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Measuring Inequality in Children's Education in Rich Countries

Anna Gromada, Gwyther Rees, Yekaterina Chzhen, Jose Cuesta and Zlata Bruckauf

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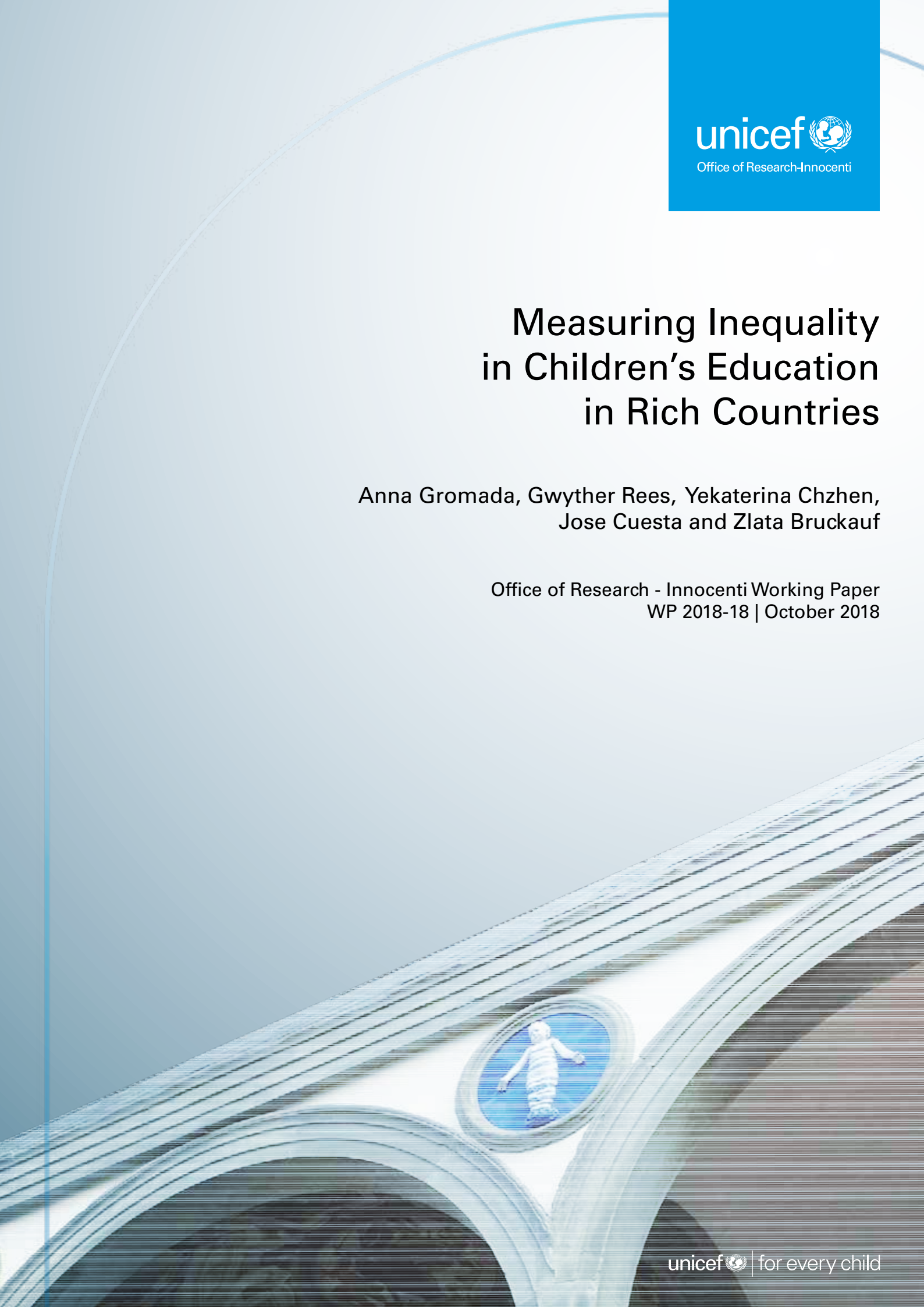

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MEASURING INEQUALITY IN CHILDREN'S EDUCATION IN RICH COUNTRIES.

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ABSTRACT

There is growing recognition among international organizations, scholars and policymakers that education systems must produce equitable outcomes, but there is far less consensus on what this means in practice. This paper analyses differences in inequality of outcome and inequality of opportunity in educational achievement among primary and secondary schoolchildren across 38 countries of the European Union (EU) and/or the Organisation for Economic Co-operation and Development (OECD). The analysis focuses on reading achievement, drawing on data from the Progress in International Reading Literacy Study (PIRLS) and the Programme for International Student Assessment (PISA). We use several measures to operationalize the two concepts of inequality in education. Our results show that inequality of outcome does not necessarily go hand in hand with inequality of opportunity. These two concepts lead to measures that produce very different country rankings. We argue that information on both inequality of outcome and inequality of opportunity is necessary for a better understanding of equity in children's education.

KEYWORDS

Inequality of opportunity, inequality of outcome, educational achievement, reading, PISA, PIRLS

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CONTENTS

1. INTRODUCTION

There is a growing recognition that educational systems should be assessed not only on the average results they produce, but also on how equal they are. For example, a report by the Organisation for Economic Co-operation and Development (OECD) on the most recent Programme for International Student Assessment (PISA) study focuses on both 'excellence' and 'equity' (OECD, 2016a). There is broad agreement on suitable measures of excellence. The most commonly used measure for this purpose is mean test scores, sometimes supplemented by the percentage of children who have reached a specific threshold of proficiency. There is much less agreement on what equality is and how best to measure it. There is debate about the relative merits of pursuing equality of opportunity vs equality of outcome as well as about how to measure these concepts.

Assessing the degree of inequality of opportunity and inequality of outcome is important for both normative and instrumental reasons. Normatively, inequality of opportunity rests on the idea that while differences in outcomes arising from individual responsibility are justifiable, those that are due to circumstances beyond the individual's control are ethically unacceptable (Roemer, 1998; Checchi, Peragine and Serlenga, 2010; Fleurbaey and Peragine, 2013). Instrumentally, a large inequality of outcome is inefficient in so far as the human capital of disadvantaged groups is lost to society. Preventing entire groups from realizing their potential can produce inequality traps that put the brakes on economic growth and prosperity (World Bank, 2005). In contrast, reducing inequality of opportunity in one generation should lead to lower inequality of outcome in the next generation (World Bank, 2016). Highlighting drivers of inequality may also increase public support for redistributive policies, because individual preferences for redistribution are correlated with beliefs about the causes of inequalities (Alesina and La Ferrara, 2005).

This paper analyses the extent of inequality in schoolchildren's reading proficiency across 38 developed countries using data from the Progress in International Reading Literacy Study (PIRLS) and PISA. It compares two approaches to the measurement of inequality – inequality of opportunity and inequality of outcome – while also testing the robustness of the cross-country comparative results for each approach using several measures:

a) Inequality of outcome measured as the gap between the highest- and lowest-scoring students using three cut-off points in the distribution of reading outcomes (P95–P5, P90–P10 and P75–P25).
b) Inequality of opportunity measured as the association between parental occupation and reading scores.
c) Inequality of opportunity measured as the share of variance in reading achievement that can be explained by children's circumstances.

The paper is the most comprehensive and up-to-date cross-country comparative analysis of inequality of opportunity and inequality of outcome in educational achievement across high-income countries. It contributes to the study of educational inequality by evaluating how the way in which educational inequality is both conceptualized and measured influences country rankings. Such choices, in turn, have implications for the policy conclusions that are drawn from international comparisons.

2. EDUCATIONAL INEQUALITY

2.1 Inequality of outcome: Concept, evidence and measures

Equality of outcome as a political idea has been integrated into ideals of the left and linked to such values as justice, solidarity and social cohesion. These values have increasingly been incorporated into a global consensus, now that they form an explicit Sustainable Development Goal (United Nations, 2014), a World Bank (2015) goal and part of the most recent International Monetary Fund (IMF) narrative (IMF, 2017; Clements et al., 2015). The same values have also been central to the aims of recent protest movements such as Occupy Wall Street and Los Indignados.

Proponents of equality of outcome argue that more equal societies have higher life expectancy rates, greater child well-being and fewer social problems such as violence, mental illness, bullying among children and teenage pregnancy (Wilkinson and Pickett, 2010). Political scientists point to the role of equality in the preservation of democracy (Packer, 2011). They argue that inequalities erode social cohesion and empathy among citizens – both of which are preconditions for meaningful political participation – while inequality of income specifically correlates with a lack of trust (Jordahl, 2007). In contrast, opponents argue that equality of outcomes might lower human motivation, creativity and invention, and can encourage dependence on the state. They reject redistributive policies as being inefficient, unjust or both. Additionally, any attempt to introduce equality of outcome would require a level of central intervention that is incompatible with freedom (Hayek, 2014).

When applied to education, assessing inequality of outcome provides a check on the school system: Does it leave behind no children, irrespective of social background, so that all can enter adulthood prepared to participate fully in society? The case for assessing inequality of educational outcome also stems from a normative approach that children determine very few, if any, of their resources and circumstances (Bruckauf and Chzhen, 2016).

Inequality of educational outcome is also a persistent feature of rich societies. Meschi and Scervini (2014) provide a longitudinal analysis of educational inequalities in European countries during the twentieth century. Inequality of outcome decreased as education systems expanded, although the rate of decrease slowed as education systems moved closer to achieving universal access to secondary education. A recent report by OECD (2017b) raises the prospect that inequalities may increase in the future due to technological changes.

All three of the well-established standardized international studies of children's educational performance – PISA, PIRLS and the Trends in International Mathematics and Science Study (TIMSS) – show substantial variation in inequality in high-income countries (OECD, 2016a; Mullis et al., 2016; Mullis et al., 2017). Between-country differences in educational inequalities may be attributable to differences in educational policies and practices. Meschi and Scervini (2014) contend that raising the compulsory school-leaving age reduces inequality of outcome, while early 'tracking' (the allocation of children to different educational pathways) increases it. OECD (2016b) identifies the contribution of factors such as early tracking and grade repetition to educational inequalities and discusses a range of potential measures to reduce these inequalities, including broadening access to high-quality early childhood education and providing extra support to disadvantaged children and schools. Countries with greater socio-economic segregation of children between schools tend to have greater educational inequality and there is little sign that this type of segregation is diminishing (Gutierrez, Jerrim and Torres, 2017).

In this paper, we analyse inequality of outcome as measured by gaps in reading test scores, which are represented as a continuous univariate scale at the level of the individual. The indicator we use for both primary school (looking at Grade 4 schoolchildren, aged around 10 years) and secondary school (looking at schoolchildren aged 15 years) is the gap between the reading scores of the lowest-performing (10th percentile) and highest-performing (90th percentile) students in the distribution of student outcomes.[1]

2.2 Inequality of opportunity: Concept, evidence and measures

The purpose of equal opportunity policies is to level the playing field rather than to equalize all outcomes (Roemer, 1998). Yet, different formulations of the concept of equality of opportunity lead to different redistributive principles (Fleurbaey, 2008). The principle of *compensation* states that differences in individual achievements that arise from 'circumstances' (characteristics beyond the individual's control) are unjust and should be compensated. The principle of *reward* states that differences in achievements that are due to 'effort' (which includes any factors that arises from individual responsibility) are equitable and should not be compensated.[2] These principles are independent of one another and can be incompatible (Ferreira and Peragine, 2015).

The underlying assumption in the conceptual work on equality of opportunity is that individuals have full agency in deciding how much 'effort' they wish to exert and in making choices. For example, Ferreira and Gignoux (2014, p. 232), in a study of inequality of educational opportunity using PISA data, argue that: "Because 15 year-olds may conceivably affect the choice of school they attend, the class they are assigned to, and thus the teachers they interact with, all school characteristic variables, for example, are included in [effort]." This is a bold leap to make, even when considering children of this age. The extent to which (a) children realistically have choices about this matter, and (b) are empowered to make these types of decisions independently of parents and other adults will vary according to context. Additionally, our analysis includes children from 8 years of age upwards, and the above argument is even less likely to apply to younger age groups. Brunori, Ferreira and Peragine (2013, p. 15) acknowledge the complexities involved in this area, however, and identify "the issue of age of responsibility, and whether or not all inequalities in access to services for children below a certain age should not be considered inequality of opportunity."

An additional complexity is that it is important to separate the notions of children's circumstances, effort and choices from those of their parents. For example, parents may choose which school their child attends, in which case this is a 'circumstance' beyond the child's control. Similarly, parents may influence their child's 'effort' in various ways, such as by funding extra tuition, but unless the child is fully involved in these decisions, and depending on the context, this may again be best regarded as a 'circumstance' from the child's perspective.

Research on educational inequalities within countries has focused primarily on family socio-economic status (SES). Children from poorer SES backgrounds typically perform significantly worse

1 P90–P10 is a measure of dispersion in the scores that is relatively easy to interpret when compared to other inequality of outcome measures analysed by the United Nations Educational, Scientific and Cultural Organization Institute for Statistics (UNESCO Institute for Statistics, 2018). Some of these measures are visual distributions of the outcome, such as the: probability density function (e.g., histogram); cumulative distribution function; and Lorenz curve. Others are numerical measures, including the: range; restricted range; ratio; measures of dispersion such as the variance and standard deviation; and cumulative information such as the Atkinson, McLoone, Gini and Theil indices.

2 Moreover, the concept of responsibility itself leads to two versions of the reward principle: 'liberal reward', which prohibits redistribution among individuals with identical circumstances (beyond that which is required by the compensation principle); and 'utilitarian reward', which calls for a policy of maximizing total welfare among subgroups with identical circumstances through redistributive effort beyond that which is required by the compensation principle (Fleurbaey, 2008).

at school. For example, a meta-analysis by White (1982) that examined 101 studies from as early as the 1920s – most of them conducted in the United States of America, and including the influential Equality of Educational Opportunity Survey (Coleman, 1966) – identified substantial SES effects on children's educational performance. Willms (2006) presented a cross-country analysis of socio-economic inequalities using PIRLS and PISA data, establishing a framework that has subsequently been developed by Caro and Lenkeit (2012). Caro and Lenkeit's analysis highlights the cumulative effect of individual SES and school-level SES in explaining educational inequalities, and also examines how factors such as family cultural capital can mediate the relationship between SES and educational outcomes.[3]

Another key aspect of within-country differences in educational inequalities is gender inequality. Gender gaps emerge in the early years (Mensah and Kiernan, 2010) and persist across different educational stages (Bradbury et al., 2015). Evidence from the most recent PISA study (OECD, 2016a) suggests that differences in achievement between girls and boys vary across subjects. Girls typically do better than boys at reading. Boys do better than girls in mathematics in around half of OECD countries, while in the rest, there is no significant gender difference. Patterns of achievement in science are more mixed.

Recently, greater attention has been paid to the issue of differences in outcomes for children with migrant backgrounds. Immigrant children in continental European countries generally do worse than non-immigrant children, even after taking into account differences in family background (Borgna, 2015). These differences are amplified by the timing of preschool and school entry, and by tracking and residential segregation (Borgna, 2015). Teltemann and Schunck (2016) also highlight between-school stratification as a factor that contributes to the lower relative performance of immigrant children. The gap in performance between immigrant and non-immigrant children is less apparent, however, in English-speaking countries (Schnepf, 2007). This may be attributable to the socio-economic backgrounds of migrants to those countries and to pre-existing familiarity with the English language. These between-country variations illustrate the importance of understanding contextual factors in relation to educational inequalities.

In the literature, there is no consensus on the formulation and measurement of inequality of opportunity. This is in part due to practical limitations: in comparison with outcomes, opportunities are not directly observable (Checchi and Peragine, 2010). In this paper, we make use of two approaches proposed respectively by Ferreira and Gignoux (2014) and by Schütz, Ursprung and Wößmann (2008). A third approach – the Dissimilarity Index (e.g., de Barros et al., 2009) – was also considered but is not pursued in this paper as it is more suited to binary outcomes (e.g., completion of education) than to the continuous measures of achievement used in Innocenti Report Card 15 (UNICEF Office of Research, 2018).

Ferreira and Gignoux (2014) propose a parametric measure of inequality of opportunity in educational achievement using data for 57 middle- and high-income countries taken from PISA 2006. Following Ferreira and Gignoux (2011) – who built on Bourguignon, Ferreira and Menéndez (2007) and Checchi and Peragine (2010) – the model is based on the ex ante approach, focusing on the between-types inequality. The individual outcome (y_i) is regressed on a vector of circumstances $(C_i^{'})$:

3 Caro and Lenkeit (2012) relied on a concept developed by Tramonte and Willms (2010), who distinguish between a static form of cultural capital (possession of cultural goods) and its dynamic form (cultural interactions). They operationalize the former as the number of books at home and the latter as the frequency of visits to libraries and/or bookshops.

$$y_i = C_i^{'} + \eta_i$$

A vector of predicted scores ($C_i^{'}\hat{\beta}$) is calculated from the equation estimated with ordinary least squares (OLS) regression. The index of inequality of opportunity ($\hat{\theta}_{IOP}$) is then calculated as the share of the total variability in the outcome (y_i) accounted for by the variance of the predicted scores:

$$\hat{\theta}_{IOP} = \frac{Var\,(C_i^{'}\hat{\beta})}{Var(y_i)}$$

According to Ferreira and Gignoux (2014), this measure is particularly suitable because: 1) it is easy to calculate as the R-squared of an OLS regression of the child's standardized test score on the observed predetermined achievement-related circumstances; and 2) it is a meaningful parametric approximation of the lower boundary on the degree of inequality of opportunity in educational achievement. Even if individual OLS coefficients are subject to omitted variable bias, the R-squared still measures the overall effect of circumstances (affecting outcomes both directly and indirectly through efforts).

Based on the Ferreira and Gignoux (2014) specification of circumstances, a fair world would be one in which 15-year-old children taking part in PISA had the same chance of achieving a given score irrespective of their predetermined characteristics, i.e., gender, father's and mother's education, language spoken at home, migration status, access to books at home, durables owned by the household, cultural items owned by the household, and the location of the school attended (i.e., urban/rural). Although PISA offers a rich list of school- and teacher-related characteristics, Ferreira and Gignoux explicitly exclude such variables from the measure of circumstances, arguing that 15-year-old PISA respondents may have influenced which school they attend.

Using this method, Ferreira and Gignoux (2014) found that circumstances could explain between 4 and 39 per cent of the variation in test scores in reading, maths and science in the PISA 2006 data for 57 middle- and high-income countries. They found that this measure of inequality of opportunity was not correlated with mean academic performance and was only weakly correlated with national wealth. It was, however, more strongly (negatively) correlated with educational spending and (positively) correlated with the degree of tracking (children being assigned to different educational pathways).

The Ferreira-Gignoux approach also has at least one potential limitation. Because the measure is based on the proportion of variance explained, then any unobserved factors that cause an increase in overall variance in test scores may also cause a decrease in the proportion of variance explained by the Ferreira-Gignoux measure. The extent of this issue will depend on the strength of the correlation between the unobserved factors and those factors included in the regression model. For example, if regional differences are introduced into educational policy within a country, and there are only weak variations in socio-economic circumstances between these regions, then overall variance in academic achievement will increase and the inequality of opportunity measure may decrease. Regional differences have been shown to play an important role in understanding educational inequalities in Belgium, for example (Ning et al., 2016). Likewise, the 'streaming' (assigning children to different groups or classes according to ability within schools), as practised in England from quite young ages (Parsons Hallam, 2014), could potentially have the effect of reducing the Ferreira-Gignoux measure while increasing overall inequalities.[4]

4 Depending on the strength of the association between pre-streaming achievement and SES factors included in the model.

A second measure of inequality of opportunity, proposed by Schütz, Ursprung and Wößmann (2008), also uses a linear regression approach. In this case, however, the inequality of opportunity measure is the regression coefficient for the independent variable measuring family SES. This approach has an intuitive appeal, and the resulting measure is expressed in terms of test scores, which is an easy idea to communicate. On the other hand, a disadvantage of this approach is that it can only represent one particular factor, in this case family SES; other salient factors that may represent inequality of opportunity, such as variations according to gender or immigration status, are invisible.

Socio-economic differences in achievement in high-income countries have also been explored in some of the previous analytical work on PISA. For example, OECD (2016a, p. 217) discusses "two main measures of equity in education outcomes: the strength of the relationship between performance and socio-economic status (the strength of the socio-economic gradient) and the size of performance differences across socio-economic groups (the slope of the socio-economic gradient). While these two measures are positively correlated, they capture different aspects of the relationship between students' performance and socio-economic status, with potentially different policy implications."

One overarching point about these methods relates to the issue of cross-national comparability. Equality of opportunity approaches assume that the circumstance variables used have the same meaning across all countries. It is not entirely clear that this is true, however. For example, Põder, Lauri and Veski (2017, p. 677) raise questions about the cross-cultural comparability of items such as books at home: "In large-number inter-country studies, it is difficult to argue that in different cultures or living conditions 'books' have the same effect on PISA scores; or, put simply, individuals in different cultures do not share the same aspiration to books." Such issues will be magnified as the diversity of countries included in the analysis increases.

3. ANALYTICAL STRATEGY

3.1 Data

We focus on countries that are a member of the European Union (EU) and/or OECD and make use of data from the latest rounds of two international surveys of student achievement: PISA 2015 and PIRLS 2016 (*see Table 1*). Both studies produce nationally representative and cross-nationally comparable data on schoolchildren's skills and knowledge in reading.[5] They cover many of the same countries, employ similar sampling designs and estimate student achievement using similar statistical methods.[6] Yet there are conceptual differences in the skills that the two studies measure. While PISA evaluates functional ability, PIRLS assesses children's capacity to meet an internationally agreed curriculum (Jerrim, 2013).

Compared to PIRLS, PISA features a richer range of student and family socio-economic characteristics, includes three subject areas at once and covers a greater number of EU/OECD countries (*see Annex, Table 13*). There is also value in analysing data from PIRLS, however, as the study covers a younger age group and serves as a robustness check on the international comparability of the PISA-based results.

Table 1. Main design features of PISA and PIRLS

	PISA 2015	PIRLS 2016
Study administrator	Organisation for Economic Co-operation and Development (OECD)	International Association for the Evaluation of Educational Achievement (IEA)
Respondents	15-year-olds (students in Grade 7 or higher)	Grade 4 students (aged around 10 years)
Number of EU/OECD countries in latest round	41 EU/OECD countries	29 EU/OECD countries
Sampling design	Two-stage stratified random sample. Schools are the first-stage sampling units; students are the second-stage units (typically 35 students per school).	Two-stage stratified random sample. Schools are the first-stage sampling units; classes are the second-stage units (typically one or two classes per school, with all students from each class included).
Typical sample size	Minimum 4,500 students (from across at least 150 schools)	4,000 students (from 100–200 schools)

Source: based on OECD (2017a); Martin, Mullis and Hooper (2017).

5 Some students with special needs or disabilities are excluded from the studies, however.

6 Based on the assumption that cognitive ability cannot be observed directly but has to be estimated using children's answers to test questions (which tend to vary in difficulty), a range of 'plausible values' of the latent cognitive ability is modelled for each child and for each subject using a statistical technique known as item response theory. Most data use the resulting 'plausible values' rather than the actual test answers.

3.2 Variables

In both surveys, each participant receives only a selection from the pool of test items. Thus, it is only possible to imprecisely estimate their 'true' achievement score. To account for this, each data set contains a number of 'plausible values', which represent estimates of the 'true' score. PISA 2015 has 10 plausible values, while PIRLS 2016 has 5. These plausible values are used to estimate standard errors and confidence intervals for statistics.

We have calculated three measures of inequality.[7] The first captures overall inequality of outcome and the other two relate to the concept of inequality of opportunity:

1. Inequality of outcome: The restricted range of the reading score distribution.

    - It is necessary to decide which two points on the distribution to use to compare the worst- and best-scoring students. We use the gap between the 10th and 90th percentiles (P90–P10) as a standard measure of dispersion (see Figure 1). To check whether the choice of the cut-off point in the distribution influences the country ranking, in this paper we compare this measure to two different cut-off points: P95-P5 and P75-P25. The former looks at the two extremes: students who have done worse than 95 per cent of their peers (5th percentile) and those who have done better than 95 per cent of their peers (95th percentile). The latter is the interquartile range – students who have done worse than 75 per cent of their peers (25th percentile) and those who have done better than 75 per cent of their peers (75th percentile) – which shows us how wide the middle half of the distribution is.
    - PISA and PIRLS reading scores were standardized for the first survey waves (conducted in 2000 for PISA and in 2001 for PIRLS) so that at that wave both surveys had an international mean of 500 points and a standard deviation of 100 points. Such standardization facilitates comparability across survey waves. Most children tend to score between 300 and 700 points.

2. Inequality of opportunity (socio-economic gradient): The coefficient for parental occupation from a linear regression without controls.

3. Inequality of opportunity (Ferreira-Gignoux): The R-squared from a linear regression with the test score as the dependent variable and the circumstances as independent variables.

Our initial list of variables replicated that used by Ferreira and Gignoux (2014) in their analysis of PISA 2006 data: gender, parental education, parental occupation, language spoken at home, migration status, number of books at home, number of cultural possessions at home, household wealth index and location of school (*see Table 2*). We would have preferred to use this list for both of our data sets but this was not possible with the PIRLS data set for two reasons.

7 All statistical analysis was undertaken using the Stata 14 software package. Unless otherwise stated, all the analysis used the 'repest' command (Avvisati and Keslair, 2014), which takes full account of plausible values and the survey design. Although the repest package was designed for OECD databases, it includes the option 'repest SVY', which allows for user-defined survey parameters related to the variance factor, weights, number of plausible values and number of replications, and so it can also be used for the analysis of PIRLS data. We adopted $p<0.05$ (95 per cent confidence) for tests of statistical significance, unless otherwise stated. Additional technical details about the analysis are provided in the results section of this paper where relevant.

First, the PIRLS survey does not include questions about cultural possessions at home and the household wealth index.

Second, we encountered problems with missing data for the variables on parental education and occupation, and migration status. For PISA, which surveys 15-year-old children, this information is gathered directly from the child in all countries. PIRLS instead gathers this information by surveying parents (although parental surveys are not conducted in every country). Even in countries that gather this information, the proportion of children without parental data was more than 15 per cent in almost half of the countries. We compared test scores for children with and without parental data and there were significant differences: children whose parents had not participated in the survey tended to have much lower test scores than children whose parents had. Therefore, at the primary school level we can only compare the inequality of opportunity for 15 countries that have fewer than 15% of missing data on parental occupation and education.

Table 2. Circumstance variables by survey for potential inclusion in the analysis

Variable	Specification	PIRLS 2016	PISA 2015
Gender	Female/Male	Y	Y
Parental education	Highest International Standard Classification of Education (ISCED) code of either parent (seven categories)	Y	Y
Parental occupation	In PISA: Highest socio-economic status of either parent (a scale variable ranging from 11 to 89) In PIRLS: a number of discrete categories	Y	Y
Language spoken at home	In PISA: A binary variable indicating whether the child's home language is the same as or different to the test language In PIRLS: A three- or four-category frequency variable indicating how often the child speaks the test language at home	Y	Y
Migration status	Whether the child was born in the country of the survey	Y	Y
	Whether each of the child's parents was born in the country of the survey	N	Y
Location of school (size of local population)	Three categories: Rural (up to 15,000 people); Town (15,001 to 100,000 people); City (more than 100,000 people)	Y	Y
Coming to school hungry	Three categories: Never; Sometimes; Every day or almost every day	Y	N
Coming to school tired	Three categories: Never; Sometimes; Every day or almost every day	Y	N
Number of books at home	Six categories in PISA: 0 to 10; 11 to 25; 26 to 100; 101 to 200; 201 to 500; More than 500 Five categories in PIRLS (top category is 'More than 200')	Y	Y
Cultural possessions at home	A standardized scale based on the presence of items such as books of poetry and works of art	N	Y
Wealth index	A standardized scale based on the presence of household items such as a dishwasher and a car	N	Y

Note: Y = Variable present in survey; N = Variable absent from survey.

Source: OECD (2017a); Martin, Mullis and Hooper (2017).

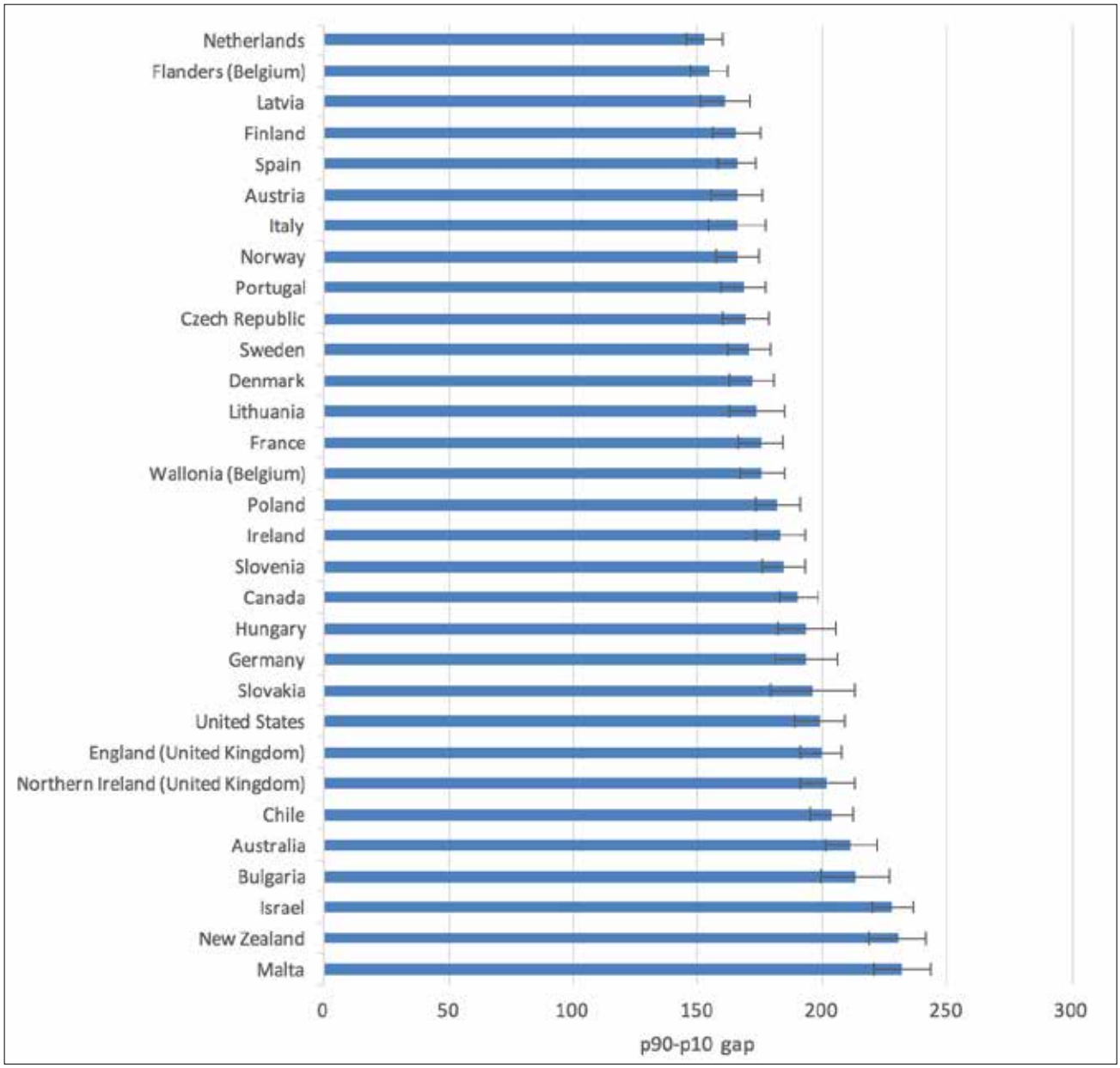
4. RESULTS: PRIMARY SCHOOL

4.1 Inequality of outcome: Reading gaps

First, we look at inequality of outcomes. We compare how different formulations of our measure of this aspect might affect a country's relative position (ranking) in terms of inequality. Cut-off points make very little difference in measuring reading gaps among fourth-graders in the 31 school systems (*see Table 3*). The main measure used in Innocenti Report Card 15 (UNICEF Office of Research, 2018) – rank on P90–P10 – shows an almost perfect correlation with both the P95–P5 and P75–P25 cut-off points: 0.98 ($p<0.001$) and 0.98 ($p<0.001$). No country changes position by more than 20 per cent (six places) when a different cut-off point is used, while only three countries in total change position by more than 10 per cent (three places). If we used the interquartile range (P75–P25) instead of the P90–P10 gap, only two countries would change position by more than three places: Norway and Sweden would both move four places up. Similarly, if we opted for the extreme cases gap (P95–P5) over the P90–P10 gap, only one country would change position by more than three places: Finland would fall five places.

This high consistency of country rankings across all three measures of dispersion suggests that P90–P10 is a reasonable measure of inequality of educational outcomes using these data.

Figure 1. P90–P10 gaps in reading scores in 31 school systems at Grade 4



Note: Flanders (Belgium) refers to the Flemish-speaking region in Belgium. Wallonia (Belgium) refers to the French-speaking Wallonia-Brussels Federation in Belgium. The mean of the reading achievement scale is 500, corresponding to the mean reading achievement in 2001; the standard deviation is 100. The performance gap is measured as the absolute difference between the 90th and 10th percentiles of the reading score. Confidence intervals are calculated by multiplying the standard error of the P90–P10 gap by +1.96 and -1.96 and adding the product to the mean score.

Source: PIRLS, 2016.

Table 3. Difference in country rankings for reading performance depending on the cut-off point at Grade 4

Country	Ranking, P95–P5	Ranking, P90–P10	Ranking, P75–P25	Difference between P90–P10 and P95–P5 rankings	Difference between P90–P10 and P75–P25 rankings
Netherlands	1	1	1	0	0
Flanders (Belgium)	2	2	2	0	0
Latvia	3	3	3	0	0
Finland	9	4	6	-5	-2
Spain	5	5	8	0	-3
Austria	4	6	9	2	-3
Italy	7	7	5	0	2
Norway	6	8	4	2	4
Portugal	8	9	12	1	-3
Czech Republic	10	10	11	0	-1
Sweden	11	11	7	0	4
Denmark	12	12	10	0	2
Lithuania	15	13	13	-2	0
France	13	14	15	1	-1
Wallonia (Belgium)	14	15	14	1	1
Poland	17	16	17	-1	-1
Ireland	18	17	18	-1	-1
Slovenia	16	18	16	2	2
Canada	20	19	21	-1	-2
Hungary	19	20	22	1	-2
Germany	22	21	20	-1	1
Slovakia	25	22	19	-3	3
United States	21	23	24	2	-1
England (United Kingdom)	24	24	25	0	-1
Northern Ireland (United Kingdom)	26	25	23	-1	2
Chile	23	26	26	3	0
Australia	27	27	27	0	0
Bulgaria	28	28	28	0	0
Israel	30	29	30	-1	-1
New Zealand	31	30	29	-1	1
Malta	29	31	31	2	0

Correlation of P90–P10 with P95–P5: 0.98, p<0.001
Correlation of P90–P10 with P75–P25: 0.98, p<0.001

Note: The performance gap is measured as the absolute difference between the 90th and 10th, between the 95th and 5th, and between the 75th and 25th percentiles of the reading score. Countries that rank more than 10 per cent higher for the alternative gap measure than for the P90–P10 measure are marked in green. Those that on the same basis rank at least 10 per cent lower are marked in red.

Source: PIRLS, 2016.

4.2 Inequality of opportunity: Occupational gradient

The second part of the analysis considers a measure of inequality of opportunity based on the gradient in reading scores associated with parental occupation. In the PIRLS data, parental occupation is represented by a variable that has a number of discrete categories. For the purpose of this analysis, we collapsed these categories into two groups: professionals and non-professionals. The former group includes typical middle-class occupations such as manager, official, teacher, nurse, engineer and doctor; the latter encompasses all non-professional occupations, such as builder, waiter, driver or cleaner.

There were high levels of missing data for this variable in some countries. So, in this part of the analysis, we include only the 15 countries with sufficiently high parental survey response rates (at least 85 per cent). Within this group of countries, the percentage of children with at least one parent with a professional occupation ranged from 32 per cent in Austria to 70 per cent in Norway. In all countries, children with at least one parent working in a professional job had (statistically significant) higher reading scores than the remaining children. The gap ranges from 28 points in Finland to 66 points in Bulgaria (*see Table 4*).

Table 4. Reading scores at Grade 4 in 15 countries, by parental occupation

Country	Reading score, non-professional	Reading score, professional	Coefficient of the binary predictor	Standard error	Significance	Ranking by occupational gradient
Finland	553	581	28.50	2.35	***	1
Latvia	546	575	28.94	3.14	***	2
Spain	520	552	31.64	2.28	***	3
Portugal	517	549	31.98	3.70	***	4
Norway	538	572	33.54	2.50	***	5
Czech Republic	532	566	34.28	2.65	***	6
Italy	541	577	36.08	2.81	***	7
Ireland	554	590	36.12	3.27	***	8
Denmark	528	565	36.90	3.25	***	9
Austria	534	571	37.12	2.80	***	10
Poland	551	591	39.52	3.09	***	11
Slovenia	525	569	43.34	3.00	***	12
Slovakia	517	572	54.37	5.21	***	13
Hungary	536	593	56.57	4.18	***	14
Bulgaria	530	597	66.43	4.44	***	15

Note: School systems are sorted by the magnitude of the absolute parental occupation gap in reading scores. We exclude countries missing more than 15 per cent of the data on parental occupation. Professionals include corporate managers, senior officials, teachers, nurses, engineers and doctors. Non-professionals include small business owners, clerical workers, skilled workers, general labourers, service or sales workers, craft or trade workers, plant or machine operators, and those who have never worked for money. All regression models are run with no controls. All countries show statistically significant differences between occupational groups (at $p<0.05$).

Source: PIRLS, 2016.

For these 15 countries, we compared country rankings using the occupational gradient with those from the P90–P10 measure discussed in the previous section. The two measures correlated at r=0.88 (*see Table 5*). The rankings were markedly different for only one country. Austria ranked six places lower (greater inequality) using the occupational gradient rather than the P90–P10 measure.

4.3 Inequality of opportunity: Personal and family circumstances

Parental occupation is not the only personal or family circumstance that influences how well children perform in school. Other factors include the child's gender, the language the s/he speaks at home, the location of the school, the country of the child's birth, parental education, and whether the child comes to school hungry or tired. In this section, we consider the extent to which this set of variables, considered jointly, explains variations in reading scores. This explanatory power is expressed as a percentage (based on the R-squared statistic from a linear regression).

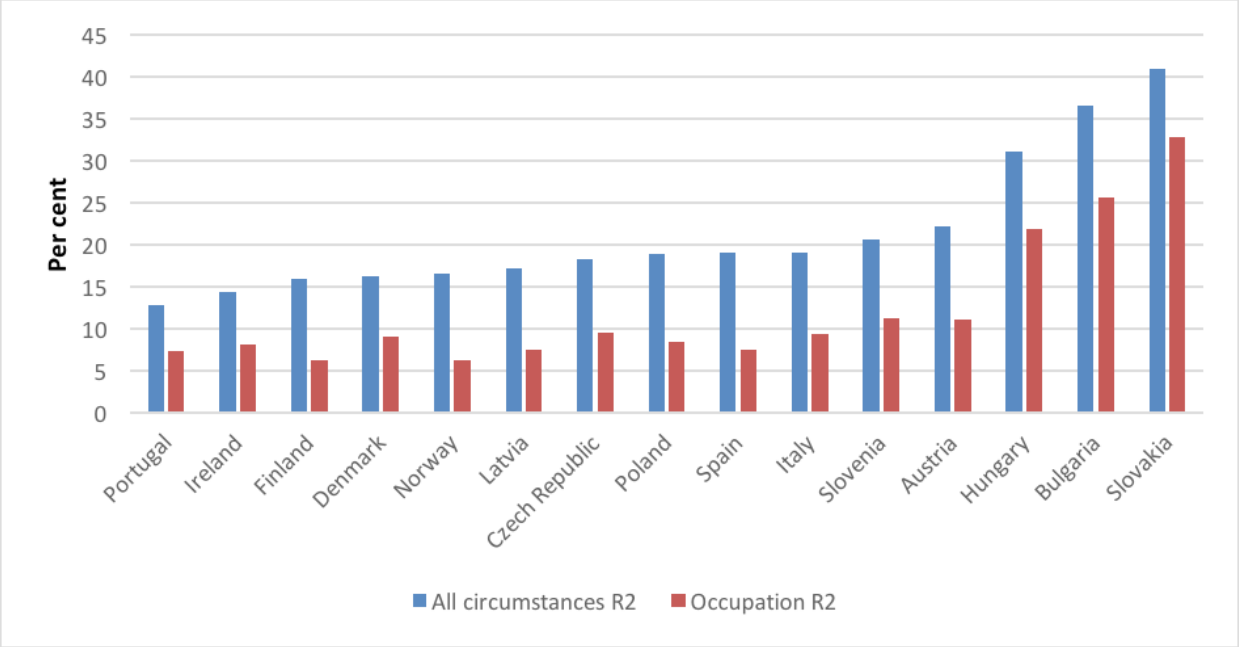
In the 15 countries for which sufficient data were available, the above set of personal and family circumstances, which includes parental occupation, explained more than 30 per cent of the variation in children's reading scores in Slovakia (41 per cent), Bulgaria (36 per cent) and Hungary (31 per cent) (*see Figure 2*), but only 13 per cent of the variation in Portugal and 14 per cent in Ireland.

For these 15 countries, we can compare the rankings based on this measure with those based on the P90–P10 gap. The rankings were markedly different for seven of the analysed countries. Ireland ranks 9 places higher (more equal) using the R-squared measure instead of the P90–P10 measure. Portugal ranks six places higher, and Denmark moves five places up. In contrast, Austria ranks eight places lower (i.e., more unequal) using the R-squared measure, and Spain, Latvia and Italy fall seven, five and four places respectively– also notably lower than when using the P90–P10 measure.

To ascertain whether the markedly different rankings are due to the new measurement method (R-squared) or the new variables, we also calculated the R-squared attributable solely to parental occupation and compared it to the overall R-squared. The two measures have shown a correlation of 0.82, while occupational R-squared has shown a correlation of 0.71 with the ranking using the P90–P10 measure.

The ranking of four countries varies. Norway and Spain would respectively rank four and six places higher (more equal) based only on the occupational R-squared than on the overall R-squared. In fact, Norway tops the overall ranking as having the lowest proportion of reading score variance that can be attributed to parental occupation. This shows that, in these countries, other inequalities have relatively more importance than occupation in terms of their effect on reading achievement. In contrast, Denmark and Ireland would fall by four places (more unequal), using only the occupational R-squared. In these countries, occupation has a relatively greater explanatory power than other circumstances.

Figure 2. Percentage of variation in children's reading achievement at Grade 4 explained by personal and family circumstances



Note: Personal and family circumstances include the child's gender, whether the child speaks at home in the language of testing, the location of the school, whether a child was born abroad or not, parental occupation and education, and whether the child comes to school hungry or tired. We exclude countries missing more than 15 per cent of the data on parental occupation.

Source: PIRLS, 2016.

4.4 Comparison of all primary school measurements

At the primary school level, whether one uses the P90–P10, P95–P5 or P75–P25 gap makes very little difference to the country rankings for inequality of outcome. Substantial differences emerge, however, between the rankings for inequality of outcome (P90–P10) and measures of inequality of opportunity – thus supporting the idea that these are separate concepts.

The P90–P10 gap shows a strong relationship with measures of parental occupation: a correlation of 0.88 with the occupational gradient and of 0.71 with the occupational R-squared. But Austria ranks much higher (more equal) using the P90–P10 inequality of outcome measure than those based on inequality of opportunity due to parental occupation (gradient or share of variance).

The single biggest difference emerges between the P90–P10 gap and the R-squared of all circumstances (correlation is not statistically significant). Almost half of the countries differ markedly in their rankings based on these two measures. This might signal not only that inequality of outcomes and inequality of opportunity are separate conceptually and methodologically but also that they do not have to go together, as seen by comparing Ireland and Hungary. At primary school, the reading gaps in Ireland (183 points) and Hungary (194 points) were quite similar, but less than 15 per cent of the variation in reading scores in Ireland could be attributed to circumstances compared to 32 per cent in Hungary.

Table 5. Comparison of country rankings according to the inequality of opportunity measure used

Country	Ranking, P90–P10	Ranking, occupa-tional gradient	Ranking, occupa-tional R-squared	Ranking, overall R-squared	Difference: P90–P10 and occu-pational gradient	Difference: P90–P10 and occu-pational R-squared	Difference: P90–P10 and overall R-squared	Difference: occupa-tional R-squared and occu-pational gradient	Difference: overall and occu-pational R-squared
Latvia	1	2	5	6	-1	-4	-5	3	1
Finland	2	1	2	3	1	0	-1	1	1
Spain	3	3	4	10	0	-1	-7	1	6
Austria	4	10	11	12	-6	-7	-8	1	1
Italy	5	7	9	9	-2	-4	-4	2	0
Norway	6	5	1	5	1	5	1	-4	4
Portugal	7	4	3	1	3	4	6	-1	-2
Czech Republic	8	6	10	7	2	-2	1	4	-3
Denmark	9	9	8	4	0	1	5	-1	-4
Poland	10	11	7	8	-1	3	2	-4	1
Ireland	11	8	6	2	3	5	9	-2	-4
Slovenia	12	12	12	11	0	0	1	0	-1
Hungary	13	14	13	13	-1	0	0	-1	0
Slovakia	14	13	15	15	1	-1	-1	2	0
Bulgaria	15	15	14	14	0	1	1	-1	0

Correlation of P90-P10 and overall R-squared	0.45	(ns)
Correlation of P90-P10 and occupational R-squared	0.71	**
Correlation of P90-P10 and occupational gradient	0.88	***
Correlation of occupational R-squared and occupational gradient	0.86	***
Correlation of occupational R-squared and overall R-squared	0.82	***
Correlation of occupational gradient and overall R-squared	0.71	**

Note: We exclude countries missing more than 15 per cent of the data on parental occupation. Countries that rank more than three places higher using occupational data instead of the P90–P10 gap are marked in green. Those that on the same basis rank more than three places lower are marked in red. P-values: ns ($p > 0.05$), * ($p \leq 0.05$), ** ($p \leq 0.01$), *** ($p \leq 0.001$).

Source: PIRLS, 2016.

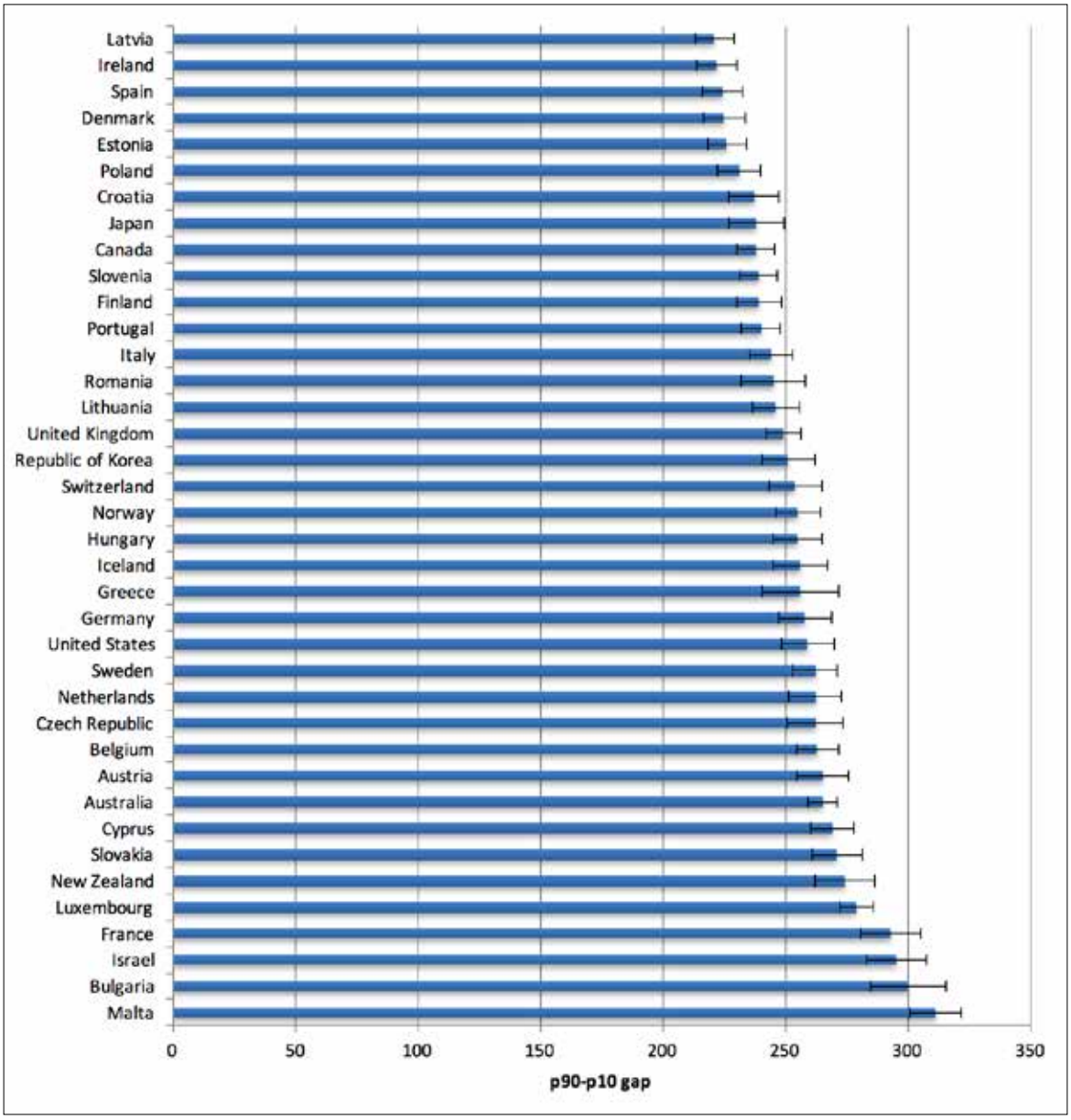
5. RESULTS: SECONDARY SCHOOL

We now follow a similar strategy to compare the rankings of inequalities between countries using different measures of inequality in children's reading scores at 15 years of age.

5.1 Inequality of outcome: Reading gaps

The distribution of secondary school reading gaps (P90–P10 measure) for the PISA data is shown, with countries ranked in descending order of equality (*see Figure 3*). Using this measure, Latvia is ranked as the most equal country and Malta as the least equal.

Figure 3. Distribution of P90–P10 gaps for 15-year olds (95% confidence intervals)



Note: The reading achievement scale has a mean of 500 and a standard deviation of 100 based on a reference group of countries. The performance gap is measured as the absolute difference between the 90th and 10th percentiles of the reading score. Chile, Mexico and Turkey are excluded from the rankings due to low participation rates (below 80 per cent) in PISA, which means that their results may not be representative. Confidence intervals are calculated by multiplying the standard error of the P90–P10 gap by +1.96 and -1.96 and adding the product to the mean score.

Source: PISA, 2015.

As with the primary school data, we conducted robustness checks by comparing these rankings with those obtained using the P95–P5 and P75–P25 gaps. The correlations between the three measures are almost perfect: 0.99, for P90–P10 with P95–P5; and 0.98 for P90–P10 with P75–P25 (*see the foot of Table 6*). This is reflected in the similarity of the rankings irrespective of the measure used. Changing the cut-off point makes little difference when comparing inequality in the reading scores of 15-year-olds (*see Table 6*).

Of the 38 countries analysed, the ranking of only one country (Hungary) varies by more than 20 per cent, and only five other countries have rankings that vary by more than 10 per cent. No country's rankings varied by more than four places for both of the alternative cut-off points compared to the P90–P10 gap.

In summary, while the choice of measure is linked with small variations in rankings for a limited number of countries, patterns of overall inequality are closely comparable using different cut-off points. These rankings are also generally robust to the inclusion or exclusion of migrant children (*see Annex 1*). This suggests that P90–P10 is a reasonable measure of inequality of educational outcomes using these data.

Table 6. Inequality gaps in reading scores at 15 years of age (ranks and differences in ranks)

Country	Ranking, P95–P5	Ranking, P90–P10	Ranking, P75–P25	Difference: P90–P10 and P95–P5	Difference: P90–P10 and P75–P25
Latvia	1	1	1	0	0
Ireland	2	2	2	0	0
Spain	3	3	4	0	-1
Denmark	4	4	3	0	1
Estonia	5	5	5	0	0
Poland	6	6	7	0	-1
Croatia	7	7	12	0	-5
Japan	10	8	8	-2	0
Canada	11	9	9	-2	0
Slovenia	8	10	10	2	0
Finland	13	11	6	-2	5
Portugal	9	12	11	3	1
Italy	12	13	14	1	-1
Romania	15	14	13	-1	1
Lithuania	14	15	17	1	-2
United Kingdom	17	16	16	-1	0
Republic of Korea	18	17	15	-1	2
Switzerland	19	18	20	-1	-2
Hungary	16	19	28	3	-9
Norway	21	20	18	-1	2
Greece	20	21	23	1	-2
Iceland	23	22	19	-1	3
Germany	26	23	22	-3	1
United States	25	24	21	-1	3
Sweden	29	25	24	-4	1
Netherlands	24	26	29	2	-3
Czech Republic	27	27	26	0	1
Belgium	22	28	31	6	-3
Austria	28	29	27	1	2
Australia	30	30	25	0	5
Cyprus	31	31	30	0	1
Slovakia	32	32	32	0	0
New Zealand	33	33	33	0	0
Luxembourg	34	34	34	0	0
France	35	35	35	0	0
Israel	37	36	36	-1	0
Bulgaria	36	37	38	1	-1
Malta	38	38	37	0	1

Correlation of P90–P10 and P95–P5 (ranks): 0.99 ***
Correlation of P90–P10 and P75–P25 (ranks): 0.98 ***

Note: Columns 1, 2 and 3 rank countries on the gap in PISA reading scores between children at the 95th and 5th, 90th and 10th, and 75th and 25th percentiles in each country respectively. The highest ranking (1) indicates the country with the lowest inequality. Countries that rank more than four places higher using the P95–5 or P75–25 measure instead of the P90–P10 measure are marked in green. Those that on the same basis rank more than four places lower are marked in red. P-values: *** ($p \leq 0.001$).

Source: PISA, 2015.

5.2 Inequality of opportunity: Occupational gradient

In PISA, the variable measuring parental occupation is a scale ranging from around 12 to 87 based on a methodology devised by Ganzeboom, de Graaf and Treiman (1992). The methodology uses an optimal scaling procedure to "maximize the role of occupation as an intervening variable between education and income" (Ganzeboom, de Graaf and Treiman, 1992, p. 1) while minimizing the direct path from education to income. While the scale does not have a simple interpretation, it denotes a continuum from lower to higher status occupations.

Linear regressions were run with no controls for each country, with the reading score as the dependent variable and the parental occupation scale as the independent variable. The results are presented in terms of both the coefficient and the explanatory power (R-squared) of these models (*see Table 7*). Parental occupation has a statistically significant association with reading scores (with p-values less than 0.001 in all countries). The gradient (coefficient) ranges from 0.87 in Iceland to 2.12 in Luxembourg. The explanatory power averages 10 per cent and ranges from 3 per cent in Iceland to more than 20 per cent in Hungary and Luxembourg.

Table 7. Reading scores at 15 years of age by highest parental occupation

Country	Binary predictor (as in Innocenti Report Card 15)					Scale predictor				
	Mean low	Mean high	Sig.	R-squared	Ranking, R-squared	Coefficient (gradient)	Ranking, gradient	Sig.	R-squared	Ranking, R-squared
Iceland	473	499	***	0.02	1	0.87	1	***	0.03	1
Japan	506	536	***	0.03	2	0.92	2	***	0.04	2
Norway	499	536	***	0.04	3	1.13	6	***	0.05	3
Republic of Korea	501	539	***	0.04	3	1.18	10	***	0.05	4
Romania	421	459	***	0.04	3	1.4	18	***	0.11	23
United States	483	522	***	0.04	3	1.16	8	***	0.07	5
Australia	485	530	***	0.05	7	1.25	15	***	0.07	6
Canada	513	552	***	0.05	7	1.17	9	***	0.07	6
Finland	509	549	***	0.05	7	1.18	10	***	0.08	11
Malta	429	481	***	0.05	7	1.47	22	***	0.07	8
Cyprus	425	472	***	0.06	11	1.32	16	***	0.07	8
Estonia	502	543	***	0.06	11	1.19	12	***	0.08	12
United Kingdom	481	528	***	0.06	11	1.21	13	***	0.07	8
Denmark	484	527	***	0.07	14	1.12	4	***	0.08	15
Germany	496	547	***	0.07	14	1.57	27	***	0.11	24
Ireland	502	547	***	0.07	14	1.21	13	***	0.09	16
Israel	462	518	***	0.07	14	1.64	31	***	0.1	19
Latvia	469	514	***	0.07	14	1.08	3	***	0.08	14
Netherlands	481	534	***	0.07	14	1.55	26	***	0.1	19
New Zealand	490	542	***	0.07	14	1.61	29	***	0.1	19
Sweden	484	535	***	0.07	14	1.44	21	***	0.09	16
Austria	461	518	***	0.08	22	1.62	30	***	0.12	27
Lithuania	453	506	***	0.08	22	1.33	17	***	0.1	22
Poland	485	533	***	0.08	22	1.12	4	***	0.08	12
Spain	473	522	***	0.08	22	1.13	6	***	0.1	18
Croatia	463	517	***	0.09	26	1.58	28	***	0.13	30
Italy	462	516	***	0.09	26	1.41	19	***	0.11	24
Slovenia	480	534	***	0.09	26	1.43	20	***	0.12	26
Czech Republic	462	525	***	0.10	29	1.89	35	***	0.14	34
Greece	443	503	***	0.10	29	1.48	24	***	0.13	31
Portugal	472	531	***	0.10	29	1.47	22	***	0.14	32
Slovakia	434	495	***	0.10	29	1.66	32	***	0.13	29
Switzerland	467	526	***	0.10	29	1.54	25	***	0.12	28
France	477	545	***	0.11	34	1.83	34	***	0.14	33
Belgium	473	541	***	0.12	35	1.77	33	***	0.16	35
Hungary	440	512	***	0.15	36	1.97	36	***	0.2	37
Bulgaria	401	488	***	0.16	37	2.01	37	***	0.17	36
Luxembourg	445	530	***	0.17	38	2.12	38	***	0.21	38

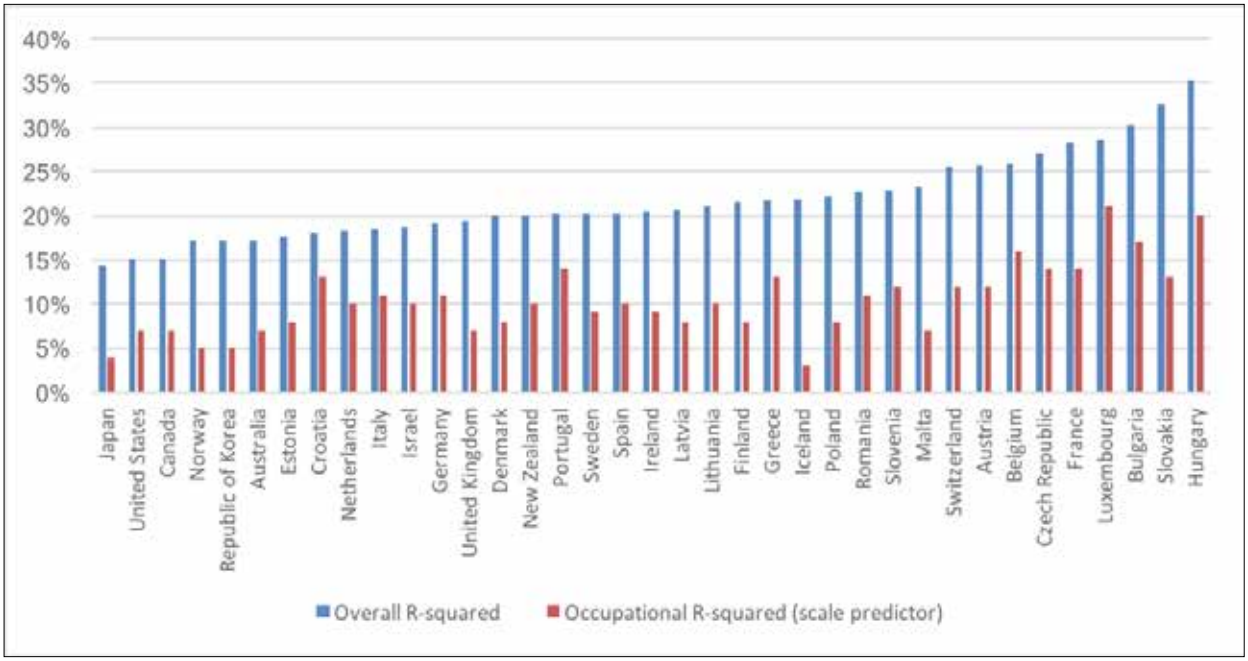
Note: The table shows the results of a regression model using reading scores as the dependent variable and the binary and scale variable of parental occupation as the independent variable. No controls are included in the model. P-values: *** ($p \leq 0.001$).

Source: PISA, 2015.

5.3 Inequality of opportunity: Personal and family circumstances

Linear regressions were run with PISA 2015 reading scores as the dependent variable. Independent variables were as similar as possible to those used by Ferreira and Gignoux (2014): gender, parental education, parental occupation, language spoken at home, migration status, number of books at home, number of cultural possessions at home, household wealth index and location of school. R-squared statistics from these regressions are presented (*see Figure 4*). On average, the independent variables explain around 20 per cent of the variation in test scores. This ranges from 14 per cent in Japan to 35 per cent in Hungary. Figure 4 also shows the explanatory power from the regressions in Table 7 using the parental occupation scale as the only independent variable. The comparison of the two columns shows how much additional explanatory power is attributable to the remaining independent variables.

Figure 4. Percentage of variation in children's reading achievement at age 15 explained by Ferreira-Gignoux measure (overall R-squared) and occupational R-squared



Source: PISA, 2015.

5.4 Comparison of all secondary school measurements

To sum up, the patterns identified in measurements of inequality in primary school (*see section 4*) are largely repeated for secondary school. Using cut-off points from P75–P25 to P90–P10 and P95–P5 makes very little difference to the measurement of reading gaps among 15-year-olds. In fact, the original cut-off point (P90–P10) shows almost perfect correlations with both the interquartile range (r=0.98) and the extreme case range (r=0.99).

All measures of inequality of opportunity are also closely related to one another (*see Table 9*). Occupational gradient and occupational R-squared scores have a correlation of 0.91. The overall R-squared (Ferreira-Gignoux) has a correlation of 0.73 with the occupational gradient and of 0.76 with the occupational R-squared.

In contrast, measures of inequality of opportunity are weakly to moderately correlated with measures of inequality of outcome. The P90–P10 measure shows only a weak correlation with the occupational R-squared (0.31) and the overall R-squared (Ferreira-Gignoux) measure (0.41) and a moderate correlation with the occupational gradient (0.62). This shows that the choice of the original concept of inequality has important consequences for the results. Figure 3– which is also the lead indicator in Innocenti Report Card 15 – reveals that none of the three countries ranked most highly based on inequality of outcome would be in the top three rankings based onthe overall R-squared (Ferreira-Gignoux) and only Latvia would be ranked in the top three using the occupational gradient.

In fact, when comparing the rankings for the P90–P10 gap and the overall R-squared (Ferreira-Gignoux), 17 countries vary by more than 10 places. A number of countries are affected to the same degree if the occupational R-squared (15 countries) or the occupational gradient (9 countries) is used instead of the P90–P10 measure.

Table 8. Comparison of country rankings by inequality measurement

Country	Ranking, overall inequality (P90–P10 gap)	Ranking, inequality of opportunity occupational R-squared), scale predictor	Ranking, inequality of opportunity (overall R-squared)	Ranking, occupational gradient	Difference: P90–P10 and overall R-squared	Difference: P90–P10 and occupational gradient	Difference: P90–P10 and occupational R-squared
Latvia	1	14	20	3	-19	-2	-13
Ireland	2	16	19	14	-17	-12	-14
Spain	3	18	18	6	-15	-3	-15
Denmark	4	15	14	5	-10	-1	-11
Estonia	5	12	7	12	-2	-7	-7
Poland	6	12	25	4	-19	2	-6
Croatia	7	30	8	28	-1	-21	-23
Japan	8	2	1	2	7	6	6
Canada	9	6	3	9	6	0	3
Slovenia	10	26	27	20	-17	-10	-16
Finland	11	11	22	11	-11	0	0
Portugal	12	32	16	23	-4	-11	-20
Italy	13	24	10	19	3	-6	-11
Romania	14	23	26	18	-12	-4	-9
Lithuania	15	22	21	17	-6	-2	-7
United Kingdom	16	8	13	13	3	3	8
Republic of Korea	17	4	5	10	12	7	13
Switzerland	18	28	29	25	-11	-7	-10
Hungary	19	37	37	36	-18	-17	-18
Norway	20	3	4	7	16	13	17
Greece	21	31	23	24	-2	-3	-10
Iceland	22	1	24	1	-2	21	21
Germany	23	24	12	27	11	-4	-1
United States	24	5	2	8	22	16	19
Sweden	25	16	17	21	8	4	9
Netherlands	26	19	9	26	17	0	7
Czech Republic	27	34	32	35	-5	-8	-7
Belgium	28	35	31	33	-3	-5	-7
Austria	29	27	30	30	-1	-1	2
Australia	30	6	6	15	24	15	24
Slovakia	31	29	36	32	-5	-1	2
New Zealand	32	19	15	29	17	3	13
Luxembourg	33	38	34	38	-1	-5	-5
France	34	33	33	34	1	0	1
Israel	35	19	11	31	24	4	16
Bulgaria	36	36	35	37	1	-1	0
Malta	37	8	28	22	9	15	29

Note: Countries that rank more than eight places higher (more equal) when using the indicated measure of inequality of opportunity instead of the P90–P10 measure are marked in green. Those that on the same basis rank more than eight places lower are marked in red.

Source: PISA, 2015.

Table 9. **Correlation matrix of inequality measures**

	P90–P10	Occupational gradient	Overall R-squared
Occupational gradient	0.62***	-	
Overall R-squared	0.41*	0.73***	-
Occupational R-squared	0.31 (ns)	0.91***	0.76***

Note: Correlations based on scores, not rankings. P-values: ns ($p > 0.05$), * ($p \leq 0.05$), *** ($p \leq 0.001$).

Source: PISA, 2015.

6. CONCLUSION

In this paper, we have discussed the potential strengths and weaknesses of applying the concepts of inequality of outcome and inequality of opportunity to children's education; presented several different measures representing each concept; and compared the implications of each measure for cross-national comparisons. We have explored these issues using two very recent surveys of children's academic competence in high-income countries at two stages of education.

This analysis highlights the substantive differences between the P90–P10 measure of inequality of outcome and all measures of inequality of opportunity. These measures are not strongly correlated with each other, and the links are particularly weak at the secondary school level. Choosing inequality of outcome or inequality of opportunity as the lead indicator makes a big difference to the country rankings. For example, all countries that top the league table in Innocenti Report Card 15 on equality of outcome – Latvia, Ireland and Spain – would drop significantly if we opted instead to measure equality of opportunity. These three countries would each fall down the rankings by 15 to 19 places if we chose the overall R-squared (Ferreira-Gignoux); by 2 to 12 places if we opted for the occupational gradient; and by 13 to 15 places if we focused on the occupational R-squared. Although these three countries have the smallest reading gaps, at least 20 per cent of those gaps can be attributed to nine circumstances measured by Ferreira and Gignoux (2014): gender, parental education, parental occupation, language spoken at home, migration status, number of books at home, number of cultural possessions at home, household wealth index and location of school. In contrast, countries from the lower echelons of the league table would ascend the rankings. For example, the United States would move up 22 places if we chose the overall R-squared (Ferreira-Gignoux), because the large reading gaps in the United States are not easily attributable to the circumstances that are the focus of this paper.

These levels of association between the various approaches to the measurement of inequality, and the differences in country rankings that result from them, suggest practical implications for international comparisons of educational inequalities. It has become common for high-performing countries (as determined by average test performance in surveys such as PIRLS and PISA) to be held up as examples for other countries to attempt to emulate – the so-called 'PISA effect' (Grek, 2009). This approach carries risks, however. Educational systems exist within a broader national policy, economic and cultural context. Policies and initiatives that are effective in one national context will not necessarily transfer successfully to another.

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ANNEX 1: WHAT DIFFERENCE DOES MIGRATION MAKE?

A.1 Primary school

In most developed countries, immigrant children typically perform worse at school than their non-immigrant peers. At the same time, the proportion of foreign-born fourth-graders differs widely, from 1.4 per cent in Hungary to almost 10 per cent in Ireland and Wallonia, Belgium (*see Table 12*).[8] We checked whether country rankings would change if we took into account only native-born children – to see whether countries that accept many migrants do worse in international rankings. Interestingly, only one country's ranking would change by more than three places: Austria would move up four places if we excluded the 7 per cent of migrant children in the country's sample.

Table 10. Distribution of educational outcomes with and without migrant children

Country	P90–P10 (all children)	Standard error	P90–P10 (native-born only)	Standard error	Difference in points between native-born only and all children	Ranking, all children	Ranking, native-born only	Difference in rankings between native-born only and all children
Flanders (Belgium)	154	4.3	154	4.5	0	1	1	0
Latvia	159	5.8	160	5	-2	2	2	0
Spain	164	4.4	165	3.5	-1	3	6	3
Finland	165	4.7	164	4.6	1	4	4	0
Norway	166	4.2	165	4.5	1	5	5	0
Portugal	166	5.2	169	4.7	-3	6	9	3
Austria	167	3.7	163	5.1	4	7	3	-4
Czech Republic	167	5.9	169	4.3	-2	8	10	2
Sweden	168	5.8	167	4.7	2	9	8	-1
Italy	169	4.4	166	5.4	3	10	7	-3
Denmark	174	4.6	171	5.1	3	11	11	0
Wallonia (Belgium)	175	5.1	174	4.1	1	12	13	1
France	175	5.8	175	4.5	1	13	14	1
Lithuania	176	3.8	174	5.8	2	14	12	-2
Poland	182	4.4	183	4.8	-1	15	16	1
Slovenia	184	4.2	182	3.7	2	16	15	-1
Ireland	185	4.5	183	5.3	2	17	17	0
Hungary	196	4.6	193	5.9	3	18	18	0
Slovakia	198	7.1	196	9.1	3	19	19	0
Chile	204	5.3	204	4.4	1	20	20	0
Bulgaria	216	4.9	213	7	3	21	21	0
Israel	228	5.1	227	4.7	1	22	22	0
Malta	229	6.4	230	5.3	-1	23	23	0

Note: Countries with at least 85 per cent of valid data on the place of birth are ranked on the size of the P90–P10 gap. Countries that would change their ranking by more than three places are marked in colour.

Source: PIRLS, 2016.

8 Only countries/regions/nations missing less than 15 per cent of the data on the country of birth variable are considered in the analysis of the impact of migrants on country rankings.

A.2 Secondary school

To compare two extreme groups, we juxtapose first-generation immigrant students with all other students (including second-generation immigrant students). First-generation immigrant students are defined as foreign-born children whose parents are also both foreign-born, while second-generation immigrant students are those who were born in the country of the survey but whose parents are both foreign-born (OECD, 2016a).

If the analysis focused instead on non-migrant children, only four country rankings would change by more than three places. Two Nordic countries (Finland and Sweden) would move up four and seven places respectively, while two post-communist countries (Croatia and Hungary) would fall four and seven places respectively. These differences are likely to reflect migration policy in these countries: Finland and Sweden accept migrants whose children score below the national average.

Table 11. Distribution of educational outcomes including and excluding migrant children

Country	P90–P10 (all children)	Standard error	P90–P10 (excl. first-generation immigrants)	Standard error	Difference in points	Ranking, with all children	Ranking, with non-immigrant only	Difference in ranking between all children and non-immigrant only
Latvia	221	4.08	220	4.2	1	1	2	-1
Ireland	222	4.16	220	4.7	2	2	3	-1
Spain	224	4.18	218	4.2	6	3	1	2
Denmark	225	4.33	222	4.2	3	4	4	0
Estonia	226	4.05	225	4	1	5	5	0
Poland	231	4.49	230	4.5	2	6	6	0
Croatia	237	5.33	236	5.5	1	7	11	-4
Japan	238	5.77	236	5.5	2	8	10	-2
Canada	238	3.95	235	4	3	9	9	0
Slovenia	239	3.98	235	4.1	4	10	8	2
Finland	239	4.64	234	4.3	5	11	7	4
Portugal	240	4.08	239	4.3	0	12	12	0
Italy	244	4.57	240	5.1	4	13	13	0
Romania	245	6.65	245	6.7	1	14	15	-1
Lithuania	246	5.01	244	4.9	2	15	14	1
United Kingdom	249	3.59	245	3.8	4	16	16	0
Republic of Korea	251	5.49	251	5.3	0	17	20	-3
Switzerland	254	5.56	248	5.5	7	18	17	1
Hungary	255	5.14	255	5	0	19	26	-7
Norway	255	4.58	249	4.4	6	20	19	1
Greece	256	7.88	252	7.7	4	21	22	-1
Iceland	256	5.66	251	6	5	22	21	1
Germany	258	5.53	253	5	5	23	24	-1
United States	259	5.44	253	5.7	6	24	23	1
Sweden	262	4.76	249	4.7	13	25	18	7
Netherlands	262	5.47	258	5.8	4	26	28	-2
Czech Republic	262	5.8	260	5.9	2	27	30	-3
Belgium	263	4.38	254	4.8	9	28	25	3
Austria	265	5.4	255	4.8	9	29	27	2
Australia	265	3.01	259	3.4	6	30	29	1
Cyprus	269	4.51	264	5.3	4	31	32	-1
Slovakia	271	5.25	263	5.1	8	32	31	1
New Zealand	274	6.21	272	6.3	3	33	34	-1
Luxembourg	279	3.41	265	4.3	14	34	33	1
France	293	6.24	284	6	9	35	35	0
Israel	295	6.24	287	6.4	8	36	36	0
Bulgaria	300	7.74	296	8	4	37	37	0
Malta	311	5.33	303	5	9	38	38	0

Correlation of P90–P10 for all children and P90–P10 without first-generation migrants (rankings): 0.98
Correlation of P90–P10 for all children and P90–P10 without first-generation migrants (scores): 0.99

Note: The highest ranking (1) indicates the country with the lowest inequality. Countries that would change their ranking by more than three places are marked in colour. All countries had more than 85 per cent of valid data on migration status so all are included regardless of the proportion of migrants in-country. This is because even countries with very few migrants (e.g., 2–3 per cent of the population in Hungary) can have a migrant population which is so different that its impact can change the relative position of the country in the rankings.

Source: PISA, 2015.

Table 12. Foreign-born children as a proportion of all children in-country

Country	% of foreign-born children		% missing data on country of birth	
	PIRLS (foreign- born)	PISA (first-generation immigrant)	PIRLS	PISA
Australia	13	10	56	5
Austria	7	7	5	1
Belgium (Wallonia; Flanders)	(9.6; 5.9)	8	(7.5; 9.7)	3
Bulgaria	2	0	1	4
Canada	9	11	18	5
Croatia	n/a	2	n/a	3
Cyprus	n/a	9	n/a	3
Czech Republic	3	2	4	2
Denmark	5	5	5	3
Estonia	n/a	1	n/a	2
Finland	4	2	7	1
France	5	4	9	3
Germany	4	3	28	13
Greece	n/a	3	n/a	2
Hungary	1	1	4	2
Iceland	n/a	3	n/a	3
Ireland	9	10	7	4
Israel	4	4	13	3
Italy	3	5	7	3
Japan	n/a	0	n/a	1
Latvia	2	1	5	1
Lithuania	2	1	14	4
Luxembourg	n/a	21	n/a	2
Malta	4	3	8	4
Netherlands	4	2	46	3
New Zealand	13	15	52	6
Norway	7	6	4	4
Poland	1	0	3	1
Portugal	5	3	2	2
Republic of Korea	n/a	0	n/a	1
Romania	n/a	0	n/a	1
Slovakia	2	1	3	3
Slovenia	5	3	4	2
Spain	4	8	7	2
Sweden	7	7	14	3
Switzerland	n/a	10	n/a	2
United Kingdom (England; Northern Ireland)	(n/a; 7.2)	8	(100; 60.5)	5
United States	n/a	7	100	4

Note: PIRLS divides children into foreign-born and native-born irrespective of their parents' origin. In turn, PISA divides children into three categories: 1. Non-immigrant student (child with at least one parent who was born in the country of the survey, irrespective of whether the child was also born there). 2. First-generation immigrant (child who is foreign-born and whose parents are also both foreign-born). 3. Second-generation immigrant (child who was born in the country of the survey and whose parents are both foreign-born).

Source: PIRLS, 2016; PISA, 2015.

ANNEX 2: TABLES

Table 13. EU/OECD countries participating in the most recent survey wave and their sample sizes in PIRLS 2016 and PISA 2015, by country/region/nation

Country	Region/nation	PIRLS 2016	PISA 2015
Australia		6,341	14,530
Austria		4,360	7,007
Belgium			9,651
	Flanders	5,198	
	Wallonia	4,623	
Bulgaria		4,281	5,928
Canada		18,245	20,058
Chile		4,294	7,053
Croatia		n/a	5,809
Cyprus		n/a	5,571
Czech Republic		5,537	6,894
Denmark		3,508	7,161
Estonia		n/a	5,587
Finland		4,896	5,882
France		4,767	6,108
Germany		3,959	6,504
Greece		n/a	5,532
Hungary		4,623	5,658
Iceland		n/a	3,371
Ireland		4,607	5,741
Israel		4,041	6,598
Italy		3,940	11,583
Japan		n/a	6,647
Latvia		4,157	4,869
Lithuania		4,317	6,525
Luxembourg		n/a	5,299
Malta		3,647	3,634
Mexico		n/a	7,568
Netherlands		4,206	5,385
New Zealand		5,646	4,520
Norway		4,232	5,456
Poland		4,413	4,478
Portugal		4,642	7,325
Republic of Korea		n/a	5,581
Romania		n/a	4,876
Slovakia		5,451	6,350
Slovenia		4,499	6,406
Spain		14,595	6,736
Sweden		4,525	5,458
Switzerland		n/a	5,860
United Kingdom			14'157
	England	5'095	
	Northern Ireland	3'693	
United States		4,425	5,712
Number of participating countries		29	42
Total respondents		168,112	318,652

Source: PIRLS, 2016; PISA, 2015.

Table 14. Summary of reading scores, primary school

Country	Mean	% meeting intermediate proficiency level	P5	P10	P25	P75	P90	P95
Australia	544	81	394	432	494	603	643	668
Austria	541	84	427	453	500	586	620	640
Bulgaria	552	83	398	437	501	611	652	678
Canada	543	83	407	443	497	596	633	657
Chile	494	61	356	386	442	550	590	614
Czech Republic	543	85	424	458	503	590	625	645
Denmark	547	86	425	456	507	594	629	650
England (United Kingdom)	559	86	421	456	508	613	655	680
Finland	566	91	449	482	526	612	647	667
Flanders (Belgium)	525	80	420	446	486	567	600	620
France	511	72	389	420	468	559	595	617
Germany	537	81	395	434	493	591	630	652
Hungary	554	85	421	450	506	606	645	668
Ireland	567	89	435	472	522	617	656	678
Israel	530	75	365	408	475	593	636	660
Italy	548	87	432	461	508	592	629	647
Latvia	558	90	451	477	518	601	635	656
Lithuania	548	86	424	458	506	595	635	654
Malta	452	45	289	329	394	517	558	583
Netherlands	545	88	441	465	508	586	620	639
New Zealand	523	73	356	401	469	586	629	656
Northern Ireland (United Kingdom)	565	87	420	458	516	619	662	687
Norway	559	90	446	475	518	603	641	661
Poland	565	89	436	471	521	615	653	675
Portugal	528	79	417	444	485	572	609	633
Slovakia	535	81	381	429	493	589	627	647
Slovenia	542	83	413	444	498	592	629	651
Spain	528	80	413	442	486	573	606	628
Sweden	555	88	434	465	515	601	633	656
United States	549	83	410	443	501	604	644	666
Wallonia (Belgium)	497	65	378	406	454	544	581	606

Note: Two proficiency levels each for Norway (90 per cent and 74 per cent) and for Denmark (86 per cent and 65 per cent).

Source: PIRLS, 2016.

Table 15. Reading score gaps, primary school

Country	P95–P5	Standard error	P90–P10	Standard error	P75–P25	Standard error
Netherlands	198	6.7	154	5.3	78	2.6
Flanders (Belgium)	200	3.9	154	4.3	82	2.3
Latvia	205	5.3	159	5.8	83	2.5
Netherlands	215	6.6	166	4.2	84	3.1
Spain	215	5.2	164	4.4	87	1.8
Finland	218	7.1	165	4.7	86	2.8
Austria	214	5.3	167	3.7	87	2.5
Italy	216	6.8	169	4.4	85	2.9
Portugal	216	6.8	166	5.2	88	3.3
Sweden	222	6.4	168	5.8	86	3.3
Czech Republic	221	7.2	167	5.9	87	2.7
Denmark	225	6.8	174	4.6	87	2.8
Wallonia (Belgium)	228	5.4	175	5.1	90	2.9
France	228	6	175	5.8	92	2.7
Lithuania	230	7	176	3.8	90	4
Slovenia	238	6.8	184	4.2	94	3.5
Poland	239	6.5	182	4.4	94	3.2
Ireland	242	9.1	184	4.5	95	3.4
Canada	249	4.5	190	3.9	98	2.4
Hungary	247	6.5	196	4.6	99	4.2
Germany	257	11.8	196	4.4	98	3.4
Slovakia	265	15.7	198	7.1	96	3.9
United States	256	7	201	5.9	104	3.2
England (United Kingdom)	259	7.1	199	4.7	105	2.7
Chile	257	5.4	204	5.3	109	3.1
Northern Ireland (United Kingdom)	267	7.7	205	8.8	103	3.6
Australia	274	6.3	210	3.8	109	3.5
Bulgaria	280	11.3	216	4.9	110	5.1
New Zealand	300	7.5	227	5.5	116	3.5
Israel	295	7.7	228	5.1	118	4.6
Malta	294	7.3	229	6.4	123	2.9

Note: Countries are ranked on the average of the three rankings (P95–P5, P90–P10, P75–P25).

Source: PIRLS, 2016.

Table 16. Summary of reading scores, secondary school

Country	Mean	% of students meeting level 2 proficiency benchmark	P5	P10	P25	P75	P90	P95
Australia	503	82	324	365	435	576	631	662
Austria	485	77	308	347	417	559	611	641
Belgium	499	80	323	360	429	573	623	650
Bulgaria	432	59	241	277	347	517	578	611
Canada	527	89	366	404	466	591	642	671
Chile	459	72	310	342	398	521	572	599
Croatia	487	80	334	367	424	553	603	632
Cyprus	443	64	268	305	372	516	573	606
Czech Republic	487	78	315	352	418	559	614	645
Denmark	500	85	347	383	443	561	608	635
Estonia	519	89	369	404	460	581	630	659
Finland	526	89	359	401	469	592	640	668
France	499	79	299	344	423	583	637	666
Germany	509	84	334	375	442	581	634	664
Greece	467	73	296	334	400	539	590	618
Hungary	470	73	306	338	399	541	593	620
Iceland	482	78	310	350	417	552	607	638
Ireland	521	90	373	406	463	582	629	657
Israel	479	73	284	326	401	562	621	655
Italy	485	79	323	359	421	552	602	631
Japan	516	87	352	391	457	581	629	656
Latvia	488	82	341	374	431	548	595	621
Lithuania	472	75	312	347	407	541	593	622
Luxembourg	481	74	299	336	405	561	616	647
Malta	447	64	236	284	366	533	595	631
Mexico	423	58	292	321	370	478	523	549
Netherlands	503	82	330	368	434	577	630	658
New Zealand	509	83	327	368	439	584	643	674
Norway	513	85	342	381	449	583	636	666
Poland	506	86	349	386	446	570	617	644
Portugal	498	83	339	374	436	564	614	641
Republic of Korea	517	86	345	386	455	586	637	666
Romania	434	61	276	310	370	499	555	588
Slovakia	453	68	269	312	382	528	583	613
Slovenia	505	85	346	382	444	570	621	648
Spain	496	84	343	379	438	558	603	629
Sweden	500	82	321	364	433	573	625	655
Switzerland	492	80	322	360	426	563	614	643
Turkey	428	60	291	322	372	487	535	561
United Kingdom	498	82	336	372	432	565	621	653
United States	497	81	326	364	430	568	624	655

Source: PISA, 2015.

Table 17. Reading score gaps, secondary school

Country	P95–P5	Standard error	P90–P10	Standard error	P75–P25	Standard error
Australia	337.9	4	265.5	3	140.6	2.2
Austria	332.9	5.7	264.6	5.4	141.8	3.8
Belgium	326.6	4.7	262.7	4.4	143.9	3.4
Bulgaria	369.9	7.9	300.1	7.7	170.3	6.2
Canada	305.3	4.8	238.4	3.9	125.5	2.3
Chile	289.4	6	229.5	4.6	123.5	3.5
Croatia	297.9	5.5	236.8	5.3	128.8	3.6
Cyprus	338.5	5.6	268.7	4.5	143.3	2.7
Czech Republic	329.9	6.7	262.2	5.8	141	3.9
Denmark	287.8	4.6	225.3	4.3	118.5	2.6
Estonia	290.2	4.5	225.9	4.1	120.5	2.6
Finland	308.9	6.5	239.2	4.6	123.2	2.9
France	367.1	7.2	293	6.2	159.8	4.4
Germany	329.8	5.5	258.4	5.5	138.4	3.2
Greece	322.5	7.9	255.7	7.9	139	4.8
Hungary	313.4	6.2	255	5.1	142.1	3.9
Iceland	328.1	6.4	256.2	5.7	135.1	3.8
Ireland	283.6	5.7	222.2	4.2	118.3	2.7
Israel	371	8.1	295	6.2	160.5	4.5
Italy	307.9	5.7	243.7	4.6	131	3.5
Japan	303.9	7.1	237.7	5.8	123.8	3.6
Latvia	279.5	5.8	221	4.1	116.8	2.7
Lithuania	309.3	5.3	245.9	5	133.7	3.2
Luxembourg	347.2	5.1	279.3	3.4	155.3	2.9
Malta	394.9	7	311.3	5.3	167.4	4.2
Mexico	257.2	5.1	201.7	4.5	108.1	3
Netherlands	328.3	6	261.8	5.5	142.6	4.2
New Zealand	346.9	6.7	274.3	6.2	145.6	4
Norway	324.7	6.6	255.4	4.6	134	3.2
Poland	294.6	5.9	231.4	4.5	123.7	3.1
Portugal	301.9	5.4	239.6	4.1	128.4	3.4
Republic of Korea	320.4	7.4	251.1	5.5	131.1	3.4
Romania	312.2	8.2	245.2	6.7	129.1	4.2
Slovakia	344.4	7.4	270.9	5.3	145.3	3.7
Slovenia	301.6	5.8	239	4	126.1	3
Spain	286	5.7	223.6	4.2	119.4	3.1
Sweden	333.6	6.3	261.6	4.8	140.3	3.1
Switzerland	320.9	6	254.3	5.6	136.9	4
Turkey	270.1	7	213.1	6.6	114.8	4.3
United Kingdom	317.2	4.5	249.4	3.6	133.6	2.5
United States	328.9	6.1	259.5	5.4	137.8	4.1

Source: PISA, 2015.

Table 18. Children of high-status parents have higher reading scores in all countries. But how big is the difference depending on the measurement of status?

Parental occupation (as per Innocenti Report Card 15)					ESCS (for all cases)					ESCS for cases that have valid data for parental occupation				
Country	Low occ.	High occ.	Gap	Ranking	Low ESCS	High ESCS	Gap	Ranking	Ranking diff. (parental occ. - ESCS for all cases)	Low ESCS	High ESCS	Gap	Ranking	Ranking diff. (parental occ. - ESCS for valid cases)
Iceland	473	499	26	1	465	500	35	1	0	467	504	37	1	0
Japan	506	536	30	2	493	541	47	7	-5	498	545	47	8	-6
Norway	499	536	37	3	494	537	43	3	0	498	539	41	3	0
Republic of Korea	501	539	38	4	493	544	51	13	-9	495	545	50	14	-10
Romania	421	459	39	5	405	462	57	22	-17	412	467	54	20	-15
Canada	513	552	39	6	505	551	46	6	0	510	555	45	5	1
United States	483	522	40	7	472	524	52	16	-9	477	527	50	13	-6
Estonia	502	543	40	8	500	540	41	2	6	502	542	40	2	6
Finland	509	550	41	9	502	552	50	11	-2	505	554	49	11	-2
Denmark	484	527	43	10	477	525	48	8	2	482	528	46	7	3
Latvia	470	514	44	11	466	511	46	5	6	469	514	45	6	5
Ireland	502	547	45	12	497	546	50	12	0	500	548	48	10	2
Australia	485	530	46	13	476	534	58	25	-12	482	536	55	21	-8
United Kingdom	481	528	47	14	473	528	55	19	-5	476	531	54	19	-5
Cyprus	425	472	48	15	421	466	45	4	11	427	471	44	4	11
Poland	485	533	48	16	481	532	51	15	1	483	535	51	16	0
Spain	473	522	49	17	471	522	51	14	3	473	524	51	15	2
Germany	496	547	51	18	489	546	57	23	-5	494	549	55	23	-5
Sweden	484	535	51	19	474	533	59	27	-8	482	537	55	22	-3
Malta	429	481	52	20	416	480	65	30	-10	423	486	62	31	-11
New Zealand	490	542	52	21	482	543	61	28	-7	487	547	60	29	-8
Lithuania	453	506	53	22	444	502	58	26	-4	450	509	59	28	-6
Netherlands	481	535	54	23	476	532	56	21	2	480	536	56	25	-2
Slovenia	480	534	54	24	480	532	53	17	7	481	535	54	18	6
Italy	462	516	54	25	462	511	49	10	15	465	514	49	12	13
Croatia	463	517	54	26	463	511	48	9	17	466	514	48	9	17
Israel	462	518	56	27	449	513	65	31	-4	459	521	62	30	-3

Parental occupation (as per Innocenti Report Card 15)					ESCS (for all cases)					ESCS for cases that have valid data for parental occupation				
Country	Low occ.	High occ.	Gap	Ranking	Low ESCS	High ESCS	Gap	Ranking	Ranking diff. (parental occ. - ESCS for all cases)	Low ESCS	High ESCS	Gap	Ranking	Ranking diff. (parental occ. - ESCS for valid cases)
Austria	461	518	57	28	454	518	65	32	-4	457	522	65	32	-4
Portugal	472	531	58	29	472	526	54	18	11	475	527	53	17	12
Switzerland	467	527	59	30	465	521	56	20	10	470	526	57	26	4
Slovakia	435	495	60	31	423	485	62	29	2	436	492	56	24	7
Greece	443	503	61	32	439	496	57	24	8	443	502	58	27	5
Czech Republic	462	525	63	33	454	524	69	33	0	459	528	70	34	-1
Belgium	473	541	68	34	465	536	71	35	-1	471	541	70	35	-1
France	477	546	69	35	462	542	80	37	-2	473	547	74	36	-1
Hungary	440	512	73	36	435	505	70	34	2	441	509	69	33	3
Luxembourg	445	530	86	37	443	522	78	36	1	447	528	80	37	0
Bulgaria	401	488	87	38	392	475	83	38	0	401	486	85	38	0

Correlation of parental occupation gap and the ESCS (for all cases) gap: 0.87
Correlation of parental occupation gap and the ESCS (for valid cases) gap: 0.89
Correlation of the ESCS (for all cases) gap and the ESCS for valid cases gap: 0.99

Note: The table shows the mean scores for children whose parents are in the top and bottom half of the occupation classification in each country. The difference in the means is statistically significant in all countries. Countries are ranked in order of the size of the reading score gap according to parental occupation, from smallest to largest. ESCS stands for the PISA index of economic, social and cultural status.

Source: PISA, 2015.


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