on this issue. We find that income inequality is associated with several key components of the intergenerational transmission process – including access to higher education, the financial returns to education, and the direct effect of parental education upon labour market earnings. Thus, consistent with theoretical models, we find that educational attainment is an important driver of the relationship between intergenerational mobility and income inequality. We hence conclude that unequal access to financial resources plays a central role in the intergenerational transmission of advantage.

JEL codes: I20, J62, J24

Keywords: Income inequality, intergenerational mobility, Great Gatsby Curve, PIAAC.

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Acknowledgements

This work has been funded by the OECD Thomas J. Alexander fellowship. We thank Paul Gregg, John Goldthorpe and Jo Blanden for comments and useful insights. This work should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed herein are those of the author(s) alone.

1. Introduction

Income inequality is high and rising in a number of developed countries (OECD 2012). There is widespread concern that this may lead to lower levels of intergenerational mobility in the future. For instance, Ermisch, Jantti and Smeeding (2012:3) stated that:

> *"Of all the potential consequences of rising economic inequality, none is more worrisome than the possibility that rising inequality will have the long-term effect of reducing equality of opportunity and intergenerational mobility"*

A statement supported by Duncan and Murnane (2011:20):

"*Only if our country* [the United States] *faces the consequences of growing income inequality will it be able to maintain its rich heritage of upward social mobility*"

A key reason why many believe income inequality and intergenerational mobility are linked is that this can be observed cross-nationally; economically unequal countries are also the least socially mobile. This is demonstrated in Figure 1, which plots the Gini coefficient (income inequality) against the intergenerational income elasticity (a common measure of social mobility). The upward sloping regression line demonstrates what has become widely known as the "Great Gatsby Curve (GGC)"; greater income inequality is associated with less social mobility[3].

<< Figure 1 >>

This striking finding has been subject to much academic and public policy attention. It has been prominently cited by Nobel Prize winning economists (Heckman 2013), high-ranking policymakers (The White House 2013; Obama 2013), bestselling authors (Wilkinson and Pickett 2009) and the popular science press (The Economist 2013). Indeed, Professor Alan Krueger (2012) even used the curve to predict:

"*persistence in the advantages and disadvantages of income passed from parents to children …..* [will] *rise by about a quarter for the next generation as a result of the rise in inequality that the U.S. has seen in the last 25 years"*

[3] Greater values of the intergenerational income elasticity (y-axis) imply *less* social mobility. Krugman (2012) reports the GGC correlation to be around 0.85, though Blanden (2013) reports a more modest 0.60.

Yet, despite the widespread interest in the GGC, relatively little work has empirically examined the mechanisms thought to underpin it[4]. This includes the role of educational attainment, despite this being deemed to be a critical factor in the transmission of (dis)advantage across generations by many economists and sociologists (Atkinson 1980; Atkinson and Jenkins 1984; Duncan and Hodge 1963; Blau and Duncan 1967; Becker and Tomes 1986). This paper aims to fill this gap in the literature by examining how the link between parental education, educational attainment of offspring and labour market outcomes varies across countries, and whether stronger associations are found in societies with more income inequality. We address the following three research questions.

First, we ask whether there is indeed a strong relationship between income inequality and intergenerational mobility. As noted by Jäntti and Jenkins (2013), Blanden (2013) and Jerrim, Choi and Roriguez (2014), different methods have been used across different countries to produce the income mobility estimates usually plotted on the GGC, with substantial differences across countries in terms of data quality. Indeed, two experts from the intergenerational mobility field (Jäntti and Jenkins 2013:188) recently emphasised that:

"despite the public prominence of the Great Gatsby curve, very little is known about how intergenerational income persistence and mobility vary across countries and how this relates to cross-sectional inequality. More research, using comparable data for multiple countries across multiple cohorts of parents and offspring, is required"

Our first aim is to provide new evidence closely related to what the aforementioned academics are calling for. Specifically, the cross-nationally comparable Programme for International Assessment of Adult Competencies (PIAAC) dataset is used to investigate the link between comparable measures of *parental education* and their offspring's earnings. We thus investigate whether the GGC can be replicated using an alternative definition of intergenerational mobility and data specifically designed to facilitate such international comparisons.

Research Question 1. How does the link between parental education and their offspring's earnings vary across countries? Is this association stronger in more unequal countries?

[4] Corak (2013) is a recent exception. He found greater returns to higher education in more unequal countries. We advance this work by formally decomposing the GGC into separate components (including both access to and returns from higher education).

Our second contribution is to consider the role of offspring's educational attainment in forming our version of the GGC. Despite the prominence of educational attainment in the theoretical models of intergenerational persistence, relatively little empirical work has examined whether this may be driving the link between income inequality and mobility[5]. We thus investigate whether educational attainment mediates the intergenerational transmission process, how this varies across countries, and whether this is independently associated with income inequality:

<u>Research Question 2</u>. Does educational attainment mediate the relationship between parental education and offspring's earnings? Is this 'indirect' effect of parental education stronger in more unequal countries?

Finally, our statistical decomposition shows that the mediating effect of education will work through two key channels:

(i) The socio-economic gradient in offsprings' educational attainment ('access to education')
(ii) The labour market value of qualifications gained ('returns to education').

We argue that both channels are likely to be stronger in more unequal countries (Solon 2004). Our final aim is thus to bring data to bear on these issues by investigating whether (a) income inequality is linked to differences in university completion rates by parental education group (b) the returns to education are indeed higher in more unequal countries and (c) if either stands out as a particularly important driver of our version of the GGC:

<u>Research Question 3</u>. Is the relationship between parental education and access to higher education stronger in more unequal countries? Are the economic returns to education greater in more unequal countries?

Readers should bear in mind that our objective is to establish whether strong *associations* between income inequality and intergenerational opportunities exist at the cross-country level, and the extent to which educational attainment is an important mediating

[5] Gregg, Jonsson, Macmillan and Mood (2013) is an exception. The paper's authors investigate the mediating role of education in explaining intergenerational income mobility across Sweden, the United Kingdom and the United States.

factor. Although establishing whether any apparent link is causal is clearly an important long-term goal, it is beyond the scope of this paper and, indeed, the data currently available[6].

The paper proceeds as follows. Our theoretical framework and empirical methodology are presented in section 2, with an overview of the PIAAC dataset following in section 3. Results are presented in section 4, with conclusions in section 5.

2. Theoretical framework and empirical methodology

Becker and Tomes (1986), Solon (2004), Duncan and Murnane (2011) and Corak (2013) argue that, in societies with more income inequality, there is greater disparity in the resources that rich and poor families invest in their children. This begins when children are in utero (e.g. quality of pre-natal care), and continues throughout early childhood via the provision of educational inputs (including parental time). Consequently, large socio-economic differences in cognitive functioning emerge even before compulsory schooling has begun (Cunha et al 2006). Income inequality then leads to greater school and neighbourhood segregation, with children from disadvantaged backgrounds attending lower quality schools than their more affluent peers. This, along with continuing disparities in educational investments, reinforces the skill gap between socio-economic groups. Thus, by the end of secondary school, there will be substantial family background differences in academic abilities, future aspirations and a range of other social ('non-cognitive') skills.

In turn, this will influence whether children obtain a bachelor degree. Income inequality may also directly influence college access if low income families are unable to afford the high costs of tertiary education. Yet young people who do graduate from college earn a substantial wage premium over other groups – with these returns likely to be higher in more unequal labour markets. Family resources are likely to continue to matter, even at this late stage, as the wealthy continue to support their offspring as they search for their first job. Successful labour market transitions are therefore likely to be harder for those from poor backgrounds – particularly when labour markets are very unequal. The Great Gatsby Curve presents '*a summary of all these underlying gradients, reflecting the outcome of a whole host of ways that inequality of incomes affects children*' Corak (2013:7).

[6] In the interest of producing replicable research, the entire analytical process, including links to the data and programme code, can be found at www.johnjerrim.com.

This argument is formalised in Figure 2. This links parental education (starting point) to offspring earnings (end result). The raw (unconditional) association between parental education and offspring earnings is the measure of intergenerational mobility used in this paper, henceforth labelled β_K (where K equals country). We estimate β_K across 24 countries using the following OLS regression model[7]:

$$Log(Y_{ij}^{Child}) = \alpha + \beta.E_{ij}^{parent} + \phi.C_{ij} + \varepsilon_{ij} \quad \nabla \text{K} \qquad (1)$$

Where:

Y_{ij}^{Child}= Offspring earnings

E_{ij}^{parent} = Highest level of parental education

C = A vector of control variables (quadratic age, immigrant status)[8]

ε = Error term

i = Individual i

j = Cluster j

K = Country K

Figure 2 illustrates that the link between parental education and offspring earnings can be separated into two components: the part that works through the educational attainment of offspring (dashed arrows) and the part that does not (solid grey arrows). Formally, following the statistical decomposition of Gregg et al (2013), the intergenerational association (β) will be divided into the following parts:

$$\beta = \gamma.\lambda + \delta \qquad (2)$$

Where:

β = Total association between parental education and offspring earnings

γ = Labour market value of qualifications

[7] The estimated β coefficients will occasionally be presented in terms of percentage differences, calculated as $\{(\exp(\hat{\beta}) - 1) * 100\}$.

[8] Immigrants' education and mobility opportunities may potentially be influenced by features of both their home and host country (including the level of income inequality). Immigrant status is therefore controlled in the analysis.

λ = Relationship between parent and offspring educational attainment

δ = The (unexplained) direct influence of parental education on offspring earnings.

The product $\gamma.\lambda$ represents the '*through education*' (or '*indirect*') effect of parental education upon offspring earnings; it is the part that <u>*can*</u> be accounted for by differences in educational attainment across families. In contrast, δ is the *direct* effect; it is the association between parental education and offspring earnings that remains once educational attainment has been controlled. We estimate the magnitude of each component across countries, and examine whether they are larger in more unequal societies. These components are discussed in further detail below.

<< Figure 2 >>

<u>*The intergenerational correlation of education (λ)*</u>

λ represents the intergenerational correlation of education; it is the strength of the association between the educational attainment of parents (E_{ij}^{parent}) and their offspring (E_{ij}^{child}). Figure 2 illustrates how three factors drive λ:

Heredity (H) = The genetic transfer of skills across generations

Non-financial resources (NF) = Non-financial inputs into children's development, including reading stories and helping with homework

Financial resources (F) = Monetary inputs into children's development (e.g. private tuition, school quality, tuition fees).

We investigate how λ varies across countries, and whether it is linked to income inequality (we denote this hypothesised correlation with income inequality as ρ_λ). We argue that if such an association exists (i.e. ρ_λ>0) then it is likely to work through channel F; greater income inequality leads to greater disparity in financial resources between high and low parental education groups which, in turn, generates bigger differences in offspring educational attainment. Thus, as illustrated in Figure 2 (dotted arrows), there is a clear theoretical link between income inequality, availability of financial resources by parental education group, and offspring educational outcomes. There is, on the other hand, little reason to believe that any impact of channel H (heredity) will vary significantly across countries; heredity transfers are unlikely to lead to stronger intergenerational associations in

Britain than Finland (for example). Likewise, because non-financial investments (NF) are family specific, they are unlikely to be influenced significantly by an external, macro-level force such as income inequality. For instance, highly educated parents are much more likely to read regularly to their child, help with homework and hold higher aspirations for their children's future than low educated parents. It is difficult to see why highly educated parents would behave differently, in terms of their non-financial investments, in countries with high and low inequality[9]. (Appendix A includes supplementary analysis of the Programme for International Student Assessment – PISA – dataset providing empirical support for this claim). We therefore argue that any association between income inequality and the intergenerational correlation of education is consistent with the view that access to financial resources matter for children's educational attainment.

λ is estimated using the following OLS regression model:

$$Ed_{ij}^{child} = \alpha + \lambda . E_{ij}^{parent} + \phi . C_{ij} + \varepsilon_{ij} \quad \nabla \mathrm{K} \qquad (3)$$

We begin by comparing λ across countries, before plotting estimates against income inequality. The stronger this association (ρ_λ), the greater the evidence that differences in access to financial resources by parental education group matter in the intergenerational transmission of advantage.

The returns to education (γ)

There is likely to be a strong association between parent and offspring education (λ) due to financial, non-financial and heredity factors. The impact this has upon offspring's earnings will depend, however, upon the value of qualifications in the labour market – i.e. the returns to education (γ). The product of $\lambda * \gamma$ hence determines the impact of offspring education on intergenerational persistence (β). For instance, there may be strong parent-child education links within a given country, but this may have little impact upon β if economic rewards to schooling are low.

Figure 2 illustrates our hypothesis that γ will be greater in more unequal countries. (We denote this correlation as ρ_γ). This is because financial rewards to more schooling are likely to be greater in societies where the income distribution is more dispersed. For example,

[9] We note that one plausible mechanism might be that a lack of financial resources amongst low parental education groups in unequal societies might constrain the quantity or quality or time parents can spend with their children.

university graduates will earn more, on average, than high school graduates in every country. But, with more inequality in the earnings distribution, the wage differential between graduates and non-graduates will be considerably larger in high income inequality countries (relative to low income inequality countries). Similarly, wages are likely to be taxed and redistributed more in low income inequality countries like Sweden than in high income inequality countries like the United States. Again, this will reduce the private returns to education in the former relative to the latter.

Consequently, income inequality will have a double influence upon the 'through education' component of the intergenerational transmission process; it will affect both the intergenerational correlation of education (λ) and the economic rewards of holding higher qualifications (γ). In Becker's work on human capital (Becker 1964) this process creates the perfect storm – more advantaged families will have greater resources to invest in their children's education and greater incentives to do so in more unequal countries. In turn, this leads to a particularly pronounced relationship between income inequality and the 'through education' component of β. We test this hypothesis in our empirical analysis.

γ is estimated via regression model (4). This captures the link between offspring's education and their earnings, conditional upon parental education:

$$Y_{ij}^{Child} = \alpha + \delta . E_{ij}^{parent} + \gamma . Ed_{ij}^{child} + \phi . C_{ij} + \varepsilon_{ij} \quad \nabla \text{K} \qquad (4)$$

Moreover, by re-arranging equation (2) one can see that the combined 'through education' effect ($\gamma . \lambda$) is simply the difference between the unconditional ($\hat{\beta}$) and conditional ($\hat{\delta}$) parameter estimates given by (1) and (4):

$$\gamma . \lambda = \left(\hat{\beta} - \hat{\delta}\right) = \text{Through education effect} \qquad (5)$$

In our empirical analysis, we investigate whether ($\gamma . \lambda$) is linked to income inequality, before considering each sub-component in turn.

Direct effects

Parental education may influence offspring earnings in ways other than through offspring educational attainment (solid grey arrows in Figure 2). This is the 'not through education' or 'direct' effect (δ_K) which operates via three mechanisms. The first is financial resources. For instance, in many countries unpaid internships are becoming an important intermediate step between college and the labour market. High parental education families can use their greater financial resources to support their offspring during this transition, while low parental education families may not. Similarly, searching for jobs can take time. Offspring from families with greater financial resources may have more time to find a suitable job than offspring from families with fewer resources. This will be more of a problem in countries with greater differences in financial resources between parental education groups - i.e. those with more income inequality.

The second mechanism is through the use of connections and networks in the labour market – i.e. non-financial resources. For instance, highly educated parents may draw upon their professional networks to secure their offspring a well-paid job. Low educated parents, who do not have the same professional networks, may not be able to provide their offspring with the same labour market opportunities (even when their offspring hold the same qualifications as those from more advantaged backgrounds). Moreover, although reasons why this would vary by income inequality are not as apparent as for the financial resources (F) channel, one cannot rule this possibility out.

The final mechanism is heredity endowments. An example is looks or beauty. Such traits are passed across generations, do not operate through educational attainment and have non-trivial labour market rewards (see Hamermesh and Biddle 2001). They will thus be incorporated in δ_K. Other examples might include personality, eloquence, the ability to read others' emotions and other non-cognitive skills that do not influence offspring's educational attainment. However, as with heredity transmission of skills, this process is unlikely to differ across countries (or be associated with income inequality).

We therefore argue that, if there is a systematic association between δ_K and income inequality, then this is likely to be driven by channel F (access to financial resources). This would, in turn, suggest that access to financial resources is central to the intergenerational transmission process. Estimates of δ_K are drawn from equation (4). We examine whether these δ_K are greater in more unequal countries.

3. Data

The Programme for International Assessment of Adult Competencies (PIAAC) was conducted by the OECD in 2011. It has been designed to provide internationally comparable information on educational attainment and labour market outcomes. A complex survey design has been used, with geographic regions firstly selected as the primary and secondary sampling units, and one person aged between 16 and 65 randomly chosen to participate within each sampled household (see OECD 2013: chapter 14 for further information). Response rates ranged from 45 percent in Sweden to 75 percent in Korea (median equals 62 percent). The survey organisers undertook a thorough analysis of non-response (OECD 2013:Chapter 16), finding that this problem was typically 'minimal' to 'low' (see Table 1). To account for missing data and complex survey design (e.g. clustering and stratification), the PIAAC response and replicate weights are applied throughout the analysis.

We restrict the sample to men aged between 25 and 59. Female respondents are excluded to maximise comparability with the existing intergenerational mobility literature (which has focused upon men) and because of the added complexity of labour market selection for women[10]. Individuals younger than 25 and older than 59 have been excluded as their earnings are subject to "transitory" fluctuations, leading to "life-cycle bias" (see Chadwick and Solon 2002 and Haider and Solon 2006 for further explanation). Our analysis thus focuses upon men born between roughly 1950 and 1985, with estimates essentially being an average for individuals born during this period. (We have re-produced all estimates having tightened our restriction to 35 - 55 year old males only with little substantive change to our results. These are available from the authors upon request). Final sample sizes range from 472 in Russia to 7,707 in Canada (with a median of 1,453) –see Table 1.

<< Table 1 >>

Respondents were asked detailed questions about their qualifications, labour market earnings and the level of education their parents achieved. The latter is measured using International Standard Classification of Education (ISCED) levels; a coding schema designed by UNESCO to facilitate cross-national comparisons. Following existing practice in much of

[10] Nevertheless, we have re-estimated all models for women as well (available from the authors upon request). The key conclusions reached continue to hold, though the observed Great Gatsby association (excluding transition countries) is slightly weaker than for men (correlation = 0.62). Moreover, the link between income inequality and the direct effect (δ) is weaker for women (correlation = 0.32) than for men (correlation = 0.67).

the cross-national literature (e.g. the Luxemburg Income Study - http://www.lisdatacenter.org/) a collapsed version has been used:

- Low = Neither parent obtained upper secondary schooling
- Middle = At least one parent attained secondary and post-secondary, non-tertiary education
- High = At least one parent attained tertiary education

Estimates of intergenerational associations (β, λ and δ) refer to differences between high and low parental education groups.

Respondents' earnings were collected via a battery of detailed questions, designed to maximise the quality of reports while minimising item non-response. Earnings could be reported hourly, daily, weekly, bi-weekly, monthly, annually or a piece rate, with categories used where respondents were unwilling to provide exact amounts. Separate questions were asked about bonuses, and to the self-employed. A monthly earnings variable has then been derived by the OECD using the following process:

(i) Converting information into a consistent reporting period (e.g. from hourly to yearly)
(ii) Conversion of categorical earnings into direct amounts
(iii) Applying a Purchasing Power Parity (PPP) correction to equalise amounts across countries[11].

. The natural logarithm of PPP adjusted earnings is used in our analysis.

Detailed questions were also asked about qualifications held. Country specific options were provided, and have been converted into ISCED levels by the OECD. The following seven educational categories are formed:

(a) Primary (ISCED level 1)
(b) Lower secondary (ISCED level 2 or 3c short)
(c) Upper secondary (ISCED level 3a, 3b and 3c long)
(d) Post-secondary, non-tertiary (ISCED level 4)
(e) Professional degree (ISCED level 5b)
(f) Bachelor degree (ISCED 5a)

[11] See OECD (2013: Chapter 20.4) for further details

(g) Master/research degree (ISCED 5a/6)

When decomposing the link between parental education and offspring earnings into indirect and direct components (recall equation 4) this seven category schema is used. In contrast, educational categories are collapsed when estimating access to education (λ) and the returns to education (γ) as follows:

i. Upper secondary school and below (categories a to c above)
ii. Post-secondary but below bachelor degree (categories d to e above)
iii. Bachelor degree and above (categories f and g above)

This is done to facilitate the production and presentation of results across a large number of countries[12]. We consider the implications for estimating the indirect and direct effects from using the seven category measure compared to the three category measure in Appendix B.

Income inequality

Income inequality is measured using the Gini coefficient. Although there are alternative measures (e.g. Atkinson coefficient, decile ratios), similar estimates of the GGC are obtained regardless of income inequality measure used (Blanden 2013). This information is drawn from the Luxemburg Income Study (LIS) [13]. This is widely considered to be the "gold standard" in income inequality measurement across countries (Atkinson 2004) due to the consistency of population coverage, income concept (disposable household income), unit of analysis and equivalence scales. We average the Gini coefficient across all years with data available. To test the robustness of results, information on income inequality has also been drawn from the Standardised World Income Inequality Dataset - SWIID[14]. This contains income inequality data for a greater number of countries than the LIS, and over a longer period of time (1960 to 2010 for most OECD countries). However, like other similar resources (e.g. Deininger and Squire 1996) it also has lower levels of cross-national comparability (Atkinson and Brandolini 2001). We average the Gini coefficient across all available years between 1965 and 2010 when using the SWIID, and find little change to our substantive results (available from the authors upon request).

[12] All respondents were also asked to complete a series of cognitive numeracy tests. This is used to test the robustness of results regarding the intergenerational correlation of educational attainment. We have standardised these test scores to mean 0 and standard deviation 1 across all participating countries.
[13] See http://www.lisdatacenter.org/data-access/key-figures/inequality-and-poverty/
[14] See http://myweb.uiowa.edu/fsolt/swiid/swiid.html

Country selection

22 OECD and two non-OECD (Russia and Cyprus) countries participated in PIAAC. However, as Andrews and Leigh (2009) argue, '*it may be unreasonable to draw a link between* [income] *inequality … and intergenerational mobility*' for 'transition' economies previously under Communist rule. In particular, recall that the sample includes men born between 1950 and 1985, when these countries did not have a market based economy. Individuals in these countries would have also experienced substantial economic, social and political change during their lives, with such instability potentially leading to unusual and unpredictable patterns of social mobility[15]. Consequently, it has been argued that these countries are unlikely to demonstrate the hypothesised link between income inequality and intergenerational mobility, and should therefore be excluded from the GGC (see Andrews and Leigh 2009).

This complication will be handled as follows. The GGC will firstly be reproduced using parental education-offspring earnings estimates from 23 of the 24 PIAAC countries (Cyprus is excluded due to a lack of income inequality data within the LIS). The sensitivity of our version of the GGC to the inclusion/exclusion of the five transition economies (Russia, Poland, Estonia, Czech Republic and the Slovak Republic) is then illustrated. Subsequent decompositions will be presented for all countries, with the transition economies only excluded from our graphical representations of how the different components of the intergenerational association (γ, λ and δ) vary with income inequality.

4. Results

Does the Great Gatsby Curve really exist?

To begin, we replicate previous findings intergenerational mobility is lower in more unequal countries. Table 2 presents estimates of the link between parental education and labour market earnings (β).

<< Table 2 >>

[15] Andrews and Leigh (2009) go on to argue that '*theoretical explanations suggesting a relationship between inequality and social mobility include private expenditure on education, political donations, and median voter models. These are more likely to apply in capitalist democracies than in Communist countries.*'

In all countries there is a strong and statistically significant association, with individuals from low parental education backgrounds earning up to 75 percent less than those from high parental education backgrounds. However, the strength of this association varies across countries. Finland, Sweden, Norway and Denmark are all towards the bottom of Table 2, where the parental education – offspring earnings gap is approximately 20 percent or less. On the other hand, the equivalent difference in the Slovak Republic and United States is more than 70 percent. Overall, the ranking of countries in Table 2 is broadly similar to Blanden (2013: Table 2) who performs a similar cross-country comparison using an alternative measure of social mobility (the link between the income of fathers and sons)[16]. Indeed, the correlation between our estimates in Table 2 and Blanden (2013: Table 2) stands at 0.73.

Figure 3 plots these β coefficients against income inequality. (See Table 1 for the key to country abbreviations). The left-hand panel includes all countries bar Cyprus (due to the lack of income inequality data in the LIS). Although we find a link between income inequality and mobility, this association is relatively weak. The correlation coefficient equals 0.39 (Spearman's rank 0.49) - notably less than the 0.85 reported by Krugman (2012) and the 0.60 by Blanden (2013). Similarly, the fitted regression line suggests that a 0.10 increase in the Gini coefficient (roughly the difference in income inequality between Sweden and the United Kingdom) is associated with a relatively small (0.11) increase in β. Nevertheless, this association does reach statistical significance at conventional thresholds[17].

<< Figure 3 >>

However, as discussed in section 2, the hypothesized link between income inequality and intergenerational mobility is unlikely to hold in the transitional economies of Russia, Poland, Czech Republic, Estonia and the Slovak Republic, where there was substantial social, economic and political change during the late 20th century. Moreover, these countries have a big impact upon the results presented in left hand panel of Figure 3, and are thus excluded in the panel on the right. Consistent with Andrews and Leigh (2009), the association between income inequality and intergenerational mobility becomes significantly stronger. The correlation coefficient increases to 0.86 (Spearman's rank = 0.81), with a 0.10 increase in the Gini now associated with a 0.26 increase in β. These magnitudes are consistent with Corak

[16] This is what other academics have typically plotted in the y-axis of the GGC.
[17] Reporting statistical significance in cross-country analyses is not without its problems – most notably the implicit assumption that countries are randomly drawn from some super-population. Nevertheless, statistical significance is reported to give some indication of uncertainties given the limited number of observations (countries).

(2013) and Blanden (2013), neither of whom included transition economies in their versions of the GGC. Together, this provides strong evidence that income inequality is indeed linked to intergenerational mobility (at the cross-national level) when alternative and comparable measures of parental background are used.

As a robustness test we draw upon Jerrim (2014: Table 2). This author estimates β using three datasets (PIAAC, EU-SILC and ESS) before combining results in a meta-analysis[18]. Consistent with the above, we find that the link between income inequality and β is weak when all countries are included (r = 0.31), but increases substantially when transition economies are removed (r = 0.70).

To what extent does educational attainment mediate the link between parental education and labour market outcomes?

Table 3 presents estimates of the decomposition of β into the part that works through offspring educational attainment ($\gamma.\lambda$), and the part that does not (δ). Educational attainment is clearly an important mediating factor in all the countries considered; in all countries $\gamma.\lambda$ accounts for more than half the total effect (β). This illustrates education's important role in the intergenerational transmission of (dis)advantage. Indeed, in several countries δ (the influence of parental education through channels other than offspring education) is small and statistically insignificant, including Denmark, Finland, Norway, Sweden, Austria, Germany, Belgium and the Netherlands. Hence the labour markets in these countries seem comparatively meritocratic – conditional upon educational achievement, parental education has little additional impact upon offspring earnings. In contrast the direct effect of parental education (δ) is substantial in France, Japan, South Korea and England and Northern Ireland, where the low parental education group earns 20 percent less than the high parental education group, even when they hold the same qualifications.

<< Table 3 >>

Figure 4 considers whether offspring educational attainment may be driving our version of the GGC. The association between income inequality and $\gamma.\lambda$ (the "through offspring education" component of β) is presented in panel (a) with analogous results for δ (the "*not* through offspring education" component) in panel (b).

[18] EU-SILC = European Union Statistics on Income and Living Conditions; ESS = European Social Survey. These meta-results have the benefit of increasing the number of countries (28 including transition economies and 20 without) while also minimizing sampling error within each country.

<< Figure 4 >>

There is a strong and statistically significant association in panel (a); the correlation coefficient equals 0.70 (Spearman's rank = 0.62), with a 0.10 increase in the Gini coefficient associated with a 0.13 increase in $\gamma^*\lambda$. This is consistent with the theoretical model presented in Figure 2; the link between income inequality and educational attainment is a key driver of our version of the GGC. Yet there is also a reasonably strong association in panel b (Pearson correlation = 0.67, Spearman's rank = 0.63, p = 0.01), with the *direct* effect (δ) increasing by 0.12 for each 0.10 increase in the Gini coefficient. Hence income inequality is also linked with the part of the intergenerational transmission process that works through channels other than offsprings' educational attainment (e.g. non-meritocratic selection in the labour market). This finding has important implications regarding the theoretical framework presented in section 2 (Figure 2); it suggests that financial resources do indeed matter in this part of the intergenerational transmission process (e.g. by financing offspring while they search for a job after university or complete an unpaid internship, for example).

Is the through education component of the GGC driven by socio-economic inequality in educational attainment or the returns to education?

As noted in section 2, the "through offspring education" component is comprised of:

(i) The intergenerational correlation of educational attainment (λ)

(ii) The labour market returns to qualifications (γ)

We now consider whether λ and γ are greater in more unequal countries.

Table 4 presents differences between low and high parental education groups in terms of (i) obtaining a bachelor's degree and (ii) PIAAC numeracy test scores. These are our measures of λ.

<< Table 4 >>

Differences by parental education in offspring's educational attainment are large and significantly significant in all countries – though there is also substantial cross-national variation. Gaps are comparatively small in Scandinavia; individuals from low parental education backgrounds are 24 percentage points less likely to graduate from university than individuals from high parental education backgrounds in Sweden, for example. On the other

hand, there is a 50 percentage point difference in the probability of university graduation in the transition economies (Slovak Republic, Czech Republic, Poland and Russia)[19]. Elsewhere, parental education differences in university graduation are comparatively large in Italy, Japan and the United States (approximately 45 to 50 percentage point gaps) relative to Austria and Canada (25 to 30 percentage point gaps).

Figure 5 plots these estimates of λ against income inequality, with university graduation results in panel (a) and numeracy test scores in panel (b). A reasonably strong and statistically significant association is observed in both. The Pearson correlation equals 0.74 in panel a (Spearman's rank = 0.74), where there is a 15 percentage point increase in the difference between low and high parental education groups graduating from university for each 0.10 increase in the Gini coefficient. Although the correlation is weaker in panel b (Pearson = 0.52, Spearman = 0.50, p = 0.03), a 0.10 increase in the Gini coefficient is still associated with a 0.28 standard deviation increase in low-high parental education differences in numeracy test scores.

This provides further indicative evidence that access to financial resources matter in the intergenerational transmission process. As discussed in section 2, heredity transfers are unlikely to vary across countries, while there is no obvious theoretical reason why non-financial parental investments would vary by income inequality (see Appendix A for empirical evidence on this matter). In contrast, disparities in financial resources by parental education group will clearly be greater in more unequal countries, translating into bigger differences in financial investments in children's development. Consequently, it is the *financial resource component* of parental education that is the most credible explanation as to why λ is positively associated with income inequality.

<< Figure 5 >>

Table 5 examines financial returns to higher education qualifications (γ) by presenting the earnings differential between university and high school (upper secondary) graduates.

<< Table 5>>

[19] The gap in numeracy scores is equally as stark, standing at more than one standard deviation in the Slovak Republic and Czech Republic, compared to approximately half a standard deviation in Scandinavia.

Wage returns are particularly high in the United States, where university graduates earn, on average, double the amount of high school graduates ($\gamma = 0.73$; $\exp(\gamma) = 1.07$). Returns are also high in Canada, Belgium, Ireland, Germany and England and Northern Ireland, where the graduate wage premium is approximately 60 percent or more. In contrast, there is just a 27 percent wage differential in Italy, 38 percent in Sweden and 42 percent in Japan. The Scandinavian countries are all within the bottom half of the table (comparatively low returns).

Figure 6 illustrates the link between these estimated γ and income inequality. Although there is an association (Pearson = 0.42, Spearman = 0.42, p = 0.10), a small number of countries have a big influence upon this result; the exclusion of Italy substantially increases the observed correlation (Pearson = 0.63), while the deletion of the United States dramatically reduces it (Pearson = 0.22). Indeed, the association actually turns negative with the removal of just three data points (Sweden, Ireland and the United States). Consequently, although differential returns to education across countries may have some influence upon our version of the GGC, it seems likely that the intergenerational correlation of education is the more important of the two indirect (through education) components.

Summary

This section has highlighted five key results:

(i) The GGC can be replicated using alternative measures of intergenerational mobility and cross-nationally comparable data. The strength of the association depends, however, upon whether transition economies are included.

(ii) In all countries, it is educational attainment that is driving the link between parental education and offspring earnings.

(iii) The association between income inequality and the "through education" component of the intergenerational transmission process is particularly pronounced.

(iv) Although income inequality is associated with both access to higher education and its financial returns, the strength and robustness of its relationship with the former is more secure than the latter. This suggests that it is the intergenerational correlation of education that is driving the link between income inequality and the "through education" component of β.

(v) The fact that the association between parental education, offspring education and offspring earnings varies by income inequality suggests that financial resources play an important role in the intergenerational transmission of advantage.

5. Conclusions

Income inequality is high and rising in a number of developed countries. Both academics and policymakers fear that this may have negative implications for future rates of social mobility. Much of this concern stems from the Great Gatsby Curve – which illustrates how economically unequal countries also tend to be the least socially mobile. However, due to variation across countries in data quality and methods used, concerns have been raised regarding the robustness of the GGC relationship (Jerrim, Choi and Rodriguez 2014; Jantti and Jenkins, 2013). Moreover, if the GGC does exist, what are the mechanisms underpinning it? Little is currently known about this important issue, including the potential role of educational attainment.

The original contribution of this paper is hence twofold. First, we have attempted to replicate the GGC using cross-nationally comparable data and an alternative definition of intergenerational mobility. Second, we have empirically investigated the potential mediating role of educational attainment in the relationship between income inequality and intergenerational mobility for the first time. Our results suggest that, despite the concerns of the aforementioned authors, the GGC can indeed be reproduced using the cross-nationally comparable PIAAC dataset (where mobility has been measured as the link between parental education and offspring earnings). Moreover, after decomposing this relationship, we find that the part of intergenerational mobility accounted for by education is particularly closely related to income inequality. This seems to be driven by the link between the intergenerational correlation of education (λ) and income inequality, rather than the labour market returns to qualifications (γ). Hence it is *access to*, rather than the *returns from*, education that is most likely driving the 'through education' component of our version of the GGC.

These findings have important implications for both academic understanding of intergenerational mobility and contemporary public policy debates. Families' financial resources are central to Becker's (1964) theory of human capital. This theory stipulates that families with greater financial resources (a) have more capacity to invest in their offspring's

human capital and (b) will invest more in their children when the economic incentives to do so are high (i.e. when the returns to human capital are larger). As explained in section 2, differences in financial resources between parental education groups are likely to be larger in more unequal countries (relating to point a), with the economic returns to qualifications also likely to be higher (relating to point b). Consequently, Becker's (1964) model of human capital suggests that a strong relationship between income inequality and the 'through education' component of intergenerational mobility ($\lambda^* \gamma$) should be observed. Results from our empirical analysis very much support this view, hence implying that financial resources available to families play an important role in the transfer of social advantage across generations. Thus ensuring adequate access to such resources, potentially through condensing the income distribution, may be pivotal in ensuring young people have equal opportunities to succeed.

These findings should, of course, be considered in light of the limitations of our study. First, we remind readers it is only currently possible to examine *associations* between income inequality and intergenerational mobility, rather than producing causal estimates. Second, the number of countries with high quality income inequality and intergenerational mobility data remains restricted. Indeed, our analysis is based upon the experiences of 23 countries (18 when transition economies are excluded), meaning statistical power is limited[20]. Finally, due to the above, it has only been possible to perform cross-sectional analyses. Yet a longitudinal study, investigating whether *change* in income inequality across countries is associated with *change* in rates of social mobility, would provide stronger evidence as to whether there is indeed a causal relationship between the two. However, although these are clearly important directions for future research, they will only become possible when new data are made available.

Thus, while we stress that our results refer to *associations* only, they nevertheless suggest that educational inequality is likely to be a key factor mediating the link between income inequality and intergenerational mobility. Likewise, our findings highlight how parental access to financial resources is likely to play a key role in the intergenerational transmission of social advantage. Policies focused on the redistribution of financial resources, and on minimising educational disparities between rich and poor, are therefore likely to be vital in ensuring the next generation of young people have equal opportunities to succeed.

[20] Consequently, attempting to include country level control factors in an analysis is not a credible empirical strategy.

References

Andrews, Dan and Andrew Leigh. 2009. 'More inequality, less social mobility.' *Applied Economics Letters* 16: 1489 - 1492.

Atkinson, Anthony. 1980. 'Inheritance and the redistribution of wealth.' In *Public Policy and the Tax System* edited by Gordon Hughes and G.M. Heal. Allen and Unwin: London.

Atkinson, Anthony and Stephen Jenkins. 1984. 'The steady state assumption and the estimation of distributional and related models.' *Journal of Human Resources* 19(3): 358-76.

Atkinson, Anthony and Andrea Brandolini. 2001. 'Promise and pitfalls in the use of 'secondary' data-sets: income inequality in OECD countries as a case study.' *Journal of Economic Literature* 39(3): 771 – 799.

Atkinson, Anthony. 2004. 'The Luxembourg Income Study (LIS): Past, present and future.' *Socio-Economic Review* 2: 165-190.

Becker, Gary. 1964 *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. National Bureau of Economic Research, New York.

Becker, Gary and Nigel Tomes. 1986. 'Human capital and the rise and fall of families.' *The Journal of Labor Economics* 4(3):S1-S39.

Blanden, Jo. 2013. 'Cross-national rankings of intergenerational mobility: A comparison of approaches from economics and sociology.' *Journal of Economic Surveys* 27(1):38–73.

Blau, Peter and Otis Duncan. 1967. *The American Occupational Structure*. New York: Wiley.

Chadwick, Laura and Gary Solon. 2002. 'Intergenerational income mobility among daughters.' *American Economic Review* 92(1):335-344.

Corak, Miles. 2013. 'Income equality, equality of opportunity, and intergenerational mobility.' *Journal of Economic Perspectives* 27(3): 79 – 102.

Cunha, Flavio, James Heckman, Lance Lochner and Dimitriy Masterov. 2006. 'Interpreting the evidence on life cycle skill formation.' Pp. 698-812 in *Handbook of the Economics of Education*, edited by Eric Hanushek and Finis Welch. Amsterdam: Holland North.

Deininger**,** Klaus and Lyn Squire. 1996. 'A new data set measuring income inequality.' *The World Bank Economic Review* 10(3): 565-91.

Duncan, Otis and Robert Hodge. 1963. 'Education and occupational mobility. A regression analysis.' *American Journal of Sociology* 68(6): 629-44.

Duncan, Gregg and Richard Murnane. 2011. *Whither Opportunity*. *Rising Inequality and the Uncertain Life Chances of Low-Income Children*. New York: Russell Sage Foundation.

Economic Report of the President. 2012. 'Economic report of the President.' Accessed 16/04/13 from http://www.nber.org/erp/ERP_2012_Complete.pdf

Ermisch, John, Markus Jäntti and Timothy Smeeding. 2012. *Inequality from Childhood to Adulthood: A Cross-National Perspective on the Transmission of Advantage*. New York: Russell Sage Foundation.

Gregg, Paul, Jan Jonsson, Lindsey Macmillan and Carina Mood. 2013. 'Understanding income mobility: the role of education for intergenerational income persistence in the US, UK and Sweden.' DoQSS working paper 13-12. Accessed 14/03/2014 from http://ideas.repec.org/p/qss/dqsswp/1312.html

Haider, Steven and Gary Solon. 2006. 'Life-cycle variation in the association between current and lifetime earnings.' *American Economic Review* 96(4): 1308-1320.

Hammersmith, Daniel and Jeff Biddle. 2001. 'Beauty and the Labor Market.' *American Economic Review* 84(5): 1174-1194.

Heckman, James. 2013. 'The economics and econometrics of human development. Presentation given at the 8th Vienna seminar of Nobel Laureates. Accessed 09/01/2014 from http://www.wu.ac.at/start/james_heckman.pdf

Jäntti, Markus and Stephen Jenkins. 2013. 'Income mobility.' *IZA Discussion Paper*s 7730. Accessed 29/11/2013 from http://ftp.iza.org/dp7730.pdf.

Jerrim, John. 2014. 'The link between family background and later lifetime income: how does the UK compare to other countries?' DoQSS working paper series 14/02. Accessed 14/03/2014 from http://ideas.repec.org/p/qss/dqsswp/1402.html

Jerrim, John, Álvaro Choi and Rosa Roriguez. 2014. 'Cross-national comparisons of intergenerational mobility: are the earnings measures used robust?' DoQSS working paper.

Krueger, Alan. 2012. 'The rise and consequences of inequality.' Presentation made to the Center for American Progress, January 12th 2012 Washington. Accessed 13/12/12 from http://www.whitehouse.gov/sites/default/files/krueger_cap_speech_final_remarks.pdf

Krugman, Paul. 2012. 'The Great Gatsby Curve.' *The New York Times.* Accessed 10/01/14 from http://krugman.blogs.nytimes.com/2012/01/15/the-great-gatsby-curve/?_r=0

Obama, Barack. 2013. Full Transcript: President Obama's December 4 remarks on the economy. Speech on economic mobility and the affordable care act, reported by the Washington Post. Accessed 14/03/2014 from http://www.washingtonpost.com/politics/running-transcript-president-obamas-december-4-remarks-on-the-economy/2013/12/04/7cec31ba-5cff-11e3-be07-006c776266ed_story.html .

OECD. 2012. "Growing income inequality in OECD countries: what drives it and how can policy tackle it?" OECD forum on tackling inequality. Accessed 02/11/13 from http://www.oecd.org/els/socialpoliciesanddata/47723414.pdf.

OECD. 2013. 'Programme for International Assessment of Adult Competencies (PIAAC) technical report.' OECD: Paris. Accessed 14/03/2014 from http://www.oecd.org/site/piaac/publicdataandanalysis.htm

Solon, Gary. 2002. 'Cross-country differences in intergenerational earnings mobility.' *Journal of Economic Perspectives* 16(3): 59 - 66.

Solon, Gary. 2004. 'A model of intergenerational mobility variation over time and place.' PP 38 – 47 in *Generational Income Mobility in North America and Europe* edited by Miles Corak. Cambridge: Cambridge University Press.

The Economist. 2013. 'The Great Gatsby Curve: Don't worry, old sport'. Accessed 14/03/2014 from http://www.economist.com/blogs/democracyinamerica/2013/07/great-gatsby-curve.

The White House. 2013. 'What is the Great Gatsby Curve?' Accessed 01/07/2013 from http://www.whitehouse.gov/blog/2013/06/11/what-great-gatsby-curve

Wilkinson, Richard and Kate Pickett. 2009. *The spirit level: why equality is better for everyone*. Penguin Books.

Table 1. Descriptive statistics

	Response rate	Non-response bias analysis	Sample size
Korea (KR)	75	Minimal	2,081
Cyprus (CY)	73	Minimal	982
Ireland (IE)	72	Minimal	1,389
Australia (AU)	71	Minimal	2,599
United States (US)	70	Low	1,380
France (FR)	67	Minimal	1,860
Czech Republic (CZ)	66	Low	1,206
Finland (FI)	66	Minimal	1,541
Slovak Republic (SK)	66	Low	1,313
Estonia (EE)	63	Low	1,607
Belgium (BE)	62	Low	1,370
Norway (NO)	62	Low	1,562
Canada (CA)	59	Minimal	7,707
England and Northern Ireland (GB)	59	Low	2,011
Poland (PL)	56	Low	1,393
Germany (DE)	55	Low	1,731
Italy (IT)	55	Low	1,121
Austria (AT)	53	Low	1,592
Russia (RU)	52	Unknown	472
Netherlands (NL)	51	Low	1,420
Denmark (DK)	50	Low	1,967
Japan (JP)	50	Low	1,528
Spain (ES)	48	Low	1,336
Sweden (SE)	45	Low	1,455

Notes: 'Non-response bias analysis' performed by the survey organisers for countries with response rates below 70 percent. Their summary of likely bias provided in the table. Non-response bias is assumed to be 'minimal' in countries where response rates are greater than 70 percent. Sample size is reported *after* restrictions applied in this paper have been made.

Table 2. The estimated difference in earnings between individuals from 'low' and 'high' parental education backgrounds

	β	SE	% difference [exp(β)]
USA	0.56	0.09	75
Slovak Republic	0.55	0.10	74
Poland	0.47	0.10	61
England and Northern Ireland	0.41	0.07	51
Japan	0.37	0.06	44
France	0.33	0.04	40
South Korea	0.33	0.05	40
Ireland	0.33	0.07	39
Spain	0.30	0.13	35
Italy	0.28	0.18	33
Czech Republic	0.26	0.06	30
Australia	0.25	0.05	28
Estonia	0.25	0.06	28
Germany	0.24	0.08	27
Canada	0.22	0.04	25
Denmark	0.21	0.06	24
Cyprus	0.21	0.07	23
Russia	0.21	0.21	23
Austria	0.20	0.07	22
Finland	0.17	0.05	19
Sweden	0.14	0.04	15
Netherlands	0.14	0.04	15
Belgium	0.14	0.04	15
Norway	0.12	0.05	13

Notes: Authors' estimates using the PIAAC dataset. Figures refer to the earnings differential between individuals from advantaged (high parental education) and disadvantaged (low parental education) backgrounds. SE refers to the standard error.

Table 3. Decomposition of the intergenerational association into the 'direct' and 'indirect' effect of family background on offspring labour market earnings

	Total (β)		**Through Ed (γ*λ)**		**Not through Ed (δ)**	
	β	**SE**	γ*λ	**SE**	δ	**SE**
Slovak Republic	0.55	0.10	0.32	0.06	0.23	0.12
Japan	0.37	0.06	0.17	0.02	0.19	0.06
England and Northern Ireland	0.41	0.07	0.23	0.03	0.18	0.07
Korea	0.33	0.05	0.20	0.02	0.14	0.05
Poland	0.47	0.10	0.34	0.04	0.14	0.10
USA	0.56	0.09	0.43	0.04	0.13	0.08
Estonia	0.25	0.06	0.13	0.02	0.12	0.06
France	0.33	0.04	0.23	0.02	0.10	0.04
Russia	0.21	0.21	0.11	0.12	0.10	0.12
Canada	0.22	0.04	0.15	0.02	0.07	0.04
Australia	0.25	0.05	0.18	0.02	0.07	0.05
Italy	0.28	0.18	0.22	0.07	0.06	0.18
Denmark	0.21	0.06	0.16	0.02	0.06	0.06
Spain	0.30	0.13	0.25	0.03	0.05	0.14
Ireland	0.33	0.07	0.29	0.04	0.04	0.06
Sweden	0.14	0.04	0.10	0.01	0.04	0.04
Austria	0.20	0.07	0.18	0.03	0.02	0.08
Finland	0.17	0.05	0.16	0.02	0.02	0.05
Czech Republic	0.26	0.06	0.26	0.04	0.01	0.08
Germany	0.24	0.08	0.26	0.04	-0.02	0.07
Netherlands	0.14	0.04	0.16	0.03	-0.02	0.05
Cyprus	0.21	0.07	0.25	0.03	-0.04	0.06
Belgium	0.14	0.04	0.18	0.02	-0.05	0.05
Norway	0.12	0.05	0.18	0.02	-0.05	0.06

Notes: Authors' estimates using the PIAAC dataset. The left hand columns provide the total earnings differential between individuals from advantaged (high parental education) and disadvantaged (low parental education) backgrounds. The right hand columns provide the analogous earnings differential after the offspring's own educational attainment has been controlled (the 'direct effect'). The middle columns give the difference between the two (the 'indirect effect').

Table 4. Socio-economic differences in university graduation rates and PIAAC numeracy test scores (λ)

	University access		PIAAC test scores	
	Percentage point difference	**Standard error**	**Effect size**	**Standard error**
Czech Republic	57.1	4.1	0.61	0.28
Slovak Republic	57.0	3.8	1.14	0.42
Poland	55.2	4.4	1.04	0.39
Italy	51.5	4.9	0.86	0.33
Russia	49.9	3.9	0.30	0.14
Cyprus	49.7	4.7	0.77	0.30
United States	46.0	2.5	1.27	0.47
Spain	45.6	3.5	0.80	0.30
Japan	44.1	3.4	0.50	0.20
France	43.0	2.8	0.90	0.33
England and Northern Ireland	42.7	4.2	1.10	0.41
Norway	36.9	2.6	0.69	0.25
Korea	36.2	3.6	0.50	0.19
Netherlands	36.1	3.1	0.57	0.22
Australia	34.5	2.4	0.66	0.25
Germany	34.0	3.4	0.98	0.38
Estonia	33.9	2.2	0.59	0.22
Ireland	33.3	3.1	0.78	0.28
Belgium	32.7	2.6	0.72	0.27
Austria	29.4	2.7	0.73	0.28
Finland	28.8	3.4	0.66	0.25
Canada	28.3	2.2	0.78	0.29
Denmark	23.9	2.3	0.63	0.24
Sweden	23.7	2.5	0.58	0.22

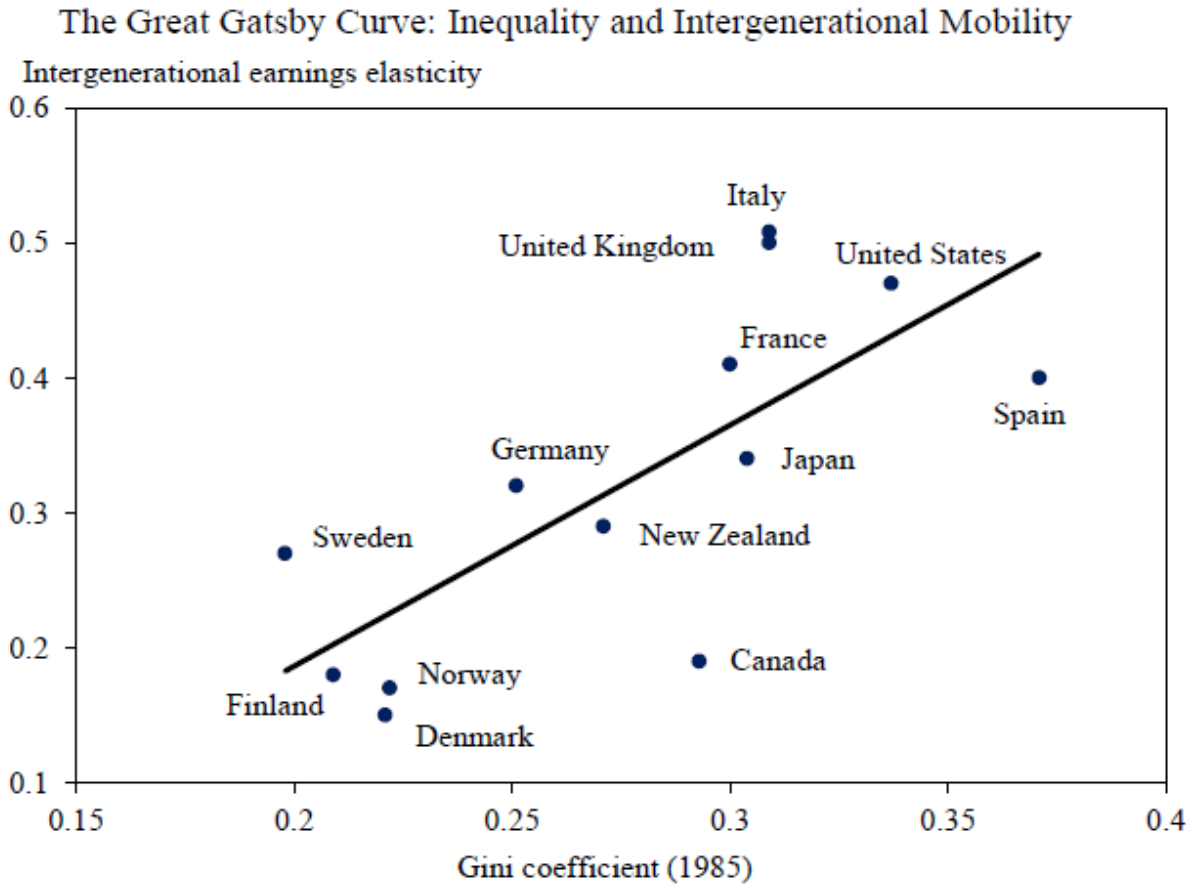
Notes: Authors' calculations using the PIAAC dataset. Left hand columns provide the estimated percentage point difference in holding a bachelor's degree between individuals from high and low parental education backgrounds. The right hand columns are the difference in PIAAC numeracy test scores between individuals from high and low parental education backgrounds, expressed as an effect size (standard deviation differences).

Table 5. The wage returns to university qualifications (γ)

	γ	SE	% difference [exp(γ)]
USA	0.73	0.07	107
Ireland	0.63	0.07	88
Germany	0.57	0.06	76
Poland	0.52	0.05	68
Slovak Republic	0.50	0.09	64
Belgium	0.48	0.04	62
England and Northern Ireland	0.47	0.05	61
Spain	0.47	0.06	60
Korea	0.45	0.05	58
Canada	0.45	0.04	57
Austria	0.45	0.06	56
France	0.44	0.04	55
Australia	0.43	0.04	54
Cyprus	0.42	0.04	52
Czech Republic	0.41	0.07	51
Netherlands	0.41	0.07	51
Finland	0.39	0.03	47
Norway	0.38	0.05	47
Denmark	0.37	0.05	45
Russia	0.36	0.34	43
Japan	0.35	0.05	42
Estonia	0.35	0.05	41
Sweden	0.33	0.03	38
Italy	0.24	0.07	27

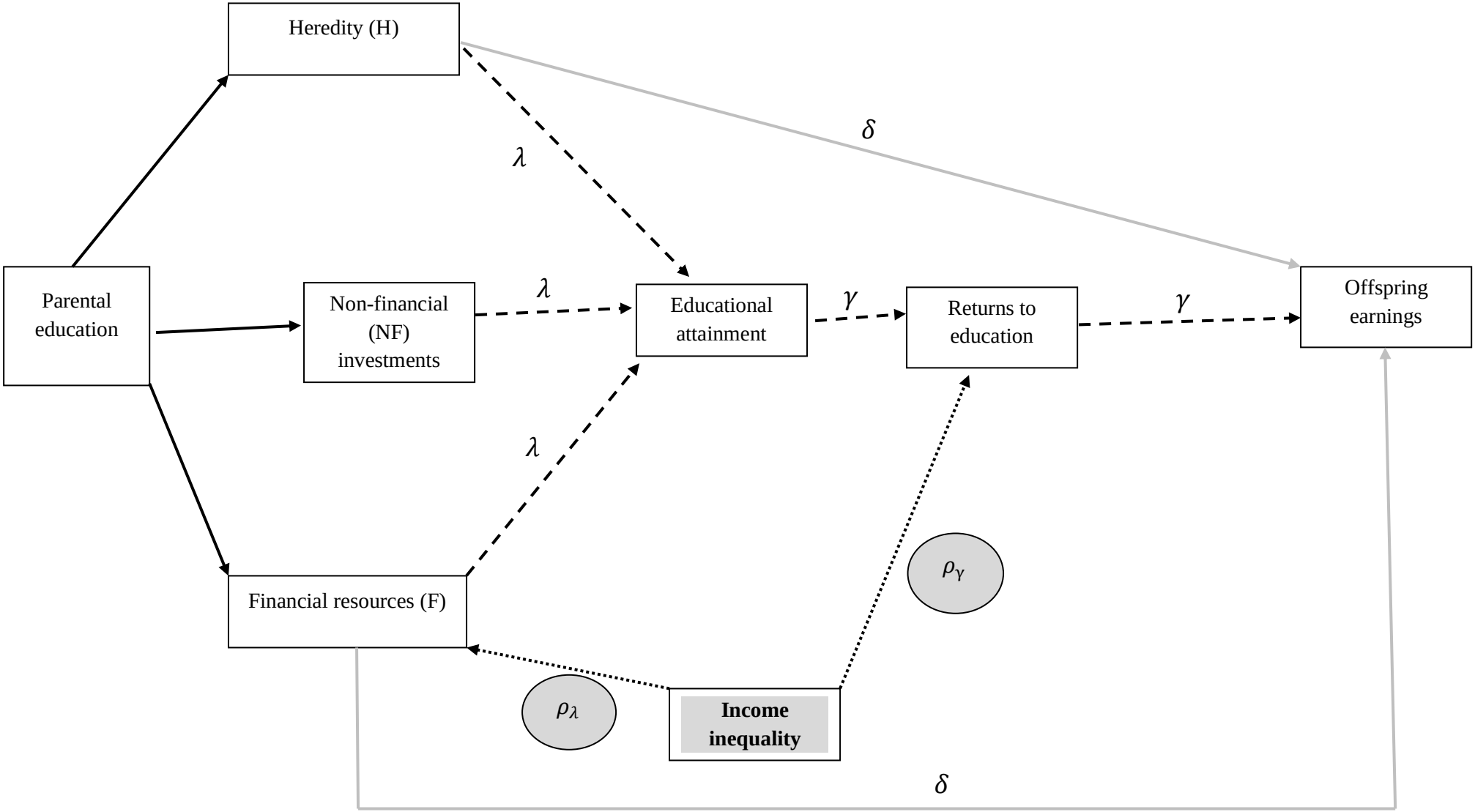
Notes: Figures refer to the difference in earnings between individuals holding a university degree relative to high school education or below. The left-hand most figures refer to the estimated regression coefficients, while the right hand column converts these into percentage differences. SE column provides the standard errors.

Figure 1. The Great Gatsby Curve: the cross-national link between inequality and intergenerational mobility



Source: Economic Report to the President (2012:177).

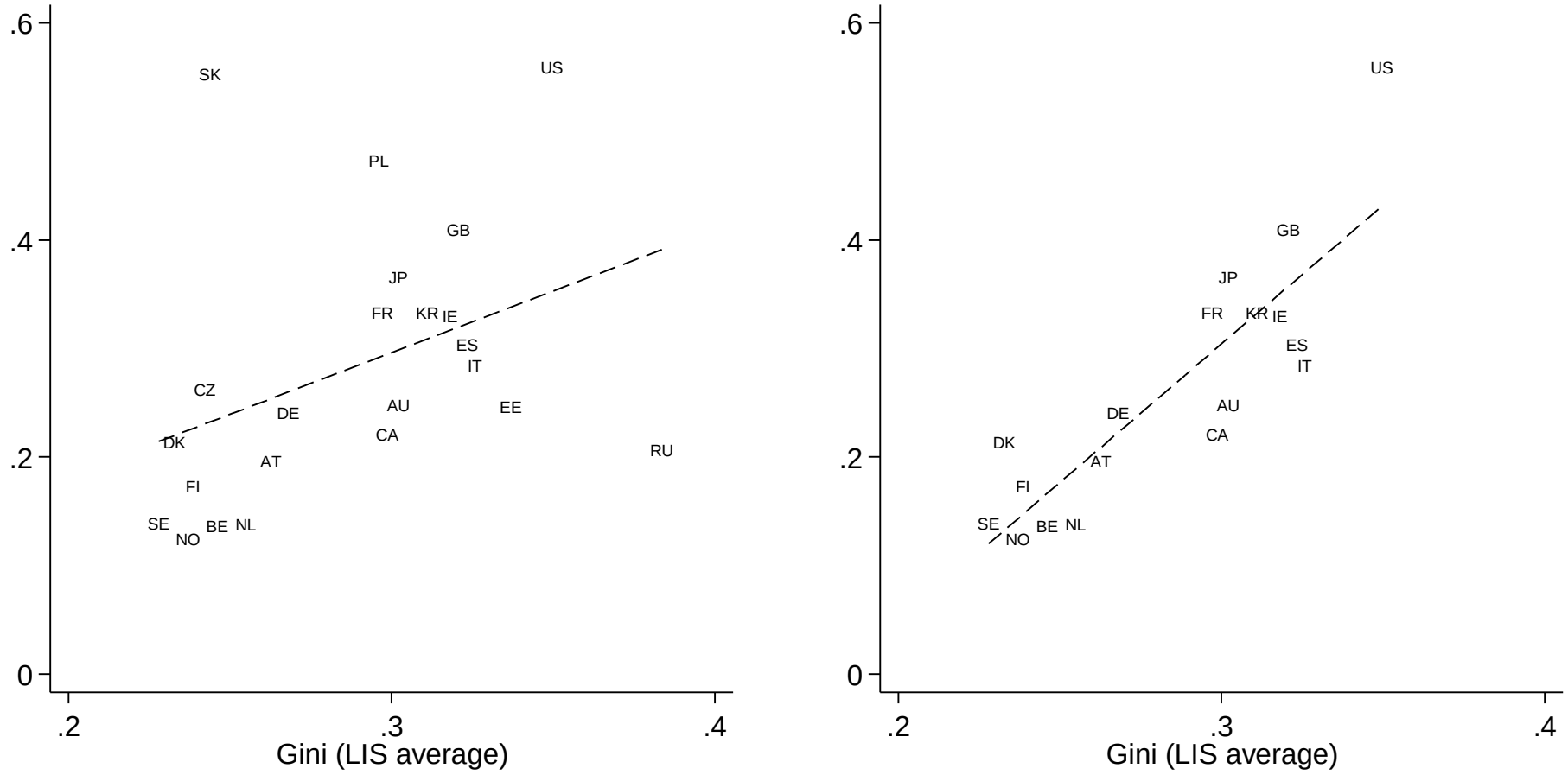
Figure 2. Income inequality and the intergenerational transmission of (dis)advantage



Notes: H indicates a heredity pathway. NF indicates a non-financial pathway. F indicates a financial pathway. λ is the estimated link between income inequality and offspring educational attainment. γ is the estimated link between income inequality and the returns to education. ρ_λ refers to the correlation with income inequality.

Figure 3. Income inequality and the link between family background and labour market earnings

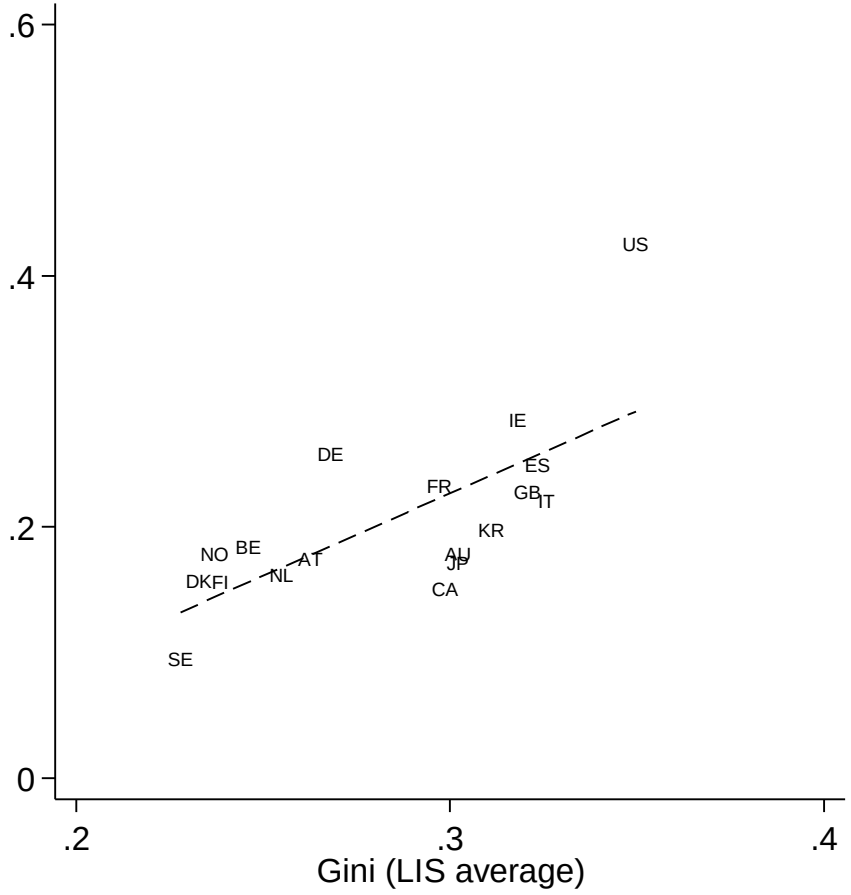
(a) All PIAAC countries **(b) Transition economies excluded**



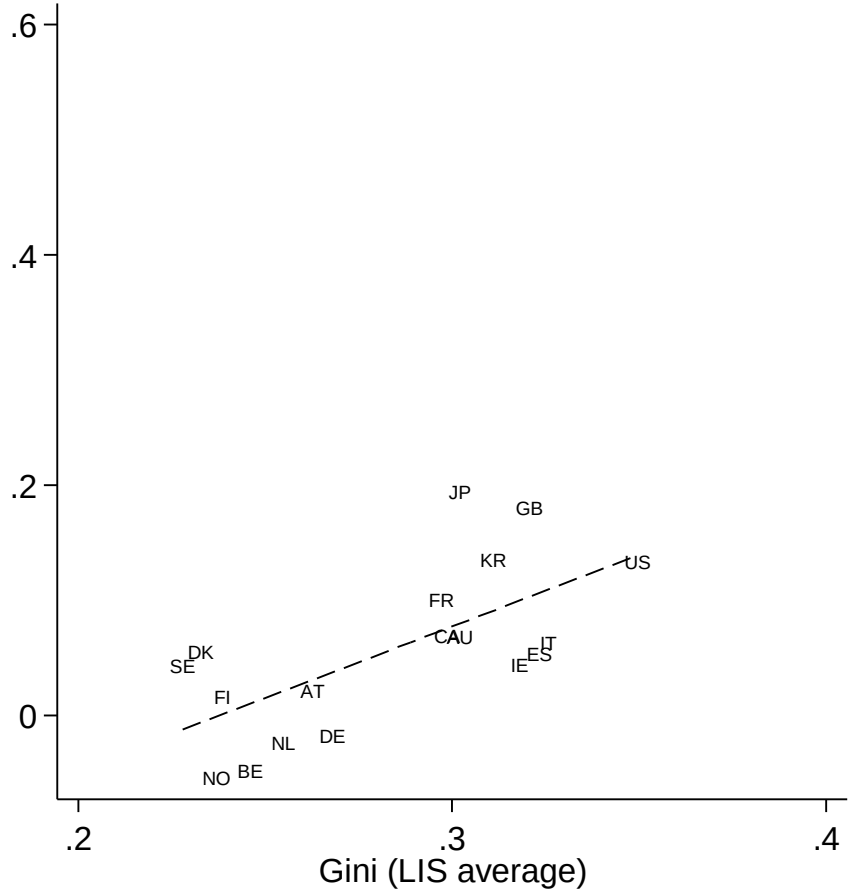
Notes: Authors' calculations using the PIAAC dataset. Left hand panel includes all countries with data available (Pearson correlation = 0.39 and Spearman's $rank = 0.49). Right hand panel excludes transition economies (Pearson correlation = 0.86 and Spearman's rank = 0.81). See Table 1 for country codes.

Figure 4. A decomposition of the Great Gatsby Curve

(a) Indirect effect (working through child's education)



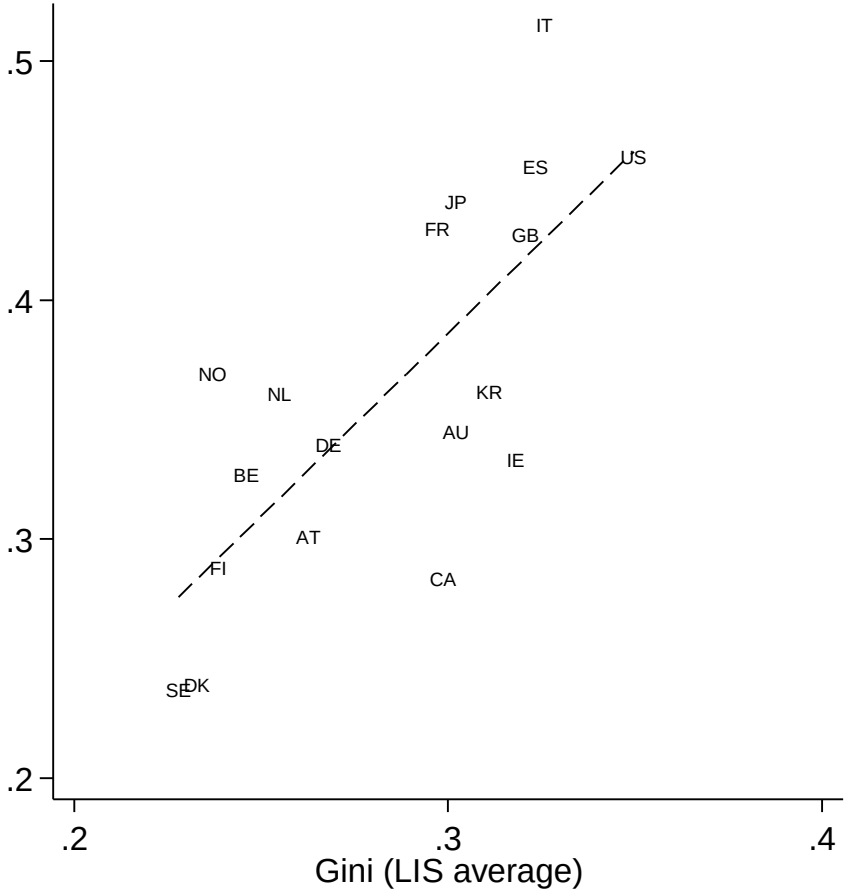
(b) Direct effect of family background



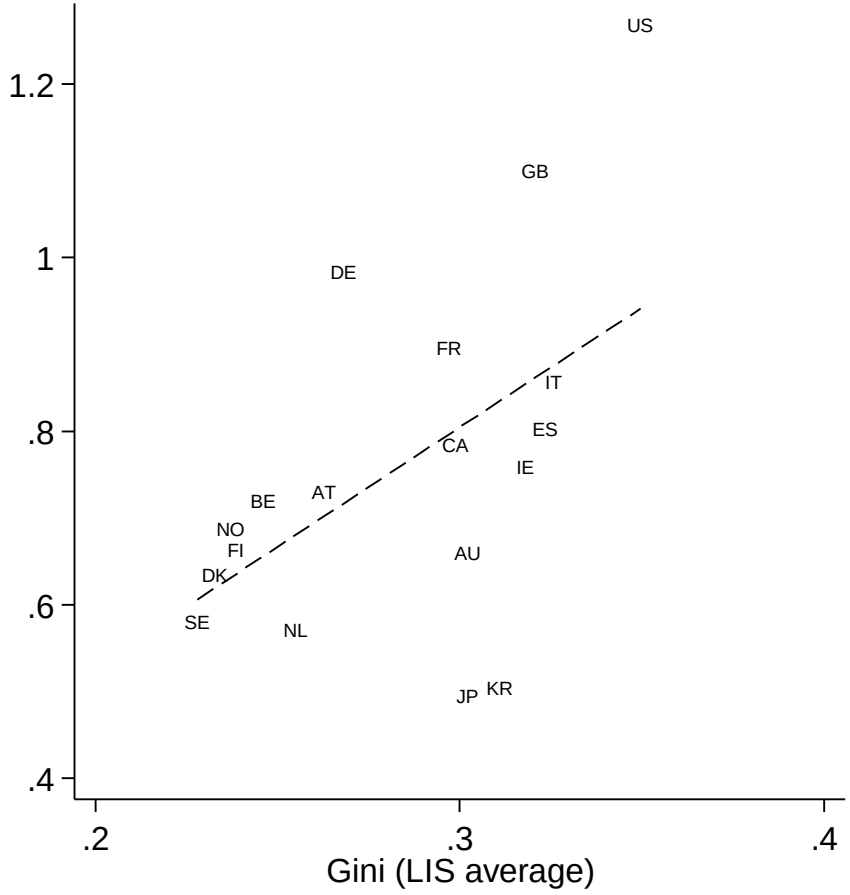
Notes: The left hand panel illustrates the relationship between income inequality and the *indirect effect* of parental education on offspring income (i.e. the part that works through offspring's education attainment). Pearson correlation equals 0.70. Right hand panel illustrates the relationship between income inequality and the *direct effect* of parental education on offspring income (i.e. net of the offspring's educational attainment). Pearson correlation equals 0.67.

Figure 5. Income inequality and socio-economic difference in educational attainment (and test scores)

(a)University graduation

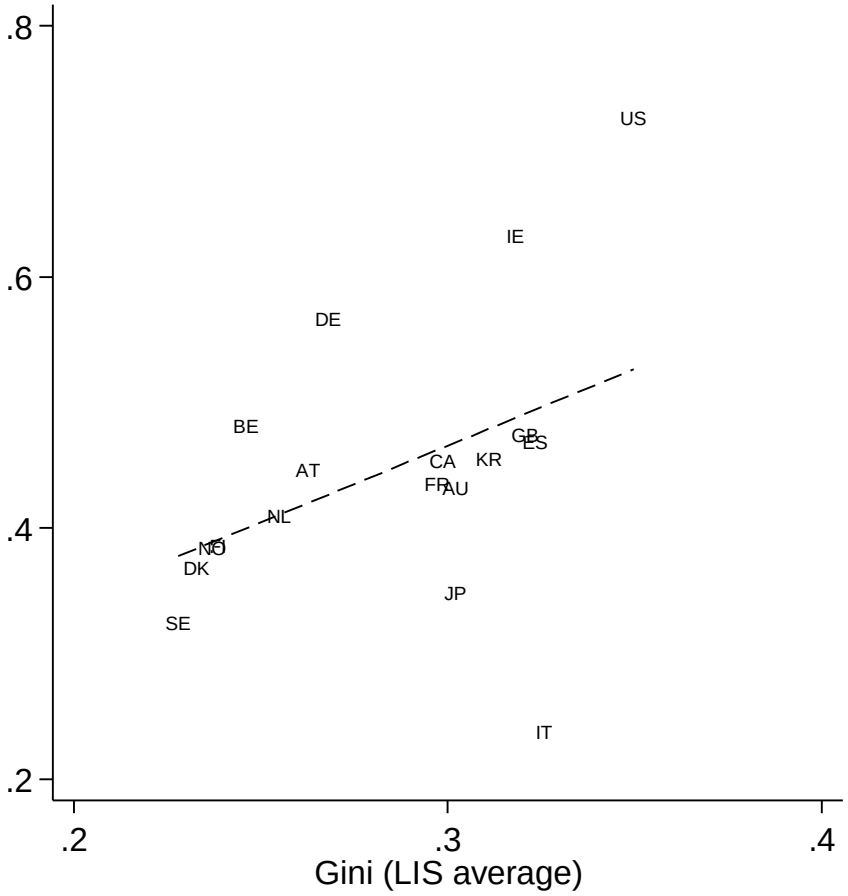


(b)PIAAC test scores



Notes: The left hand panel illustrates the relationship between income inequality and the high-low parental education gap in holding a bachelor's degree. Pearson correlation equals 0.74. The right hand panel illustrates the relationship between income inequality and the estimated high-low parental education gap in respondents' PIAAC numeracy test scores. Pearson correlation equals 0.52. See Table 1 for country codes.

Figure 6. Income inequality and the wage returns to university education across countries



Notes: Authors' calculations using the PIAAC dataset. Figures on the y-axis refer to the percentage difference in wages between individuals holding a bachelor degree (or higher) relative to individuals with only post-secondary education. Correlation coefficient = 0.42 (0.63 with Italy excluded and 0.22 when United States is excluded). See Table 1 for country codes.

Appendix A. Income inequality and differences in investments by parental education group

Section 2 presents a theoretical framework linking parental education to offspring's educational attainment and earnings. Parental education is supposed to influence offspring education via three channels: heredity (H), non-financial inputs (NF) and financial inputs (F). We argue that:

(i) the impact of heredity is unlikely to vary across countries;
(ii) the link between parental education and non-financial inputs (NF) into children's schooling is *unlikely* to vary with income inequality
(iii) the link between parental education and financial inputs (F) *does* vary with income inequality (as channel F is picking up the " financial resources" component of parental education).

Points (ii) and (iii) are now examined empirically using the 2000 round of the Programme for International Student Assessment (PISA)[21]. This is a study of 15 year olds cognitive achievement across OECD countries In 2000 it was conducted across all OECD countries.

As part of PISA, children were asked:

During the last three years, have you attended any of these special courses <u>outside of your school</u> to improve your results?

- *Private tutoring*
  (a) Never
  (b) Sometimes
  (c) Regularly

In most countries, out-of-school private tuition represents a major financial investment by parents in their children's development. This is therefore a good indicator of a significant "financial input" (F). We hypothesise that the probability of a child receiving private tuition differs by parental education group, but also that the magnitude of this difference is greater in high income inequality countries. This is because differences in financial resources available by parental education group will be greater when the income distribution is more dispersed.

[21] We use the 2000 wave of PISA as subsequent rounds do not contain such detailed information on parental inputs into their children's development – particularly with regards indicators of non-financial assistance with their schooling.

In turn, this means that there will also be bigger differences in capacities to invest in things like private tuition by parental education group (as discussed in section 2).

To test this hypothesis, we estimate the follow linear probability model:

$$T_{ij} = \alpha + \beta . P_i + \varepsilon_{ij} \quad \nabla K \qquad \text{(A1)}$$

Where:

T = A binary indicator of amount of private tuition (0 = Never, 1 = sometimes or regularly)

P = A vector of parental education dummy variables (Ref: 'low' = ISCED 0 – 2).

i = child i

j = school j

K = Country K

Parental education is measured using the same groupings as in the main body of the paper:

- Low = Neither parent has obtained upper secondary schooling
- Middle = At least one parent has attained secondary and post-secondary, non-tertiary education
- High = At least one parent has attained tertiary education

Estimates presented in this Appendix are hence based upon consistent definitions with those in the main text. The parameter of interest is the β coefficient for the 'high' parental education group (bachelor degree or higher). This captures the probability difference between children from low and high parental education backgrounds receiving private tuition.

These β coefficients are plotted against the Gini coefficient for 19 (non-transition) OECD countries with relevant data were available in Figure A1 panel (a). (Very similar results are obtained if we restrict the analysis to the 15 countries for whom PIAAC data, used in the main body of the paper, is also available). There is a pronounced relationship between the magnitude of the parental education – private tuition gap and income inequality. The Pearson correlation coefficient equals 0.65 and Spearman's rank 0.73. (Note that the strength of these correlations remain above 0.65 even when the four outing observations are removed). This illustrates that differences in substantial financial investments in children's schooling by parental education group tend to be larger in high income inequality countries.

<< Appendix Figure A1>>

Children were also asked the following question(s) about assistance with schoolwork:

How often do the following people work with you on your schoolwork?

- Your mother
- Your father
- Your brothers and sisters

Responses were recorded on a five point scale, ranging from never or hardly ever (lowest option) through to several times a week (highest option). The survey organisers then created a standardised 'family educational support' scale.

This scale is used as a measure of 'non-financial' investments made by families in their children's education. Our hypothesis is that although this will differ substantially by parental education group, and may vary across countries, it is unlikely to be strongly linked to income inequality. To examine this further, we re-estimate the OLS regression model presented in Equation A1, but now using a different response variable ('S'). This refers to the standardised scale of family support. Formally:

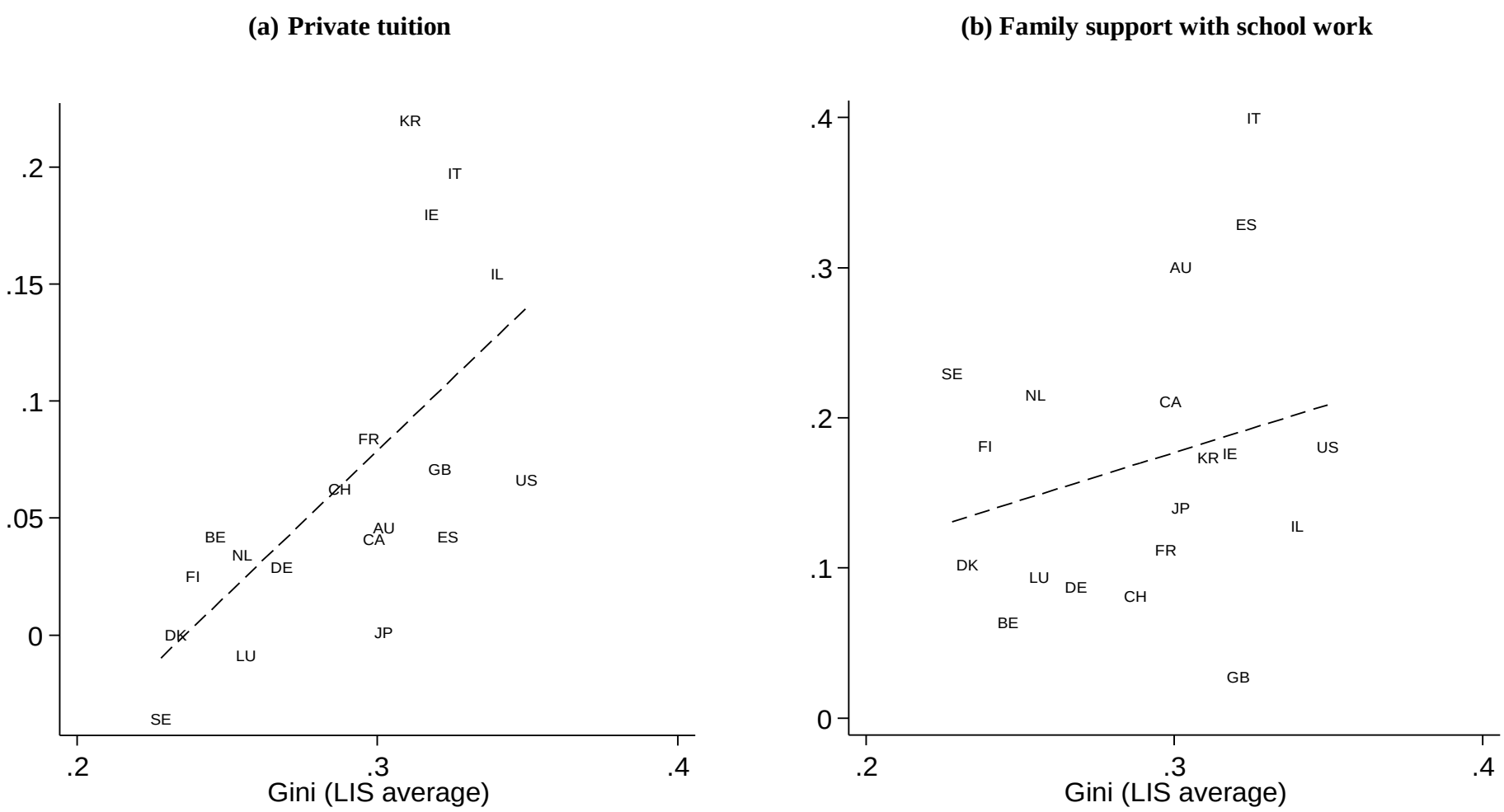
$$S_{ij} = \alpha + \gamma . P_i + \varepsilon_{ij} \quad \nabla K \qquad \text{(A2)}$$

Where S = A scale of family support with children's schoolwork (standardised across all PISA countries by the survey organisers to mean 0 and standard deviation 1).

The parameter of interest from equation A2 is γ. This captures the difference in parental support between the high and low parental education groups (i.e. it is analogous to the β coefficient discussed in reference to equation A1). These γ coefficients are plotted against the Gini coefficient in Appendix Figure A1 panel (b).

In all countries children from high parental education backgrounds receive more family support with their school work than children from low parental education backgrounds. However, the relationship with income inequality is relatively weak. The Pearson correlation stands at just 0.25 (Spearman's rho 0.20). Moreover, these correlations would fall below 0.05 if Spain and Italy were excluded. This is consistent with arguments made in section 2; non-financial investments in children's education differ across countries and by parental education group, but are not related to income inequality.

Appendix Figure A1. The link between income inequality and differences in parental investments by parental education group



Notes: Authors' calculations using the PISA 2000 dataset. Y-axis in left hand panel illustrates difference in probability of receiving private tuition between children from 'low' and 'high' parental education background. Y-axis in left hand panel illustrates effect size differences in family support with school work, comparing children form 'low' and 'high' parental education backgrounds. Pearson correlation coefficient in the left hand panel equals 0.65 and Spearman's rank 0.73. Pearson correlation in the right hand panel equals 0.25 and Spearman's rho 0.20

Appendix B .Use of a seven category education schema versus a three category schema

A detailed seven-category schema is used to control for educational attainment when decomposing the link between family background and labour market earnings into the part that works through education (indirect) and that not associated with education (direct). By contrast, when we consider the role of educational inequality and the returns to education separately in the final stage of the paper, a three-category schema is used to avoid over-complicating the descriptive analysis. We may therefore be understating the indirect component in the latter analysis. Here we consider whether this has any implications for our cross country rankings by education inequality and returns to education.

Table B1 illustrates the total not through education (δ) and the total through education ($\gamma^*\lambda$) using the 7-category schema and condensed 3-category schema. As expected, in most cases, the direct effect is larger in the latter case as we are including less information about the sons' highest educational attainment. Comparing columns 2 to 5, we can see that this makes only minor differences to the cross-country rankings – with the exception of the US, Italy and Ireland, most countries' estimated direct effects are around 3 percentage points higher when the condensed measure of sons' education is used.

Table B1. Seven-category compared to three-category measure of sons' education

	PIAAC 7 category education			PIAAC 3 category education		
	β	γ*λ	δ	β	γ*λ	δ
Slovak Republic	0.55	0.32	0.23	0.55	0.29	0.27
Japan	0.37	0.17	0.19	0.37	0.16	0.21
England and Northern Ireland	0.41	0.23	0.18	0.41	0.20	0.21
Korea	0.33	0.20	0.14	0.33	0.17	0.16
Poland	0.47	0.34	0.14	0.47	0.30	0.17
USA	0.56	0.43	0.13	0.56	0.35	0.21
Estonia	0.25	0.13	0.12	0.25	0.10	0.14
France	0.33	0.23	0.10	0.33	0.20	0.14
Russia	0.21	0.11	0.10	0.21	0.12	0.09
Canada	0.22	0.15	0.07	0.22	0.13	0.09
Australia	0.25	0.18	0.07	0.25	0.16	0.09
Italy	0.28	0.22	0.06	0.28	0.14	0.15
Denmark	0.21	0.16	0.06	0.21	0.12	0.10
Spain	0.30	0.25	0.05	0.30	0.22	0.09
Ireland	0.33	0.29	0.04	0.33	0.21	0.12
Sweden	0.14	0.10	0.04	0.14	0.09	0.05
Austria	0.20	0.18	0.02	0.20	0.15	0.05
Finland	0.17	0.16	0.02	0.17	0.13	0.05
Czech Republic	0.26	0.26	0.01	0.26	0.24	0.02
Germany	0.24	0.26	-0.02	0.24	0.22	0.02
Netherlands	0.14	0.16	-0.02	0.14	0.14	0.00
Cyprus	0.21	0.25	-0.04	0.21	0.21	-0.01
Belgium	0.14	0.18	-0.05	0.14	0.17	-0.04
Norway	0.12	0.18	-0.05	0.12	0.15	-0.02

Notes: Authors' calculations using the PIAAC dataset. Total (β) and direct (δ) effect sizes calculated as highest parental education coefficient minus lowest parental education coefficient. Indirect (γ*λ) = Total (β) – direct (δ).