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Reducing Inequality in Education and Skills: Implications for Economic Growth

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EENEE Analytical Report

Reducing Inequality in Education and Skills: Implications for Economic Growth

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Executive Summary (English)

In this paper we focus on understanding the important dimensions of educational inequality; its impacts on society and individuals. We also review policies to alleviate it.

Empirical studies show that income inequality, which is closely connected to educational inequality, limits growth. An explanation is limited access to credit: when individuals cannot borrow freely against future income to invest in their human capital, the initial distribution of resources can have large impact on the economy's pattern of investment and therefore growth. As a result, low income households that are most affected by credit constraints underinvest in education. This can occur even with a public education system if investments in the home matter to outcomes.

We document various measures of educational inequality across countries. The distribution of educational achievements can be measured in much the same way as income inequality, for example, using the 90-10 ratio, standard deviation or Gini coefficient. An alternative approach, more closely related to a concept of inequality of opportunity, is to consider inequalities between groups – for example, comparing achievements for children from different regions, socio-economic groups and migration status – because they show how education/economic outcomes are linked to characteristics of individuals other than their effort or inherent abilities. Inequality of opportunity is particularly destructive as it prevents individuals from reaching their potential and this is transmitted to their children (causing a lack of intergenerational mobility).

Research evidence shows that inequality in educational outcomes is pervasive across the lifecycle and at all stages of education, even before children start school. The difference in educational achievement between high and low socio-economic groups at age 15 (PISA) is equivalent to between 1 and 2.5 years of schooling (lower in Norway, Iceland, Sweden, Finland and higher in Portugal, Bulgaria, France, Hungary, and the Slovak Republic). Further evidence on differences by socio-economic background can be found for adult skills in PIAAC. Differences in literacy scores between people whose parents were from high and low education groups (netting out various factors) are equivalent to about 2.5 years of schooling. Conversely, most of the differences according to whether or not parents are migrants can be accounted for by the socio-economic background of migrants and whether they speak the language of the host country. Thus, inequality between migrants and natives has more often

to do with the characteristics of migrants (which vary considerably across countries) than with migration status *per se*.

Inequality has consequences also at the micro-level, as it prevents individuals from fulfilling their potential in education and thus in the labour market. Researchers have investigated whether earnings returns from education vary by social background, migration status etc. Generally differences are small so that those from disadvantaged groups would benefit substantially if educational inequality were reduced.

We identify two approaches to reducing educational inequality. The first is to pursue redistributive policies and remove institutional mechanisms that discriminate against low income people (e.g. school admission rules). The second is to use the most effective educational policies to directly improve the achievements of disadvantaged children. Policies that disproportionately help disadvantaged children include high quality early-years provision; some programmes to improve school resources; postponing ability-tracking to a later age; and measures to give schools autonomy such that they can come up with a creative combination of strategies to improve outcomes for the most disadvantaged. This suggests a direction of travel for policy in order to pursue the combined objectives of higher economic growth and lower inequality.

Executive Summary (German)

In diesem Bericht konzentrieren wir uns darauf, die wichtigen Dimensionen von Bildungsungleichheit und deren Auswirkungen auf die Gesellschaft und die Individuen zu verstehen. Wir bewerten außerdem Politikmaßnahmen, die diese mindern. Empirische Studien zeigen, dass Einkommensungleichheit, welche eng mit Bildungsungleichheit verbunden ist, Wachstum begrenzt. Eine Erklärung ist ein beschränkter Zugang zu Krediten: Wenn Individuen nicht uneingeschränkt in zukünftige Erträge ihres Humankapital investieren können, kann die ursprüngliche Verteilung von Ressourcen einen großen Einfluss auf das volkswirtschaftliche Investitionsverhalten und damit auch auf das Wachstum haben. Folglich investieren Haushalte mit niedrigem Einkommen, welche am meisten von Kreditbeschränkungen betroffen sind zu wenig in Bildung. Dieser Fall kann sogar bei einem öffentlichen Bildungssystem eintreffen, wenn häusliche Investitionen das Bildungsergebnis beeinflussen.

Wir berichten über verschiedene Maßnahmen von Bildungsungleichheit in den einzelnen Ländern. Die Verteilung von Bildungsergebnissen kann in der gleichen Weise gemessen werden wie die Einkommensungleichheit, z.B. mit dem 90-10 Verhältnis, der Standardabweichung oder dem Gini-Koeffizienten. Ein alternativer Ansatz, der stärker an das Konzept der Chancenungleichheit angelehnt ist, ist es, die Ungleichheit zwischen Gruppen zu betrachten – z.B. indem die Ergebnisse von Kindern aus unterschiedlichen Regionen, sozio-ökomischen Gruppen und mit unterschiedlichem Migrationsstatus verglichen werden – weil sie zeigen, wie Bildungs- oder wirtschaftliche Ergebnisse mit Charakteristiken der Individuen verbunden werden können, die nicht auf ihre Anstrengung oder ihre angeborenen Fähigkeiten zurückgehen. Chancengleichheit ist besonders zerstörerisch, da sie verhindert, dass Individuen ihr Potential erreichen, was wiederum auf ihre Kinder übertragen wird (was zu einem Mangel an Mobilität zwischen den Generationen führt).

Forschungsergebnisse zeigen, dass die Ungleichheit bezüglich Bildungsergebnissen über den ganzen Lebenszyklus hinweg und in jeder Phase der Ausbildung allgegenwärtig ist und schon vor der Einschulung beginnt. Der Unterschied in Bildungsergebnissen zwischen Gruppen mit einem hohen und einem niedrigen sozio-ökonomischen Hintergrund im Alter von 15 Jahren (PISA) entspricht 1 bis 2,5 Jahren Schulunterricht (der Unterschied ist in Norwegen, Island, Schweden und Finnland niedriger und in Portugal, Bulgarien, Frankreich, Ungarn und der Slowakei höher). Weitere empirische Belege zu Unterschieden im sozio-ökonomischen Hintergrund können für die Fähigkeiten von Erwachsenen in PIAAC gefunden werden. Unterschiede in den Testergebnissen zur Lese- und Schreibfähigkeit zwischen Leuten, deren Eltern aus einer hoch- und niedrig gebildeten Gruppe kommen (unter Berücksichtigung verschiedener Faktoren) entsprechen ca. 2,5 Schuljahren. Umgekehrt können die meisten Unterschiede, die darauf zurückgehen, ob Eltern Migranten sind oder nicht, auf den sozio-ökonomischen Hintergrund der Migranten und auf ihre Fähigkeit, die Sprache des Gastlandes zu sprechen, zurückgeführt werden. Folglich hat Ungleichheit zwischen Migranten und Einheimischen häufiger mit den Eigenschaften der Migranten zu tun (die zwischen den Ländern stark variieren) als mit dem Migrationsstatus *per se*.

Ungleichheit hat auch auf der Mikro-Ebene Konsequenzen, da sie Individuen davon abhält, ihr Potential in der (Aus-)Bildung und somit auch auf dem Arbeitsmarkt auszuschöpfen. Forscher haben untersucht, ob Einkommenserträge aus der Bildung mit dem sozialen Hintergrund, dem Migrationsstatus etc. variieren. Im Allgemeinen sind die Unterschiede klein, so dass diejenigen aus benachteiligten Gruppen erheblich davon profitieren würden, wenn Bildungsungleichheit reduziert würde.

Wir identifizieren zwei Ansätze zur Verringerung von Bildungsungleichheit. Der erste Ansatz schlägt vor, eine Umverteilungspolitik zu verfolgen und institutionelle Mechanismen abzubauen, die Menschen mit niedrigem Einkommen diskriminieren (z.B. Schulzulassungsregeln). Der zweite Ansatz regt an, die wirksamsten politischen Bildungsmaßnahmen zu nutzen, um direkt die Ergebnisse von benachteiligten Kindern zu verbessern. Politikmaßnahmen, die überproportional benachteiligten Kindern helfen, umfassen qualitativ hochwertige frühkindliche Maßnahmen; einige Programme um Schulressourcen zu verbessern; das spätere Aufteilen auf unterschiedliche Schulzweige; und Maßnahmen, die Schulen Autonomie zugestehen, so dass sie kreativ Strategien kombinieren können, um die Ergebnisse der am meisten Benachteiligten zu verbessern. Das deutet auf eine Fahrtrichtung in der Politik hin, bei der die Ziele höheres Wirtschaftswachstum und geringere Ungleichheit gemeinsam verfolgt werden.

Executive Summary (French)

Cet article vise à comprendre les inégalités scolaires et leur impact sur la société et les individus. Nous présentons également des moyens de réduire ces inégalités. Des études empiriques montrent que les inégalités de revenu, qui sont étroitement liées aux inégalités scolaires, constituent un frein à la croissance. Une explication possible à ce phénomène réside dans l'accès limité au crédit : lorsque les individus ne peuvent pas emprunter librement en vue de revenus futurs pour investir dans leur capital humain, la distribution initiale des revenus peut avoir, dans une économie donnée, un fort impact sur l'investissement et donc la croissance. Ainsi, les ménages à faibles revenus, qui sont aussi les plus contraints en termes de crédit, sous-investissent dans l'éducation. Cela peut se produire indépendamment de l'existence d'un système public d'éducation, à partir du moment où l'investissement du foyer a un impact sur les résultats des élèves.

Nous présentons différentes mesures des inégalités scolaires dans plusieurs pays. La distribution de l'instruction peut être mesurée de la même manière que les inégalités de revenu, en utilisant par exemple le ratio 90-10, l'écart-type ou encore le coefficient de Gini. Une approche alternative, plus proche du concept d'égalité des chances, consiste à mesurer les inégalités entre groupes – en comparant par exemple le degré d'instruction d'enfants issus de différentes régions, de différents groupes sociodémographiques ou de différents statuts migratoires – car ils montrent comment les résultats économiques et scolaires sont liés à des

caractéristiques individuelles autres que l'effort et les capacités intrinsèques. L'inégalité des chances est particulièrement destructrice dans la mesure où elle empêche les individus de réaliser leur potentiel et constitue également une trappe pour leurs enfants (causant un déficit de mobilité intergénérationnelle).

Des études ont montré que les inégalités scolaires sont présentes à toutes les étapes de la vie et à tous les niveaux d'éducation, et ce y compris avant l'entrée à l'école. La différence en termes de résultats scolaires entre les groupes sociodémographiques les plus aisés et les plus pauvres varie de 1 à 2,5 années de scolarisation (moins en Norvège, en Islande, en Suède et en Finlande et plus au Portugal, en Bulgarie, en France, en Hongrie et en Slovaquie). Des résultats similaires pour les compétences des adultes peuvent être trouvés dans les études du PIAAC. Les différences dans les résultats aux tests de litératie entre les élèves dont les parents sont les plus instruits et ceux dont les parents sont les moins instruits (en tenant compte de divers autres facteurs) sont équivalentes à 2,5 années de scolarisation. Réciproquement, une part importante des différences entre les élèves issus de l'immigration et les autres peut être expliquée par les caractéristiques socioéconomiques des migrants ainsi que le fait que leurs parents parlent ou non la langue du pays d'accueil. Ainsi les différences entre immigrés et natifs ont davantage à voir avec les caractéristiques des migrants (qui varient considérablement entre les pays) qu'avec le statut de migrant en soi.

L'inégalité a aussi des conséquences au niveau microéconomique dans la mesure où elle empêche les individus d'accomplir leur potentiel en termes d'éducation et ternit donc leurs perspectives sur le marché du travail. Des chercheurs ont par ailleurs tenté de savoir si le rendement de l'éducation variait avec le milieu social, le statut migratoire, etc. Leur conclusion est que les différences sont généralement faibles, de telle sorte que les groupes défavorisés bénéficieraient grandement d'une réduction des inégalités scolaires.

Nous identifions deux approches dans l'optique d'une réduction des inégalités scolaires. La première consiste à mettre en place des politiques redistributives et d'éliminer les barrières institutionnelles qui discriminent les populations à faible revenu (les mécanismes d'admission dans certaines écoles par exemple). La seconde consiste à prendre les mesures les plus efficaces pour améliorer directement les résultats des élèves désavantagés. Parmi les politiques qui aident proportionnellement plus les élèves désavantagés on trouve : une instruction de qualité dès le plus jeune âge ; des programmes pour améliorer les ressources des écoles ; des évaluations de compétences différées ; et enfin des mesures pour donner aux écoles davantage d'autonomie afin qu'elles aient la possibilité d'innover et de s'adapter en matière de lutte contre les inégalités scolaires. Tout ceci donne une ligne de conduite pour

les politiques publiques afin d'atteindre le double objectif d'une croissance économique renforcée et d'un plus bas niveau d'inégalité.

1. Introduction

In this report, we examine inequality in education and skills and its implications for economic growth. We begin by outlining the reasons why inequality in education and skills is bad for growth, building on Woessmann's EENEE report (Section 3) and drawing on the macroeconomic literature. We then characterise the extent of inequality in several ways in Section 4. Firstly, the distribution of educational achievements can be measured in much the same way as income inequality is measured – for example, using the 90-10 ratio, standard deviation or Gini coefficient. Secondly, one can look at educational inequality by comparing the education and/or skills of different groups – for example, comparing achievements for children from different socio-economic groups, migration status or by region of residence. In Section 5 we then consider the implications of educational inequality and low skills for groups affected in terms of labour market outcomes. We look at what evidence there may be for policies to ameliorate the situation (Section 6) before drawing some conclusions (Section 7).

2. Growth and inequality

The impact of income inequality on economic growth has long been of interest to economic theorists, and helpful reviews can be found in Perotti (1996), Aghion et al. (1999) and more recently by Galor (2011). An early view was the inequality in a country provided strong incentives to succeed and this was growth enhancing. This view was challenged by a number of empirical studies, often based on cross-country regressions of GDP growth on income inequality. They all found a negative correlation between the average rate of growth and a number of measures of inequality. These have been reviewed by Benabou (1996), who reports that the magnitude of the effect is consistent across studies: a one-standard deviation decrease in inequality raises the annual growth rate of GDP per capita by 0.5 to 0.8 percentage points. This amounts to between 30% and 45% of the standard deviation of growth rates found in most samples and it also implies an income gap of about 25% after 30 years. Thus, inequality has serious social and economic consequences.

By comparison the literature on educational inequality and growth is less well-developed, however there are clear links and interactions between the two, with some approaches treating educational inequalities as the main driver of income inequalities[1] while the same mechanisms are discussed in both contexts.

Castello and Domenech (2002) consider educational inequality directly using data across 108 countries between 1960-2000 and show that inequality in education, as measured by the Gini coefficient in the years of schooling has a negative relationship with economic growth. They conclude that educational inequality might be more important than income inequality for economic growth (although as mentioned above the two are strongly related). They argue that human capital inequality leads to lower investment in human capital owing to credit constraints, an aspect which has been well considered in the income inequality and growth literature as will be discussed in detail below. In addition Castello and Climent (2010a, 2010b) emphasise that demographics might be another important channel through which educational inequality hinders growth, especially in developing countries. The argument is that groups in society with low levels of education have higher fertility and lower life-expectancy; and both of these features discourage investment in education.

The reviews of the impact of income inequality and growth already cited are concerned, as are Castello and Domenech, with the link between capital market imperfections, the distribution of income and wealth, and a society's aggregate investment in human and other forms of capital. Perotti (1996) explains the underlying idea most simply: when individuals cannot borrow freely against future income, the initial distribution of resources can have large impact on the economy's pattern of investment and therefore growth. Various empirical studies are consistent with this hypothesis. For example, Deninger and Squire (1998) find that initial inequality of assets has a significant adverse effect on education and economic growth and that credit constraints have a larger effect on the investment decisions of individuals with lower income. More specifically, this means that those most affected by credit constraints (i.e. low income individuals and/or their parents) underinvest in education because they do not have access to adequate resources. There is thus a relationship between inequality and a low level of education and skills.

Most models looking at the 'credit imperfections' channel conclude that if wealth is distributed more equally, more individuals are able to invest in human capital and therefore growth is higher. This can be the case despite the provision of free public education;

[1] Examples are Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993) and Galor and Tsiddon (1997).

parental investments in the home matter and material and educational disadvantage can stop parents choosing the best schooling environment for their children. More specifically this means that parents from higher socio-economic groups are better able to invest in human capital than those from lower socio-economic groups. This may happen in many different ways from being able to supplement public education with other educational resources (e.g. books in the home; private tuition) to being able to afford to live near high quality schools.[2] The latter phenomenon is common in many countries and is reflected in a premium on house prices (as shown by Black and Machin, 2010). Because of unequal investment opportunities Galor (2011) explains that inequality may adversely affect macroeconomic activity and economic development in the short-run. Due to intergenerational transfers and their effect on the persistence of inequality, it may generate a detrimental effect on economic development in the long run as well. In fact, a whole range of negative correlations between income inequality and health and social problems have been found in cross-country studies.[3]

Most papers considering educational inequality use qualifications as measures of education rather than skills. However, Woessmann (2014) stresses the importance of skills attained rather than years of education completed. Following his argument, we might expect that differences in skills are more important than differences in educational qualifications for economic growth, as poor literacy and numeracy limit the extent to which individuals can participate in the labour market and in society.

Figure 1 panel (a) provides a sense of the relationship between growth and inequality in skills by plotting the average annual rate of growth of real GDP per capita in 1980-2000 against the within-country gap between people at the 90th percentile and 10th percentile of the literacy score in the OECD skills survey 2013 (PIAAC). This suggests a negative relationship with a correlation coefficient of around -.3.[4]

This is a similar approach to that taken by Woessmann (2014) who plots countries' average annual rate of growth of real GDP per capita in 1960-2000 against educational achievement scores, and demonstrates that countries with higher average skills grow faster.

[2] However, there are potential channels that are less obvious. For example, Goodman and Gregg (2010) note how children from poor backgrounds are much less likely to experience a rich home learning environment than children from better-off backgrounds.

[3] For example, see Wilkinson and Pickett, (2009); Rowlingson (2011). Although correlations can be shown, it is more difficult to prove causality.

[4] It is obviously not ideal to look at the relationship between growth and skills inequality when skills are measured at a later date then growth. However, growth measured in more recent years will be affected by the financial crisis and the Great Recession; exceptional events. We therefore use earlier data and assume strong correlation over time in the data on skills inequality.

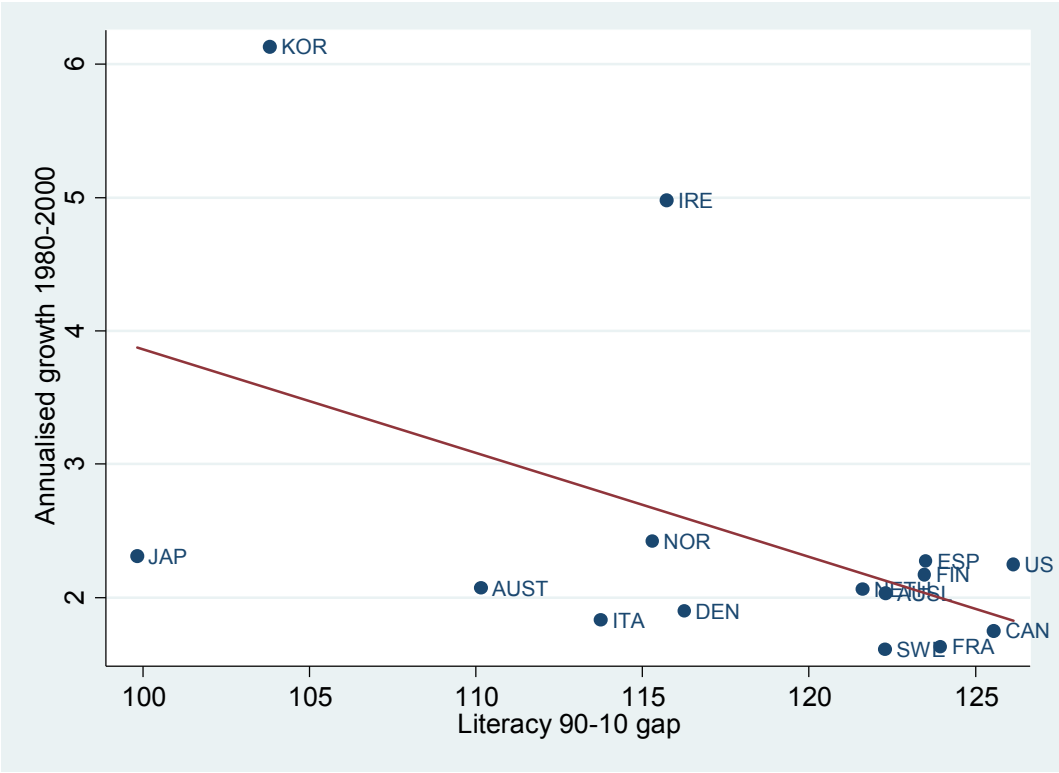
Woessmann accounts for countries' initial level of economic development by conditioning both variables on the initial level of GDP and the average years of education in 1980. This is important, as countries that seem to be growing fast might be doing so in part because of an initially low starting point. Additionally, the level and distribution of skills will be influenced by the development of the education system. In panel (b) of Figure 1 we also condition on these factors and find a slightly stronger negative correlation; in addition results seem to be somewhat less driven by outliers (Japan, Korea and Ireland). Although there are clearly many other influences at work which determine growth, these graphs provide a simple illustration of the negative relationship between educational inequality and economic growth that has been found in many academic studies (e.g. Castello and Domenech 2001).

In fact, the correlation between inequality (e.g. the 90-10 gap in Figure 1) and attainment at the 10^{th} percentile is (unsurprisingly) very strong. We could reframe educational inequality as a problem of relatively low skills in some countries compared to others.[5]

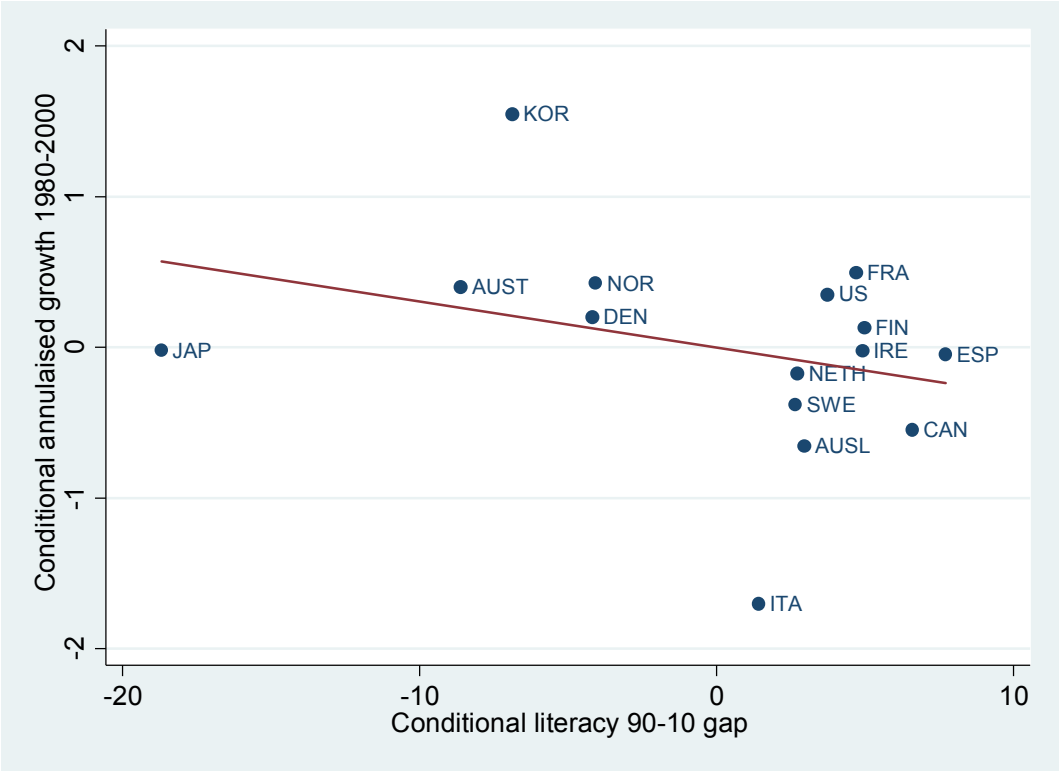
[5] Morrisson and Murin (2013) examine long-term global trends in education inequality since 1870. Inequality in years of schooling is shown to have mechanically decreased along with the decline in the share of illiterate people.

Figure 1: Educational Inequality and Economic Growth Rates

(a) Unconditional relationship



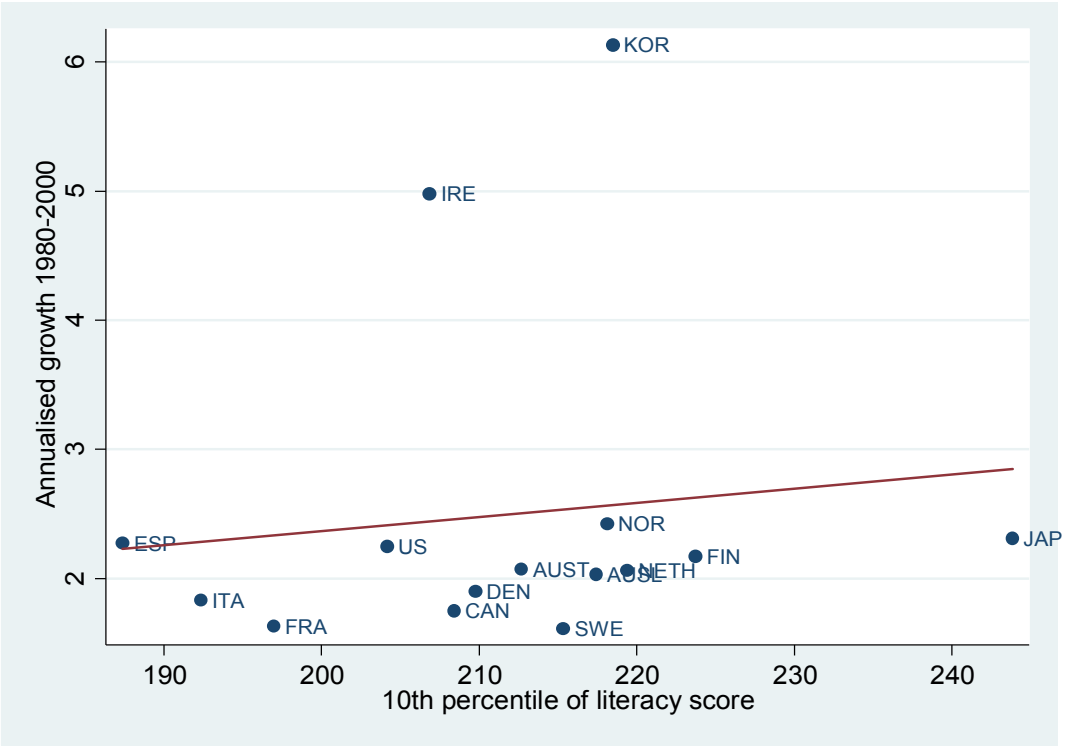
(b) Conditional on economic development



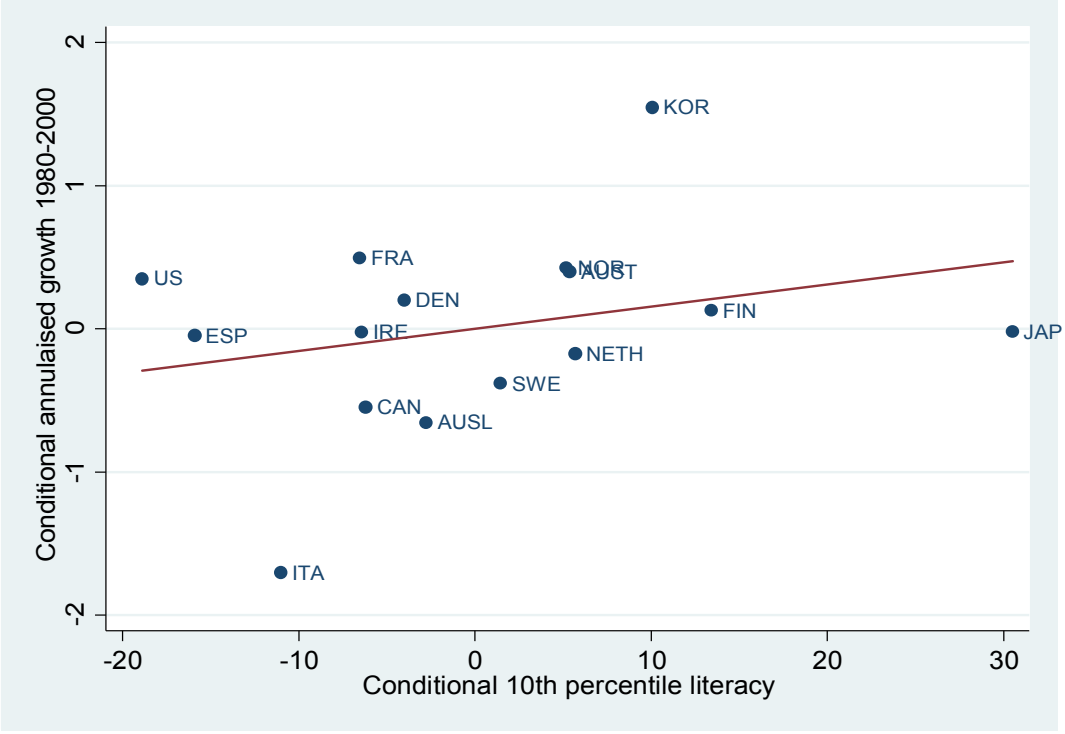
Notes: Plot of the residual of annualised growth from 1980-2000 on the residual of 90-10 ratio of literacy scores in 2013. In both cases residuals are obtained by regressing the variables on GDP in 1980 and average years of education in 1980 to remove the effect of initial conditions.
Data from the OECD Skills Outlook (2013) and Hanushek and Woessman 2010 Table 1.

Figure 2: Educational Achievement of the Lower Skilled and Economic Growth

a) Unconditional



b) Conditional on economic development



Notes: Plot of the residual of annualised growth from 1980-2000 on the residual 10th percentile literacy score in 2013. In both cases residuals are obtained by regressing the variables on GDP in 1980 and average years of education in 1980 to remove the effect of initial conditions.
Data from the OECD Skills Outlook (2013)| and Hanushek and Woessmann 2010 Table 1.

In Figure 2, we plot the growth rate against the 10th percentile of the literacy score (again in panel (a) the relationship is unconditional and in panel (b) it is conditional on the initial level of economic development). This shows that economic growth is higher in countries where the 10th percentile of the population has a higher average literacy score, although the correlations are somewhat weaker than those between growth and inequality.

So we can see what lower levels of basic skills are disadvantageous for growth. However, we naturally ask whether it is more advantageous (in terms of growth) for countries to focus on improving basic levels of education or whether they should focus more in getting more people into tertiary education, and therefore expanding the population with higher level skills. For example one might hypothesise that the focus should be very different for developing and developed countries (where the latter usually have a higher proportion of the workforce educated to a basic level). Vandenbussche et al. (2006) and Aghion and Howitt (2006) argue that tertiary education is key for developed countries because this enables them to move the 'world technology frontier' out through innovation. However, Hanushek and Woessmann (2011) consider the payoffs of different types of skill (rather than different educational attainments). They separately measure basic and top skills based on international achievement tests and then consider the implications of different levels of skill and tertiary schooling on growth. Their results show that basic skills have substantial growth payoffs in OECD countries (as well as non-OECD countries) and that the return to top skills is similar in OECD and non-OECD countries. Hence the improvement of both basic skills and top skills are relevant for growth in OECD countries generally. The policy recommendation will vary by country. For example, the UK performs relatively well at the upper part of the distribution (i.e. the proportion of graduates) but has long had problems with the 'long tail' of poorly performing schools and pupils compared to other countries. Addressing this problem is important for growth (LSE Growth Commission, 2013).

To the extent that human capital endowments differ between regions, this can also be an important source of growth inequality between regions. Ballas et al. (2012) review evidence and state that the overwhelming majority of studies suggest that investment in education, training and infrastructure is 'invaluable and has a positive impact on regions and individuals'. One mechanism is that the presence of skilled and educated workers can attract

firms and enhance productivity. Another mechanism is that investment in human capital can contribute to technological change and diffusion.[6]

One interesting question is the effect of expanding the number of people with education and skills on country-level (or regional-level) inequality. The UK provides an interesting case-study as towards the end of the last century there was a large expansion in access to academic qualifications in schools (comprehensivisation) and a rise in the number of people benefitting from higher education. More recently there has been a substantial increase in investment in education in the UK directly targeting children from deprived backgrounds. Blanden and Macmillan (2014) examine the extent to which this educational expansion has led to a decline in educational inequality as measured by differences in the educational performance (in terms of qualifications) of those from poorer compared to richer backgrounds. They find that educational inequality in the UK has declined and this is driven by the improved performance of children from more deprived backgrounds. However, they also find some evidence that education is being used as a positional good - as more children reach the expected levels of qualifications, those from the most advantaged families are pursuing higher levels of qualifications. This widens educational inequalities at the top (even though the average level of inequality has declined). Thus, the interactions between educational investment and inequality are complex.

3. International Evidence on Inequality of Educational Outcomes

Overall inequality – descriptive evidence

Castello and Domenech (2002) provide some descriptive statistics about how inequality in education varies across different world regions. We reproduce these in Table 1. Countries in the European Union are included in Advanced Countries, and immediately we see that these richer countries (closely followed by the former communist countries) have much lower educational inequality than any other grouping. The extent of inequality is closely associated with the overall level of education. Relative to these other country groupings, advanced countries have higher education levels overall and less inequality.

[6] Relevant examples include López-Bazo and Moreno Serrano (2008), Serrano and Cambrer (2004), Erikisson (2004) and de la Fluente and Ciccone (2002).

Table 1: Average Human Capital Inequality by Groups of Countries

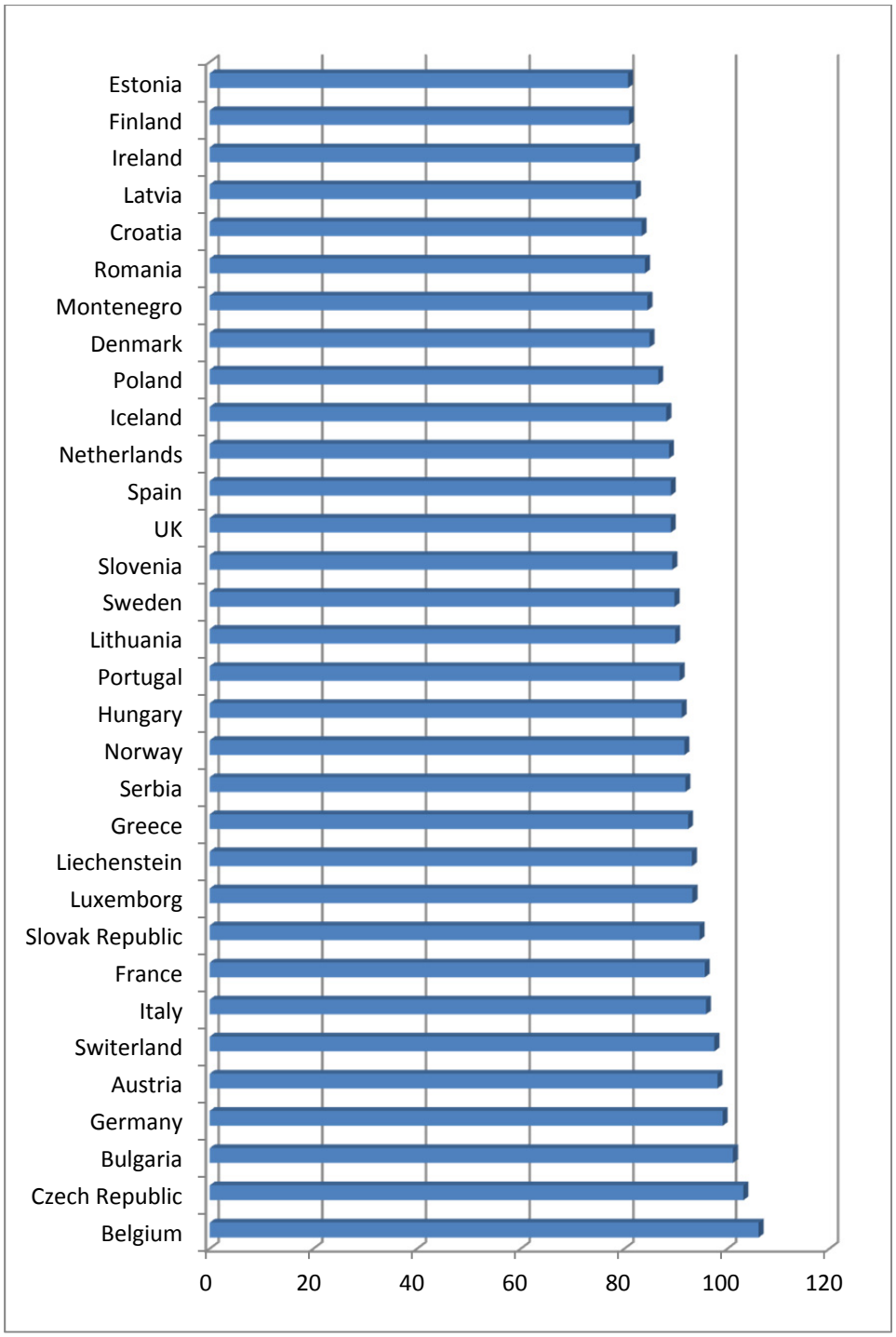
	Gini coefficient	20^{th} percentile/ 80^{th} percentile	Stock of human capital
Middle East and North Africa	0.583	0.032	3.931
Sub-Saharan Africa	0.637	0.005	2.430
Latin America and the Caribbean	0.367	0.127	4.784
East Asia and the Pacific	0.377	0.092	5.558
South Asia	0.697	0.010	2.400
Advanced Countries	0.208	0.362	7.940
Transitional Economies	0.223	0.299	7.045

Source: Table 2 of Castello and Domenech (2002). The Gini coefficient is the Gini in years of education. The 20/80 ratio is also based on years of education. The stock of education is the average years of education of the population aged 15 and over.

To discover how inequality in skills varies within Europe, we turn to Ferreira and Gignoux (2011) who adopt a measure based on the skills of teenagers and report the standard deviations for all countries who participated in PISA. Figure 3 shows within-country standard deviations for mathematics scores across all European countries.[7] Figure A1 represents the table as a map. It is difficult to see any strong patterns in these numbers. The highest inequalities are in Northern mainland Europe, with some evidence of less inequality in the Nordic nations and UK. However, it is more important to note that differences in standard deviations between countries are fairly small.

[7] The full paper also provides information on the standard errors on the inequality measures which are between 1 and 3, so gaps of 6 points or more are likely to be statistically significant.

Figure 3: Standard Deviations in Mathematics Scores in PISA



Source: Ferreira and Gignoux (2011) Table 1.

Inequality and socio-economic status

As discussed by Ballas et al. (2014) in their 'Social Atlas of Europe', most of the important social divides across the continent are within states rather than between them. In a study that focuses on education inequality, Ballas et al. (2012) review evidence suggesting that

inequalities in human capital between regions are likely to be associated with increasing economic inequalities. They suggest that in countries where regional economic disparities are widening, investment in education and training in weaker regions may play a part in achieving more even growth. Overall, educational inequality between regions within a nation state are often larger than differences between countries. Nations where Ballas et al (2014) note particularly pronounced differences in educational outcomes between regions in France, Greece and Spain; but there is less commonality across the measures about which countries have low regional inequality. However many of the differences between regions are likely to be strongly determined by wider socio-economic differences, or as the authors of the report state "Spatial disparities of educational opportunities and outcomes reflect wider inequalities" for example by socio-economic group, ethnicity, and migration status, differences which can also manifest themselves within region. We now move to directly consider the impact of such characteristics.

Research evidence shows that inequality in educational outcomes is pervasive across the lifecycle and at all stages of education. Even before pupils start school, there is a large gap in cognitive ability between children from high and low socio-economic backgrounds. Feinstein (2003) finds significant gaps between children from a high and low socio-economic background in an index of development, which is derived from tests of ability (at 22 months) in cube stacking, language use, drawing and personal development. Furthermore, he finds that the test-score gap tends to widen as children age; and through the levels of the education system.[8] Dustmann et al. (2010) illustrate early gaps in vocabulary skills by gender and ethnic group. They shows the vocabulary skills of five year olds in the Millennium Cohort Study (MCS)[9]. The test scores have been standardised to have a mean of 50 and a standard deviation of 10. It is evident that sizeable gaps in vocabulary skills exist even at the time of school entry. This illustrates that human capital acquisition is not something that begins only at school and that inequality is evident even at an early stage.

[8] The extent to which inequalities actually widen with age is controversial (Jerrim and Vignoles, 2011). However, educational inequalities are certainly present at all stages of the lifecycle (Machin and McNally, 2011).

[9] The MCS is a longitudinal survey of around 19,000 children born in the UK over a twelve month period from 2000 to 2001. The first survey took place when the children were around nine months old. Follow-up interviews have, at the time of writing, taken place when children were aged three, five and seven.

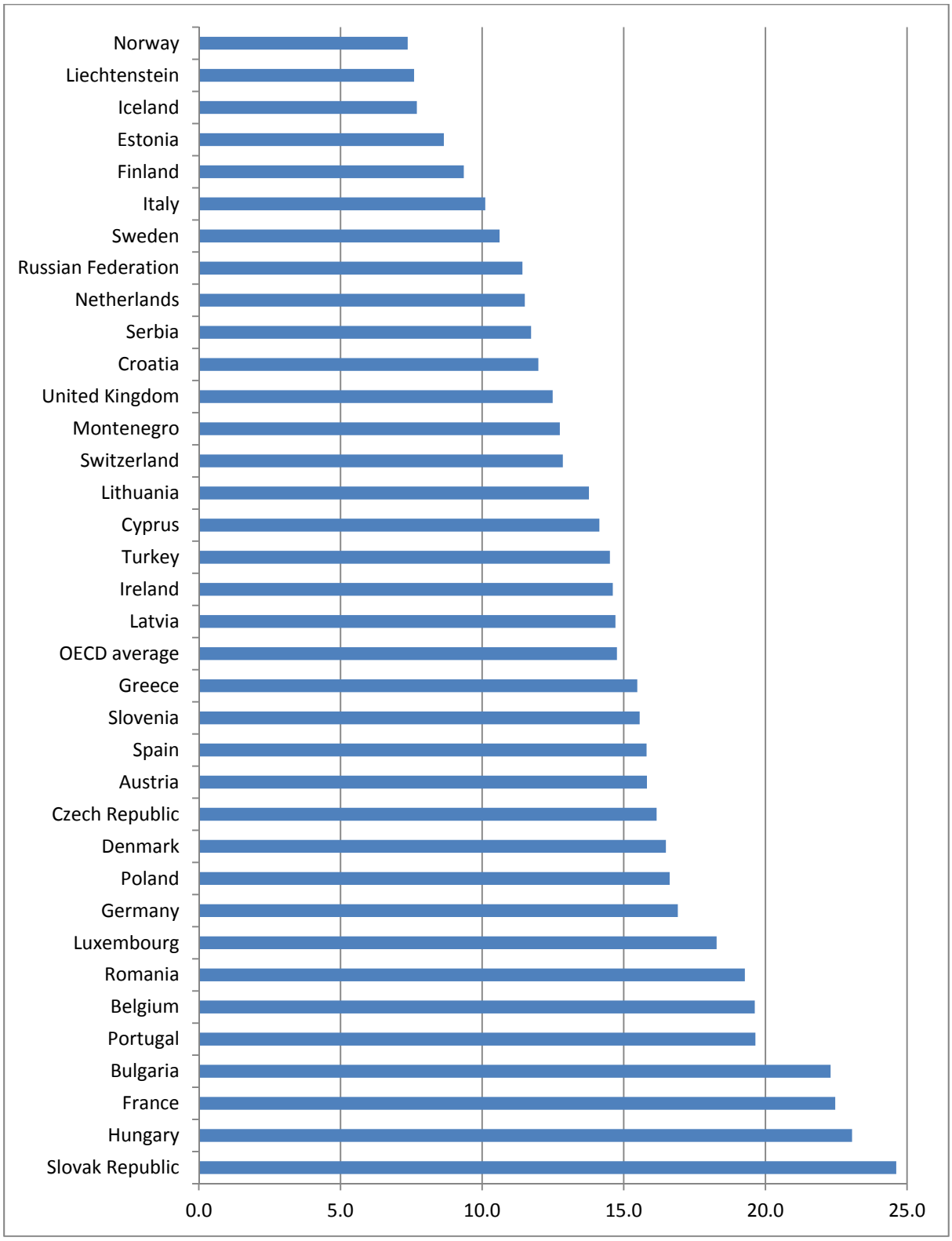
Table 2: Age 5 Differences in Vocabulary Tests by Gender and Ethnicity, Millennium Cohort Study (UK)

Ethnic Group	Boys	Girls
White British	55.9	56.5
Black, Caribbean	48.4*	51.0*
Black, Other	44.2*	47.2*
Bangladeshi	40.4*	41.7*
Pakistani	40.6*	40.7*
Indian	49.8*	50.3*
Chinese	41.2*	55.2
Number of Children	4,587	4,452

Notes: Based on Table 3 of Dustmann, Machin and Schonberg (2010). The vocabulary test is standardised to have mean 50 and a standard deviation of 10. A * denotes statistically significant differences relative to White British boys or girls respectively.

Inequality of educational attainment is evident throughout schooling and across all countries. This has been clear in all the PISA surveys of students' attainment at the age of 15. For example, results from PISA 2012 found that 15 percent of the variation in student performance in mathematics is attributable to differences in students' socio-economic status (as measured by an index of social, cultural and economic status – which is based on indicators such as parental education and occupation, the number and type of home possessions, and educational resources available at home). However, there is marked variation between countries (OECD, 2013). Figure 4 shows an extract based on this report for participating European countries and regions. Norway is at the top, with 7.5% of the variation in performance explicable by family background measures (the country with the least educational inequality according to this measure). At the other end of the spectrum the Slovak Republic has almost one quarter of the variance in performance related to family background (i.e. the most unequal country). We represent these figures as a map in Appendix Figure A2. We see evidence of less inequality of opportunity in the Nordic nations and UK. However, any conclusion about a North/South divide is confounded by the presence of Italy as a country with particularly low inequality of opportunity by this measure.

Figure 4: Percentage of variance in mathematics performance explained by students' PISA index of economic, social and cultural status



Source: OECD. PISA 2012 Results: Excellence through Equity. From Table II. A.
European countries only.

As is pointed out in OECD (2013), these patterns not only reflect the inherent advantages in resources provided from relatively high socio-economic status, but also reflect many other characteristics of individuals, systems and countries. At an individual level, two potential reasons for the association between attainment and family background are home investments (time and goods inputs) and heredity/inheritance factors.[10] The cross-country variation in the association is useful for showing that the relationship is not mainly driven by the latter (on the assumption that the influence of heredity/inheritance factors should not vary widely between countries).[11]

Several studies use versions of PISA to estimate the difference in performance between high and low socio-economic groups. The precise estimates will depend on the measure of socio-economic status, what other controls are included and the version of PISA used. The most recent OECD study (OECD 2013) based on PISA 2012 suggests that on average, a more socio-economically advantaged student (based on the PISA index of social, cultural and economic status) scores 39 points higher in mathematics than a less advantaged student. This translates into nearly one year of schooling. Other studies have suggested a bigger difference of around 95 PISA test points – which translates to about two-and-a-half years of schooling.[12]

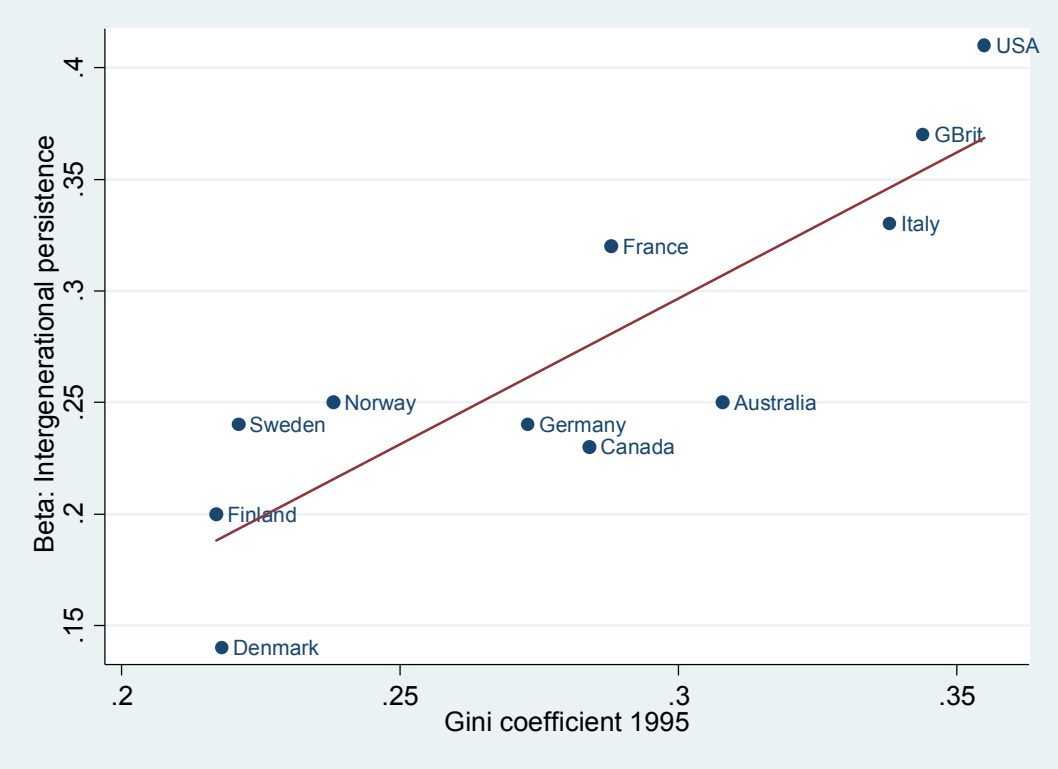
Although the reasons behind the high link between socio-economic status and educational achievement are complex, they are clearly not inevitable as the between-country differences in the association show (Figure 4). An alternative measure of the importance of family background is given by the intergenerational income elasticity (beta), which measures the proportion of any income advantage in one generation which is passed on to the next. Blanden (2013) among others has demonstrated a positive relationship between the intergenerational income association (beta) and the Gini coefficient for income across countries. This relationship is known as the Great Gatsby Curve and is shown below as Figure 5. Blanden (2013) demonstrates a strong relationship between the intergenerational links in income and the intergenerational links in education.

[10] Following the framework of Haveman and Wolfe (1995) and also the discussion in Jerrim (2012). The latter explains the potential heredity link as follows: bright parents tend to hold high socio-economic positions and produce offspring of above-average intelligence (who will thus do well in later achievement tests). Using British data, Gregg and Goodman (2010) fine that nearly one fifth of the gap in test scores between the richest and poorest children is explained by an apparent 'direct' link between the childhood cognitive ability of parents and that of their children.

[11] Beller (2009) and Blanden (2013).

[12] Jerrim (2012); Machin et al. (2013). Both studies are based on PISA 2009 and look at raw differences between high and low socio-economic groups using different indicators than in OECD (2013). Jerrim (2012) uses the HISEI index of occupational status (widely used in the sociological literature).

Figure 5: The Great Gatsby Curve



Notes: The preferred income beta is a measure of the association in earnings across generations for sons born around the1960s/70s. The Gini coefficient is measured in 1995.
Source: Blanden (2013)

Further evidence on differences by socio-economic background can be found for adult skills in PIAAC (OECD, 2013). Table 3 shows adjusted differences in literacy scores between those whose parent(s) attained tertiary education and those where neither parent attained upper secondary education. Since parental education is a good proxy for resources, this should be considered here as a measure of socio-economic status rather than an indicator of the advantages of education *per se*. The differences reported in Table 3 take account of other characteristics of the individual (age, gender, educational attainment, immigrant and language background and type of occupation). Thus many of the mechanisms through which parental education might impact on the skills of their children (e.g. educational attainment of children) have already been 'netted out' here. Yet, a very strong difference remains on average (18 points). Taking the estimates in the OECD report as to how point differences translate to years of education, this is about two and a half years. As with the PISA results for younger people, there is marked variation between countries in the association between this measure of socio-economic background and a person's skill level.

Table 3: Adjusted differences in literacy scores between categories (PIAAC)

	Parents' educational attainment
	Score dif.
OECD Average	**18.0**
Australia	17.4
Austria	16.5
Canada	18.6
Czech Republic	15.2
Denmark	17.0
Estonia	11.1
Finland	18.2
France	20.0
Germany	20.9
Ireland	19.4
Italy	18.9
Japan	10.9
Korea	11.5
Netherlands	14.4
Norway	18.0
Poland	22.7
Slovak Republic	24.4
Spain	14.6
Sweden	14.7
United States	27.9
Flanders (Belgium)	16.6
England (UK)	26.9
Northern Ireland	20.0

Notes:
Parents' educational attainment: difference between adults with at least one parent who attained tertiary and neither parent who attained upper secondary
Differences are based on a regression model and take account of differences associated with the following variables: age, gender, education, immigration and language background, and type of occupation. Only the score-point differences between two contrast categories are shown.
Source: Survey of Adult Skills (PIAAC) (2012). Table extracted from OECD Skills Outlook Table A3.1(L)

Inequality and migration status

OECD (2013) also shows huge differences between foreign-born adults and native born adults in PIAAC. The adjusted model takes account of both immigrant status and language background (i.e. whether the person is proficient in the language of the home country). The average difference between this group and natives who are proficient in their language is roughly twice as high as that between those of low and high socio-economic background (i.e. lower skills for immigrants who are not proficient in the language of the host country). There

is also wide variation between countries, which is unsurprising since the composition of immigrants (and characteristics of natives) also varies widely. Of more relevance to the success of integration policies is how second generation immigrants fare in their host countries. Dustmann et al. (2011) provide a comparative study across different European countries of second generation immigrants. They analyse how they perform in terms of education compared to their native peers and their peers back in their parents' home country. They also contract the European experience with the classic immigration countries US, Australia and Canada.[13]

Their results show that educational achievement (as measured in PISA tests) of children of immigrants is heterogeneous across countries and strongly related to achievements of their parents. In countries where foreign-born parents are well educated, the children of immigrants tend to do well (sometimes better than their native peers). In countries where children of native-born parents outperform the children of immigrants, this is mainly due to the more disadvantaged family background of immigrant children. The disadvantage considerably reduces – and even disappears for some countries – once they control for parental background characteristics.

Table 4 shows a measure of socio-economic status in different countries by whether or not parents are natives (column 2) or immigrants (column 3). This measure is based on the Socio-Economic Index of Occupational Status (ISEI), where higher values correspond to higher status. This shows a lot of variation between countries. For example, in countries such as Australia, Canada and the UK, this index looks similar for natives and immigrants. However, in other countries (e.g. Austria, Belgium, Germany), the index is much higher for natives compared to immigrants. Dustmann et al. (2011) look at how the children of natives and immigrants compare in these countries based on their reading performance in PISA. Column 3 gives a summary of the results in each country before including other controls and column 4 gives a summary of the results after including controls for family background and language. A positive differential (e.g. for Australia, Canada and the UK) shows that the children of immigrants perform better at reading than the children of natives, whereas a negative sign shows the opposite. A key finding is that these controls (for family background and language) account for the entire immigrant-native gap in Nordic and Southern European countries (except for Finland) while they magnify the achievement advantage of immigrants in Australia and Canada. In Central Europe, they account for the entire gap in Germany and

[13] This work builds on Schepf (2007) and Dronkers and de Heus (2010).

France. They account for over 60% of the gap in Austria, Belgium and Switzerland and for 40% in The Netherlands. These results do not provide us with a policy prescription on what to do about gaps. However, the results show that the gap between children of immigrants and natives is not largely driven by immigrant status *per se* in most countries considered here. It also shows that the socio-economic gap and immigrant/native gap are not independent of each other.

There have been a number of studies looking at whether the presence of immigrants in schools has an impact on native students. Several of these studies find that the effect is small or non-existent (e.g. for the UK, The Netherlands) whereas some find negative effects (e.g. for Denmark and Israel).[14] One would not expect the effects of immigration to be the same across countries because this will depend on the institutional context as well as the characteristics of immigrant communities. However, Brunello and Rocco (2013) use cross-country data and suggest that overall effects are small. Hunt (2012) uses US census data from 1940-2010 to look at the impact of immigration on the high school completion of natives in the US and finds *positive* effects of immigration, particularly for native-born blacks.[15] Thus, although one can't generalise from country studies (because the characteristics of immigrant groups differ across countries), one can say that there are few studies in which immigrants have been found to have a negative impact on native students in terms of educational attainment.

[14] See Geay et al. (2014) for the UK; Ohinata and van Ours (2011) for The Netherlands; Jensen and Rasmussen (2011) for Denmark; and Gould et al. (2008) for Israel.
[15] The reason for positive effects is because of competition between natives and immigrants.

Table 4. Differences between Immigrants and Natives

Country	Natives Highest parental occupation index (ISEI)	Immigrants Highest parental occupation index (ISEI)	Reading score differential between immigrants and natives in PISA. Before including controls	Reading score differential between immigrants and natives in PISA. After including controls for family background and language
Australia	52.7	52.1	+ 10 points	+ 12 points
Canada	53.8	51.9	+ 10 points	+ 18 points
UK	51.4	50.4	+ 10 points *	+17 points *
US	54.2	46.8	-2 points *	+8 points *
Denmark	49.1	41.9	-37 points	- 2 points *
Finland	49.0	54.4	-75 points *	-86 points
Norway	53.5	47.9	-37 points	-4 points *
Sweden	51.0	48.0	-24 points	-10 points *
Austria	50.2	38.0	-80 points	-32 points
Belgium	51.1	41.9	-79 points	-31 points
France	49.3	43.4	-22 points	-6 points *
Germany	50.7	39.4	-77 points	-14 points *
Netherlands	52.8	44.1	-42 points	-26 points
Switzerland	50.7	44.5	-39 points	-14 points
Greece	49.4	47.6	+ 13 points *	-25 points *
Italy	46.9	42.7	-26 points *	0 points
Portugal	41.6	48.0	-11 points *	-22 points
Spain	45.0	47.6	+5 points *	+9 points *

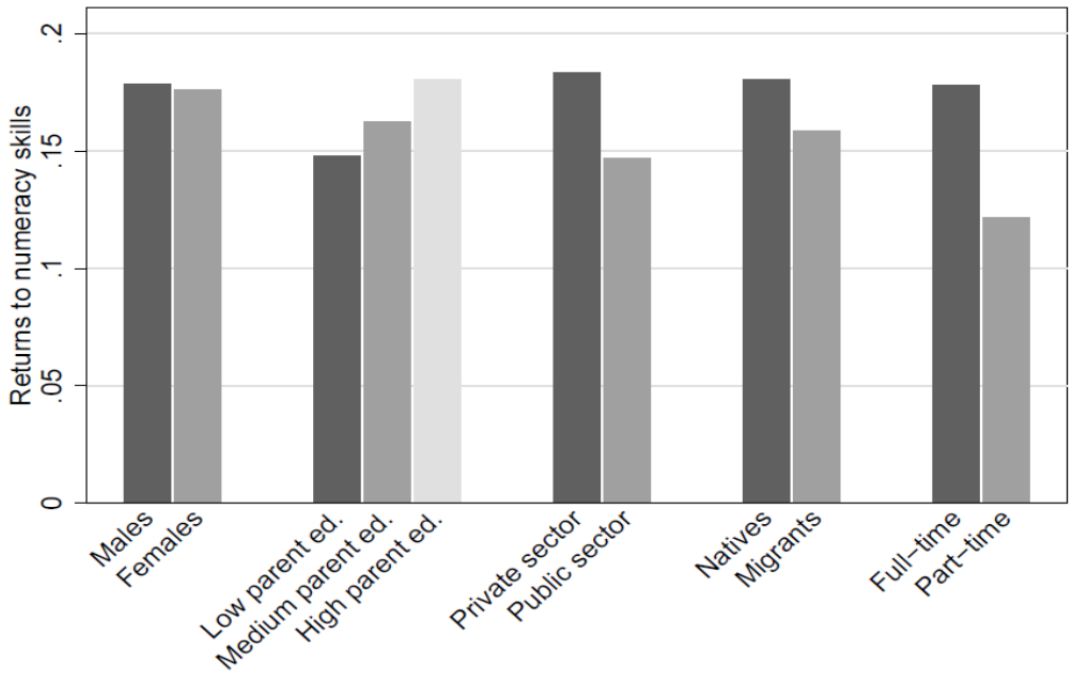
Source. Derived from Dustmann et al. (2011). Tables 4.1. and 4.2 (columns 1 and 7). Results from PISA 2006 (except in the case of the US, where this is PISA 2003). Difference between children of immigrants and natives in terms of PISA points scores are described in the last two columns. * Not statistically different from zero.

4. Implications of Inequality and Low Skills for Affected Groups

As discussed by Woessmann (2014), the main expected return to higher levels of education and skill is the increased productivity that is made possible. If a more educated person contributes a larger marginal product to the production process of a firm, in a market economy, the firm will pay the person higher earnings accordingly. In other words, the earnings premium to additional education/skills mainly reflects a person's contribution to productivity and this in turn is important for economic growth in an economy (as discussed in Section 3). Educational inequality reflects the fact that too many people have relatively low education and skills. The question is whether such people would increase productivity if they were provided with more education and skills. Woessmann (2014) shows that there are high returns to education and skills across all countries (although they vary between countries). Are these returns still evident if we look at subgroups known to have lower average skills? (e.g. those from low socio-economic groups; migrants). Hanushek et al. (2013) look at

whether returns to skills are different for these groups. Their graph is reproduced below (Figure 6).

Figure 6: Returns to Skills in Different Subgroups



Source: Hanushek et al. (2013): figure 3 in their paper. (Based on regressions using PIAAC). Note: Coefficient estimates on numeracy score (standardized to std. dev. 1 within each country) for indicated subgroup in a regression of log gross hourly wage on numeracy, gender, a quadratic polynomial in actual work experience, and country fixed effects. Sample of full-time employees aged 35-54 pooling all countries. With the exception of gender, all subgroup differences are statistically significant at the 5% level.

Figure 6 shows estimates of the return to skill by subgroup from their analysis (defined by gender; whether parents have an education level which is high, medium or low; whether the person works in the private or public sector; natives compared to migrants; full-time compared to part-time workers). While there are differences (which are statistically significant in each case, apart from gender), they are generally quite small. Thus, the estimated return to skill is high (on average) whether someone comes from a low or high socio-economic group or whether he/she is a migrant or a native. For example, the estimated return to an increase in numeracy skills (by 1 standard deviation) ranges only from 14.8 percent for workers with low-educated parents to 18 percent for workers with high-educated

parents. Estimated returns are only slightly higher in the native population (19.8 percent) than among immigrants (15.9 percent).[16]

Woessmann (2014) also shows that there is a strong positive return to an additional year of education (as well as skill) across countries and discusses studies that have attempted to show a causal effect of an additional year of education. Card (1999) discusses the puzzle that many of the papers using 'natural experiments' (more specifically studies using Instrumental Variables) find a higher return than the OLS average estimate. An example of a 'natural experiment' is a change in the law that increases the age at which people may leave compulsory education. Researchers compare the education level of those cohorts first exposed to the law with older cohorts who were not exposed (e.g. Harmon and Walker, 1995). This 'natural experiment' makes it possible to identify a causal effect of an additional year of education (because the decision to stay on an extra year is not related to any difference in preference between the cohort first exposed to the law and the older cohort who were not exposed). This 'natural experiment' (like many others) gives rise to higher estimates of the returns to schooling than the OLS estimate. Although there are several possible explanations for this, one reason Card (1999) puts forward is that these 'natural experiments' will affect the choices of certain subgroups in the population (i.e. directly affected by the policy change) and do not capture the average response in the population. For example, changes in the law that increase the age at which people may leave compulsory education impacts most directly on those who would otherwise have left full-time education immediately after that time. These individuals may well have higher-than-average marginal returns to schooling. This could arise if the marginal return to schooling is decreasing (i.e. if the payoff to an additional year of education is higher at the end of compulsory education compared to an additional year several years into higher education). If this is true, then we might expect the 'true' marginal return to additional human capital to be even greater for those groups likely to end up as low educated or skilled (e.g. those from poorer backgrounds).

Dearden et al. (2004) consider returns to staying on in education for 'the marginal learner'. As they consider returns to 'staying on', this is very relevant to the EU objective of reducing the share of early leavers from education and training. Dearden et al. (2004) use a cohort of all children born in 1970 in Britain (the British Cohort Study 1970). Although, they do not use 'natural experiment' approaches to estimate returns to education, they can control

[16] Rodriguez-Pose and Tselios (2010) look at whether economic returns to education vary between migrants and non-migrants and finds similar returns to education in European labour markets.

explicitly for many characteristics of individuals and their families as this is a longitudinal study that collects extensive information at each stage. They evaluate returns to this birth cohort when they are aged 29/30 (in 1999/2000). They estimate the wage return to staying on in post-compulsory schooling after age 16 (versus leaving education at this time) and the return to completing any form of higher education (versus obtaining a lower level qualification).[17] A summary of some of the results is shown in Table 5. Their overall estimate for staying on is 11% for men and 18% for women. They estimate that men and women from low income families who drop out would have enjoyed very similar returns from staying on (not statistically different from the average). They find sizeable average wage returns to going to higher education relative to a lower level qualification (about 15% for men and 22% for women). For women, returns do not vary by social background, but for men returns to staying on in higher education are substantially higher for those from a low socio-economic class or from a low-income family.

Table 5: Returns to education estimated in Dearden et al. (2004)

	Men	Women
	Staying on in education after age 16 v dropping out	
Overall estimate of earnings return	11%	18%
Estimate for those from low socio-economic background	11%	15%
	Going to higher education v obtaining a lower level qualification	
Overall estimate of earnings return	15%	22%
Estimate for those from low socio-economic background	20%	23%

Thus, we can see from Section 4 that socio-economic background is a strong predictor of educational attainment and a manifestation of inequality. However, the evidence reported here suggests that if such individuals did acquire education and skills to equal their more advantaged peers, they would be (at least) similarly rewarded for their productivity.

5. What is the Evidence on Interventions to Reduce Inequality?

Inequality in education is clearly important for macroeconomic growth and for individuals' life-chances. We now turn to exploring policies which might close these inequalities. First,

[17] Specifically in the UK context, Higher Education refers to participation in university (whether the outcome is a diploma or degree). The comparison group with respect to those participating in Higher Education is those who obtained a level 2 or level 3 qualification. A person who leaves schools with reasonably good grades in the national examination at age 16 is considered to have a 'level 2' qualification.

we briefly consider the role which income distribution could have. This returns to the concerns about the impact of income inequality and the role of credit constraints discussed in Section 3. Second, we consider evidence on the differential effects of education policies on disadvantaged groups (thus helping to reduce educational inequality).

Credit constraints and parental income effects

As we have seen credit market imperfections have been emphasised as a primary mechanism leading from inequality to poor economic growth. The argument made is that poorer parents are unable to invest in their children's education to the optimal extent. This leads to lower levels of education in the next generation and therefore lower growth. An implication of this is that attempts to reduce income inequality through redistribution would ease credit constraints and promote growth.

The credit constraint argument can be practically interpreted in various different ways. Carneiro and Heckman (2002) investigate the factors which explain participation in post-compulsory schooling in the US and find little role for parental finances in the late-teens and a much greater role for measures of cognitive and non-cognitive ability, they take this as evidence against the credit constraint hypothesis. Chowdry et al (2013) find a similar result for the UK where parental socio-economic status has little effect on university participation once school performance is taken into account.

However, this is a somewhat limited interpretation of credit constraints. A wider view recognises that achievement in the school years is also affected by family financial circumstances. Cooper and Stewart (2014) have recently conducted a systematic review of the literature on whether income has a causal effect on educational outcomes. They place particular weight on studies which adopt a close to experimental design, or use policy variation to induce a natural experiment. They find that parental income does have a causal effect on children's educational performance which could be responsible for around half of the attainment gap at age 11 between low and average income children. The remainder of the gap is explained by differences in ability, educational and cultural investments which would not be changed through income redistribution. However, some of the effects of income (for example on school choice) could be removed by changing institutional structures. For example, in the UK schools are allowed to use distance from the school as a basis for selecting pupils if the school is oversubscribed. This necessarily has some effect on house

prices in the local area (as is the case in other countries). If schools dealt with oversubscription by using a lottery (among applicants), it would reduce the link between income and school choice.

Education policies

As discussed in Section 4, inequalities in human capital are evident even before children start school (for example, by socio-economic group). We might therefore ask: do schools make any difference to the gap? Inequalities by socio-economic background are actually exacerbated as children progress through school (see for example, Goodman and Gregg, 2010), although that does not necessarily mean that schools *cause* the gap to widen. Several studies investigate how much of the variation in educational attainment can be attributed to schools versus families and peers. They all suggest that families are much more important.[18] However, it might still be the case that inequalities can be addressed at school, whatever their source.[19] In this Section, we discuss existing evidence on what school-level programmes/policies make a difference to observed inequalities. We provide a summary of findings in Table 6.

[18] Teddlie and Reynolds, 2000; Todd and Wolpin, 2007; Kramarz, Machin, Ouazad, 2009.

[19] The evidence on whether adult programmes to improve literacy and numeracy improve economic outcomes is mixed and often based on less good research methodologies than when investigating these issues for young people. However, Vorhaus et al. (2011) reviews such evidence as there is and concludes that improving literacy and numeracy in adulthood has a significant socio-economic impact. However, they also say that too little is known about the impact of interventions designed to improve adult literacy and numeracy.

Table 6 Summary of findings on policies to improve educational outcomes (selected studies)

Policy Type	**Brief description**	**Overall effect on educational outcomes**	**Effect on disadvantaged students**
Whole-school intervention	Allowing schools to become autonomous facilitates innovative approaches to improve performance. Angrist et al. (2012) evaluate a particular type of charter school in Boston following a 'no excuses model', involving longer days and terms, and placing more demands on teachers	Gain of 0.12 standard deviation in reading scores per year (similar to estimated effect of having a high quality teacher – see Hanushek and Rivkin, 2010)	About 3 times as large as the average. Big enough to eliminate average socio-economic gap in PISA 2012.
School expenditure/resources	Many studies; class size or school expenditure typically used as measures of resources; Sometimes programme evaluations like 'Excellence in Cities' in the UK	Wide range of estimates and no consensus on effects.	Where positive effects are found, they are usually larger for disadvantaged students.
Pre-school interventions	Universal free pre-school provision	Positive effects of high quality programmes, negative effects are found primarily when there are questions over quality.	In general, effects are stronger for more disadvantaged children, measured by mother's education level or language spoken at home.
Tracking	Studies investigating whether countries that allow 'early tracking' have better outcomes than those that do not; studies investigating the consequences of moving away from 'early tracking'	Results generally suggest that later tracking is associated with better outcomes; Positive gains associated with moving away from 'early tracking'	Effects of reform usually interpreted as a reflection of positive impacts on disadvantaged students.

Whole-school intervention (multiple components)

Some good evidence for this comes from evaluation of particular school types (which could be thought of as a 'whole school' intervention). For example, Angrist et al. (2012) evaluate the effect of attending a particular type of autonomous school in Boston: a charter school organised by the 'Knowledge is Power' (KIPP) management. This group run a chain of schools and target low-income and minority pupils. They are sometimes called 'No Excuses' schools and they focus on traditional reading and maths skills, have a long school day and year, selective teacher hiring, strict behaviour norms and a strong student work ethic. Applicants who want to attend this school have to take part in a lottery. If they lose the lottery, they usually attend a public school. Angrist et al. evaluate the effects of winning the lottery by following winners and losers of the lottery as they progress through their education. They find overall reading gains of about 0.12 standard deviations, for each year a

student spends at KIPP, with significantly larger gains for special education and 'limited English proficiency' students of about 0.3-0.4 standard deviations. Furthermore, their evidence suggests that the school benefits weakest students by most. These effect sizes are substantial. They are big enough to wipe out the average socio-economic gap (of 39 points) in the latest PISA study (OECD, 2013) and discussed in Section 3.

However, it is difficult to know whether these effects are generalizable. This study refers to one school in Boston. Applicants to KIPP schools in Boston may not be typical of parents/students more generally. Furthermore, there are other studies of autonomous schools (called by different labels in different countries) that do not find such large effects.[20] On the other hand, this study shows that it is possible to overcome the socio-economic gap by policies implemented at a school level. The success of KIPP is probably not just down to running a school in a strict 'no excuses' way. For example, the school day and year is extended and teachers are 'on call' at evenings and weekends. Similarly an evaluation of the 'Harlem Children's Zone' in New York finds very big effects for disadvantaged children (Dobbie and Fryer, 2011) but also provide a range of services not typically provided by schools (e.g. a much longer school day and year; after school tutoring). It would seem that in these examples, teachers partly substitute for the role of parents. Thus, these sorts of intervention can be very successful but go beyond what most schools provide (and as a consequence have significant resource implications). In the next section we review the specific policy measures that might be implemented to improve schools generally, we consider in particular those policies which will be more effective for disadvantaged groups.

School expenditure/resources

Gibbons and McNally (2013) review evidence on the effects of school resources. One of the general patterns that emerged from the review is that where increases of resources are effective, they are usually more effective for disadvantaged schools/pupils. If disadvantaged students are genuinely more responsive to resource-based interventions, then targeting resources at these pupils will lead to higher average achievement as well as more equitable outcomes. However, it is not possible to say how much would need to be spent on schools or

[20] For example, in the UK, Machin and Silva (2013) analysed the effects of early school academies. They found that the benefits were entirely concentrated among students of medium-high prior attainment (as measured by attainment at the end of primary school). The policy did nothing to help the lowest achieving students. These students did the same as they would have done without the policy. As students from disadvantaged families are more likely to be found in this low-ability group, one might conclude that the policy did not help reduce inequality (at least not within schools).

pupils to remove, for example, inequality between low and high socio-economic groups. There is a very large range of estimated effects in studies that look at the effect of additional resources.

In some countries, efforts have been made to reduce inequality by targeting resources in particular areas. One example is the 'zones d'éducation prioritaires' (ZEP) in France, for which an evaluation showed no positive effects on educational outcomes (Bénabou *et al.* 2009). Another example, is the 'Excellence in Cities' policy in England, for which positive effects were found for maths but not for English (Machin et al. 2010). The biggest effects were found to be concentrated on medium to high ability pupils in the most disadvantaged schools. Both these studies are about secondary school interventions about which there is less evidence relative to primary schools.[21]

In the school resources literature, there are more studies finding positive resource impacts in primary schools and early years than in secondary school. But this is partly because there have been more studies of primary education and the research designs have typically been better (see review by Gibbons and McNally, 2013). There is a good argument to say that disparities in achievement should be addressed early on so that these disparities are not propagated to, and amplified, in later stages of the lifecycle (Cunha and Heckman, 2007). But a counter-argument is that the effects of early interventions often fade out (insofar as we can tell from limited research evidence). Furthermore, where comparable research designs are available in the same economic and educational context in primary and secondary school (e.g. analysing the effects of school resources in the England), effect sizes at different phases seem comparable. Moreover a closer reading of the Heckman literature on investments over the life cycle (Cunha and Heckman 2007) suggests that a balanced approach with investments throughout the lifecycle is preferable to interventions at any one stage.

Pre-school interventions

In recent years, there has been growth in the public provision of universal pre-school across many countries and this has led to a growing literature evaluating the impact of such policies on children's outcomes (in the Argentina, Norway, France, Spain, the US). Positive effects

[21] One of the exceptions is Lavy and Schlosser (2005) who evaluate the impact of remedial education of teenagers on achievement at high school and find strong evidence on the efficacy of augmenting instruction time for targeted students.

of pre-school on educational outcomes have been found in most of these studies.[22] A number of studies consider the heterogeneity of outcomes for different subgroups and impacts are often found to be larger for more disadvantaged groups (i.e. for children of lower educated/lower income mothers; children of migrants)[23].

Startling outcomes have been found when the most disadvantaged children are placed in high-quality intensive programmes. The Perry pre-school and the Abecedarian programmes in the 1960s and 1970s demonstrated very high long-term returns (with Abecedarian which gave free full-time childcare from babyhood being particularly impressive in terms of educational outcomes, Carneiro and Heckman, 2002). However, the quality of programme must be high to achieve strong effects. More recent studies have confirmed this point with $5 a day childcare in Canada leading to negative outcomes (Baker et al. 2008). In the UK a recent evaluation of free part-time childcare has found no long-term consequences for any children, including the disadvantaged, and there is speculation that this is because of insufficient quality (Blanden et al 2014).

Tracking

When children get to school, another controversy is how early they should be tracked – typically into a more academic route vis-à-vis a more vocational route. Countries differ in how and when ability tracking takes place in education. Countries that track students into different schools at age 10/11 include Austria, Germany, Northern Ireland and Hungary. In other countries, including Britain, Canada, Norway, Sweden and the US, education at this age is comprehensive and tracking happens later. There have been important changes over time. European countries used to be more selective in how children were educated in the 19th and early 20th century. The idea of comprehensive education gathered support in the post Second World War period, though there were large differences between countries in the extent of support for this concept and whether (and how) it was implemented (see Kerckhoff *et al.* 1996). We have some evidence about the effects of these reforms for Norway, Sweden and

[22] For example, short-term benefits of pre-school on educational outcomes have been found by Cascio and Whitmore Schanzenbach (2013) for the US, Felfe and Lalive (2013) for Germany and Berlinski et al. (2009) for Argentina. Longer term benefits are revealed by Havnes and Mogstad (2011) for Norway, Berlinski et al. (2008) for Uruguay, Dumas and LeFranc (2012) for France and Felfe (2012) for Spain.

[23] Dustmann, Raute and Schoenburg (2013) find that impacts are concentrated on the children of migrants (in one German region). Havnes and Mogstad (2011), Felfe et al (2012), Cascio (2012) find impacts concentrated on children of lower educated or lower income mothers.

Finland.[24] There is an interesting similarity in the results emerging from these studies. Also, the papers are strong methodologically because the reforms were implemented gradually across municipalities, allowing one to compare outcomes across regions and cohorts (using a difference-in-differences analysis). Both Meghir and Palme (2005) and Pekkala *et al.* (2013) find small positive effects of the reform on overall measures of educational attainment (for Sweden and Finland respectively) and show that the effect comes entirely from those with a lower socio-economic background (as measured by parental occupation or education). Aakvik *et al*. (2010) use various reforms in Norway to estimate the returns to different levels of education and estimate high returns – especially for 'medium-length' education (up to two years of college education). They interpret their results as reflecting the effect of the reforms on pupils with poor family backgrounds or pupils with long travel distances to the nearest schools. The fact that all these papers show an effect for those from low socio-economic backgrounds is indicative of the equity-enhancing effect of the reforms – as manifest, for example, in increasing intergenerational mobility. In other countries, it is much more difficult to comment on the effects of reforms because they generally get implemented everywhere (within a country) at the same time. Hanushek and Woessmann (2006) make use of PISA and find that inequality in performance is higher in countries that adopt early tracking compared to countries that do not. Thus, their results are consistent with the equity-enhancing aspects of comprehensivisation.

It would be unrealistic to think that any one particular policy would fix deeply entrenched inequalities – of which educational inequality is one manifestation. However, there are policies that appear to have greater effects on more disadvantaged students (if well implemented and generally effective in the institutional context): high quality early-years provision; additional resources at school; reforms that provide a good 'general' education for disadvantaged children (i.e. ability tracking at a later age) and all-round 'super schools' (e.g the KIPP school in Boston discussed above) which have many components behind their success.

[24] Aakvik et al. (2010), for Norway; Meghir and Palme (2005), for Sweden; Pekkala et al. (2013), for Finland

6. Conclusion

Many theoretical and empirical studies show a negative relationship between human capital inequality and economic growth. When there is an unequal distribution of assets and imperfect credit markets, low-income individuals cannot make optimal investment decisions. It is the resulting misallocation of resources which leads to lower economic growth. Thus, to achieve higher economic growth, it is not enough to increase average levels of education and skills (or concentrate on expanding tertiary education). It is also necessary to reduce educational inequality and this means a particular focus on disadvantaged groups.

The main expected return to higher education and skills is the increased productivity that is made possible. Although socio-economic background is a strong predictor of educational attainment, the evidence reviewed here suggests that if economically disadvantaged individuals did acquire education and skills to equal their more advantaged peers, they would be (at least) similarly rewarded for their productivity – and thus contribute similarly to economic growth.

We identify two approaches to reducing educational inequality. The first is to pursue redistributive policies and remove institutional mechanisms that discriminate against low income people (e.g. school admission rules). The second is to use the most effective educational policies to directly improve the achievements of disadvantaged children. Policies that disproportionately help disadvantaged children include high quality early-years provision; some programmes to improve school resources; postponing ability-tracking to a later age; and measures to give schools autonomy such that they can come up with a creative combination of strategies to improve outcomes for the most disadvantaged. Policies should be developed with the needs of the most disadvantaged students in mind (and not only the average student) because this is the way to both reduce inequality and achieve economic growth.

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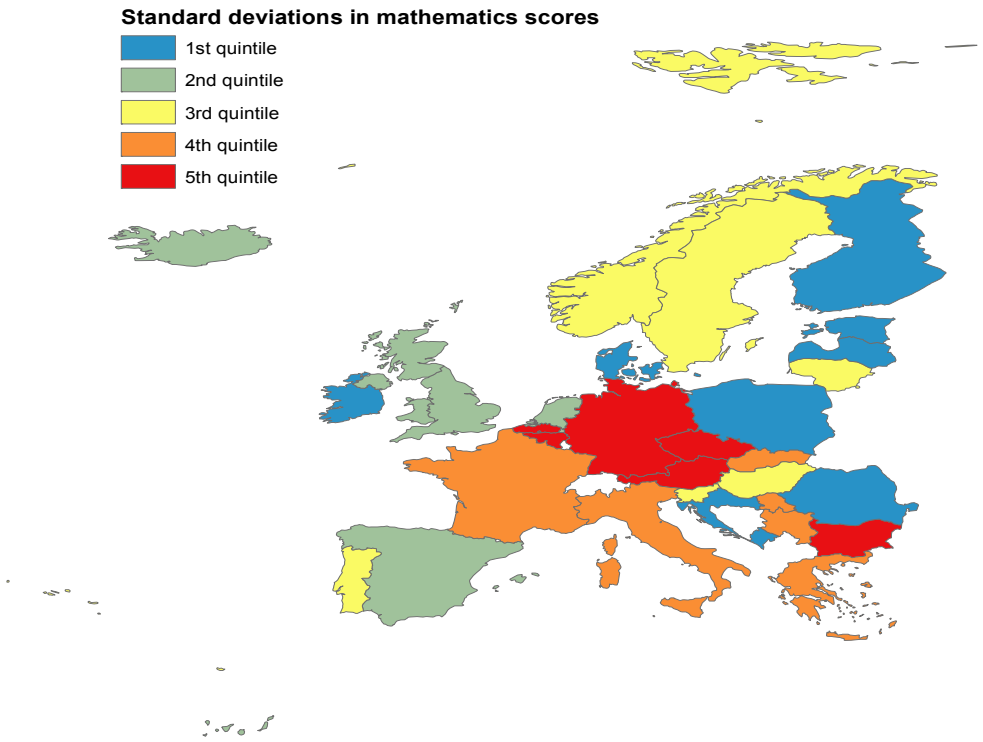
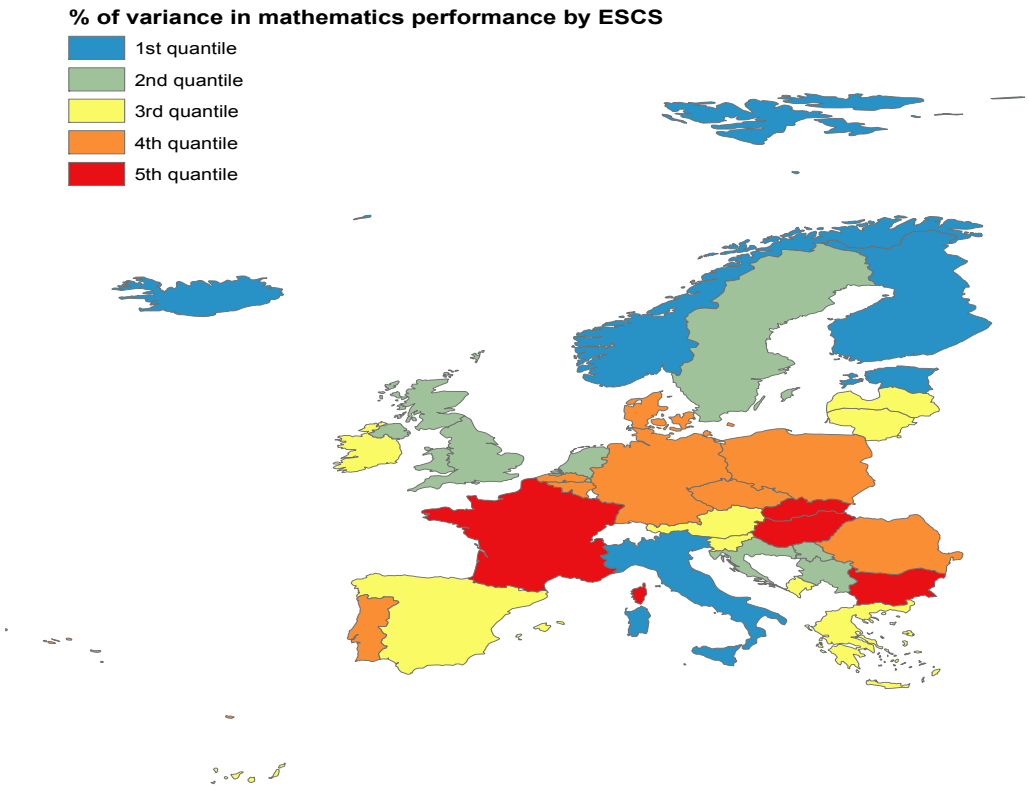
Appendix Figure A1: Standard Deviations in Mathematics Scores (representation of Figure 3)



Appendix Figure A2: % of variance in Mathematics achievement that is accounted for by a measure of socio-economic status (representation of Figure 4)



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