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**SOCIAL BACKGROUND, STUDENT PERFORMANCE
AND NATIONAL SCHOOL SYSTEMS**

*THE ROLE OF NATIONAL EDUCATIONAL SYSTEMS IN SHAPING
THE EFFECT OF SOCIAL BACKGROUND ON THE
PERFORMANCE OF 15 YEAR-OLD STUDENTS*

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Chapter 1 Introduction

The aim of this study is to provide a foundation for national policy review, focusing on the most pertinent policy issues emerging from OECD's *Programme for International Student Assessment* (PISA) to do with social background and performance as they relate to the impact of national educational systems. It has a particular focus on the effect of national school systems because there are good grounds for expecting that these systems shape student performance. The report investigates how national educational systems amplify or mute the effect of social background on student reading, mathematical and scientific literacy. In the first two chapters there is focus on social background, identifying which aspects are important influences on performance, and the extent to which these influences vary between countries. In the third chapter the focus shifts to individual schools and how they compound or ameliorate the effect of family background. In the fourth chapter, the report identifies two broad types of national educational system — 'comprehensive' and 'differentiated' — and considers which of these systems seems to reduce the impact of social background on student performance. It is found that the effects of social background are stronger in differentiated systems.

The PISA study

PISA is a collaborative effort among the Member countries of the OECD to measure how well young adults, at age 15 are prepared for adult life. It concentrates on young people's ability to use their knowledge and skills to meet challenges they are likely to encounter as adults. It concentrates less on the extent to which they have mastered a specific school curriculum within their country. Thus, PISA focuses on knowledge and skills that 15-year-olds are likely to need in their future lives and seeks to assess what they can do with what they have learned. In other words, PISA assesses students' knowledge, but it also examines their ability to reflect on their knowledge and experience, and to apply that knowledge and experience to real world issues.

The first PISA survey was conducted in 2000 in 32 countries (including 28 OECD Member countries). There were around 172 000 fifteen-year-old students in over 6 000 schools who were tested. Written tasks answered in schools under standardised test conditions were used. PISA 2000 surveyed reading literacy, mathematical literacy and scientific literacy, with a primary focus on reading. Tests included both multiple choice and open-ended questions. Students also completed a questionnaire that provided in-depth data on their family background and their perceptions of school,

as well as some data on their future plans. The survey will be repeated every three years, with the primary focus shifting to mathematics in 2003, science in 2006 and back to reading in 2009.

The international perspective of PISA offers policy-makers a chance to compare their own educational systems with those of other countries. That some countries can achieve a high average level of student performance with only a modest gap between the highest and lowest level of student performance, for example, suggests large disparities in outcomes do not have to be the price for high average performance. Similarly, the fact that the strength of the relationship between social background and learning outcomes varies widely between countries suggests that schools and education systems can succeed in moderating this relationship. Low levels of performance by students from lower social backgrounds are not inevitable. There are things that schools and policy-makers can do about poor performance.

Aims of the report

The main aim of this report is to identify which type of national educational system seems to reduce the impact of social background on student performance. Student performance is an important predictor of a range of subsequent educational and labour market outcomes, including school track, early school leaving, graduation from secondary school, and participation in university. Student performance also influences unemployment, unemployment duration, occupational status and earnings. Reducing the impact of social background is desirable, not only from an equity perspective, but also from an economic perspective. It is important to remove the barriers inhibiting students from disadvantaged backgrounds reaching their full productive potential. However, before addressing the question about the impact of national educational systems, a number of preliminary questions need to be answered.

The first question concerns the strength of the relationship between socioeconomic background and student performance. This report aims to provide definitive conclusions on the strength of the relationship between socioeconomic background and student performance. The second question is about whether or not the strength of the relationship between socioeconomic background and student performance varies widely between countries. Confident conclusions about between-country differences in the strength of this relationship is a necessary preliminary step for understanding how national educational systems modify the effect of socioeconomic background on student performance. The third question addresses the processes through which socioeconomic background affects student performance. Such processes are not well understood and are rarely investigated in a systematic manner cross-nationally. This report examines the extent to which

material, cultural, social resources and schools themselves account for the relationship between social background and student performance.

An overview of the PISA results

As shown in Table 1, average PISA scores are higher in some countries than others. This does not necessarily mean that the schools in higher scoring countries are more effective. Learning starts before school and occurs in a range of settings outside of schools. These differences do mean, however, that if a country's average PISA scores are higher, then the cumulative impact of all the learning experiences of students in that country has resulted in more desirable outcomes in reading, mathematical and scientific literacy. Table 1 shows the average student scores and associated 95 per cent confidence limits by country for the three PISA test domains.

Table 1 PISA Test Scores: Estimates of student means and associated confidence intervals

Country	Reading		Mathematics		Science	
	Mean	95 % Confidence Limits	Mean	95 % Confidence Limits	Mean	95 % Confidence Limits
Australia	528	(520-535)	533	(527-540)	527	(520-534)
Austria	507	(502-513)	515	(509-521)	519	(513-525)
Belgium (Flanders)	532	(525-540)	542	(535-549)	519	(512-526)
Belgium (French)	476	(458-494)	491	(474-508)	467	(447-486)
Brazil	395	(388-403)	333	(325-341)	374	(367-381)
Canada	534	(531-538)	533	(530-536)	529	(526-533)
Czech Republic	492	(487-497)	498	(492-503)	512	(507-517)
Denmark	497	(491-502)	514	(508-519)	481	(474-487)
Finland	547	(542-552)	537	(532-541)	538	(534-543)
France	504	(499-510)	518	(513-523)	501	(495-507)
Germany	484	(470-497)	490	(478-501)	486	(475-497)
Greece	474	(463-486)	447	(435-459)	460	(450-471)
Hungary	480	(468-492)	488	(476-500)	496	(484-508)
Iceland	507	(500-513)	515	(509-520)	496	(489-503)
Ireland	527	(520-534)	503	(497-509)	513	(506-520)
Italy	487	(479-495)	458	(451-466)	478	(469-486)
Japan	522	(512-532)	557	(546-567)	551	(540-561)
Korea	525	(520-530)	547	(542-553)	553	(547-558)
Latvia	459	(449-469)	462	(451-472)	461	(451-471)
Liechtenstein	482	(414-550)	515	(450-580)	475	(412-539)
Luxembourg	441	(413-468)	446	(424-469)	442	(417-468)
Mexico	422	(413-431)	387	(378-396)	421	(413-428)
Netherlands	532	(525-538)	563	(556-571)	529	(521-537)
New Zealand	529	(521-536)	537	(530-545)	528	(520-535)
Norway	506	(500-511)	499	(493-504)	500	(494-506)
Poland	480	(470-489)	470	(459-482)	483	(473-493)
Portugal	470	(460-480)	453	(444-462)	459	(450-468)
Russian Federation	462	(454-470)	478	(469-488)	461	(452-469)
Spain	493	(487-498)	476	(470-483)	491	(485-497)
Sweden	516	(511-520)	510	(504-515)	512	(506-517)
Switzerland	495	(485-504)	528	(519-538)	497	(487-507)
United Kingdom	523	(516-531)	530	(522-537)	533	(525-541)
United States	504	(493-514)	493	(482-503)	500	(488-511)

Framework

There is a variety of factors that influence student performance. These include individual-level factors such as socioeconomic background; factors operating at the classroom and school level; factors stemming from the local community, the policies of the school district and jurisdiction; and

factors from the national context. This report focuses upon background factors and examines the effects these have on student performance, before considering aspects of national school systems. It is argued that schools and material, cultural and social resources mediate the relationship between social background and student performance. Figure 1 shows a depiction of the relations between the key variables in the model. Ability is also involved, through its interaction with these factors. Once the relations between these variables are described, it then becomes possible to identify how they vary across countries, and how national educational systems influence these relations.

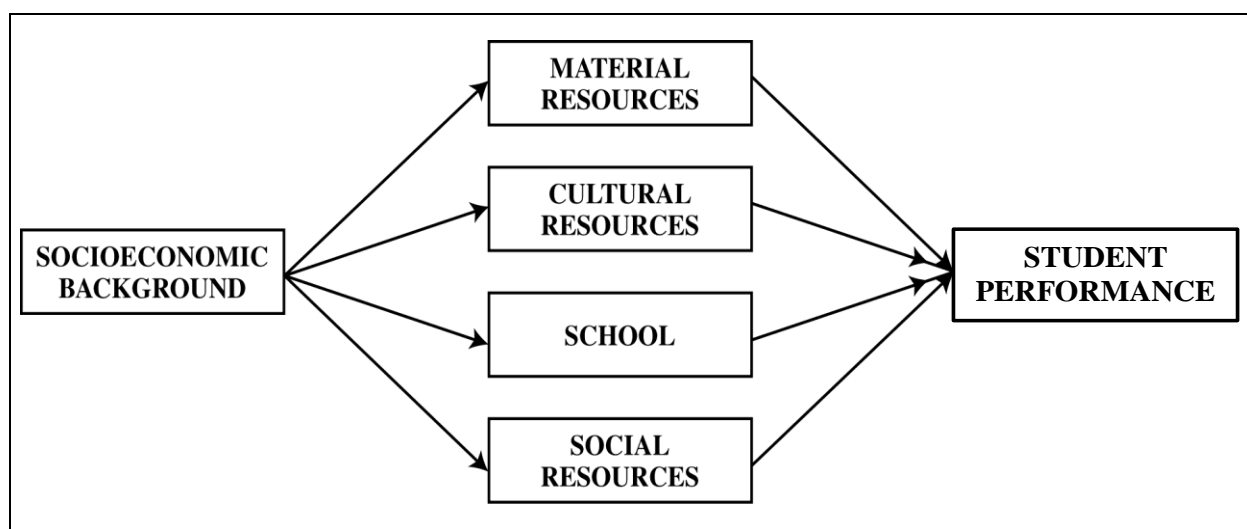


Figure 1 Path model showing how material, social and cultural resources and schools may mediate the relationship between socioeconomic background and student performance

Material Resources

Material resources include wealth and parental income, and a variety of educational resources, such as a desk for studying, textbooks, and computers. Material resources may be important because differential access to financial resources may lead to differences in student performance. In brief, well-off parents are in a better position to meet the financial costs of education.

Cultural Resources

Cultural explanations focus on how a social group's economic and social opportunities are influenced, either by their own cultural factors or by the host community's.

Schools

In most countries there are different types of schools — government and private schools, religious schools, comprehensive, academic and vocational schools, and schools types that purportedly differentiated on the basis of academic ability. School type is usually associated with particular educational and occupational pathways. Not only are there different types of schools, there may also be considerable variation between individual schools within each school type.

Social Resources

Social resources comprise the social networks and social relationships that people can draw upon. In student performance studies, social resources are often understood as the ties that exist between parents and the school, parents and the local community, and parents and teachers. Coleman (1987; 1988) provides the most well-known theory of educational outcomes focusing on the resources provided through social ties that can be mobilised to improve educational performance. Coleman argues that children do better in schools that have a more closely knit network (community) around them; where parents, teachers and the local community interact and facilitate educational success among students.

Ability

If student performance is largely determined by ability then the impact of material, social and cultural resources, will be minimal. On the other hand, if these resources have a substantial influence on performance, then the observed influence of ability will be less. To argue that ability plays no role is equivalent to arguing that educational systems judge students on the basis of social background and little else. It is clear that ability should be included in any full account of student performance. If ability is correlated with resource availability, and it is sometimes argued that the availability of social, cultural and economic resources in the early years shapes the development of ability, the result of not including it in models that relate resources to performance will be an overestimation of the influence of resources on student performance in later stages of schooling.

Conclusion

This report aims to investigate how the effects of family background are mediated by material, cultural and social resources and individual schools in order to systematically investigate the impact of national educational systems on the relation between family background and student performance. In this way it aims to provide a foundation for national policy review.

Chapter 2 The effect of social background on student performance

This section of the report examines the effect of social background on student performance. It aims to address three questions:

1. What is the strength of the relationship between socioeconomic background and student performance?
2. To what extent do material, cultural, and social resources account for the relationship between social background and student performance?
3. How does student performance vary between countries?

To deal with these questions, it is necessary to examine how best to measure family socioeconomic status. This is done by investigating the effects of parental occupation and education and their relative importance as measured by the strength of their effects on student performance. It is clear from the PISA data that an adequate measure of family socioeconomic status requires that both father's and mother's occupational status and educational levels are needed. Once this is established, it becomes possible to consider to what extent the effect of family socioeconomic status is mediated by material resources, cultural resources, individual schools and social resources, and to what extent socioeconomic status has a direct effect on student performance (See Figure 1.) To further investigate this, a composite variable is constructed which measures home socioeconomic, material and cultural environments. This variable accounts for between 10 and 25 per cent of variance in student scores suggesting that the effects being considered here are non-trivial.

Parental occupation and education

Figure 2 presents the correlation coefficients between father's occupational status¹ and reading literacy in order of the size of the correlation coefficient. The OECD average is 0.29 with a standard deviation (across countries) of 0.07. The correlation coefficients reported here are larger than those reported from previous studies. There are possibly two reasons for this. The procedures for data collection and coding of occupation are likely to be superior for PISA 2000 compared with previous studies. In addition, the PISA 2000 measures of literacy used in this study are corrected for measurement error. The average correlation is below 0.30 in each of the three domains. In other

words, about 10 per cent of the variation in student performance is explained by father’s occupational status.

For countries with substantially stronger relationships, the correlation coefficients tend to be weaker for science literacy than for literacy in reading or mathematics. This finding may reflect the greater involvement of schools in the teaching of science, and the fact that mathematics is often streamed both within and between schools. For those countries with substantially weaker relationships, the correlation coefficients tend to be larger for reading than for mathematics and science literacy. Similarly, this result may also indicate that countries can more effectively reduce inequalities in mathematics and science literacy through the school systems, but that parents play a greater role in reading literacy.

In every country the effects of both father’s and mother’s occupational status on reading literacy are statistically significant. The influence of mother’s occupational status on reading literacy is not subsumed under that of father’s and so neither should be excluded from analyses of student performance.

Effect

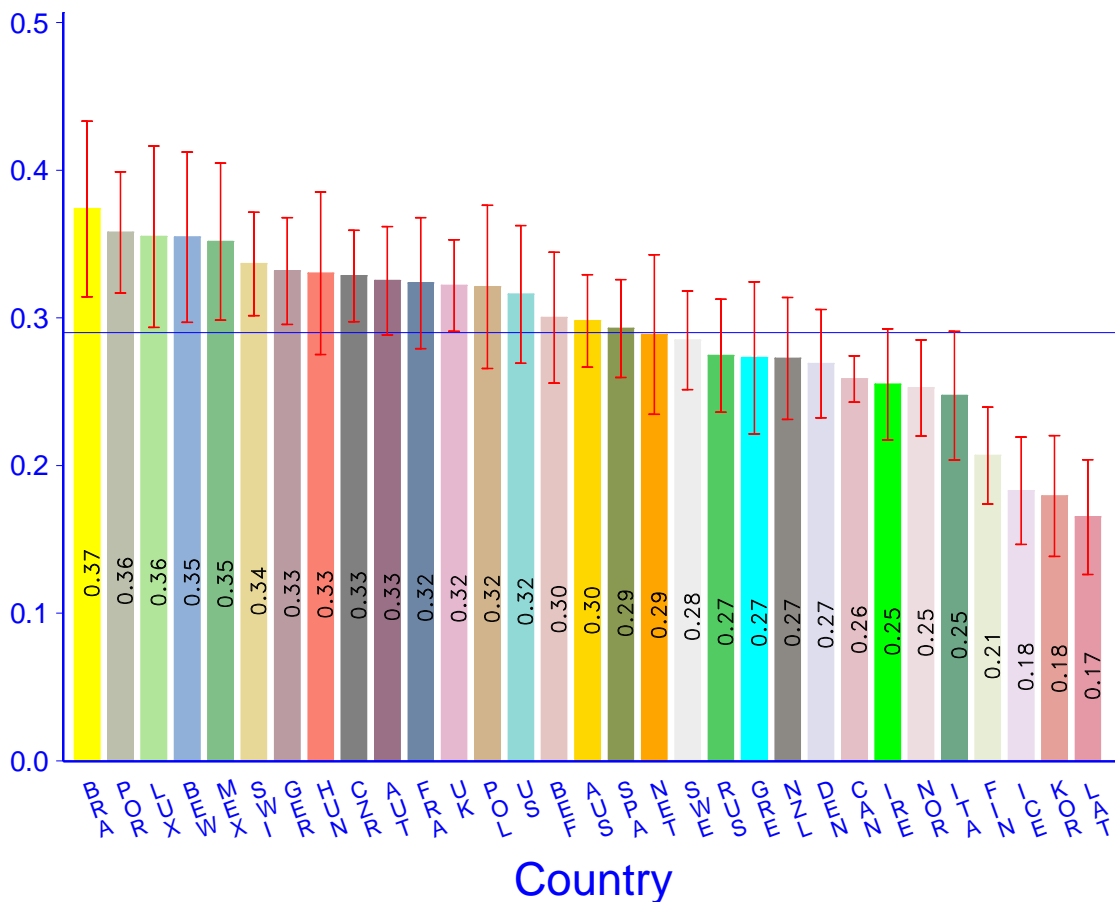


Figure 2 Correlation between father’s occupational status and reading literacy

Figure 3 presents the correlation coefficients between mother’s education (optimally scaled) and reading literacy in order of the size of the coefficient. The OECD average is 0.30 with a standard deviation across countries of 0.07. These effects are equally as strong as socioeconomic status. Father’s educational level had similar effects. In every country the effects of both father’s and mother’s education on reading literacy are statistically significant. Both have an influence on students’ reading literacy, so neither should be excluded from analyses of student performance.

Effect

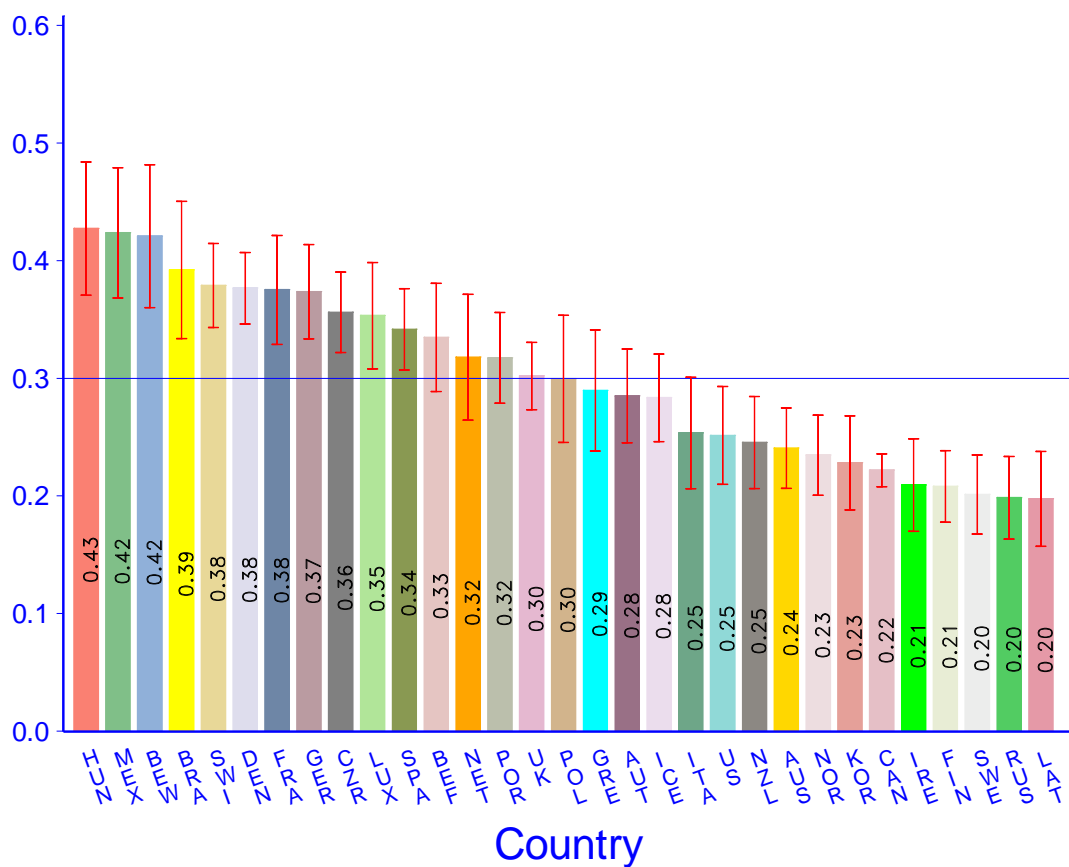
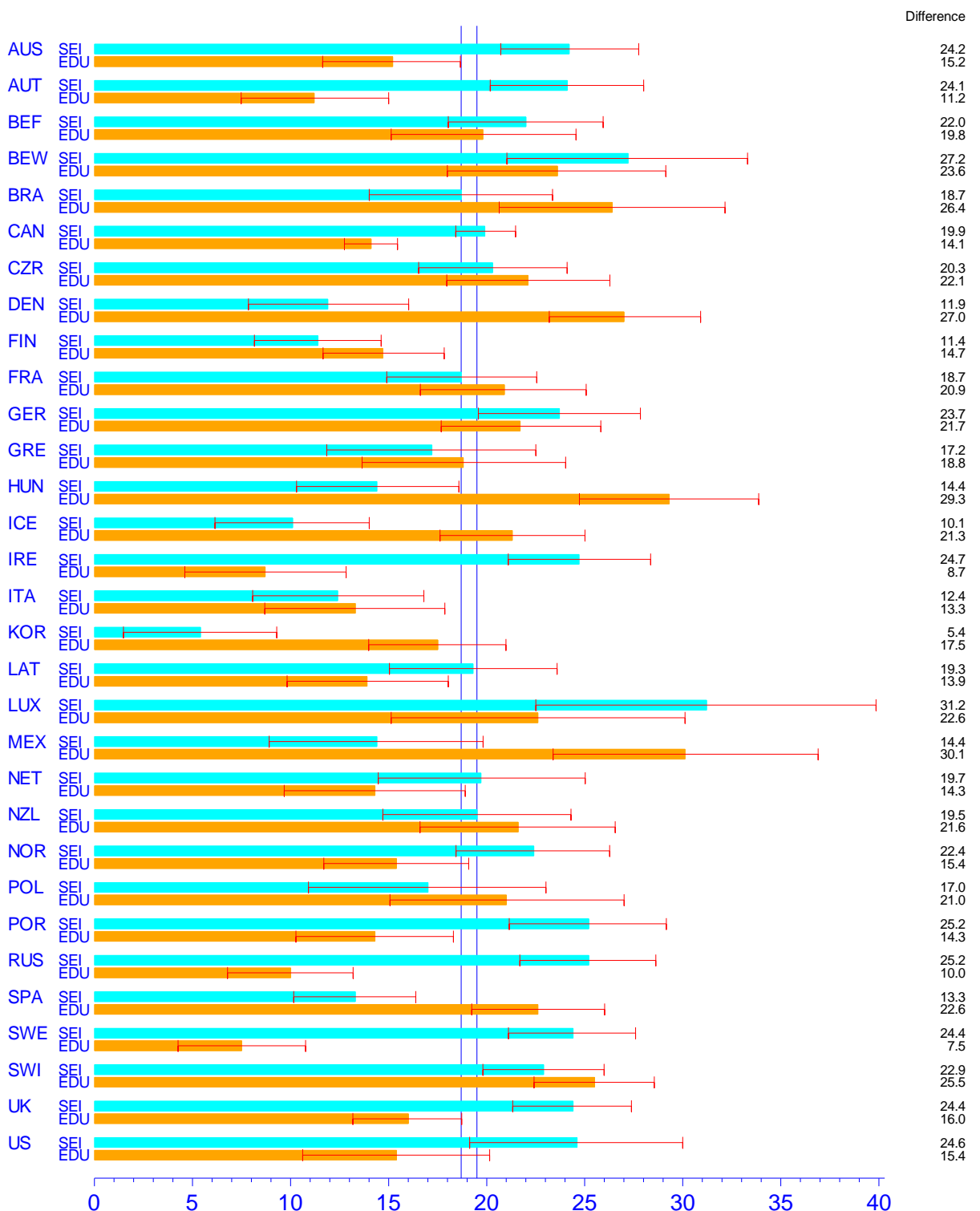


Figure 3 Correlation between mother’s education and reading literacy

An examination of the relative influence of parental occupation and education shows that for reading literacy, overall the (optimally scaled) correlations with father’s occupational status are marginally stronger (0.32) than that for father’s education (0.29). It can be seen by examining Figure 4, that most countries fit this pattern. In Austria, French-speaking Belgium, Canada, Greece, Ireland, Iceland, New Zealand, Portugal, Sweden Switzerland, the United Kingdom and the United States, the

correlation coefficients for occupational status are considerably higher. Only in Flemish-speaking Belgium, Denmark, Hungary and Korea are the correlation coefficients substantially higher for father's education. For mathematics and science, measures of father's occupational status show stronger correlations with student performance than the comparable education measures.



Average for Parent's SEI=19.5
Average for Parent's Educ=18.7

Figure 4 Effects of parent's occupation and education on reading literacy

Overall, the effect of parental occupation was very slightly higher than that for parental education. A one standard deviation increase in parental occupational status is associated with a 20 score point difference in reading literacy. This compares with an effect size of 19 for a one standard deviation difference in parental education. In many countries the impact of parental occupation was substantially stronger than that for parental education: Australia, Austria, Canada, Ireland, Norway, Portugal, Russia, Sweden, the United Kingdom and the United States. The countries in which the impact of parental education was substantially stronger included Brazil, Denmark, Hungary, Iceland, Mexico and Spain. In all countries, the effects of parental education were statistically significant after allowing for the influence of parental occupational status. Similarly, in countries where parental education had a stronger impact the effect of parental occupational status was usually substantial and always statistically significant. Therefore, excluding parental occupation or education from an analysis of student performance is not compensated for by the presence of the other. This result suggests that measures of socioeconomic status should include both occupational and educational characteristics.

Four measures of father's and mother's occupation and education were combined into a single composite variable that maximized the overall effect on student performance². Since the measure incorporates these four aspects of socioeconomic background, it provided more robust conclusions regarding the strength of the relationship and cross-national differences. Figure 5 presents the correlation coefficients between socioeconomic background and reading literacy in order of the size of the correlation coefficient. The OECD average is 0.37 with a standard deviation across countries of 0.09. This correlation coefficient is over 20 per cent higher than that for father's occupational status (0.29) and mother's education (0.30). Figure 6 presents the correlation coefficient between socioeconomic background and mathematical literacy and Figure 7 presents the correlation coefficient between socioeconomic background and science literacy in order of the size of the coefficient. These results show substantially stronger correlations between socioeconomic background and student performance than those found using single measures such as father's occupational status and mother's educational level.

There were few differences between domains. The rank ordering of countries according to the size of the correlation coefficient is much the same across domains. The country level inter-correlations are all close to 0.90. The correlation coefficients for countries with substantially stronger relationships tend to be marginally stronger for reading than for science or mathematics. Among countries with substantially weaker correlation coefficients, the effects are again stronger for reading.

A likely explanation is that schools play a greater role in the teaching of science and mathematics and so attenuate the influence of socioeconomic background.

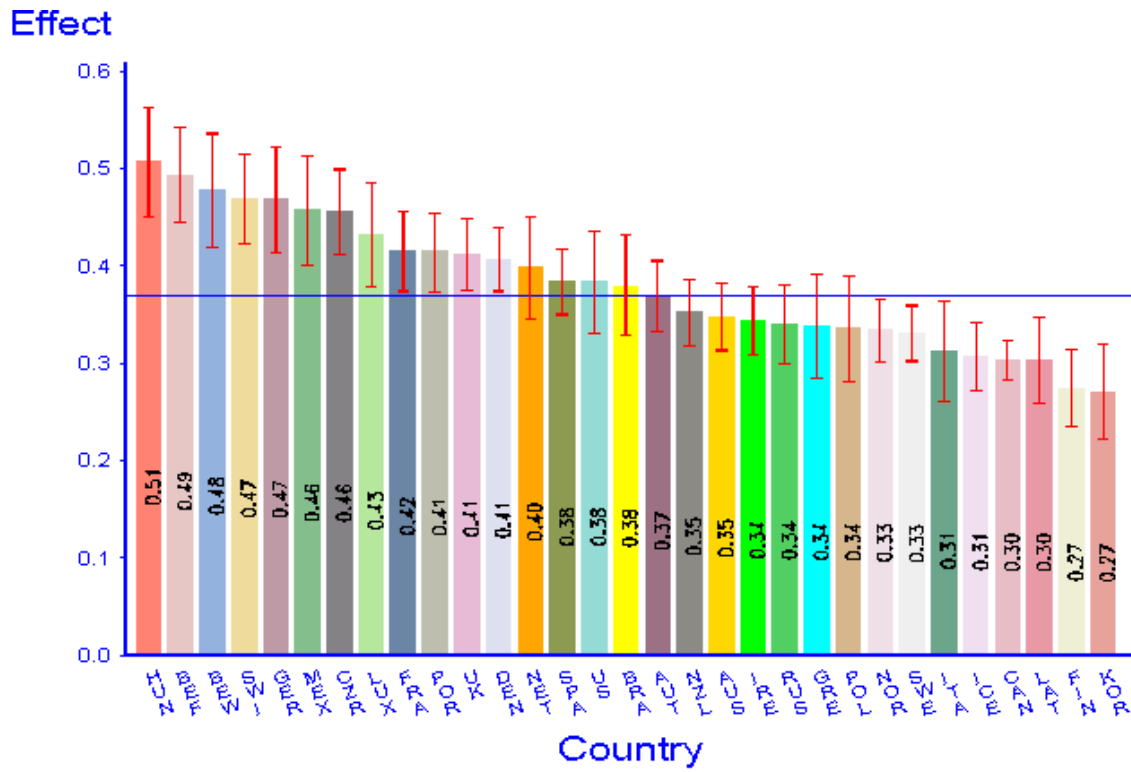


Figure 5 Correlation between socioeconomic background and reading literacy

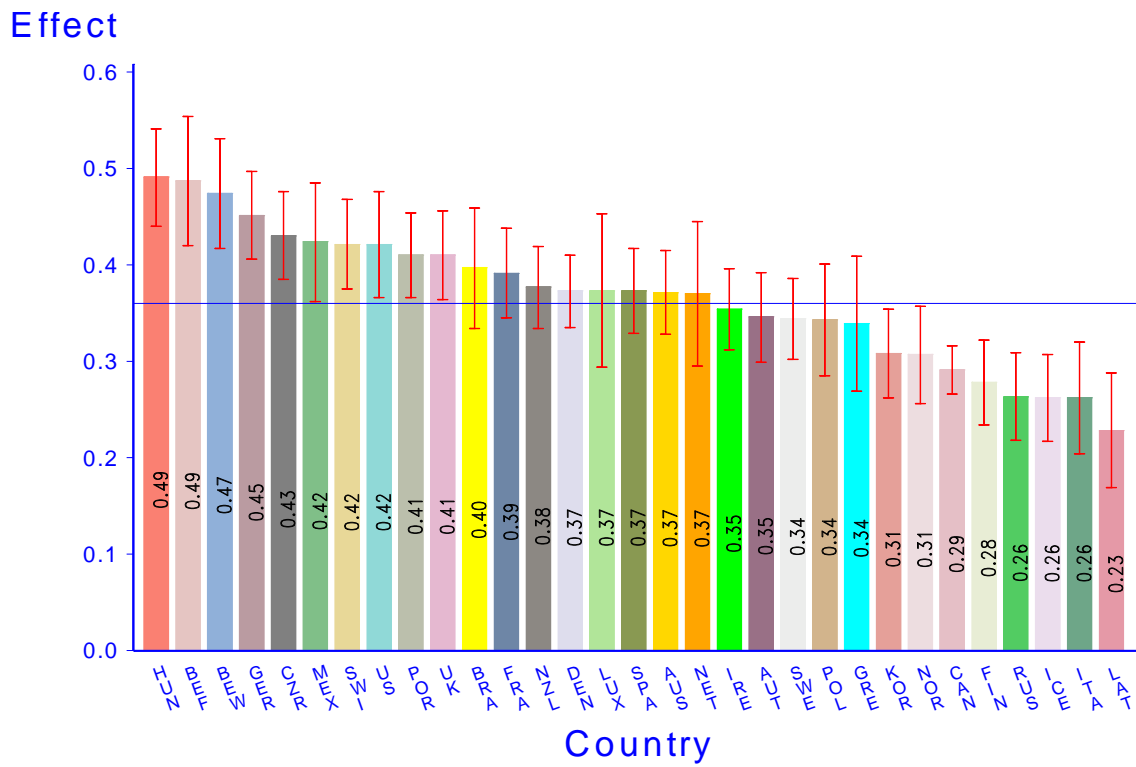


Figure 6 Correlation between socioeconomic background and mathematical literacy

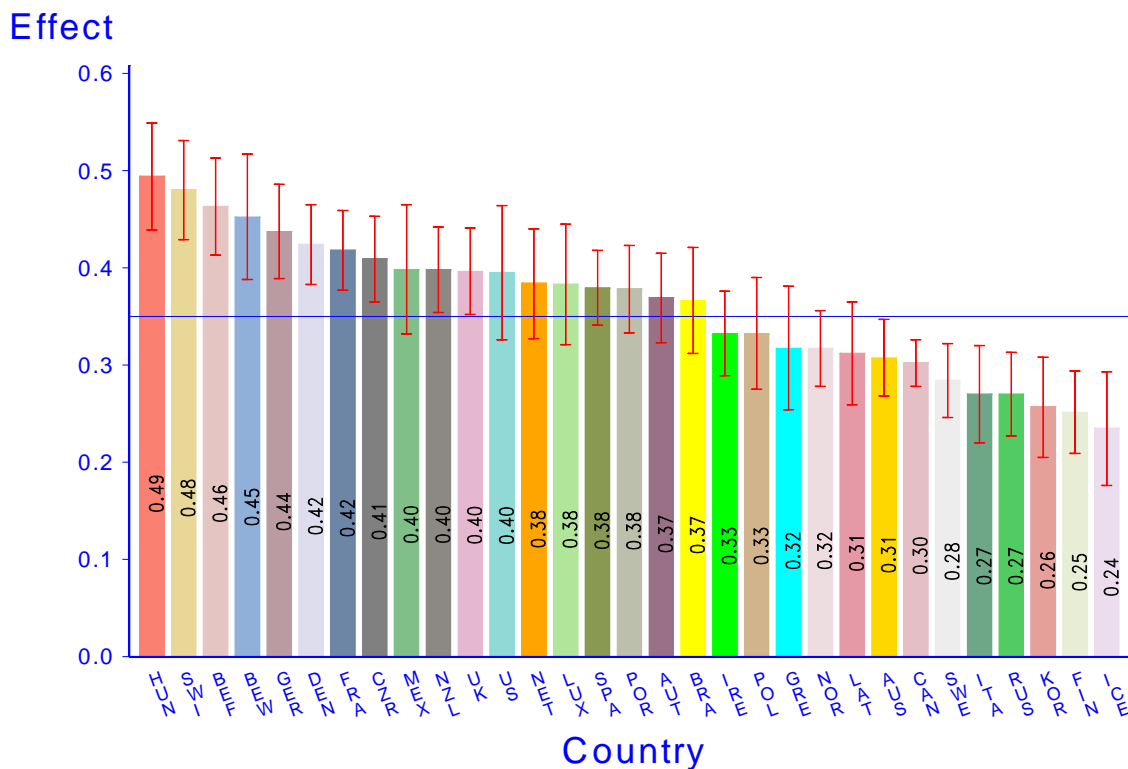


Figure 7 Correlation between socioeconomic background and science literacy

Summary

The socioeconomic status of the family as measured by combining the occupational status and educational levels of both the mother and the father, has important effects on student performance. These effects vary between countries, with up to 25 per cent of the variance in student performance being explained by this variable.

Material, social and cultural resources

This section focuses on material, social, and cultural resources to explore whether one or other of these factors plays a greater role than the other factors.

Material resources

Two measures relating to material resources were available from the PISA data: wealth (or home possessions) and educational resources. The wealth measure comprised the presence (or absence) of, a dishwasher, a room for the student, and a link to the internet; and the number of mobile phones, televisions, computers, cars and bathrooms, associated with the student’s home. The

educational resources measure comprised, possession of a dictionary, a quiet place to study, a desk for study, textbooks, and the number of calculators in the home.

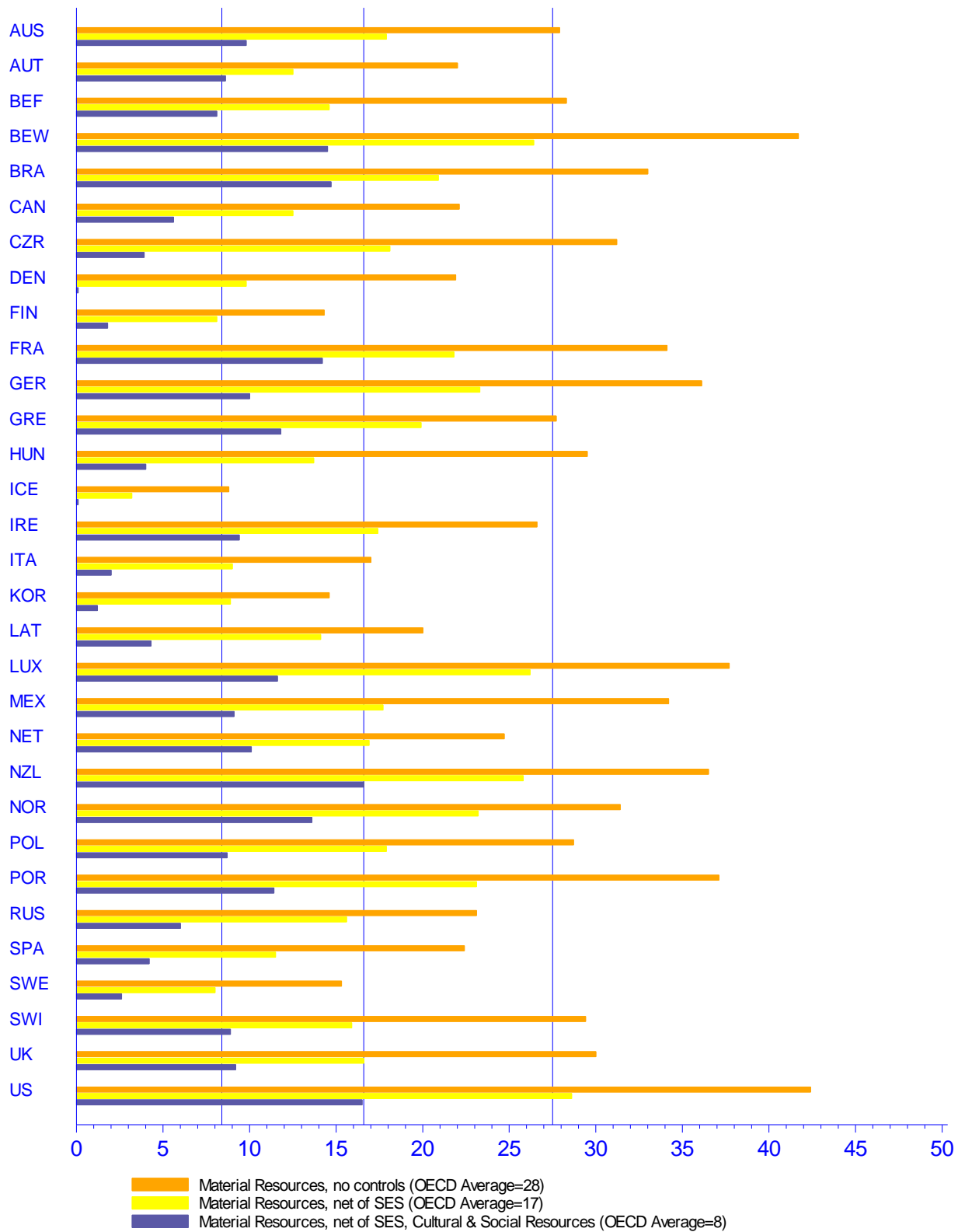


Figure 8 Effects of material resources on reading literacy

The average correlation coefficient between home possessions and reading literacy was 0.17. It was strongest in Brazil (0.38), Portugal (0.33), the United States (0.32), Mexico (0.30), France (0.28), Luxembourg (0.27), French-speaking Belgium (0.23), Germany (0.22) and Australia (0.21). It was weakest in Latvia (0.01), Iceland (0.02), Japan (0.04), the Netherlands (0.07), and Russia (0.09). For mathematical and scientific literacy, similar results were found. For reading literacy the average correlation coefficient between educational resources and reading literacy was 0.24. This is higher than the correlation coefficient for home possessions (0.17). For mathematical and scientific literacy, similar results were found. The net impact of material resources can be seen in Figure 8. It can be seen that in most countries, the effects of educational resources are substantially reduced when controlling for socioeconomic status. In other words, in most countries the independent effect of material resources is small (less than 15 score points). The effect of wealth (overall) is reduced by about 70 per cent after controlling for socioeconomic status and social and cultural resources.

Social Resources

Social resources refer to social networks both within and outside the family. Advocates of the importance of social resources argue that the more parents and the local community are involved in a student's schooling and learning, the better the student's performance. From the PISA 2000 data two indices were constructed to measure social networks pertaining to education. The first, *Family Educational Support*, was constructed from a question on the extent to which the student's mother, father, and brothers and sisters, worked with the student on the student's schoolwork. The second, *Social Communication*, was constructed from a question on how often the student's parents; discussed how well the student doing at school, ate the main meal around a table, and spent time just talking to the student.

For reading literacy the average correlation coefficient between family educational support and reading literacy was negative at -0.11 . The range was from -0.20 (Austria) to 0.12 in Japan. Only in Korea and Japan, is the correlation coefficient in a positive direction and in Korea it is very close to zero. For mathematics and science the correlation coefficients were almost invariably negative with only Japan showing a positive correlation. For parental social communication the correlation coefficients were generally positive. Some countries show substantial correlation coefficients between social communication and reading literacy. These are Korea (0.34), the Netherlands (0.32), Japan (0.26), Denmark (0.22), Australia (0.21) and Portugal (0.21). The mean correlation coefficient was 0.16 and weak correlation coefficients were found in Sweden (0.07), Hungary (0.10), Germany (0.10),

Flemish-speaking Belgium (0.11), Greece (0.12) and Ireland (0.12). Similar patterns were found for mathematics and science with Korea showing the strongest relationship.

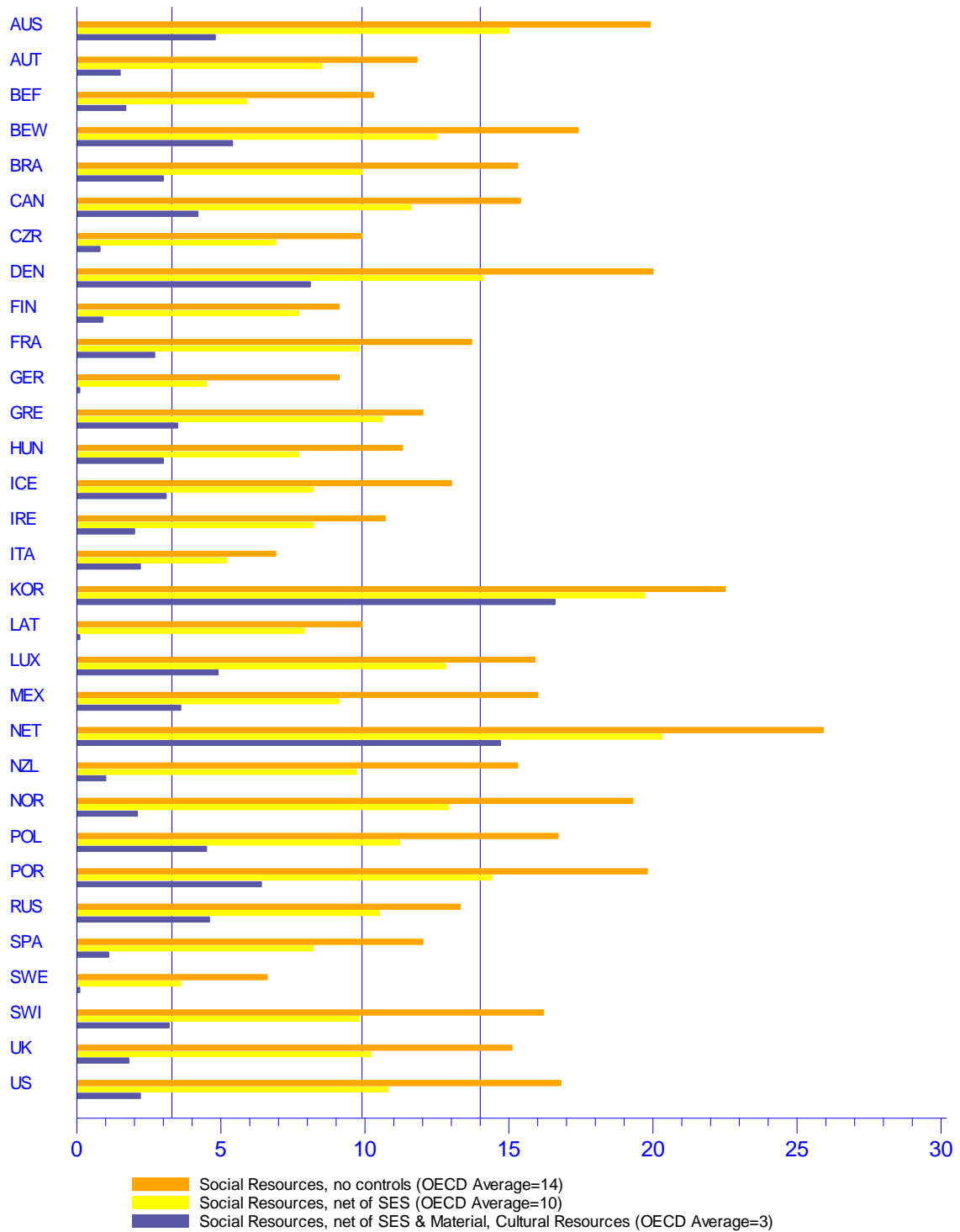


Figure 9 Effects of social resources on reading literacy

The net impact of Social resources (measured by parental communication variable only) can be seen in Figure 9. In most countries, the effects of social resources were reduced by about a third by controlling for socioeconomic status. In other words, in most countries the independent effect of

Social resources is small. It has an insignificant effect after controlling for socioeconomic status, material resources and cultural resources.

Cultural Resources

Theories that emphasise the importance of cultural resources argue that cultural beliefs and practices are important influences on educational outcomes. A prominent cultural approach to educational inequality is Bourdieu's theory of cultural capital that argues that teachers, schools and educational systems implicitly judge students on cultural criteria which students from privileged backgrounds are most adept. Generally, international studies have not attempted to operationalise cultural capital. However, some have included a variety of measures that could be seen as relating to the cultural resources. These include measures of books in the home, composite measures of reading resources and educational and occupational aspirations. 'Books in the home' may reflect the degree to which the family is interested in and values reading. Occupational aspirations could be seen to arise from or constitute part of the cultural milieu explaining student performance (Boudon, 1974).

In several international studies, students have been asked the simple question, "Approximately, how many books are there in your home'. Although this question was probably intended as a predictor of reading performance (it was included in the first international reading study), it correlates with mathematics and science performance. In the *First International Science Study* the overall correlation coefficient between books in the home and science performance was 0.2. (Comber & Keeves, 1973:259). Aspirations also tend to have a strong relationship with student performance. Using data from the *First International Science Study*, Husen (1967:39) reported correlation coefficients among 13 year-olds between mathematics test score and years of education planned (0.42) and years of education desired (0.38).

From the PISA 2000 data several indices relating to cultural resources were available. These were: cultural communication, cultural activities, cultural possessions, books in the home and occupational aspirations. Cultural communication is derived from a question on how often do the student's parents and the student; discuss political or social issues; discuss books, films or television; and listen to classical music. Cultural activity was measured by asking students how often they had visited a museum or art gallery; attended opera, ballet or concerts; and (3) watched live theatre. The cultural possessions measure comprised the presence (or absence) in the family home of: classic literature; books of poetry; and works of art. 'Books in the home' was based on a single question asking how many books are in the family home. Occupational aspirations were measured by asking for the occupation that the student expected to be working in when 30 years of age.³ 'Books in the

home' and 'cultural possessions' are clearly related to the home environment and not the interests, talents and personality of the student. Consequently, the concept of 'cultural resources' was operationalised by constructing a composite of only these two variables.

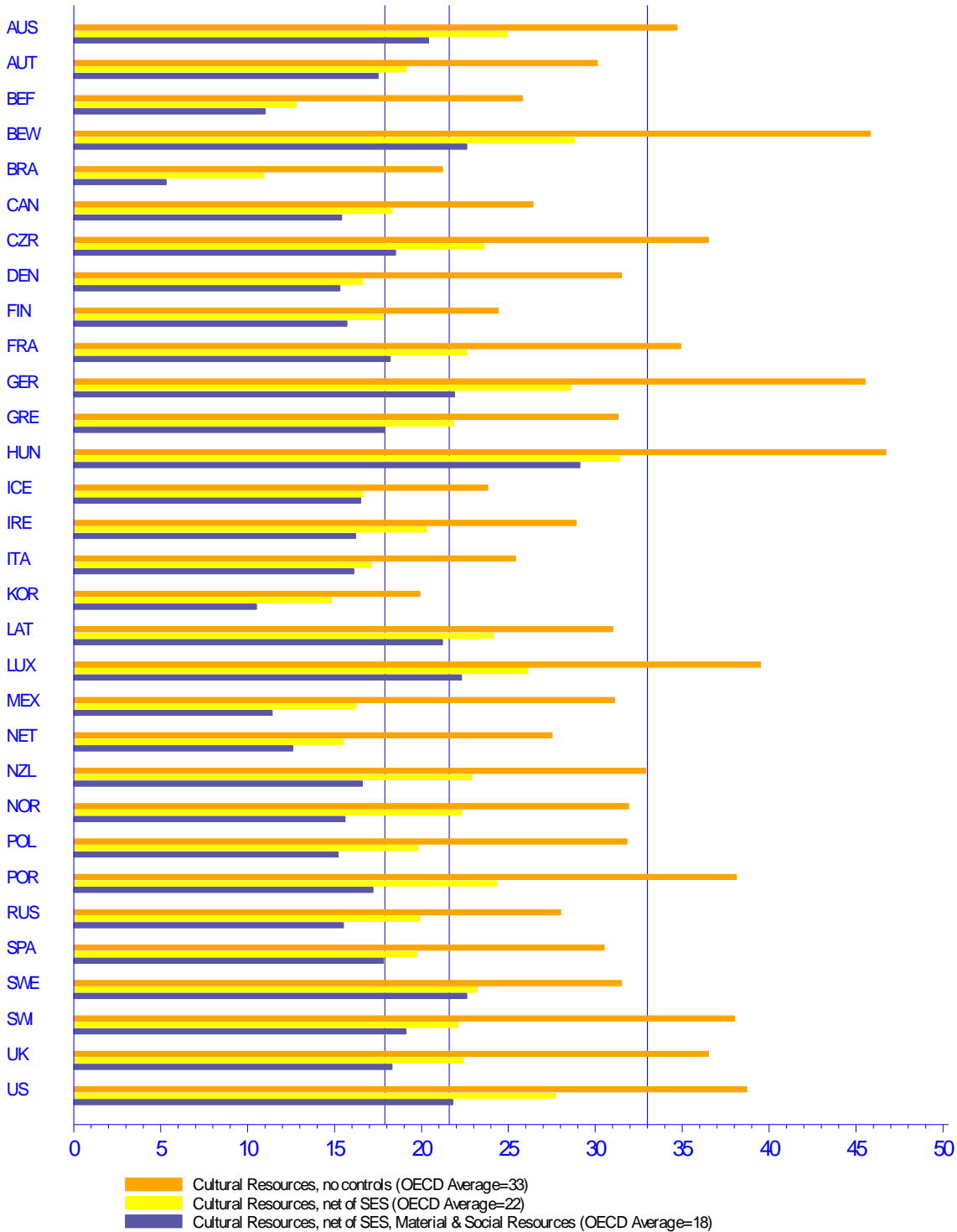


Figure 10 Effects of cultural resources on reading literacy

The total and net effects of cultural resources on reading literacy can be seen in Figure 10. The first line of Figure 10 shows the change in reading score for a one standard deviation difference on the cultural resources measure. The second line of Figure 10 shows the change in reading score for a one standard deviation difference on the cultural resources measure net of socioeconomic background. The third line of Figure 10 shows the change in reading score for a one standard deviation difference on the cultural resources measure net of socioeconomic background and both material and social resources. In all countries, the effect of the base measure of cultural resources (books in the home and possessions) on reading literacy was comparable to that for material resources but less than that for socioeconomic background. The overall effect of cultural resources (for a one standard deviation difference in cultural resources) was 32 score points compared to 27 score points for material resources and 36 score points for socioeconomic background. Including socioeconomic background in the analysis reduces the impact of cultural resources on reading literacy by about a third. The OECD average decreases from 33 to 22 score points. This reduction is less than that observed for material resources, and similar to that observed for social resources. The addition of material and social resources to the analysis further reduces the impact of cultural resources, but not substantially. The OECD average was reduced to 18 score points, a reduction of only 4 score points. This reduction is considerably smaller than that observed for both material and social resources. From this, it can be concluded that cultural resources have a much larger independent effect on reading literacy than material or social resources. Its net effect of 18 score points compares with a net effect of 9 score points for material resources and 4 score points for social resources.

Home Socioeconomic, Material and Cultural Environment

Since the components of material and cultural resources unambiguously relate to the student's home environment, as does socioeconomic background, it is important to know what the total effect of the student's economic and cultural environment is on student performance. The purpose of this section is to examine the influence of a composite measure of socioeconomic background and material and cultural resources on performance in the domains of reading, mathematics and science. Figure 11 presents the correlations between family's socioeconomic, material and cultural environment and reading performance in order of the size of the correlation coefficient. The OECD average is 0.43 with a standard deviation across countries of 0.07. This compares with the correlation coefficient of 0.37 and standard deviation of 0.09 for socioeconomic background.

Figure 12 shows the correlation coefficient between home environment and mathematics literacy. The OECD average is 0.41 with a standard deviation across countries of 0.07. This compares with an average correlation coefficient of 0.36 and a standard deviation of 0.07 for socioeconomic background. The increase in the size of the correlation coefficient is around 14 per cent.

Effect

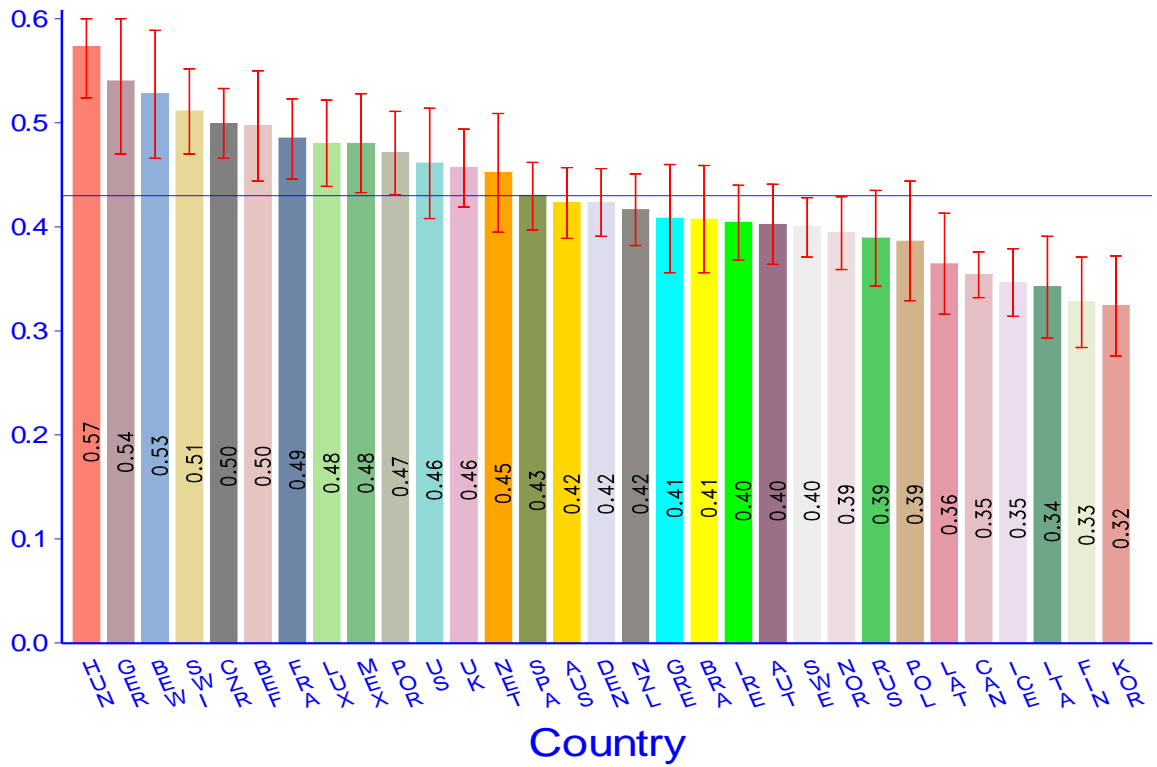


Figure 11 Correlations of home socioeconomic, material and cultural environment with reading literacy

Effect

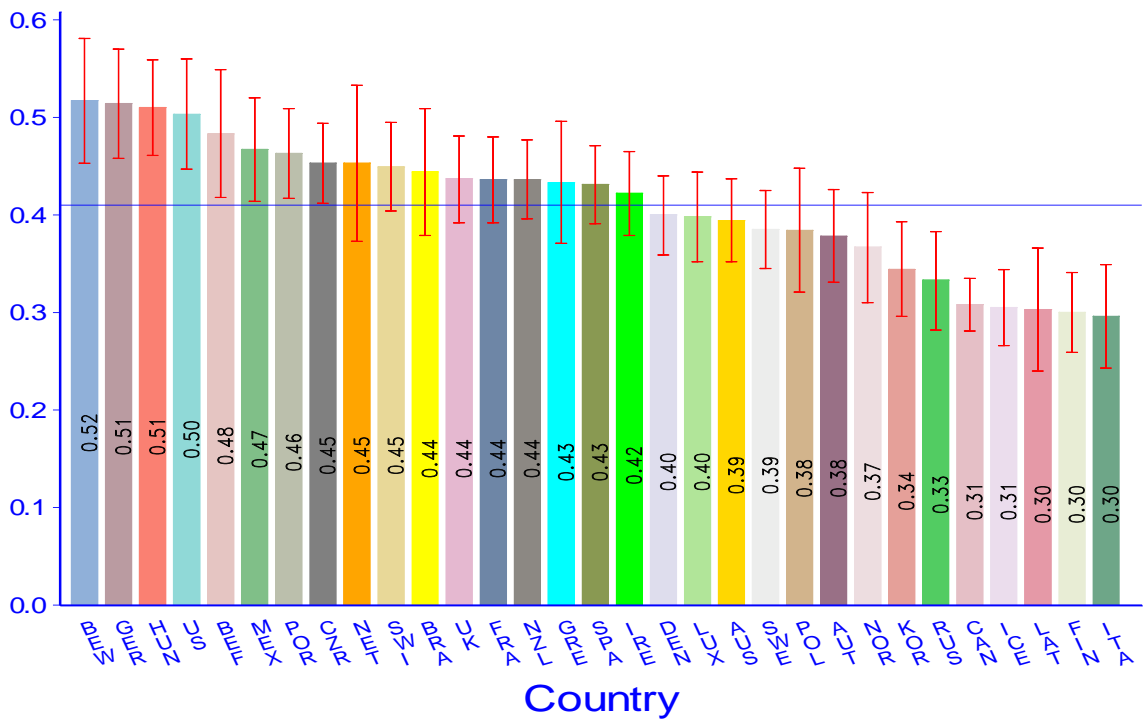


Figure 12 Correlations of home socioeconomic, material and cultural environment with mathematics literacy

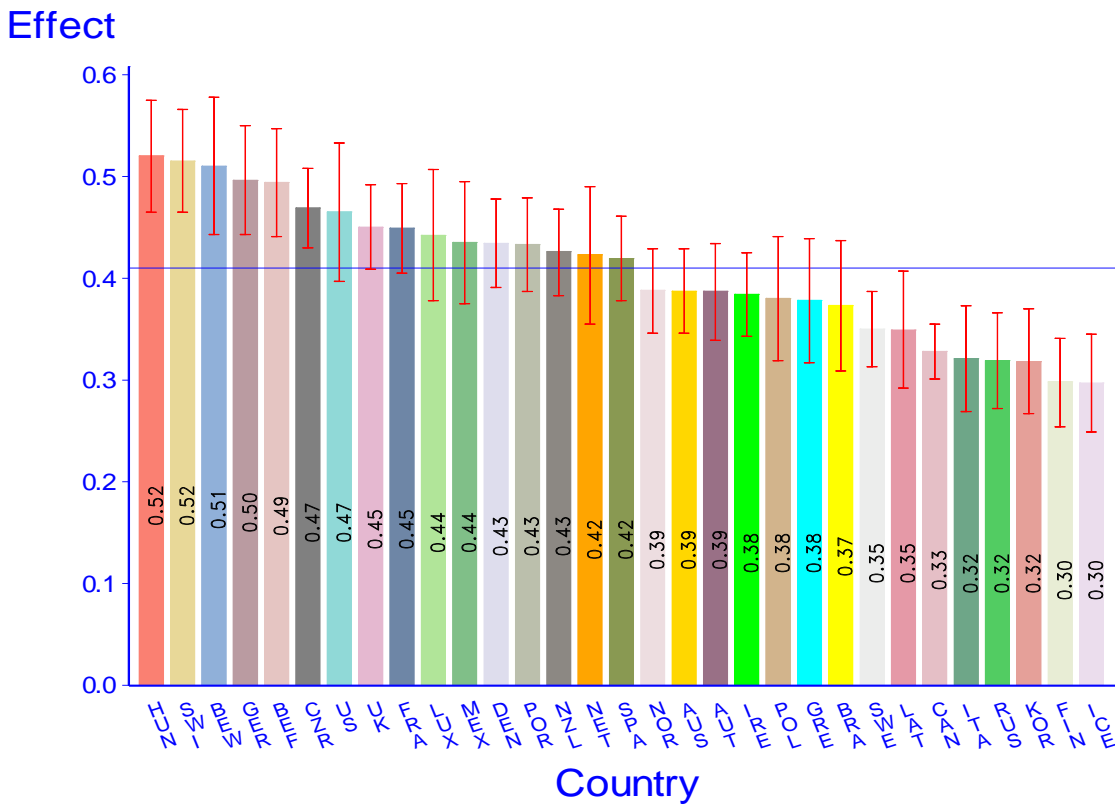


Figure 13 Correlations of home socioeconomic, material and cultural environment with science literacy

Figure 13 shows the correlation coefficient between home environment and science literacy. The OECD average is 0.41 with a standard deviation across countries of 0.07. This compares with a correlation coefficient of 0.35 for socioeconomic background. As was the case for reading and mathematics literacy, the variation in the country-level correlation coefficients (reflected by the standard deviation) is less for the home environment measure than was the case for socioeconomic background.

Finally, Figure 14 shows that the average effect for OECD countries is 41, which means a one standard deviation difference between students on this composite measure of home environment is reflected by a difference of 41 score points in reading literacy. This compares with the OECD average of 36 score points for socioeconomic background alone.⁴

These results show stronger correlations between the socioeconomic, material and cultural environment of the home and student performance than between socioeconomic background and student performance. The correlations indicate about 10 to 25 per cent of the variation in student performance can be accounted for by this measure of the home environment.

Effect

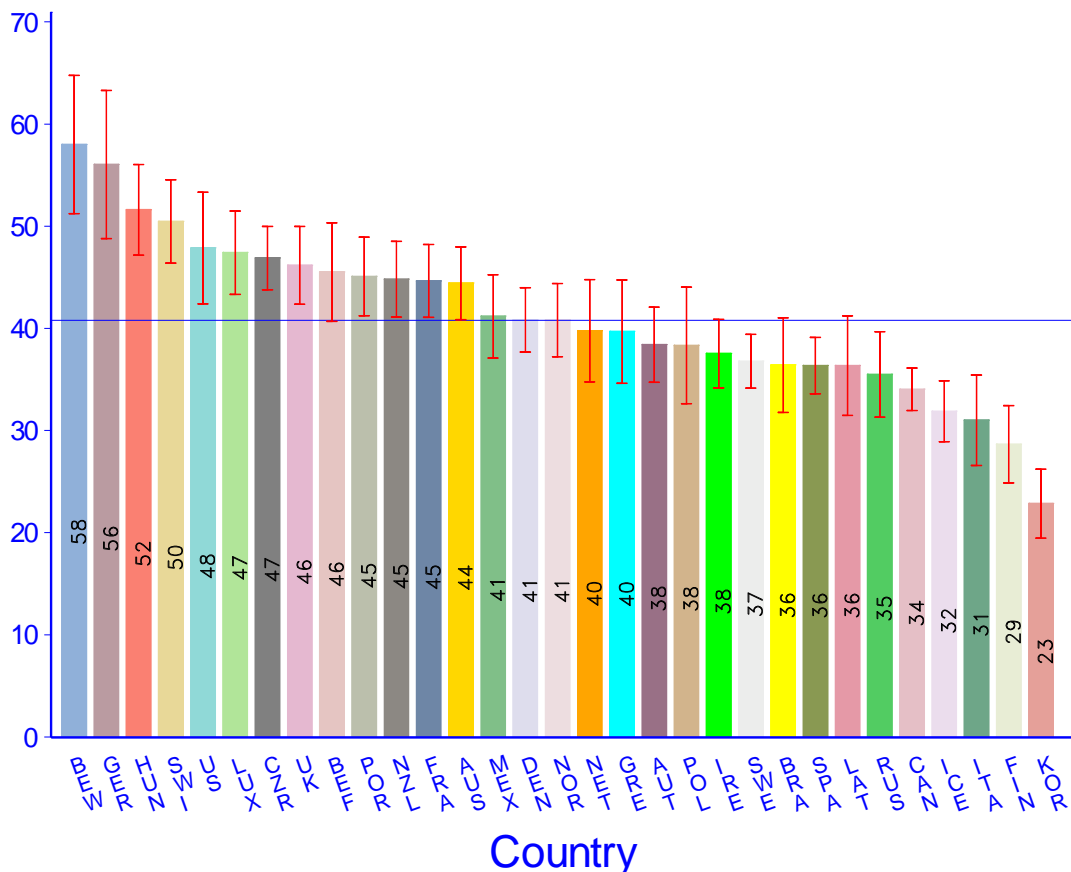


Figure 14 Effect on reading literacy score for a one standard deviation difference in home literacy

Conclusion

This chapter aimed to address three issues: the strength of the relationship between socioeconomic background and student performance, the variation in the strength of that relationship between countries and the extent to which material, cultural and social resources account for the relationship between social background and student performance.

The results of these analyses indicate that the correlation coefficient between any of the components of socioeconomic background and student performance is around 0.30. This is equivalent to nine per cent of the variance in student performance being attributable to one of these aspects of socioeconomic background. When fathers' and mothers' occupational status and fathers' and mothers' educational attainment are combined to form a composite measure of socioeconomic status, the correlation coefficient increases to an average of 0.37. This is equivalent to saying that 14 per cent of the variance in performance can be accounted for by differences in overall socioeconomic background. In other words, although socioeconomic background has some influence on student performance there is much that remains to be explained by other factors. The strength of the relationship between socioeconomic background and student performance is a little stronger for reading literacy than for mathematical or scientific literacy. Expressed in an alternative way schools have a slightly stronger influence on the development of mathematics and science literacy than on reading literacy.

There is considerable variation between countries in the strength of the relationship between socioeconomic background and student performance but these variations are similar for all three of the domains. Using the composite measure of socioeconomic background, the correlation coefficients range from just under 0.25 to around 0.5. These differences may relate to the extent to which educational structures provide differentiated opportunities for learning, there are differences in the support provided in the early years of childhood and societies are themselves stratified in terms of wealth and rewards.

From these analyses it is possible to conclude that in most countries the effects of cultural resources (the patterns of beliefs and practices that a person draws on) are greater than the effects of material resources (access to the possessions measured in PISA). The effects of material resources are, in turn, greater than the effects of social resources (as reflected in social communication). The effects of differences in cultural resources are of similar magnitude to the effects of differences in socioeconomic background and remain an influence after allowance is made for the effects of socioeconomic background. Differences in student performance associated with material resources are more modest. Despite this, there are some countries in which material resources matter. Differences in social resources have very little influence on student performance and disappear when allowance is made for the influence of socioeconomic background. Moreover, most of the effects of socioeconomic background operate through mechanisms other than these three resources.

These results indicate that there are sound bases for investigating the extent to which the effects of family background are modified by national educational systems. There is variation

between countries; there is a known relationship between family background and student performance; and importantly, there is now some understanding of how socioeconomic status influences student performance. Before considering these sets of relations, however, it is also important to consider how individual schools influence the effect of family background on student performance.

NOTES:

- ¹ Fathers' occupational status was measured on an international scale — the International Socio-economic Index (ISEI). The ISEI groups individuals according to occupations ranked by the direct role that occupation plays in maximising income. The skill required to perform the requirements of an occupation serve as the primary criterion for distinguishing different levels of occupational status.
- ² The formation of a composite variable from a set of related constituent variables serves to provide greater parsimony and facilitates interpretation and discussion. It was formed by determining a set of weights that resulted in the optimum correlation with performance.
- ³ The measure of Occupational Aspirations was derived from the following question: Q40. *What kind of job do you expect to have when you are thirty years of age?* The occupational title was coded to ISCO 88 codes and from these codes an occupational status scale was constructed. The occupational status scale used was the ISEI.
- ⁴ The magnitude of these effects and ranking of countries are similar to those using a different composite measure. The measure used in the initial report does not include books in the home and the only the education level of the parent with the highest level ((OECD, 2001:308, 221)

Chapter 3 The Role of Schools

This chapter investigates how schools and school systems mediate the influence of socioeconomic background on student performance. The previous chapter focused on the material, social, and cultural resources, their independent influence on student performance and the extent to which they accounted for the influence of socioeconomic background. This chapter adds schools to the analyses.

Academic Location

Academic location refers to a combination of the grade or level of the student relative to other students of the same age and the school program. There are two main reasons why grade is associated with student performance. First, academically more capable students are likely to be found in a higher grade than their same-aged peers. Similarly, in those countries where grade promotion is not automatic, the academically less capable students are more likely to repeat a grade and thus be in a grade lower than their peers. Secondly, students in higher grades are exposed to more complex concepts and more difficult problems. Given this, it is likely that students in higher grades will perform better than students of the same age in lower grades.

Similarly, school programs are likely to be associated with student performance because they may differ in the extent to which they emphasise analytic skills. However, the causal order of school program and student performance is not clear. School programs may influence student performance by the material presented and the level of instruction. On the other hand, the most academically able students may be admitted to a program and these students will tend to perform better in tests because they have higher levels of general ability.

Grade

For PISA 2000, all students indicated their grade at school. A grade variable was constructed to be relative to the modal grade for 15-year-olds of the country. If the students were in the modal grade they were given a score of 0, if one grade above the modal grade 1, if one grade below the modal grade -1, and so on. Information on school program comes from a question asking students what type of program they were in at school. Responses were coded to the *International Standard Classification of Education (ISCED)* categories.¹ This classification separates academic, vocational and work preparation programs at two levels, upper and middle secondary school. For these analyses, the

small number of students classified in the 'C' group — 'work preparation' — were grouped with students in vocational programs. The categories of programs used in these analyses are: Lower Level Academic Program, Lower Level Non-Academic Program, Higher Level Academic Program, and Higher Level Non-Academic Program.

The correlation coefficient between grade and reading literacy in the pooled data for all countries is 0.25. However, in countries where less than 80 per cent of students were in the modal grade, strong correlation coefficients are evident. The countries showing the strongest correlation coefficients are Portugal (0.72), France (0.64), French-speaking Belgium (0.61), Mexico (0.57), Flemish-speaking Belgium (0.54), Spain (0.56), Brazil (0.55), the Netherlands (0.45), Luxembourg (0.42), and Germany (0.40). Countries in which education is organized on a regional basis (such as Australia, Canada, Switzerland, the United Kingdom, and the United States) tend to show smaller correlations. It is likely the correlations in these countries are attenuated because the modal grade differs between regions².

For mathematics a similar pattern is evident, although the correlation coefficients are slightly weaker. The largest correlation coefficients are found in Portugal (0.65), French-speaking Belgium (0.64), France (0.60), Flemish-speaking Belgium (0.55), Brazil (0.54), Mexico (0.55), Spain (0.49), the Netherlands (0.50), Luxembourg (0.45), Germany (0.41) and Switzerland (0.40). For science literacy the correlation coefficients between grade and student performance are again slightly lower than those for reading, but the pattern is the same as that for reading and mathematics. The largest correlation coefficients are observed in Portugal (0.65), French-speaking Belgium (0.58), France (0.60), Flemish-speaking Belgium (0.55), Spain (0.50), Mexico (0.47), Brazil (0.46), the Netherlands (0.44), and Germany (0.40).

Program

The correlation between school program and student performance is strong, with the higher-level academic programs being associated with higher student performance in each of the three domains. Countries showing strong correlation coefficients between program and reading performance are, Flemish-speaking Belgium (0.67), French-speaking Belgium (0.64), the Netherlands (0.63), Austria (0.60), France (0.61), Hungary (0.57), Greece (0.56), Poland (0.56), Portugal (0.54), Luxembourg (0.53), Brazil (0.51), Mexico (0.44) and Switzerland (0.41).³ In these countries higher correlation coefficients are also found between programs and performance in mathematics and science literacy.

It is important to note that the measure of school program may not be adequate in some countries. The German educational system is well known for its tracking but almost all 15 year olds were (correctly) assigned to the lower academic track (ISCED 2A). Similarly, almost all students in Italy were assigned to the ISCED 3A, in Switzerland 82 per cent were assigned to ISCED 2A, and in the Netherlands students were assigned to either lower non-academic or high academic. The ISCED categories are too broad to capture the complexity of tracking in some countries. In some non-tracked systems, a similar problem arises. Where students take different combinations of subjects they are sometimes streamed in mathematics and science but not other subjects. In the PISA 2000 study most students in these countries indicated they belonged to the ISCED categories 2A or 3A.

Academic Location

Differences in student performance according to grade and school program can be associated with socioeconomic background. Students from privileged backgrounds, it is argued, are more likely to be in higher grades and more academically orientated programs. Figure 15 presents the effects of academic location on reading literacy with and without controls for home background factors. The top line shows unadjusted or total effects. The second line shows the net effects controlling for socioeconomic background. The third line shows the net effects taking into account the socioeconomic backgrounds of the students and their home material and cultural resources. As previously described academic location is a composite of grade and school program⁴.

Among OECD countries the average effect size of academic location was 43 score points. In other words a one standard deviation difference in academic location is associated with a difference of 43 score points. The countries showing strongest effects for academic location are French-speaking Belgium (74), Portugal (67), Luxembourg (62), Flemish-speaking Belgium (60), France (60), Hungary (58), Greece (54), Germany (42), the Czech Republic (40), Mexico (40) and the Netherlands (40). The effects of academic location are reduced if a statistical allowance is made for the effects of student socioeconomic background. The OECD average decreases from 43 to 37 score points.

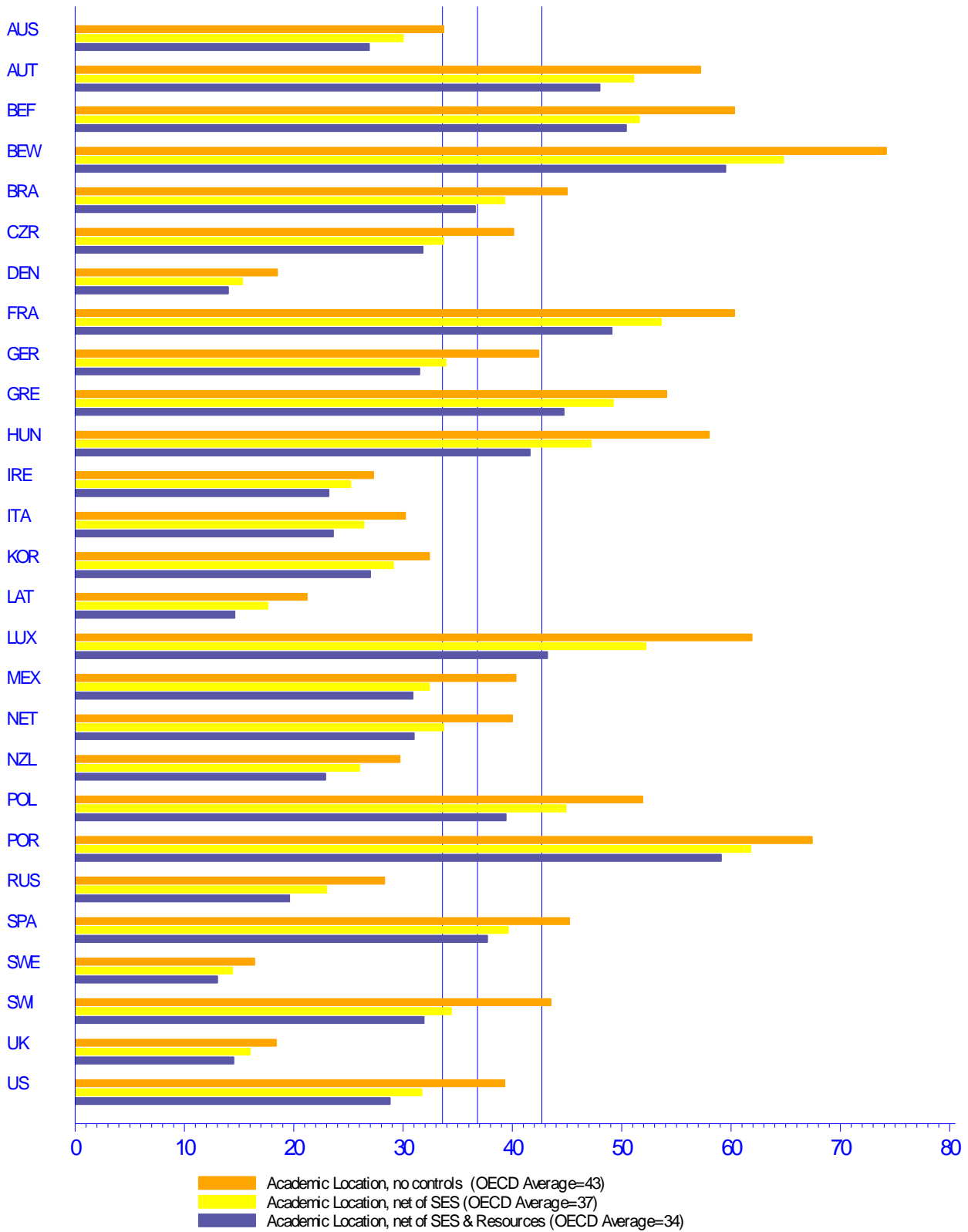


Figure 15 Effects of academic location on reading literacy with and without controls for SES and resources

These analyses suggest that the relationship between academic location and reading literacy is not simply a reflection of socioeconomic background. This is probably due to schools and school systems allocating students to grades and school programs based on their performance rather than their socioeconomic backgrounds. Socioeconomic background does play a role, however, probably through its association with performance and possibly through the ways in which schools and teachers make judgments.

Individual Schools

Schools affect student performance over and above the effects of student-level factors. In other words, students who attend a 'good' school may show higher levels of performance than students with identical characteristics attending other schools. A common starting point for the examination of school effects is the intra-class correlation. An intra-class correlation coefficient indicates the degree to which student performance varies between schools and is simply the between-school variance in student performance as a proportion of the total variance in student performance. In highly tracked education systems the intra-class correlation coefficient is large, whereas in non-tracked systems with standard curricula the intra-class correlation coefficient tends to be small. In countries with both elite and non-elite schools the intra-class correlation coefficient can also be high depending on the numbers of elite schools and the degree to which elite schools deliver superior educational outcomes.

Differences between schools in educational performance may be the result, at least in part, of selection effects. Schools whose students have high socioeconomic backgrounds will show higher levels of performance because socioeconomic background is related to student performance. More importantly, schools or school systems that select students based on ability (or prior performance) will show considerable differences in school performance. Therefore, it is possible that between school differences in student performance could be attributed not to what schools do and provide but the academic and social mix of their students. Finally, differences between schools may reflect also the effect of different academic programs especially in highly tracked systems.

Figure 16 presents the intra-class correlation coefficients with and without controls for home background factors. The top line shows unadjusted intra-class correlation coefficients. The second line shows the intra-class correlation coefficients after adjusting for the fact that schools differ in the socioeconomic backgrounds of their students. The third line shows the intra-class correlation coefficients after adjusting for differences in the socioeconomic backgrounds of students and their

material and cultural resources at home. In OECD countries the average intra-class correlation coefficient is 36, which means that between school differences constitute, on average, 36 per cent of the total variation in student reading literacy. The unadjusted intra-class correlation coefficients are much higher in countries with stratified school systems. The countries showing the largest intra-class correlation coefficients are Hungary (67), Poland (63), Austria (60), Germany (59), French-speaking Belgium (58), Flemish-speaking Belgium (54), Mexico (54), the Czech Republic (53), Greece (51), the Netherlands (51) and France (50). The countries showing low intra-class correlations are Iceland (8), Sweden (9), Norway (10), Finland (13), New Zealand (16), Australia (18), Canada (18) and Denmark (20).⁵

In most countries controlling for differences in the socioeconomic backgrounds of students across schools does not substantially reduce the intra-class correlation coefficient. In OECD countries the average intra-class correlation coefficient declines from 0.36 to 0.32. In absolute terms the reduction in the intra-class correlation coefficient is similar across countries but proportionally, the decrease is larger in countries with lower intra-class correlation coefficients. Ignoring countries with very low initial intra-class correlations, the (proportionate) reduction tends to be larger in those countries with a substantial private school system: Australia (a decrease of 40 per cent), the United Kingdom (36 per cent), Canada (23 per cent) and the United States (22 per cent). In countries with tracked school systems (which show high intra-class correlations), controlling for the effects of socioeconomic background only marginally reduces the intra-class correlation coefficient. For example, the intra-class correlation for Germany declines only three units (from 0.59 to 0.56) when controlling for socioeconomic background. Many other countries show little change in the intra-class correlation with the addition of students' socioeconomic background.

Material and cultural resources in the home have little effect on the intra-class correlation coefficients. Only in Brazil, Denmark, New Zealand and the United States does the presence of material resources make a substantial difference to the intra-class correlation. Cultural resources substantially reduce the intra-class correlation coefficient in only a handful of countries: Australia, Ireland, Spain and the United Kingdom. In tracked school systems, the between-school differences in student performance are not accounted for by between-school differences in the socioeconomic, material and cultural backgrounds of students. There are two explanations for the high intra-class correlations in these countries. First, the between-school differences may reflect student differences in ability since ability shapes the prior selection of students to different school tracks. Secondly, the more academic tracks emphasize cognitive skills so students in them will tend to perform at higher levels in the PISA tests. Conversely, students in vocational tracks may be unfamiliar with and lack practice in the cognitive processes necessary to perform well in PISA tests.

In most countries, the addition of academic program to the analysis further reduced between-school differences in reading literacy. The average intra-class correlation coefficients among OECD countries declined to 0.25, a decline of around 20 per cent on the intra-class correlation net of home resources. In some countries the reduction was more substantial, Brazil (55 per cent), the Czech Republic (30 per cent), Hungary (45 per cent), Italy (30 per cent), Mexico (33 per cent) and Poland (25 per cent). Therefore, the high initial intra-class correlations found in these countries can be attributed to differences in the academic location of students to a substantial extent. Although the declines are large, these countries still show high intra-class correlations suggesting substantial differences between schools in the same track (or sub-tracks not identified in the study).

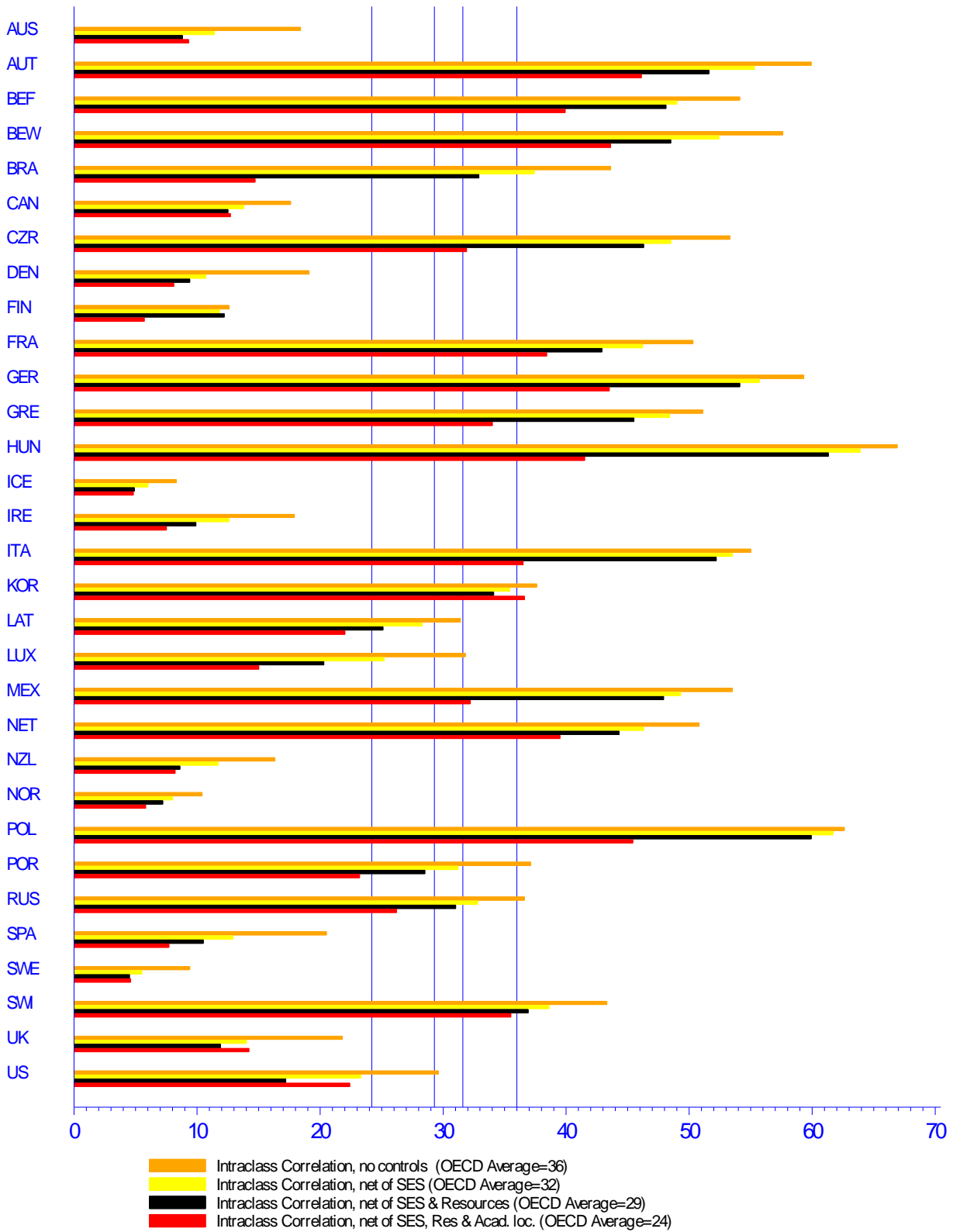


Figure 16 Intra-class correlation coefficients with and without controls for SES, resources and academic location

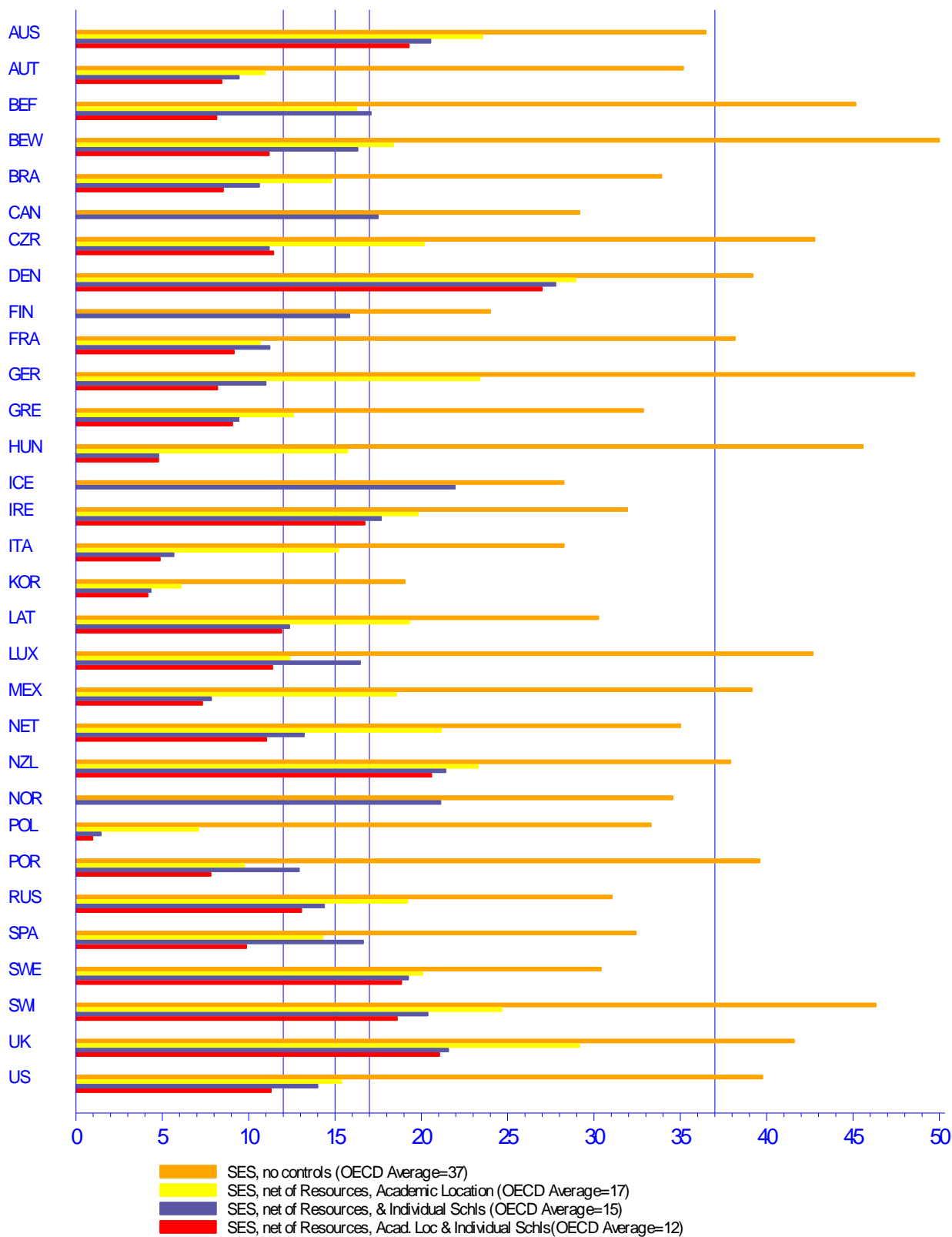


Figure 17 Effects of SES on reading literacy with and without controls for schools and resources

Schools and the Influence of Socioeconomic Background

Academic location and individual school membership can affect the way socioeconomic background influences student performance. Figure 17 presents the results from four analyses. The top line shows the (total) effect of socioeconomic background on reading literacy. The second line shows the effects of socioeconomic background, net of material and cultural resources, and academic location. The third line shows the effects of socioeconomic background net of material and cultural resources, and individual schools. The bottom line is the effect of socioeconomic background net of home resources, academic location and individual schools. Academic location produces a further decline in the effect of socioeconomic background on reading literacy from that achieved by material and cultural resources. The addition of academic location further reduces the effect of socioeconomic background from 24 score points to 17 score points. Countries where academic location has a strong impact are almost invariably those countries showing strong effects of socioeconomic background. Such countries include Poland (where the effect of socioeconomic background is reduced by 64 per cent), Austria (50 per cent), Flemish-speaking Belgium (55 per cent), France (54 per cent), Luxembourg (54 per cent), Portugal (54 per cent), Korea (50 per cent), French-speaking Belgium (45 per cent), Greece (40 per cent) and Hungary (38 per cent). The reduction in the effect of socioeconomic background with the addition of academic location was minimal in a number of countries: Australia, Denmark, Ireland, New Zealand, Sweden, and the United Kingdom.

Controlling for the effects of individual school membership also substantially reduces the impact of socioeconomic background, beyond that obtained with material and cultural resources. Controlling for individual schools reduced the effect of socioeconomic background from 24 score points to 14 score points. Again the reduction is greatest in tracked school systems. Such systems include those in Poland (where the effect of socioeconomic background is reduced by 95 per cent), Hungary (81 per cent), Germany (65 per cent), Austria (61 per cent), Greece (57 per cent), France (54 per cent), Flemish-speaking Belgium (53 per cent), French-speaking Belgium (52 per cent), Korea (50 per cent), Portugal (41 per cent), and Luxembourg (38 per cent).

Controlling for material and cultural resources, academic location and the effect of individual school membership explains a large proportion of the total effect of socioeconomic background. Across OECD countries, the effect decreased from 37 score points to 12. This means that nearly 70 per cent of the influence of socioeconomic background on reading literacy is accounted for by the material and cultural resources in the home, academic location, and differences between individual schools.

A question that emerges from these analyses is whether additional factors may be important. 'Occupational aspirations' could be a possible influence since students from higher socioeconomic backgrounds tend to have higher aspirations. Furthermore, occupational aspirations are correlated with student performance. Overall, aspirations made a small additional contribution to explaining the influence of socioeconomic background. However, in some countries aspirations made a substantial contribution. In Norway, the socioeconomic effect is reduced from 21 to 13 score points. Substantial declines are evident in New Zealand, Denmark, Ireland, Sweden, Finland, Australia, the United Kingdom, Canada and Iceland. Aspirations had little or no effect in Austria, Belgium, the Czech Republic, France, Germany, Greece, Hungary, Italy, Luxembourg, the Netherlands and Switzerland. These are countries with tracked school systems. One interpretation of this result is that, in countries with a tracking system, aspirations have been to a large extent shaped by schools so aspirations have little or no impact on the influence of socioeconomic background, in addition to that of academic location and individual schools.

Home or School

In the literature on the relationship between socioeconomic background and educational outcomes there is an implicit debate about the relative importance of the home and the school. Some theoretical approaches emphasise home factors such as income and wealth in the home, or working class sub-cultures, or the appreciation of high culture. Other approaches focus on how schools judge students from different socioeconomic backgrounds. The analyses conducted suggest that in countries in which the school system is tracked, or which have school systems tending to cater for different socioeconomic groups, there will be a relatively larger school component. Figure 18 records the results of analyses concerned with the influence of home environments⁶ on reading literacy. The first line shows the total impact of home environment on reading literacy. The second line shows the effect net of academic location, and individual schools⁷.

The home environment plays a much more limited role in highly tracked systems. In Poland only 13 per cent of the effect of the home environment was not mediated through schools. Other countries that show a limited role of the home are Flemish-speaking Belgium (between 20 and 22 per cent), Italy (19 to 23 per cent), Mexico (29 to 32 per cent), Germany (29 to 31 per cent), Hungary (27 to 31 per cent), French-speaking Belgium (29 to 33 per cent), Portugal (31 to 38 per cent), Austria (37 to 39 per cent), Brazil (41 per cent), France (40 to 42 per cent), Greece (35 to 43 per cent) and the Netherlands (35 to 42 per cent). The home environment has relatively strong direct effects on reading literacy in Sweden where between 70 and 92 per cent of the influence of the home environment is

not mediated by school factors. Other countries where the home is considerably more important than the school are, Denmark (where between 59 to 88 per cent is not mediated through schools), New Zealand (62 to 82 per cent), Ireland (61 to 79 per cent), Australia (59 to 77 per cent), the United Kingdom (59 and 72 percent), and the United States (58 and 67 percent). In the countries where it is not possible to include a measure of academic location, the greater proportion of the influence of home socioeconomic, material and cultural environment on reading literacy is not mediated through schools and the school system. In Canada, between 73 and 88 per cent of the total effect of the home environment on reading literacy was a direct effect. In other words between 12 and 27 per cent of the overall influence is mediated through school systems. For Finland between 71 and 97 per cent of the overall effect of the home environment on reading literacy is not mediated through schools, for Iceland 75 to 94 per, and for Norway 68 and 95 per cent.

Thus, there appear to be differences between countries in the way in which the influence of the home environment on student performance operates. In some countries schools play the dominant role but in others schools play a minor role. Those countries in which the influence is through schools also tend to show a stronger overall effect of the home environment on student performance. Similarly, countries in which the effect of the home environment is relatively weak, schools play a minor role in mediating this relationship.

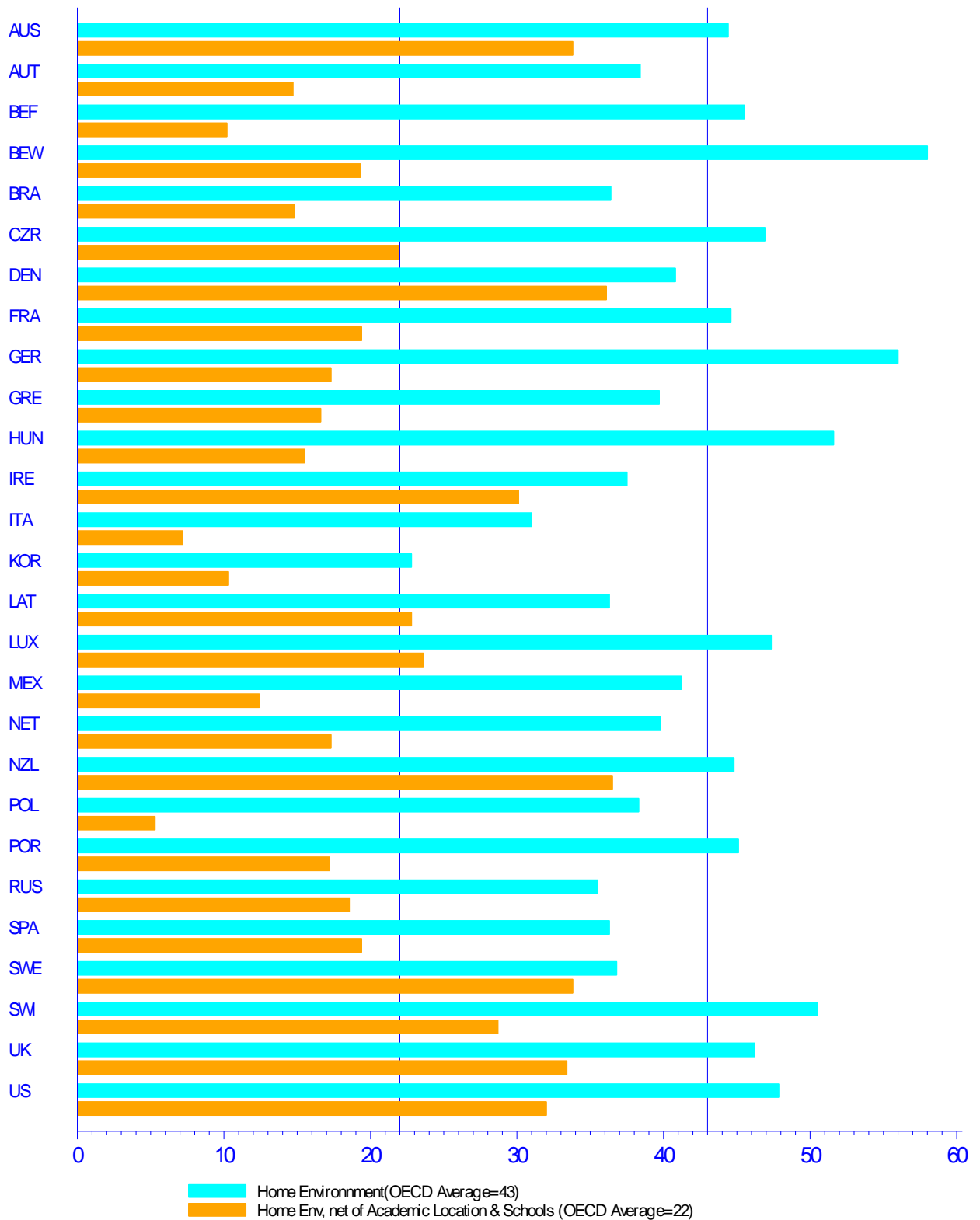


Figure 18 Effects of home socioeconomic, material and cultural environment with and without controls for academic location and individual schools

Conclusion

This chapter adds school-related factors to previous analyses of the influence of socioeconomic background (including the relative effects of material, social, and cultural resources) on performance. Academic location (a combination of grade and program) is associated with performance. It is found that the overall correlation coefficient between grade and reading literacy was 0.25. However, in countries where less than 80 per cent of students were in the modal grade, stronger correlations are found. For mathematics and science a similar pattern was also found. Similarly, more academically oriented programs are associated with higher performance. Overall, the correlation coefficient between academic location and performance is 0.43.

Typically differences between schools contribute 36 per cent of the total variation in student reading literacy. However, the range is from approximately 10 per cent to more than 60 per cent. In most countries, these differences between schools do not result from differences in the socioeconomic backgrounds of students across schools. Similarly, material and cultural resources in the home have little effect on these differences between schools. Where there are large differences among schools it is largely due to differences in the academic location of students.

There are differences between countries in the way in which home environments influence student performance. In some countries schools play the dominant role in that influence, but in others they do not. Those countries in which the influence of home environments operates through schools also tend to show a stronger overall effect of the home environment on student performance.

NOTES:

¹ ISCED are summarised in the ISCED manual (OECD, 1999).

ISCED 2 refers to lower and middle secondary school programs. Typically at completion students have completed 9 years of school.

ISCED 2A: programs designed to prepare students for direct access to Level 3 in a sequence which would ultimately prepare students to attend tertiary education, that is, entrance to ISCED 3A or 3B.

ISCED 2B: programs designed to prepare students for direct access to programs at Level 3C.

ISCED 2C: programs primarily designed for direct access to the labour market at the end of this level (sometimes referred to as "terminal" programs).

ISCED 3 refers to higher secondary school programs. Typically at completion students have completed 12 years of school.

ISCED 2A: academic programs (a wide range).

ISCED 2B: vocational programs.

ISCED 2C: preparation for work programs

- ² Regions include the Australian states, Canadian provinces, German Lander, Swiss cantons, states and school districts in the United States and the separate education systems for England and Scotland in the United Kingdom. It is possible to calculate modal grade of the region in some but not all countries.
- ³ The correlations are low in Germany because almost all students were classified as belonging to the lower academic track.
- ⁴ Academic location was constructed in the same manner as other composite variables used in this report. Some countries are not included since all sampled students were in the same grade or there was no differentiation of school programs.
- ⁵ There are differences between these intra-class correlations and the ones published in the initial report (OECD, 2001:60-61). For many countries the differences are small, the OECD average is identical (36) and the general pattern of between country differences is much the same. The measure used in the initial report differs in that it is expressed as a percentage of the average variation in performance across countries. The intra-class correlations in this report are almost identical to the ones published in the Australian national report (Lokan, Greenwood, & Cresswell, 2001)]. The intra-correlations presented in that report were calculated independently of the authors of this report.
- ⁶ The home socioeconomic, material and cultural environment is called the 'home environment'
- ⁷ For Canada, Finland, Iceland, Norway, the effects for the second and third lines are net of individual schools only.

Chapter 4 Explaining cross-national variations in family background effects In student achievement

The analysis of the PISA data in the previous chapters has shown that there are socioeconomic background effects on students' academic achievement. Whether measured by parental education or parental occupation, children of higher status parents score better on the reading, mathematics and science literacy tests than children of lower status parents. However, although these effects were observed in all PISA countries, the magnitudes of these family background effects vary among countries. The primary aim of this chapter is to explain these cross-national variations in family background effects in terms of the structure of the national educational systems of the PISA countries. Educational systems that do not formally stream or track, are described as 'comprehensive', while educational systems that provide different streams, track or types of school are called 'differentiated'. It is hypothesised that differentiated educational systems evoke stronger social background effects than comprehensive systems.

Müller and Shavit (1998) discuss the concept of 'comprehensive' and 'differentiated' systems in the context of the transition of school to work. Their operationalisation of these concepts forms a useful starting point. Comparing 12 countries, they measure differentiation of educational systems using indicator variables:

- Vocational specificity (or the existence of vocational tracks): Müller & Shavit point to Germany, Netherlands and Switzerland as countries with educational systems with highly specific vocational tracks.
- Standardisation (or whether education in a country is organised by a national curriculum): Müller & Shavit cite Australia, Britain and the United States as examples of countries with less standardisation than elsewhere.
- Stratification (or the extent of tracking, other than vocational tracking, used in a system).

Müller and Shavit (1998) measure the variations in vocational specificity, national standardization and stratification using simple indicator variables. They show that the degree of differentiation is a strong predictor of the association between educational credentials (highest degree completed) and early labour market outcomes. Like many comparative analysts of cross-

national variations, Müller and Shavit are limited by the small number of countries in their study. Comparing 12 national systems leaves little opportunity to identify the sources of cross-national variation in a definitive way and leaves no room to assess the relative importance of the four components of educational differentiation that they distinguish.

This chapter elaborates the analyses of Müller and Shavit by applying their approach to influences of family background on academic achievement. This is done by expanding the number of indicators to measure 'educational differentiation' and by improving the empirical basis of measurement. In doing this, it is intended to broaden the empirical underpinning of the concept of 'educational differentiation'. The analysis is intended to show that the relationship between differentiation of educational systems and social selectivity does not critically depend upon a particular empirical measure, but holds across a variety of measures. In these analyses several forms of differentiation are examined: tracking, vocational tracking, age of selection, grade repetition, and between-school variation in student performance.

Tracking

The most commonly used device to differentiate among students is the use of tracks that sort students by level of performance. Students of similar performance levels are sorted into the same track on the argument that their talents will develop best in a learning environment in which they can stimulate each other equally well, and that an intellectually homogeneous student body will increase efficiency of teaching. Both for the able and for the less able, it is argued homogeneous grouping makes it easier to adapt teaching to the cognitive demands of the student. However, there is no intrinsic reason why tracking should lead to either more differentiated academic outcomes for the students, or to greater social selectivity. If teaching homogeneous groups of students is more efficient than teaching of heterogeneous groups, it should increase the level of student performance rather than the dispersion of scores. (It is conceivable that dispersion in achievement scores could be the same in both tracked and non-tracked systems. In untracked systems all dispersion would occur within programs, while in tracked systems it would mostly occur between programs.)

However, one reason to assume homogeneous grouping could result in a wider dispersion of scores may be found in the learning environment the students generate. In heterogeneous environments, the low performers will profit from the presence of high performers (that is, learn from them or imitate their standards of learning), while high performers may not profit from the presence of low performers, or may even adopt their style of learning. In homogeneous environments, the high performing students profit from the wider opportunities to learn from one another, and stimulate

each other's performance, while the low performers will not be able to access effective models and support.

This argument does not lead to expectations about social selectivity. Even when homogeneous grouping leads to more dispersion in performance, it should not necessarily increase the gap in performance between students from low status and high status backgrounds. One reason why such a process may occur in practice is that homogeneous environments of low performing students may decrease the aspirations of low status parents and their children and increase the aspirations of high status parents and their children. The very existence of a tracked system may function as a labeling or as a signalling device to students with low status parents about what to expect from life.

Number of tracks

One major measure of tracking is the number of tracks that can be distinguished in an educational system. The educational systems in the PISA countries vary from various comprehensive systems (characteristic of Nordic and north-American countries) to fine-grained systems such as that in the Netherlands, in which 15-year-olds are sorted into at least six different tracks. Determining the number of tracks available to students is not a trivial task. First, identifying what constitutes a track is difficult. Even in comprehensive systems, informal tracking may occur. Tracked systems may be fluid, as students from different tracks may still share some of the same resources, teachers, lessons or schools. In addition tracked systems may offer opportunities to change tracks, in which case it may be unclear what can be called a track, and to what degree these operate as effective signals. Secondly, tracking may occur at different ages. Many systems are more or less undivided up to a certain level and then become tracked. For this study, it was decided to count the number of tracks for students of standard PISA age, even though tracking that appears shortly after this age may foreshadow variations that could not be captured. In developing an empirical measure of the number of tracks, two tracking indicators were investigated: the number of tracks available to the student at 15 years of age, and the number of tracks shortly after.

In order to determine the number of tracks in each system, information from *Education at a Glance* (OECD, 1997) was used. Expert advice was also sought. The measure of number of tracks does not take into account the degree of dispersion of performance in the different tracks. It may well be that a very fine-grained tracking system such as in the Netherlands is in fact less differentiated than a bifurcated system. Data on performance levels by track, and mobility between tracks was needed to say more about the differentiating effect of the tracks. These data were unavailable.

Vocational and terminal tracking

The second measure of differentiation of education builds upon the conception of vocational specificity that Müller and Shavit introduced. The existence of programs that train specific vocational skills – most often for manual occupations – is only an extension of the existence of differentiated tracks *per se*. Vocational tracks are not only distinguished by a curriculum of a certain level of complexity, they are also different from academic tracks in that they provide the student with a specific destination. Sometimes tracks are not terminal but lead only to a continuation in terminal vocational tracks. These are often referred to as ‘pre-vocational’.

The ISCED classification used in the PISA data distinguishes between vocational and pre-vocational tracks. Thus the PISA database not only helped to determine the existence of tracks, but also the proportion of PISA respondents that participated in them for each country. The measure of vocational tracking was calculated as the odds of a 15-year-old being found in such a track.

Age of selection

In most educational systems, some tracking occurs and students and their parents are faced with choices. Variations in choice not only occur in their range, but also in the age at which these choices have to be made. The age of selection is a strong determinant of social selectivity. This is likely because students will be more dependent upon their parents and their parental resources when they are younger. This is based upon Mare’s observation, replicated in many subsequent studies, that early selections in school careers tend to be much more driven by family background than later selections.¹ By using cross-national data, Rijken (1999) was able to separate out selection and aging effects. As students are selected at a later age, social background effects diminish, net of the number of students left in the school system, or nature of the transition made. The likely explanation is that students who make an earlier selection have their decision more influenced by parents (either by helping them to do well in their academic work or by influencing the selection process). In educational systems that are characterized by early selection and a high degree of sorting before or at age 15, it would be expected that social background effects will be stronger than in countries that have more comprehensive systems. In strongly stratified systems with early selection, high status parents are in a better position to promote their children’s life chances than in a system in which they have to wait for a later age and leave the decision to the students themselves.

A complication in determining an empirical measure of the age of selection is that such selection ages are not standardized. For instance, in some countries selection occurs at an earlier age

for a small group of high ability students than for the other students. For example, in Hungary, a small group of students is transferred to the *gymnasium* at age 10, another group at age 11, but the majority of students that end up in a *gymnasium* enter it at age 12. (In this case, 12 was chosen as the earliest age of selection for the analyses reported here, although it might be argued that this could have been age 10.)

Grade repetition

The fourth measure of differentiation is the degree to which grade repetition is practiced. This practice constitutes yet another form of adapting curriculum contents to the students' abilities, and thus its effects should be similar to the effects of tracking. Grade repetition was measured by taking the standard deviation in the grade level reported by the PISA students for each of the countries. Note that this measure also captures the degree to which students can be accelerated through school (or can be sent to school at an earlier age).

Between-school variation in academic achievement

The final measure of educational differentiation is the between-school variation in academic achievement. In tracked educational systems, there is a tendency to organize tracks in separate schools, thus creating a spatial separation between students of different achievement levels. However, this need not be the case and may differ by country and within countries. It is expected that in systems in which tracks are organized in different schools, social selectivity will be strongest. However, in untracked systems, schools may differ in average academic achievement too, for reasons of informal tracking. In these cases, larger between-school variation in academic achievement may signify that schools attract and select students of different backgrounds.

Methodological issues

Measurement issues

Imperfect measurement of either student performance or of family background will reduce the observed relationships between these variables such that the effect of family background will be reduced.² While the PISA data were collected under stringent conditions, there remains the possibility that these standards were not always fully implemented. In at least one case, the PISA data misrepresent some family background indicators: in the Japanese data, some 60 per cent of parental educational and occupational data are missing. There is evidence that the remaining Japanese data on parental background are heavily biased, because children of low status parents did not provide the

information. (A simple 'solution' was to exclude Japan from parts of the analysis. However, the Japanese students did provide information on other useful family background indicators, such as cultural practices and wealth indicators. This made it possible to assess the position of Japan on some of these dimensions.)

Sample selection bias

PISA drew its sample of students from the population of all 15-year old students in schools, on the basis that in all OECD countries students in this age group are required to attend school. In reality, the sampled population was not always the total population of 15-year olds in a country. For example, in two of the PISA countries, Brazil and Mexico, the enrolled population is around 50 per cent of the total population in the relevant age group. (OECD, 2001, page 232)

There may also have been deviations from the sampling design that could have resulted in some sample selection bias. For example, in the Netherlands, the specifications of the sample design were not met due to a high non-response among sampled schools. Another source of sample selection bias may be the degree to which students are dispersed among different institutions. A particularly striking case here is Brazil, where many 15-year olds are still in primary education. (These students, while sampled were not included in the PISA database.)

The biases brought about by sample selection are likely to be predominantly in one direction. As low achieving children and children of low status families tend to be early leavers, temporary absentees, or remain in primary schools that were not sampled, sample selection will drive down the observed effects of family background on student achievement.

It should be noted that the analysis is subject to the limitation that there were 33 independent educational systems from which PISA students were sampled³. While this number of countries is an advance over most previous comparative analyses, it remains small. Consequently, effects need to be fairly strong to be detectable by conventional statistical standards. Expressed as a bivariate correlation, only coefficients of 0.30 or higher will be statistically significant. While effects of that size may still be substantially important, there is no way to distinguish them from no effect at all in the theoretical population from which the sample was taken. By the same token, the results of the statistical analysis may be sensitive to particular data points from cases that are outside the normal range. These problems are aggravated because the analyses involve multivariate relationships of correlated variables.

Measures of educational differentiation

Table 2 introduces the variables measured as an indicator of educational differentiation, sample selectivity and measurement reliability.

As previously described, the number of tracks in secondary education was determined using *Education at a Glance* (OECD, 1997) and national experts. The measure ranges from essentially undivided secondary education at this age (Denmark, Iceland, New Zealand, Spain, Sweden, United States) to systems with at least four tracks (Austria, Belgium-Wallonia, England, Hungary, Netherlands, Switzerland). Note that Germany does not belong to the most differentiated group because differentiation occurs for students after the age of 15 years.

Table 2 Independent variables in the macro-analysis

Country	Number of tracks	Proportion of students in a pre-vocational program	First age of selection	Second age of selection	Grade Repetition	Total variation in student performance between schools
Australia	3	23	14.0	17.0	0.47	20.9
Austria	4	44	10.0	14.0	0.61	68.6
Flanders	3	18	12.0	14.0	0.59	76.0
Wallonia	4	18	12.0	14.0	0.59	76.0
Brazil	2	0	10.0	14.0	0.90	35.8
Canada	3	22	12.5	18.0	0.48	17.0
Czech Republic	4	16	10.5	15.0	0.55	51.9
Denmark	1	0	16.0	19.0	0.28	19.6
England	4	5	11.0	16.0	0.50	22.4
Finland	1	0	16.0	19.0	0.32	10.7
France	3	9	15.0	18.0	0.69	
Germany	3	30	10.0	18.0	0.63	74.8
Greece	2	27	14.5	17.5	0.46	53.8
Hungary	4	30	11.0	14.0	0.59	71.2
Iceland	1	0	16.0	20.0	0.00	7.0
Ireland	2	2	15.0	18.0	0.84	17.1
Italy	3	0	14.0	19.0	0.52	50.9
Japan	3	26	15.0	18.0	0.00	36.5
Korea	2	35	15.5	18.5	0.13	19.7
Latvia				18.0		35.1
Liechtenstein	4	2	15.0	18.0	0.47	
Luxemburg	3	18	12.5	15.5	0.70	33.4
Mexico	4	40	11.5	14.5	0.79	42.9
Netherlands	4	20	12.5	16.0	0.60	
Norway	2		15.5	18.5	0.11	12.6
New Zealand	1	0	17.0	20.0	0.35	20.1
Poland	3	27	15.0	19.0		67.0
Portugal	3	5	14.5	17.5	0.95	37.5
Russia	3	20	14.5	17.0	0.50	33.6
Spain	1	0	17.0	21.0	0.50	15.9
Sweden	1	0	16.0	19.0	0.15	8.9
Switzerland	4	2	15.0	19.5	0.50	48.7
United States	1	6	17.0	21.0	0.55	35.1

The share of students in (pre-) vocational tracks was determined using the PISA data. Students who reported that they were enrolled in an ISCED 2B/C or 3B/C program were classified as in a pre-vocational program.

The first age of selection was obtained using the same information and methods as with number of tracks. Extreme early selection takes place in Austria, Brazil and Germany, at age 10. Relatively late selection, at age 17, is found in New Zealand, Spain and the United States. Only in a minority of countries (Austria, Belgium, Brazil, Hungary, Mexico) does the next selection take place before 15 years of age. It is argued that selection at an age closer to this point might be a relevant indicator of education differentiation, as these decisions will be foreshadowed in the curriculum. Grade repetition was measured using the PISA data and the standard deviation of the grades in which the PISA students were found. According to these data, no grade repetition is practiced in Iceland, Japan and Poland. (There was no confirmation that this was true for Poland and so it was excluded from the analysis.) Grade repetition is minimal in Korea, Sweden and Norway. The measure for between school variance in achievement was taken from *Knowledge and Skills for Life* (OECD, 2001, Table 2.4, page 257). It is high in Belgium, Germany, Hungary and Poland, reflecting the fact that in these countries education is not only tracked, but that different tracks are organized in different school buildings.

Table 3 **Correlations between indicators of educational differentiation (n = 33 countries)**

*Bold text - Pearson's product moment correlations,
Italic text - Spearman's rank correlations*

	Number of tracks	Proportion of students in a pre-vocational program	First age of selection	Second age of selection	Grade Repetition	Total variation in student performance between schools
Number of tracks		<i>.53</i>	<i>.70</i>	<i>.65</i>	<i>.42</i>	<i>.70</i>
Proportion of students in a pre-vocational program	.52		<i>.51</i>	<i>.52</i>	<i>.15</i>	<i>.54</i>
First age of selection	.68	.51		<i>.84</i>	<i>.58</i>	<i>.63</i>
Second age of selection	.66	.50	.83		<i>.60</i>	<i>.56</i>
Grade Repetition	.37	.00	.48	.50		<i>.47</i>
Total variation in student	.66	.53	.56	.56	.32	

performance
between schools

Table 3 shows two sets of correlation coefficients between the six indicators, computed over the 33 countries. (These correlation coefficients were computed using pairwise treatment of missing values.) The cells marked in bold below the diagonal show the Pearson correlation coefficient and the cells marked in italic text above the diagonal show the rank order correlation coefficient. The rank order correlation coefficient is less efficient, but also less sensitive to outliers. The pattern in the two matrices is strikingly similar, suggesting that the measures are not sensitive to outliers and that the results of analyses are robust.

All correlation coefficients are positive and all except one (grade dispersion with share of vocational training) are strong and statistically significant. They display a homogeneous pattern, suggesting that there is one underlying dimension to these observed measures. Two different versions of an educational differentiation index were created. One used metric scores (by averaging indicators transformed to standardized (z) scores) and the other used rank scores (by averaging percentile ranks). The results correlated with each other with a coefficient over 0.96, and there were no noticeable differences in the behaviour of the two versions.

A measure for sample coverage was calculated from Table A3.1 in *Knowledge and Skills for Life* (OECD, 2001, page 232). This table shows how many students were covered by the PISA sample. This variable is mainly a dichotomy between Brazil and Mexico on the one hand, and all the other countries. A measure for Gross Domestic Product was used in the analyses reported here. These data were taken from Table A3.6 in *Knowledge and Skills for Life* (OECD, 2001, page 264)

A measure of reliability of the social background variables was computed using Cronbach's *alpha* on four indicators: father's and mother's education, and father's and mother's score on the International Socioeconomic Index (ISEI). Cronbach's *alpha* for the ISEI was very low in Japan. This was due to measurement problems previously described. It was also relatively low in the Russian federation.

For the analysis in this chapter, four measures of social selectivity were used:

- ESCS — an indicator used in *Knowledge and Skills for Life* (OECD, 2001) — see Table 8.6. This is an amalgamation of social, cultural and economic status measures. A major virtue of this indicator is that it includes a measure for Japan.
- TOTREAD, TOTMATH, TOTSCIE: Total effects of social background as defined by father's and mother's education and occupation on reading, mathematics and science achievement.

Table 4 shows that these measures are strongly correlated indicating that there could be a common underlying factor that is manifest in each measure.

Table 4 Correlations between various indicators of Social Selectivity (family background effects)
n = 33 countries

	ESCS	TOTREAD	TOTMATH	TOTSCIE
ESCS				
TOTREAD	0.76			
TOTMATH	0.78	0.90		
TOTSCIE	0.81	0.92	0.89	

Analysis: Educational differentiation and variations in family background effects

Table 5 shows the results for four versions of the social selectivity model. They vary by specific dimension of family background used and by field of achievement. In each, the first equation shows the total effect of educational differentiation as the correlation coefficient and the second equation the effect that remains (as a standardized regression coefficient or beta) when the three control variables are taken into account. Coefficients are reported in their standardized form, to facilitate comparisons among them.

Table 5 Multiple regression equation for effects of educational differentiation and control variables on various indicators of social selectivity
(n = 33 countries. Standardised coefficients)

	Effect of ESCS on Reading		Effect of SES on Reading		Effect of SES on Mathematics		Effect of SES on Science	
	Corr. Coeff.	Beta Coeff.	Corr. Coeff.	Beta Coeff.	Corr. Coeff.	Beta Coeff.	Corr. Coeff.	Beta Coeff.
Educational Differentiation	0.43***	0.55***	0.63***	0.70***	0.30***	0.59***	0.51***	0.58***
Sample Coverage		0.13		0.09		-0.08		-0.04
GDP		0.47**		0.35*		0.55**		0.47***
Reliability		0.31		0.31		0.33*		0.30
R Square	0.16	0.34	0.38	0.48	0.26	0.47	0.24	0.35

From the data in Table 5 it can be concluded that for all measures of social background, irrespective of the domain — reading, mathematics and science — there is a reasonably strong and statistically significant correlation between measures of social selectivity and measures of educational stratification. Expressed as a standardized coefficient, the relationship hovers around 0.55. This is true for the simple correlation coefficient and for the measures that take account of the influence of the control variables (sample selectivity, quality of measurement, GDP).

Sample selection, as measured by sample coverage, does not have a statistically significant effect but tends to increase social background effects. The effect appears largely due to the influence of the extreme cases — Brazil and Mexico — and disappears when they are omitted from the analysis.

There were positive, and statistically significant, effects of measurement quality (as reflected in the reliability measure) of the social status variables on the family background effect. That is, as measurement quality improves (the index increases in value), the observed family background effects increase. However, the effect of measurement quality is weak. (The indicator of measurement quality is derived from the consistency between educational level and the International Socioeconomic Index derived from the occupational titles of parents.) There seems to be an effect of Gross-Domestic Product (GDP) on family background effects. Stronger social background effects are found in wealthier countries. It is not clear why this is so or what is the direction of causality. This effect does not, however, have implications for the main conclusion to do with educational stratification.

These analyses were repeated using Spearman's ranked correlation coefficient. The conclusions were unchanged.

Table 6 Unique contributions of six indicators of educational stratification in the explanation of variation in social selectivity in reading achievement (standardised coefficients) $n = 33$ countries
(Model A: simple correlation. Model B: standardised metric regression effect controlling the other five indicators)

	(A)	(B)
	Unique as Single Indicator	Unique as Additional Indicator
Number of Tracks	.63*	.44*
Share in Vocational Tracks	.60*	.41*
First Age of Selection	.60*	.03
Second Age of Selection	.50*	-.05
Grade Dispersion	.20	-.20
Between Schools Variance	.58*	.31*

* Statistically significant $P < 0.05$

These data support the argument that educational differentiation is a relatively strong predictor of the strength of family background effects. However, the question remains as to whether all indicators contribute to this relationship. For instance: is it true that early selection contributes to social selectivity over and above the number of tracks in a national educational system? Assessing the contributions in a multiple regression is not the best strategy in this context. (The small number of countries means that estimates become very unstable.) Table 6 shows the results of another approach to this issue. Column A reports the associations of each of the indicators. Each of these is strongly to moderately related to social selectivity (in reading achievement). Column B assesses the effect of each indicator, while controlling for the effect of all of the other indicators. This analysis confirmed the contributions of tracking (number and proportion in vocational courses) and between-school variance. Table 6 shows that the effects of age of selection and grade dispersion were no longer significant. It therefore remains unclear whether these dimensions contribute independently to social selectivity.

Conclusion

The results of the analysis of the antecedents of family background effects on academic achievement among the 15-year-old PISA students indicate that the educational systems in the PISA countries can be scaled meaningfully according to educational stratification, using a number of indicators. Three indicators (number of tracks, first age of selection, second age of selection) were measured using documentary analysis and expert advice, while three others (grade dispersion, share of vocational schools, between school variance in achievement) were measured using the PISA data. From these analyses there is consistent and good evidence that the degree of educational stratification is directly related to the size of family background effects. The more differentiated an educational system, the larger the performance differentials between children of high and low status parents. This is true for various combinations of social background effects (father's and mother's status, parental education and parental occupation) and domain (reading, mathematics, science) and whether or not control variables are taken into account.

NOTES:

- 1 See Rijken (1999) for an overview and comprehensive replication of Mare's finding.
- 2 It is hard to conceive of measurement error that will increase family background effects. For example, such measurement error would occur when children of high status parents would misreport the status of their parents, while low status children give more correct answers, and this seems to be implausible.
- 3 Two systems were identified in Belgium (Flanders (Dutch speaking) and Wallonia (French speaking)) and, in the United Kingdom, England and Scotland are treated as two systems. Liechtenstein was excluded from the sample.

Chapter 5 Conclusion

The aim of this study was to provide a foundation for national policy review of social background and performance as they relate to the impact of national educational systems. The report investigated how national educational systems amplify or mute the effect of social background on student reading, mathematical and scientific literacy. In order to do this, it was first necessary to show which aspects of family background are important influences on student performance, and the extent to which these influences vary between countries. It was also necessary to show how individual schools compound or ameliorate the effect of family background. Once these effects could be shown to exist, it became possible to examine the extent to which national educational systems — conceived as ‘comprehensive’ and ‘differentiated’ — impacted on the effect of social background on student performance.

From both an equity and an efficiency perspective, it is important that educational systems function so that the best available talent can be developed for various roles both in the world of work and other socially important spheres. Where student performance arises from the effects of factors such as socioeconomic background, neither equity is being served for the individual student, nor is the society as a whole being provided with an efficient distribution of human capital. Since national educational school systems vary, and are amenable to policy initiatives, and since family background was known to affect student achievement, this investigation sought to establish which educational systems provide the most meritocratic outcomes for individuals, and the most efficient outcomes for society.

The pooled data from 32 countries indicated that, when fathers’ and mothers’ occupational status and fathers’ and mothers’ educational attainment were combined to form a composite measure of socioeconomic status, the correlation coefficient with student performance averaged 0.37. (This is equivalent to saying that 14 per cent of the variance in student performance was accounted for by socioeconomic background.) The strength of this relationship was a little stronger for reading literacy than for mathematical or science literacy. There was considerable variation between countries in the strength of the relationship between socioeconomic background and student performance. The correlation coefficients ranged from just under 0.25 to around 0.5. Further analyses showed that in most countries the effects of cultural resources (the patterns of beliefs and practices that a person draws on) were greater than the effects of material resources (access to the possessions measured in PISA). The effects of material resources were, in turn, greater than the effects of social resources (as

reflected in social communication). The effects of differences in cultural resources were of similar magnitude to the effects of differences in socioeconomic background and remained an influence after allowance was made for the effects of socioeconomic background. Differences in student performance associated with material resources were more modest. Despite this, there were some countries in which material resources were important. Differences in social resources had very little influence on student performance and disappeared when allowance was made for the influence of socioeconomic background. Most of the effects of socioeconomic background operate through mechanisms other than these three resources.

It was established that in most countries the effects of socioeconomic background were not substantially reduced by the effect of individual schools. Similarly, material and cultural resources in the home had little effect on the relationships. After allowance was made for the effect of schools, nearly 70 per cent of the influence of socioeconomic background on reading literacy was accounted for (that is, by the material and cultural resources in the home, academic location, and differences between individual schools). There were, however, large differences between countries in the way in which the influence of the home environment on student performance was mediated. In some countries schools played the dominant role but in others they did not.

The educational systems in the PISA countries could be scaled meaningfully according to educational stratification, using six indicators: number of tracks, first age of selection, second age of selection grade dispersion, share of vocational schools, and between school variance in achievement. It was found that the more differentiated an educational system, the larger the achievement differentials between children of high and low status parents. This was true for various combinations of social background effects (father's and mother's status, parental education and parental occupation) and field of achievement (reading, mathematics, science) and whether or not controls for other influences were taken into account.

In summary, national educational systems do influence the ways in which family background affects reading, mathematics and science literacies. The strongest effects of family background occur in differentiated systems. National systems that are more comprehensive appear to deliver more equitable and more efficient outcomes than those which are more differentiated.

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