# The intergenerational transmission of noncognitive skills and its effect on student performance

Ildefonso Mendez*
University of Murcia

**Abstract**

We analyze whether country differences in the noncognitive skills that children are encouraged to learn at home, i.e. differences in culture, account for country differences in schoolchildren's scholastic performance. In particular, we compare PISA language, mathematics and science scores of second-generation immigrants of different origins living in Australia, Austria, Belgium, Finland, Luxembourg, the Netherlands and Switzerland. We use the valuation of different child qualities in the student's country of ancestry by mid 1980s to obtain our cultural proxy. Our estimates suggest that culture plays a prominent role in explaining variation in 15-years-old scholastic performance in almost all the subjects and host countries considered. A one-standard-deviation increase in our cultural proxy accounts for 20% to 30% of the standard deviation of student performance across ancestries. The corresponding interval for Australia, the country in which the effect of culture is largest, is 65% to 85%. We find that it is the intergenerational transmission of qualities like independence and imagination and of those related to the conscientiousness personality factor like thrift, perseverance and responsibility what improves student performance.

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# 1 Introduction

A growing literature shows that noncognitive skills play a prominent role on education, employment and health outcomes (Almlund et al., 2011).[1] Noncognitive skills appear to be, in some cases, even more relevant predictors of observed individual differences in life-time outcomes than innate intellectual ability. Less is known, however, about the origin of noncognitive skills. Cunha and Heckman (2008) show that cognitive and noncognitive skills are jointly determined by parental environments and investments at different stages of childhood. In particular, they find that parental investments are more effective in raising noncognitive skills and that noncognitive skills promote the formation of cognitive skills, while causality does not run in the opposite direction.[2]

In this paper we aim at contributing to this literature by analyzing the existence of a cultural component on the formation process of noncognitive skills and by testing for its effect on 15-year-old schoolchildren's scholastic performance. In particular, we analyze whether country differences in the noncognitive skills that children are encouraged to learn at home, i.e. differences in culture, lead to international differences in student performance. Following Fernandez and Fogli (2009), we define culture as the set of beliefs and preferences that conditions individuals' actions, that systematically vary across either socially or geographically defined groups and that are transmitted to successive generations.[3]

Since the effect of culture cannot be separately identified from those of economic and institutional factors in a between-country analysis, we follow Fernandez (2008) by taking advantage of the differential "portability" of culture relative to economic and institutional factors. The idea behind this identification approach is that when individuals emigrate they may take some of the predominant beliefs and preferences in their birthplace with them and transmit them intergenerationally. Thus, noncognitive skills may also vary across second-generation immigrant groups reflecting culture in their country of origin. These second-generation children were born in the same country, they face the same markets and institutions, but their cultural heritage is likely to differ according to their parents' country of birth.[4]

[1] The U.S. Department of Education (2013) defines noncognitive skills as attributes, dispositions, social skills, attitudes and intrapersonal resources, independent of intellectual ability.

[2] Cunha, Heckman and Schnnach (2010) and Borghans, Meijers and Weel (2008) also provide evidence that noncognitive skills influence cognitive tests performance.

[3] Tabellini (2010) provides an interesting discussion on the economic meanings of culture.

[4] Behavioral genetics show that noncognitive skills are as heritable as cognitive traits. In particular, Bouchard and Loelhin (2001) show that heritability estimates for personality traits are relatively stable across the life

There is large evidence that culture matters for relevant economic outcomes. A non-exhaustive list of such outcomes includes female work and fertility (Fernandez and Fogli, 2009), trust and trade (Guiso, Sapienza and Zingales, 2009), economic growth (Tabellini, 2010), children's living arrangements (Giuliano, 2007), employment patterns of different demographic groups (Algan and Cahuc, 2005), the design of labor market institutions (Algan and Cahuc, 2006), gender roles (Alesina, Giuliano and Nunn, 2011) and risk and trust attitudes (Dohmen et al., 2012).[5]

We use 2003 to 2012 data from the Program for International Students Assessment (PISA), coordinated by the OECD, to obtain information on 15-year-old students' performance in reading, mathematics and science and to characterize their family and schooling environments. Additionally, we use the first two waves of the World Values Survey (WVS), carried out around 1982 and 1990, respectively, to approximate student's cultural heritage. In particular, we obtain the share of citizens from the student's country of ancestry that chose each child quality out of a list of eleven qualities as one of the five most important ones that children should be encouraged to learn at home. Since beliefs and preferences defined over different child qualities are correlated across ancestries, we use the first principal component of the valuation of the different child qualities as our synthetic cultural proxy.

Unlike most papers in the economic literature on culture that only provide evidence for one host country, we present estimates for seven countries: Australia, Austria, Belgium, Finland, Luxembourg, Netherlands and Switzerland. These are the countries for which PISA informs on the country of parents' birthplace and whose sample of second-generation immigrants comprises at least four ancestries that participated in the at least one of the first two waves of the WVS. This way of proceeding allows us to test whether our results are robust to the economic, institutional and cultural singularities of the host country and to variations in the set of ancestries.

Our estimates suggest that the intergenerational transmission of noncognitive skills plays a prominent role in explaining variation in 15-years-old schoolchildren's scholastic performance. The coefficient associated to our cultural proxy is positive and statistically significant for all the subjects and host countries considered but for Finland. An increase of one standard deviation in our cultural proxy is associated with an increase in student performance that accounts for

cycle at about 40-60%.

[5] See Fernandez (2011) and Guiso, Sapienza and Zingales (2006) for a review on the relevance of culture for economic outcomes.

20% to 30% of the standard deviation of student performance across ancestries, depending on the subject and host country considered. The corresponding interval for Australia, the country in which the effect of culture is largest, is 65% to 85%. These estimates provide a lower bound on the effect of the on student performance since the epidemiological approach tends to underestimate the effect of culture.[6]

Our findings are robust to relevant checks like controlling for differences in family size and level of development across ancestries and excluding the largest ancestry within each host country from the estimation sample. We provide additional evidence in favor of the cultural hypothesis by showing that the effect of interest is generally larger when both parents were born in the same country and the larger is the share of students of the same ancestry in the school that the student attends. The latter result is obtained for Australian, Austrian and Luxembourg second-generation immigrants. We reach to similar results when we use the mother's instead of the father's birthplace to assign a country-of-ancestry culture and we reject the hypothesis that the effect of culture is heterogeneous in the student's sex.

We argue that central to both the economic and anthropological definitions of culture is the assumption that culturally determined beliefs and preferences are shared by a large majority of the group members. Then, we further support the cultural hypothesis by showing that we reach to similar results when we use the valuation of child qualities of different collectives of citizens from the student's country of ancestry to obtain our cultural proxy. In particular, we consider the following collectives: men, women, young (under 30 years), middle-aged (30 to 45 years) and older than 45 years old citizens. In most cases, the effect of culture is larger when we use women's instead of men's responses and the older is the group of citizens considered. We also show that the estimate of interest remains relatively stable when we use more recent waves of the WVS to obtain our cultural proxies. This is coherent with the characterization of culture as a slow-moving institution (Roland, 2004).

Finally, we find that the students that perform better in the three subjects are those whose ancestries placed a higher value on thrift, perseverance, responsibility, independence and imagination, and a lower value on religious faith, unselfishness and obedience as qualities that children should be encouraged to learn at home. We establish a correspondence between the

[6]First-generation immigrants may not hold the preferences and values that are representative of their country's culture. Moreover, although analyzing the second instead of the first-generation of immigrants has the advantage of minimizing group differences due to language barriers, it also means that the impact of culture from the source country is likely to have been attenuated over time (Fernandez and Fogli, 2009).

child qualities in the WVS and the personality factors in the Big Five, the most frequently used taxonomy of personality skills. This allows us to conclude that the intergenerational transmission of child qualities positively related to the conscientiousness personality factor like thrift, perseverance and responsibility favors the acquisition of cognition as measured by achievement test. The opposite holds for religious faith, a quality negatively related to conscientiousness. These results are in line with the findings in Cunha and Heckman (2008), Heckman, Pinto and Savelyev (2013) and Borghans, Meijers and Weel (2008), among others, that the conscientiousness personality factor plays a powerful role in explaining educational achievement.

A major implication of our findings is that not taking into account the additional benefit that results from the intergenerational transmission of the improved skills will result in an inefficiently low provision of programmes aimed at improving noncognitive skills.

The outline of the paper is as follows. Sections 2 and 3 present the identification strategy and describe the data, respectively. Section 4 presents and discusses the estimates and, finally, Section 5 concludes.

# 2 Methodology and datasets

To analyze the effect of culture on test achievement we propose the following regression model:

$$T_{ijt}^{s} = \beta_0 + \beta_1 X_{it} + \delta \widetilde{Z}_j + \lambda_t + \varepsilon_{ijt}^{s}, \tag{1}$$

where $T_{ijt}^{s}$ is the achievement test score on subject $s$ of student $i$ of ancestry $j$ interviewed in year $t$. The main explanatory variable is our cultural proxy $\widetilde{Z}_j$. Equation (1) is estimated by ordinary least squares using the sample of second-generation immigrants living in the same host country. To control for the possibility of common group error terms that would bias the estimates, we use a clustered-robust standard error where we interpret each ancestry as a cluster. This is a relevant issue since the outcome variable varies at the individual level but our cultural proxies do so only at the country-of-ancestry level.[7]

We use the 2003, 2006, 2009 and 2012 reports of the Program for International Students Assessment (PISA), coordinated by the OECD, to obtain information on students' performance in

[7] Our results remain qualitatively unchanged when we interpret each ancestry-PISA report combination as a cluster. This is relevant since, as shown in Hansen (2007), the clustered covariance matrix is valid for inference when the number of clusters is large and the size of the clusters is fixed.

reading, mathematics and science and to characterize their family and schooling environments. The 2000 report is excluded from the estimation because it does not inform on the country of birth of the student's parents. We pool data from the four waves together in order to increase sample size. We take into account the complex sampling design of PISA in computing the standard error of our estimates by using the "unbiased shortcut" procedure described in OECD (2009).

Our cultural proxy is obtained by using data from the first two waves of the WVS, carried out around 1982 and 1990, respectively. We pool data from these two waves together in order to attain a sufficiently large number of ancestries. In particular, we use the responses to the following question: "Here is a list of the qualities that children can be encouraged to learn at home. Which, if any, do you consider to be specially important? Please choose up to five". There were eleven child qualities in the list: good manners; independence; feeling of responsibility; hard work; imagination; tolerance and respect for other people; thrift, sparing money and things; determination, perseverance; religious faith and unselfishness. We calculate the share of citizens from the student's country of ancestry that chose each quality as one of the five most important ones that children should be encouraged to learn at home. Since beliefs and preferences defined over different child qualities are likely to be correlated across ancestries, we use the first principal component of the variation in the valuation of the eleven child qualities across ancestries as our synthetic cultural measure. Our cultural variable is expected to proxy for the prevalent beliefs and preferences regarding child qualities in the student's country of ancestry at the time his parent lived there.[8]

We present estimates for seven host countries: Australia, Austria, Belgium, Finland, Luxembourg, the Netherlands and Switzerland. These are the countries for which PISA informs on the country of parents' birthplace and whose sample of second-generation immigrants comprises at least four ancestries that participated in at least one of the first two waves of the WVS. Most papers in the economic literature on culture analyze only one host country, tipically the United States. The advantadge of using several host countries is that we can check whether our results hold independently of the economic, institutional and cultural characteristics of the

[8]The students interviewed in PISA 2003, 2006, 2009 and 2012 were born around 1988, 1991, 1994 and 1997, respectively. We would ideally want our cultural measures to be recorded several years before 1988 in order to ensure that the student's father was still living there at that time. Thus, we would ideally restrict the analysis to the first wave of the WVS. However, this way of proceeding leads to an insufficient number of ancestries per host country when merging the WVS with the PISA datasets. We expect the option of pooling the first two waves of the WVS to be a reasonable approximation since culture is a slow-moving institution (Roland, 2004).

host country and of the immigrant groups living there. The host countries that we consider differ to a great extent in the design of their educational systems, a dimension that affects student performance (Hanushek and Woessmann, 2011). According to Dronkers and de Heus (2012), Switzerland is an example of a highly stratified educational system, i.e. a system in which educational choices are made at a relatively early age, whereas Luxembourg and Australia are moderately and hardly stratified educational systems, respectively. Additionally, as we will show when describing the data, the educational and socioeconomic characteristics of the students' parents dramatically vary across host countries.

All the controls in $X$ are relevant determinants of student's scholastic performance according to Hanushek and Woessmann (2011). We control for individual and familiar characteristics like the student's sex and age, the highest education level of the parents, their occupational status in the current or previous job, if any, the number of books at home and whether the language that the student speaks at home most of the time is the test language or not. Regarding the school they attend, we control for whether it is private or not, for the size of the community in which it is located, for whether the school capacity to provide instruction is hindered by a shortage or inadequacy of qualified teachers or instructional materials, for whether the school has the main responsability for selecting teachers for hire, determining teachers' salary increases or formulating the school budget, for whether students are grouped by ability or not in at least one class and for the average index of economic, social and cultural status of the students enrolled in the same school as the respondent.[9] We include year dummies ($\lambda_t$) in all the specifications. Regional dummies are also included for Australia since they are not provided for the other countries.

Tables 1 and 2 provide a summarized description of the data at hand at the country and the student levels, respectively. Our countries are mainly European. According to Table 1, Australia, Luxembourg and Switzerland are the countries with both the largest sample of second-generation immigrants and the largest number of different ancestries living there. Thus, these are the countries that provide the most credible estimates of the effect of culture on student performance. Despite such heterogeneity, the largest discrepancies in average grades across ancestries are not found in those countries but in Austria and Belgium. Indeed, Australia, the country with the largest number of students of different ancestries, stands out

[9] We considered many other controls that were discarded on the basis of their (lack of) statistical significance in at least one host country.

as the country with the lowest discrepancy in average grades across ancestries. The results for Austria and Belgium are explained by the low average grades of students with Turkish fathers, the lowest-low grades obtained by those students in the five host countries in which they are present. We also find substantial variation in the valuation of child qualities by ancestries. These discrepancies are largest, on average, in Austria, Australia and the Netherlands and, with respect to specific qualities, when valuing the relevance of independence, hard work and, to a lesser extent, religious faith as qualities that children should be encouraged to learn at home.

In Table 2 we report summary statistics at the student level for each host country. The largest discrepancies across countries are found with respect to the parent's education level and occupational status. First-generation immigrant fathers living in Finland and Australia report the highest education level and the best occupational status of all the fathers. In particular, the share of fathers with an university degree in Finland and Australia is 80% and 46% higher than those in other host countries. That differential is even higher when looking at mothers. The share of mothers with an university degree in Finland and Australia is 159% and 79% higher than the average of the remaining host countries, respectively. A similar picture emerges when looking at the percentage of parents employed in their current or previous job in one of the two highest occupation groups (managers and professionals). The percentages for Finland and Australia more than double those for most of the other host countries. Differences in school characteristics are quite reduced across host countries.

# 3 Child qualities and the Big Five

Before moving to the estimates it is worth to establish a correspondence between the child qualities in the WVS and the personality factors in the Big Five, since most results in the literature are referred to the Big Five taxonomy of personality skills. The Big Five was derived from factor analysis of measurements of personality from different sources and it comprises the following personality factors: Conscientiousness (C), Openness to Experience (O), Extraversion (E), Agreeableness (A) and Neuroticism (N).

Heckman (2011) resumes the facets and childhood temperament traits related to each of the five personality factors. That information is reproduced in Table 3, where we also inform on the sign of the expected correlation, if any, between the child qualities in the WVS and

the personality factors in the Big Five. Child qualities like hard work, responsibility, thrift and perseverance are related to the conscientiousness factor since they are included in its description (responsibility and hard work), in the list of related traits (perseverance) or they are strongly related to some of the associated childhood temperament traits. The latter is the case of thrift, a quality closely related to "effortful control" and "impulse control/delay of gratification" traits.

Obedience is also likely to be related to conscientiousness given the definition of conscientiousness in John and Srivastava (1999): "conscientiousness refers to individual differences in the propensity to follow socially prescribed norms for impulse control, to be task- and goal-directed, to be planful, delay gratification, and follow norms and rules".[10] Also, disobedience is (negatively) associated to conscientiousness in Heckman, Pinto and Savelyev (2013). We also expect obedience to be related to the agreeableness factor in its compliance facet. Regarding religious faith, Saroglou (2002) reviews evidence on the relationship between religion and the Big Five and he concludes that religiosity in general is associated inversely with both agreeableness and conscientiousness.

Imagination is one of the trait adjectives associated to the openness to experience personality factor, while unselfishness and good manners are expected to be positively related to agreeableness. Good manners might also be related to conscientiousness according to the definition in John and Srivastava (1999). Independent children are a priori less likely to act in a cooperative manner (A) or to be oriented toward the outer world of people and things (E).

Finally, we expect tolerance to be related to almost all the personality factors in the Big Five. Tolerant children are a priori more likely to act in a cooperative manner (A), to be open to new experiences (O), to be oriented towards the outer world (E) and to be predictable in their reactions (N). Less clear-cut to us is the association between tolerance and conscientiousness. More conscientious children are a priori more likely to follow socially prescribed norms and traditions. This, in turn, might lead them to be less tolerant than less conscientious children if the prevailing norms are exclusionary or intolerant.

[10] A detailed description of Conscientiousness and its replicable facets is provided by Professor Brent W. Roberts at the following link: http://faculty.las.illinois.edu/bwroberts/conscientiousness/index.html

# 4 Estimates

This section presents our estimates for the effect of the intergenerational transmission of noncognitive skills on student performance. We first comment on the estimation of our synthetic cultural proxy and then we present the estimates of the effects of interest and the robustness checks.

## 4.1 The synthetic cultural variable

Preferences declared over different child qualities are correlated across ancestries. According to Table 4, those ancestries that placed a higher value on perseverance as a quality that children should be encouraged to learn at home also placed a higher value on thrift, independence, imagination and responsibility and a lower value on tolerance, religious faith, unselfishness and obedience. This, in turn, means that the effect of a particular child quality on student performance cannot be identified since we cannot simultaneously control for the eleven child qualities in our estimates. Thus, we use the first principal component of the relevance of the different child qualities across ancestries as our synthetic cultural measure. The first principal component captures the common underlying determinants to the social norms determining the valuation of child qualities across ancestries.

In Table 5 we resume the estimation of the first principal component for each host country.[11] The first principal component accounts for at least one third of the variation in the valuation of child qualities across ancestries. Indeed, it accounts for at least half of such variation in five out of the seven host countries. The loading factors are quite stable across ancestries for most child qualities. Independence, responsibility, thrift and perseverance are among the child qualities with the largest loading factor in all the host countries. In particular, perseverance and thrift are ranked among the three most relevant child qualities according to their loading factor in all the host countries but in Belgium. Additionally, the loading factors associated to religious faith, unselfishness and obedience are negative in almost all the host countries considered.

[11] Alternatively, we could have estimated an unique first principal component for all the ancestries in the seven host countries. The estimates for the effect of culture remain largely unchanged if we use the latter approach. These estimates are available upon request to the author.

## 4.2 Culture and student performance

In Panel A of Table 6 we present our baseline estimates of the effect of culture on student performance obtained using equation (1) and the fathers' birthplace to assign a country-of-ancestry culture to the second-generation immigrants in our sample. The estimates for the control variables are reported in another table and they are commented later on this section.

The coefficient associated to our cultural proxy is positive and statistically significant for all the subjects and host countries considered but for Finland. Indeed, the estimate of interest is highly significant in Australia, Belgium, Luxembourg and Switzerland. This is important since Australia, Luxembourg and Switzerland provide the most credible estimates of the effect of culture because they comprise both the largest number of ancestries and the largest number of students per ancestry. The estimates in Panel A suggest that the intergenerational transmission of noncognitive skills or child qualities plays a prominent role in explaining variation in student performance as measured by the PISA achievement tests.

Regarding the economic magnitude of the estimated effects, we find that a one standard deviation increase in the synthetic cultural variable would account to between 20% and 30% of the difference in student performance across ancestries for most subjects and host countries. The Netherlands and Australia stand out as the countries in which the effect of culture is largest. While that effect is approximately ten percentage points larger in the Netherlands than it is in the other five countries, that difference amounts to at least 45 percentage points in the case of Australia. A one standard deviation increase in the cultural proxy is associated in Australia with an increase in student performance that would account to between 65% and 85% of the standard deviation of student performance across ancestries, depending on the particular subject considered. As indicated in the introduction, these estimates provide a lower bound on the effect of interest since our identification strategy tends to underestimate the effect of culture (Fernandez and Fogli, 2009).

When jointly considered, the estimates in Tables 5 and 6 suggest that the students that perform better are those whose ancestries placed a higher value on thrift, perseverance, responsibility, independence and imagination, and a lower value on religious faith, unselfishness and obedience as qualities that children should be encouraged to learn at home. This, in turn, means that the intergenerational transmission of noncognitive skills or child qualities positively related to the conscientiousness personality factor like thrift, perseverance and responsibility

favors the acquisition of cognition as measured by achievement test. The opposite holds for religious faith, a quality negatively associated to conscientiousness according to Table 3. These results are coherent with the finding in Cunha and Heckman (2008), Heckman, Pinto and Savelyev (2013) and Borghans, Meijers and Weel (2008), among others, that the conscientiousness personality factor plays a powerful role in explaining educational performance.

Our estimates also suggest that the intergenerational transmission of the child quality imagination, related to the Openness to Experience personality factor, improves student performance. Less clear-cut is the effect of the Agreeableness factor since the results for independence and religious faith suggest a positive effect on student performance but the estimates for unselfishness and obedience go in the opposite direction.

Alternatively, we could have used country-of-ancestry dummies instead of child qualities as cultural proxies. These estimates are summarized by means of its adjusted-$R^2$ in Panel B of Table 6. We find that goodness-of-fit values improve only marginally when we use the set of country-of-ancestry dummies instead of the first principal component as explanatory variables. Thus, we conclude that our approach is preferable since it has the advantage of informing on why the country of ancestry matters for student performance.

Next, we tested whether the effect of culture is heterogeneous in the student's sex and in the mother's birthplace or not. The estimates in Panel C do not allow us to reject the hypothesis that the effect of culture is the same for sons than it is for daughters. That is the case since the coefficient associated to the interaction between the cultural proxy and the student's sex is not statistically significant at conventional levels for five out of the seven host countries and it is opposite signed for the other two countries. In particular, while for second-generation Australians the effect of culture is lower for daughters than it is for sons, the opposite holds for Swiss students in science.

The estimates in Panel D show that the effect of culture is larger if both the father and the mother were born in the same foreign country. This result, coherent with the cultural hypothesis, is obtained for Australia and Switzerland and also for second-generation Finish students in science. The significance of the latter estimate is relevant given the particularly low number of second-generation Finish students. In Panel E we report the estimates obtained when using the mother's birthplace to determine the student's ancestry. These estimates are almost identical to those in Panel A but in that the effect of culture vanishes in Austria while it improves its significance in the Netherlands and Finland. These variations are due to the

change in the number of ancestries included in the estimation when we use the mother's instead of the father's birthplace to determine the student's cultural heritage. In particular, while the number of ancestries lowers in Austria, it increases in the Netherlands and Finland.

Finally, in Table 7 we present the estimates obtained for the control variables when analyzing reading achievement tests. We focus on these estimates since they are qualitatively identical to those obtained for maths and science but in that girls outperform boys in reading, while the opposite holds in mathematics and science.[12] We find that older children outperform younger ones and that test performance is positively related to the number of books at home, to the parents' occupational status and also to the father's educational level in Australia and Austria. Second-generation immigrants usually perform better if the language that they speak at home most of the time is the language of the test. We find almost no association between test performance and the characteristics of the school that the student attends once we control for differences in student and family characteristics.

## 4.3 Robustness

A major concern with our identification strategy is that some omitted variable exists. Family size is the main suspect since PISA only informs on the student's number of siblings in the 2009 report and Chiswick (1988) showed that differences in schooling across racial and ethnic groups in the United States were consistent with a child quality investment model in which group differences in fertility and female labour supply determined the price of quantity relative to quality of children. We addressed this concern by controlling for the total fertility rate in the student's country of ancestry by mid 1980s by using data by Barro and Lee (1994). Fernandez and Fogli (2009) showed that the 1950 values of the total fertility rate in their country of ancestry predicted the fertility outcomes of second-generation married American women in the 1970 Census. Thus, we expect the 1980s values of the total fertility rate to control for differences in the number of siblings across second-generation students in PISA.

The resulting estimates are summarized in Panel A of Table 8. The direct marginal effect of the total fertility rate is statistically significant in all the countries but in Finland. In particular, and coherent with the hypothesis that groups with higher fertility invest less in each child (Chiswick, 1988), the effect of fertility on test achivement is negative in all the countries

[12] The estimates obtained when analyzing student performance in maths and science are available upon request to the author.

but in Australia and Luxembourg. The effect of culture remains statistically significant and positive in Australia, Belgium, Luxemboug and Switzerland. Conversely, our results for Austria and the Netherlands suggest that culture plays no role on test achievement once we control for differences in fertility across ancestries. Anyway, it might also be the case that including an additional variable measured at the country-of-ancestry level is a too demanding test for Austria and the Netherlands given the relatively low number of ancestries and observations per ancestry in these two host countries.

Alternatively, we could have used the information on the student's number of siblings in the 2009 PISA report. However, this approach has two limitations with respect to the preceding one. First, the student's number of siblings in PISA is a worse proxy of group differences in completed fertility than the total fertility rate in the student's country of ancestry. That is the case since PISA does not inform on the mother's age and, thus, differences in the number of siblings across ancestries are not necessarily a good proxy for group differences in completed fertility. Second, the reduction in the number of observations per ancestry and, in some cases, also in the number of ancestries compromises the validity of the estimates for countries like Austria, Finland and the Netherlands.

In Panel B we report the estimates obtained when restricting the analysis to the 2009 report. We included two dummy indicator variables that inform on whether the student has one sibling or more than one, respectively, as additional explanatory variables. While the direct marginal effect of the student's number of siblings is not statistically significant for none of the countries, the effect of culture remains positive and significant in most cases. The significant estimates obtained for Finland lack a causal content since the estimation sample includes only 59 individuals and we obtained no significant estimates in Panel A of Table 8.

Next, we tested and rejected the hypothesis that our estimates were driven by the largest ethnic group within each country in Panel C. That is the case for Australia, Belgium, Luxembourg and Switzerland, the countries with a sufficiently large sample to credibly perform this robustness check.

We also analyzed whether our results were indeed driven by the level of development of the student's country of ancestry at the time the cultural proxies were recorded. To address this concern we included the real per capita GDP in 1985 at 1980 international prices by Barro and Lee (1994) as an additional explanatory variable. The resulting estimates in Panel D reject the hypothesis that our cultural variable merely proxies for an ancestry's level of development. The

effect of culture remains positive and statistically significant for most countries. Anyway, the coefficient associated to the cultural variable is lower in magnitude and statistical significance than that in Panel A of Table 6 for most countries and subjects. This, in turn, suggests that country differences in preferred child qualities are related to differences in their level of development. As in Panel B of Table 8, the effect of culture vanishes in Austria and the Netherlands once we include another explanatory variable measured at the country-of-ancestry level. This, in turn, suggests that the number of observations and ancestries is not high enough to perform this robustness check.

We provide additional evidence in favor of the cultural hypothesis by investigating the role of the schooling ethnic composition in cultural transmission. In particular, we test the hypothesis that the greater the proportion of students of the same ancestry in the school, the larger the effect of the cultural proxies on student performance. Fernandez and Fogli (2009) showed that the greater the average density of an ethnic group on the neighborhood, the greater the impact of culture on a woman's work and fertility outcomes. As they argue, this social component of culture might emerge because a high proportion of coethnics in the same neighborhood makes it easier to punish behaviors that are different from the social norm, or it might make it easier for individuals of the same ancestry to obtain role models or to diffuse their believes about how individuals should act.

To analyze this issue we included density, as measured by the share of students of the same ancestry in the school the student attends, and its interaction with the cultural proxy as additional explanatory variables in our regression analysis The results are summarized in Panel E of Table 8. As expected under the cultural hypothesis, the effect of culture is larger the larger is the share of students of the same ancestry in the school. That is the case for Australian, Austrian and Luxembourg second-generation students. The full marginal effect of density is negative in most cases and it is statistically significant in Austria.

We have defined culture as the set of intergenerationally transmitted beliefs and preferences that systematically vary by socially or geographically defined groups and that determine individuals' actions (Fernandez and Fogli, 2009). Alternatively, we could have used a well-known anthropological consensus definition of culture by Hofstede (2001) that runs as follows: "the collective programming of the mind (i.e. thinking, feeling and acting) that distinguishes the members of one group or category of people from another", where groups are usually defined by countries. Common to both definitions is the assumption that culturally determined beliefs

and preferences are shared by a large majority of the group members. Thus, we could provide additional evidence in favor of the cultural hypothesis if we reached to qualitatively similar results by alternatively using the preferred child qualities of different collectives of citizens from the student's country of ancestry to obtain our cultural proxy.[13] We considered the following five groups of citizens from the student's country of ancestry: men and women; younger (under 30 years), middle-aged (30 to 45 years) and older (over 45 years) citizens. The corresponding estimates, reported in Panels F to J of Table 8, respectively, show that the effect of culture remains positive and statistically significant in almost all the cases no matter the collective of citizens whose preferences are used to obtain the synthetic cultural variable. In most cases, the effect of culture is larger when using women's preferences and also the older is the group of citizens used to obtain the cultural variable.

As an additional robustness check we analyzed whether the effect of culture remained relatively stable when using more recent waves of the WVS to obtain our cultural proxy. The intuition behind this check is that if culture drives our results we should not reach to contrasting results to those in Panel A of Table 6 if we used, for example, the third and fourth waves of the WVS, carried out in the years 1995-1998 and 1999-2004, respectively, instead of the first two waves to obtain our cultural proxy. That would be coherent with the characterization of culture as a slow moving institution (Roland, 2004). The resulting estimates in Panel K attest that the estimate of interest remains positive and statistically significant, although lower in magnitude in most cases, in all the countries and subjects considered.

Our results and, in particular, their interpretation under the cultural hypothesis, are also coherent with those in Borghans and Schils (2012). They document that performance of students in PISA achievement test substantially drops during the test, with the performance drop differing by countries, being stable over the years and sparsely correlated to test scores. They show that the decline in test scores during the test is related to personality traits and to motivational attitudes towards learning. Our cultural variable should be correlated to the performance drop estimated in Borghans and Schils (2012) for each participating country if it really captured noncognitive skills that are intergenerationally transmitted and that affect test achievement in PISA.

The resulting correlation once the 24 ancestries were pooled together was of 0.59. In

[13] Note that the opposite does not necessarily holds since culture is a slow moving institution (Roland, 2004) but it might well be the case that, for example, younger and older individuals hold different views about what children should be encouraged to learn at home.

particular, the correlation between the performance drop and the relevance of the different child qualities became highest (0.72) when analyzing independence, a quality associated to the Agreeableness personality factor according to Table 3. This result is coherent with the finding in Borghans and Schils (2012) that the performance drop is related to personality traits, mainly to those associated to the Agreeableness personality factor.

# 5 Conclusion

This paper analyzes whether country differences in the noncognitive skills that children are encouraged to learn at home, i.e. differences in culture, lead to international differences in student performance. To investigate this issue we compare test achievements in language, mathematics and science in PISA 2003 to 2012 of second-generation immigrants of different origins living in the same host country. These children were born in the same country and they face the same markets and institutions but their cultural heritage is likely to differ according to their parents' country of birth.

We use the first two waves of the World Values Survey (WVS), carried out around 1982 and 1990, respectively, to approximate student's cultural heritage. In particular, we calculate the share of citizens from the student's country of ancestry that chose each quality out of a list of eleven child qualities as one of the five most important ones that children should learn at home. Unlike most papers in the economic literature on culture, we present estimates for several host countries. In particular, we consider seven host countries: Australia, Austria, Belgium, Finland, Luxembourg, Netherlands and Switzerland. This way of proceeding allows us to test whether our results are robust to the economic, institutional and cultural singularities of the host country and to variations in the set of ancestries.

Our estimates suggests that culture plays a prominent role in explaining variation in 15-years-old schoolchildren's scholastic performance. The coefficient associated to our cultural proxy is positive and highly significant for most subjects and host countries considered. An increase of one standard deviation in our cultural variable is associated with an increase in student performance that accounts to between 20% and 30% of the standard deviation of student performance across ancestries, depending on the subject and host country considered. Australia stands out as the country in which the effect of culture is largest. In particular, the effect of culture is 45 to 55 percentage points larger in Australia than it is in the other host

countries considered. These estimates provide a lower bound on the effect of the intergenerational transmission of noncognitive abilities on student performance since our identification strategy tends to underestimate the effect of culture.

Our findings are robust to relevant checks like controlling for differences in family size and level of development across ancestries and excluding the largest ancestry within each host country from the estimation sample. We provide additional evidence in favor of the cultural hypothesis by showing that the effect of interest is generally larger when both parents were born in the same country and also the larger is the share of students of the same ancestry in the school that the student attends. The latter result is obtained for Australian, Austrian and Luxembourg second-generation immigrants. We reach to similar results when we use the mother's instead of the father's birthplace to assign a country-of-ancestry culture and we also reject the hypothesis that the effect of culture is heterogeneous in the student's sex.

We argue that central to both the economic and anthropological definitions of culture is the assumption that culturally determined beliefs and preferences are shared by a large majority of the group members. We further support the cultural hypothesis by showing that we reach to similar results when we alternatively use the valuation of child qualities provided by different collectives of citizens from the student's country of ancestry to obtain our cultural proxies. In particular, we consider the following collectives: men, women, young (under 30 years), middle-aged (30 to 45 years) and older than 45 years old citizens. In most cases, the effect of culture is larger when we use women's instead of men's responses and the older is the group of citizens considered. We also show that the effect of interest remains relatively stable when we use more recent waves of the WVS to obtain our cultural proxies. This is coherent with the characterization of culture as a slow-moving institution (Roland, 2004).

Finally, we find that the students that perform better are those whose ancestries placed a higher value on thrift, perseverance, responsibility, independence and imagination, and a lower value on religious faith, unselfishness and obedience as qualities that children should learn at home. We establish a correspondence between the child qualities in the WVS and the personality factors in the Big Five, the most frequently used taxonomy of personality skills. This allows us to conclude that the intergenerational transmission of child qualities positively related to the conscientiousness personality factor like thrift, perseverance and responsibility favors the acquisition of cognition as measured by achievement test. The opposite holds for religious faith, a quality negatively related to conscientiousness. These results are in line

with the common finding in the literature that the conscientiousness personality factor plays a powerful role in explaining educational achievement.

A major implication of our findings is that not taking into account the additional benefit that results from the intergenerational transmission of the improved skills will result in an inefficiently low provision of programmes aimed at improving noncognitive skills.

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Table 1. Average grades and the valuation of child qualities by country of ancestry

| Country | Sample | Average grade | | | Good manners | Independent | Hard work | Responsable | Imagination | Tolerant | Thrift | Perseverant | Religious faith | Unselfish | Obedient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Read | Math | Science | | | | | | | | | | | |
| Australia | 3127 | | | | | | | | | | | | | | |
| China | 277 | 587.4 | 607.4 | 598.6 | 52.7 | 84.0 | 64.6 | 66.9 | 26.7 | 61.7 | 55.6 | 45.0 | 1.2 | 30.9 | 8.5 |
| Germany | 56 | 535.7 | 529.6 | 536.1 | 67.1 | 72.1 | 15.2 | 84.8 | 31.1 | 75.9 | 48.7 | 50.6 | 18.5 | 7.7 | 23.2 |
| India | 181 | 555.4 | 553.3 | 558.7 | 94.2 | 29.6 | 66.9 | 60.1 | 22.4 | 59.2 | 24.4 | 27.6 | 28.8 | 31.6 | 55.9 |
| Italy | 205 | 513.6 | 500.3 | 512.6 | 69.3 | 27.4 | 21.3 | 67.7 | 12.0 | 56.9 | 25.0 | 22.9 | 31.0 | 24.0 | 31.2 |
| Korea | 29 | 540.7 | 567.1 | 568.0 | 82.4 | 50.3 | 53.7 | 74.8 | 6.2 | 42.1 | 44.7 | 29.2 | 16.8 | 11.1 | 15.8 |
| Netherlands | 57 | 533.9 | 533.1 | 527.3 | 68.5 | 36.8 | 13.8 | 69.1 | 15.9 | 71.1 | 22.6 | 23.0 | 14.3 | 15.1 | 27.8 |
| South Africa | 71 | 539.8 | 538.6 | 553.6 | 80.8 | 16.2 | 29.9 | 44.6 | 7.8 | 61.2 | 17.2 | 27.9 | 49.5 | 19.9 | 41.8 |
| U. Kingdom | 2172 | 531.1 | 526.4 | 540.4 | 79.3 | 34.4 | 23.1 | 37.3 | 15.3 | 71.7 | 18.9 | 24.8 | 16.4 | 49.7 | 38.4 |
| U. States | 79 | 560.7 | 560.8 | 581.6 | 68.7 | 40.5 | 36.6 | 56.1 | 16.8 | 60.7 | 18.2 | 24.2 | 46.1 | 26.3 | 33.2 |
| Average[a] | - | 544.3 | 546.3 | 553.0 | 73.7 | 43.5 | 36.1 | 62.4 | 17.2 | 62.3 | 30.6 | 30.6 | 24.7 | 24.0 | 30.6 |
| Std. deviation | - | 20.0 | 28.8 | 25.6 | 11.2 | 20.7 | 19.5 | 13.9 | 7.8 | 9.4 | 14.0 | 9.5 | 14.8 | 12.0 | 13.3 |
| Austria | 585 | | | | | | | | | | | | | | |
| Germany | 132 | 520.2 | 527.4 | 540.1 | 67.1 | 72.1 | 15.2 | 84.8 | 31.1 | 75.9 | 48.7 | 50.6 | 18.5 | 7.7 | 23.2 |
| Hungary | 10 | 506.2 | 537.5 | 522.9 | 59.7 | 58.0 | 45.7 | 53.3 | 7.9 | 43.3 | 39.7 | 14.9 | 14.5 | 18.8 | 36.5 |
| Poland | 40 | 521.5 | 523.7 | 513.1 | 45.1 | 11.9 | 86.7 | 68.2 | 9.9 | 76.5 | 43.7 | 27.4 | 62.7 | 9.4 | 42.0 |
| Romania | 42 | 495.0 | 507.4 | 502.9 | 92.3 | 23.8 | 71.4 | 56.1 | 17.2 | 56.0 | 36.7 | 40.3 | 43.4 | 19.7 | 19.5 |
| Turkey | 361 | 410.3 | 429.2 | 412.4 | 91.7 | 19.2 | 72.5 | 65.7 | 23.3 | 69.1 | 36.2 | 20.3 | 44.2 | 27.8 | 31.4 |
| Average[a] | - | 490.6 | 505.1 | 498.3 | 71.2 | 37.0 | 58.3 | 65.6 | 17.9 | 64.2 | 41.0 | 30.7 | 36.7 | 16.7 | 30.5 |
| Std. deviation | - | 41.3 | 39.1 | 44.6 | 18.4 | 23.6 | 25.3 | 11.1 | 8.6 | 12.8 | 4.7 | 13.1 | 17.9 | 7.4 | 8.3 |
| Belgium | 912 | | | | | | | | | | | | | | |
| France | 241 | 512.5 | 520.5 | 512.0 | 35.7 | 20.8 | 43.7 | 54.1 | 17.0 | 67.6 | 33.9 | 27.3 | 11.8 | 30.4 | 33.7 |
| Germany | 144 | 528.9 | 537.9 | 534.4 | 67.1 | 72.1 | 15.2 | 84.8 | 31.1 | 75.9 | 48.7 | 50.6 | 18.5 | 7.7 | 23.2 |
| Netherlands | 169 | 535.7 | 555.1 | 541.7 | 68.5 | 36.8 | 13.8 | 69.1 | 15.9 | 71.1 | 22.6 | 23.0 | 14.3 | 15.1 | 27.8 |
| Turkey | 358 | 427.1 | 445.1 | 422.5 | 91.7 | 19.2 | 72.5 | 65.7 | 23.3 | 69.1 | 36.2 | 20.3 | 44.2 | 27.8 | 31.4 |
| Average[a] | - | 501.1 | 514.7 | 502.6 | 65.8 | 37.2 | 36.3 | 68.4 | 21.8 | 70.9 | 35.3 | 30.3 | 22.2 | 20.2 | 29.0 |
| Std. deviation | - | 43.5 | 42.0 | 47.6 | 19.9 | 21.3 | 24.1 | 11.0 | 6.0 | 3.1 | 9.3 | 12.0 | 12.9 | 9.3 | 3.9 |
| Finland | 363 | | | | | | | | | | | | | | |
| China | 17 | 555.7 | 568.8 | 592.2 | 52.7 | 84.0 | 64.6 | 66.9 | 26.7 | 61.7 | 55.6 | 45.0 | 1.2 | 30.9 | 8.5 |
| Estonia | 52 | 507.9 | 490.9 | 513.4 | 74.4 | 42.6 | 92.0 | 76.1 | 12.8 | 70.2 | 35.1 | 50.8 | 3.3 | 24.9 | 18.8 |
| Russia | 83 | 500.6 | 486.4 | 508.6 | 57.3 | 29.2 | 92.6 | 69.5 | 11.3 | 70.2 | 60.9 | 39.7 | 8.0 | 24.0 | 25.9 |
| Sweden | 157 | 519.0 | 515.2 | 524.9 | 66.8 | 27.8 | 4.5 | 76.6 | 28.8 | 81.4 | 40.6 | 25.3 | 5.9 | 20.1 | 19.4 |
| Turkey | 54 | 483.7 | 472.3 | 498.3 | 91.7 | 19.2 | 72.5 | 65.7 | 23.3 | 69.1 | 36.2 | 20.3 | 44.2 | 27.8 | 31.4 |
| Average[a] | - | 513.4 | 506.7 | 527.5 | 68.6 | 40.5 | 65.2 | 71.0 | 20.6 | 70.5 | 45.7 | 36.2 | 12.5 | 25.5 | 20.8 |
| Std. deviation | - | 24.1 | 34.0 | 33.5 | 13.8 | 23.0 | 32.2 | 4.6 | 7.2 | 6.3 | 10.6 | 11.6 | 16.0 | 3.6 | 7.7 |

Table 1. Average grades and the valuation of child qualities by country of ancestry (contd.)

| Country | Sample | Average grade | | | Good manners | Independent | Hard work | Responsable | Imagination | Tolerant | Thrift | Perseverant | Religious faith | Unselfish | Obedient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Read | Math | Science | | | | | | | | | | | |
| Luxembourg | 2807 | | | | | | | | | | | | | | |
| Belgium | 211 | 526.9 | 530.6 | 527.7 | 64.9 | 31.1 | 35.5 | 62.2 | 15.1 | 62.4 | 35.9 | 33.8 | 16.1 | 23.7 | 34.7 |
| France | 300 | 499.9 | 504.2 | 503.0 | 35.7 | 20.8 | 43.7 | 54.1 | 17.0 | 67.6 | 33.9 | 27.3 | 11.8 | 30.4 | 33.7 |
| Germany | 187 | 520.9 | 520.7 | 527.4 | 67.1 | 72.1 | 15.2 | 84.8 | 31.1 | 75.9 | 48.7 | 50.6 | 18.5 | 7.7 | 23.2 |
| Italy | 453 | 466.9 | 472.0 | 469.1 | 69.3 | 27.4 | 21.3 | 67.7 | 12.0 | 56.9 | 25.0 | 22.9 | 31.0 | 24.0 | 31.2 |
| Portugal | 1636 | 448.7 | 462.1 | 449.0 | 82.7 | 24.1 | 68.1 | 77.5 | 20.3 | 69.6 | 31.7 | 23.5 | 25.8 | 28.5 | 45.6 |
| U. Kingdom | 20 | 548.8 | 558.8 | 571.1 | 79.3 | 34.4 | 23.1 | 37.3 | 15.3 | 71.7 | 18.9 | 24.8 | 16.4 | 49.7 | 38.4 |
| Average[a] | - | 502.0 | 508.1 | 507.9 | 66.5 | 35.0 | 34.5 | 63.9 | 18.5 | 67.3 | 32.3 | 30.5 | 19.9 | 27.3 | 34.5 |
| Std. deviation | - | 34.7 | 33.3 | 40.3 | 15.2 | 17.2 | 17.8 | 15.5 | 6.2 | 6.2 | 9.3 | 9.7 | 6.5 | 12.4 | 6.8 |
| Netherlands | 291 | | | | | | | | | | | | | | |
| Belgium | 18 | 544.5 | 565.9 | 560.9 | 64.9 | 31.1 | 35.5 | 62.2 | 15.1 | 62.4 | 35.9 | 33.8 | 16.1 | 23.7 | 34.7 |
| China | 25 | 513.4 | 531.0 | 518.7 | 52.7 | 84.0 | 64.6 | 66.9 | 26.7 | 61.7 | 55.6 | 45.0 | 1.2 | 30.9 | 8.5 |
| Germany | 27 | 519.6 | 531.8 | 537.4 | 67.1 | 72.1 | 15.2 | 84.8 | 31.1 | 75.9 | 48.7 | 50.6 | 18.5 | 7.7 | 23.2 |
| Italy | 9 | 512.7 | 509.4 | 522.8 | 69.3 | 27.4 | 21.3 | 67.7 | 12.0 | 56.9 | 25.0 | 22.9 | 31.0 | 24.0 | 31.2 |
| Turkey | 196 | 467.5 | 481.2 | 463.9 | 91.7 | 19.2 | 72.5 | 65.7 | 23.3 | 69.1 | 36.2 | 20.3 | 44.2 | 27.8 | 31.4 |
| U. Kingdom | 16 | 517.2 | 511.5 | 529.0 | 79.3 | 34.4 | 23.1 | 37.3 | 15.3 | 71.7 | 18.9 | 24.8 | 16.4 | 49.7 | 38.4 |
| Average[a] | - | 512.5 | 521.8 | 522.1 | 70.8 | 44.7 | 38.7 | 64.1 | 20.6 | 66.3 | 36.7 | 32.9 | 21.2 | 27.3 | 27.9 |
| Std. deviation | - | 22.8 | 25.9 | 29.4 | 12.2 | 24.3 | 22.1 | 14.0 | 6.9 | 6.5 | 12.6 | 11.4 | 13.4 | 12.4 | 9.8 |
| Switzerland | 3902 | | | | | | | | | | | | | | |
| Austria | 120 | 514.4 | 541.3 | 525.2 | 78.9 | 65.0 | 14.0 | 85.2 | 25.3 | 66.6 | 54.4 | 39.2 | 23.3 | 7.6 | 25.6 |
| France | 353 | 514.3 | 531.9 | 515.1 | 35.7 | 20.8 | 43.7 | 54.1 | 17.0 | 67.6 | 33.9 | 27.3 | 11.8 | 30.4 | 33.7 |
| Germany | 330 | 542.6 | 579.3 | 562.9 | 67.1 | 72.1 | 15.2 | 84.8 | 31.1 | 75.9 | 48.7 | 50.6 | 18.5 | 7.7 | 23.2 |
| Italy | 1564 | 475.5 | 497.2 | 477.6 | 69.3 | 27.4 | 21.3 | 67.7 | 12.0 | 56.9 | 25.0 | 22.9 | 31.0 | 24.0 | 31.2 |
| Portugal | 685 | 480.0 | 498.3 | 474.4 | 82.7 | 24.1 | 68.1 | 77.5 | 20.3 | 69.6 | 31.7 | 23.5 | 25.8 | 28.5 | 45.6 |
| Spain | 357 | 494.6 | 516.7 | 496.7 | 71.6 | 31.9 | 38.4 | 72.6 | 33.2 | 62.7 | 18.7 | 18.4 | 24.2 | 6.6 | 38.3 |
| Turkey | 493 | 444.2 | 464.1 | 439.8 | 91.7 | 19.2 | 72.5 | 65.7 | 23.3 | 69.1 | 36.2 | 20.3 | 44.2 | 27.8 | 31.4 |
| Average[a] | - | 495.1 | 518.4 | 498.8 | 71.0 | 37.2 | 39.1 | 72.5 | 23.2 | 66.9 | 35.5 | 28.9 | 25.5 | 18.9 | 32.7 |
| Std. deviation | - | 29.8 | 34.3 | 37.0 | 16.4 | 20.3 | 22.4 | 10.3 | 6.9 | 5.5 | 11.6 | 10.9 | 9.4 | 10.2 | 7.0 |

Notes: We report average grades and the share of citizens from the student's country of ancestry that chose each child quality as one of the five most important ones that children should be encouraged to learn at home in the first two waves of the World Values Survey. [a] Unweighted averages.

Table 2. Descriptive statistics at the student level by host country

| | Australia | Austria | Belgium | Finland | Luxembourg | Netherlands | Switzerland |
|---|---|---|---|---|---|---|---|
| Age | 15.8 | 15.8 | 15.8 | 15.7 | 15.8 | 15.7 | 15.8 |
| | (0.29) | (0.28) | (0.29) | (0.27) | (0.28) | (0.29) | (0.28) |
| Woman | 50.4 | 52.7 | 50.0 | 51.9 | 51.9 | 53.8 | 49.2 |
| Father, university degree | 45.9 | 30.6 | 35.9 | 56.5 | 23.5 | 32.2 | 34.5 |
| Father, high school | 51.2 | 59.7 | 49.1 | 40.1 | 39.7 | 42.5 | 50.6 |
| Mother, university degree | 47.8 | 17.0 | 36.9 | 69.1 | 23.3 | 26.7 | 29.6 |
| Mother, high school | 49.9 | 63.6 | 43.8 | 29.6 | 40.3 | 40.4 | 56.7 |
| Father's occupation | | | | | | | |
| Manager, officials, legislators | 16.2 | 5.9 | 9.0 | 18.0 | 5.7 | 10.6 | 7.2 |
| Professionals | 23.5 | 4.4 | 12.7 | 19.9 | 8.1 | 8.2 | 8.9 |
| Technicians | 12.5 | 7.4 | 9.4 | 10.2 | 8.6 | 8.9 | 14.9 |
| Clerks | 7.5 | 4.7 | 7.0 | 2.7 | 9.9 | 6.8 | 9.5 |
| Service and sales workers | 9.3 | 8.8 | 11.0 | 12.4 | 12.8 | 14.7 | 16.4 |
| Skilled agricultural, construction and industry workers | 15.1 | 34.7 | 17.0 | 20.2 | 21.4 | 19.9 | 18.7 |
| Plant, machine operators | 4.6 | 4.4 | 6.9 | 10.8 | 7.9 | 6.8 | 5.1 |
| Elementary occupations | 11.3 | 29.7 | 27.0 | 5.9 | 25.7 | 24.0 | 19.3 |
| Mother's occupation | | | | | | | |
| Manager, officials, legislators | 15.6 | 8.8 | 11.3 | 10.8 | 5.9 | 13.7 | 8.2 |
| Professionals | 25.6 | 4.4 | 11.9 | 21.8 | 9.4 | 8.2 | 10.3 |
| Technicians | 12.5 | 5.8 | 9.4 | 14.2 | 6.6 | 11.6 | 12.7 |
| Clerks | 7.9 | 2.1 | 5.0 | 6.7 | 8.2 | 3.8 | 7.9 |
| Service and sales workers | 11.2 | 4.5 | 11.1 | 20.7 | 12.9 | 13.4 | 16.1 |
| Skilled agricultural, construction and industry workers | 12.7 | 46.2 | 17.6 | 13.2 | 21.7 | 24.0 | 23.1 |
| Plant, machine operators | 3.6 | 12.3 | 7.4 | 3.8 | 9.0 | 9.2 | 6.0 |
| Elementary occupations | 10.9 | 15.9 | 26.2 | 8.9 | 26.3 | 16.1 | 15.7 |
| No siblings[a] | 14.3 | 13.9 | 17.0 | 8.9 | 15.3 | 15.1 | 15.4 |
| Only one sibling[a] | 41.8 | 45.3 | 41.7 | 46.4 | 43.7 | 38.4 | 38.2 |
| At least two siblings[a] | 44.0 | 40.8 | 41.3 | 44.6 | 41.1 | 46.5 | 46.4 |
| Private school | 17.2 | 15.8 | 15.2 | 18.3 | 13.0 | 19.5 | 16.6 |
| School located in town | 30.5 | 30.2 | 31.1 | 30.1 | 27.0 | 30.1 | 31.0 |
| School located in city | 34.7 | 37.6 | 33.0 | 32.5 | 35.9 | 31.2 | 33.5 |
| Books at home, $< 10$ | 5.3 | 21.4 | 16.7 | 8.3 | 11.9 | 25.7 | 15.0 |
| Books at home, 11-25 | 8.0 | 22.6 | 19.4 | 12.1 | 17.1 | 23.3 | 20.8 |
| Books at home, 26-100 | 27.4 | 27.1 | 29.7 | 39.8 | 32.1 | 27.1 | 31.2 |
| Books at home, 101-200 | 22.1 | 12.9 | 14.8 | 19.6 | 16.6 | 11.6 | 16.5 |
| Books at home, 201-500 | 23.8 | 8.0 | 12.7 | 12.4 | 12.4 | 10.3 | 11.1 |
| Books at home, $> 500$ | 13.5 | 8.0 | 6.8 | 7.8 | 9.9 | 2.1 | 5.4 |
| Language at home | 91.7 | 45.8 | 58.6 | 62.1 | 17.2 | 60.6 | 68.6 |
| Lack of qualified teachers | 27.2 | 28.8 | 28.5 | 29.3 | 27.8 | 31.5 | 26.2 |
| Average socioeconomic and cultural index, school | 0.8 | 1.5 | 0.9 | 0.1 | 0.7 | -0.3 | 1.1 |
| 2006 report | 22.7 | 27.4 | 25.7 | 6.5 | 22.4 | 0.0 | 27.8 |
| 2009 report | 24.0 | 37.3 | 23.3 | 15.1 | 27.5 | 55.5 | 27.7 |
| 2012 report | 25.3 | 23.0 | 30.7 | 69.6 | 37.1 | 44.5 | 29.3 |
| Observations | 3235 | 635 | 1007 | 372 | 2545 | 286 | 3955 |

Notes: We report population-weighted averages. We present percentages and means and standard deviations (in brackets) for discrete and continuous variables, respectively. [a] Information on the student's number of siblings is only provided in the 2009 report.

Table 3. The Big Five domains and their expected correlation with the child qualities

| Big Five factors | American Psychology Association Dictionary | Facets (and correlated trait adjective) | Related Traits | Childhood Temperament Traits | Expected correlation with child qualities |
|---|---|---|---|---|---|
| Conscientiousness | "the tendency to be organized, responsible, and hardworking" | Competence (efficient)<br>Order (organized)<br>Dutifulness (not careless)<br>Achievement striving (ambitious)<br>Self-discipline (not lazy)<br>Deliberation (not impulsive) | Grit<br>Perseverance<br>Delay of gratification<br>Impulse control<br>Achievement striving<br>Ambition<br>Work ethic | Attention/(lack of) distractibility<br>Effortful control<br>Impulse control/delay of gratification<br>Persistence<br>Activity* | Hard work<br>Responsability<br>Thrift<br>Perseverance<br>Religious faith (-)<br>Obedience |
| Openness to Experience | "the tendency to be open to new aesthetic, cultural, or intellectual experiences" | Fantasy (imaginative)<br>Aesthetic (artistic)<br>Feelings (exciTable)<br>Actions (wide interests)<br>Ideas (curious)<br>Values (unconventional) | - | Sensory sensitivity<br>Pleasure in low intensity activities<br>Curiosity | Imagination<br>Tolerance |
| Extraversion | "an orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability" | Warmth (friendly)<br>Gregariousness (sociable)<br>Assertiveness (selfconfident)<br>Activity (energetic)<br>Excitement seeking (adventurous)<br>Positive emotions (enthusiastic) | - | Surgency<br>Social dominance<br>Social vitality<br>Sensation seeking<br>Shyness*<br>Activity*<br>Positive emotionality<br>Sociability/affiliation | Tolerance |
| Agreeableness | "the tendency to act in a cooperative, unselfish manner" | Trust (forgiving)<br>Straight-forwardness (not demanding)<br>Altruism (warm)<br>Compliance (not stubborn)<br>Modesty (not show-off)<br>Tender-mindedness (sympathetic) | Empathy Perspective taking Cooperation<br>Competitiveness | Irritability*<br>Aggressiveness<br>Willfulness | Good manners<br>Independence<br>Tolerance<br>Religious faith (-)<br>Unselfishness<br>Obedience |
| Neuroticism/ Emotional Stability | Emotional stability is "predictability and consistency in emotional reactions, with absence of rapid mood changes."<br><br>Neuroticism is "a chronic level of emotional instability and proneness to psychological distress." | Anxiety (worrying)<br>Hostility (irritable)<br>Depression (not contented)<br>Self-consciousness (shy)<br>Impulsiveness (moody)<br>Vulnerability to stress (not self-confident) | Internal vs. External Locus of control<br>Core self-evaluation<br>Self-esteem<br>Self-efficacy<br>Optimism<br>Axis I psychopathologies (mental disorders) including depression and anxiety disorders | Fearfulness/behavioral inhibition<br>Shyness*<br>Irritability*<br>Frustration<br>(Lack of) soothability<br>Sadness | Tolerance |

Notes: All the columns but the last one are taken from table 1 in Heckman (2011). Facets specified by the NEO-PI-R personality inventory (Costa and McCrae, 1992). Trait adjectives in parenthesis from the Adjective Check List (Gough and Heilbrun, 1983). * These temperament traits may be related to two Big Five factors.

Table 4. Correlation between child qualities. All host countries

| | Good manners | Independence | Hard work | Responsibility | Imagination | Tolerance | Thrift | Perseverance | Religious faith | Unselfishness | Obedience |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Good manners | 1.000 | | | | | | | | | | |
| Independence | -0.062 | 1.000 | | | | | | | | | |
| Hard work | 0.061 | -0.192 | 1.000 | | | | | | | | |
| Responsibility | 0.006 | 0.3456 | -0.041 | 1.000 | | | | | | | |
| Imagination | -0.055 | 0.257 | -0.271 | 0.401 | 1.000 | | | | | | |
| Tolerance | -0.165 | -0.214 | -0.080 | 0.200 | 0.312 | 1.000 | | | | | |
| Thrift | -0.170 | 0.443 | 0.292 | 0.538 | -0.035 | 0.139 | 1.000 | | | | |
| Perseverance | -0.015 | 0.446 | -0.002 | 0.378 | 0.202 | 0.315 | 0.693 | 1.000 | | | |
| Religious faith | 0.200 | -0.573 | 0.139 | -0.146 | -0.093 | 0.064 | -0.349 | -0.259 | 1.000 | | |
| Unselfishness | 0.185 | -0.135 | 0.165 | -0.600 | -0.235 | 0.150 | -0.159 | -0.071 | -0.251 | 1.000 | |
| Obedience | 0.152 | -0.600 | -0.024 | -0.261 | -0.053 | 0.170 | -0.477 | -0.493 | 0.407 | 0.169 | 1.000 |

Notes: We report unconditional correlations.

Table 5. Estimation of the first principal component

| Loading factors | Australia | Austria | Belgium | Finland | Luxembourg | Netherlands | Switzerland |
|---|---|---|---|---|---|---|---|
| Good manners | -0.297 | -0.157 | 0.060 | -0.359 | -0.053 | -0.107 | 0.009 |
| Independence | 0.417 | 0.317 | 0.374 | 0.422 | 0.385 | 0.470 | 0.425 |
| Hard work | 0.063 | -0.278 | -0.248 | 0.177 | -0.172 | 0.098 | -0.309 |
| Responsibility | 0.319 | 0.390 | 0.360 | -0.112 | 0.282 | 0.038 | 0.327 |
| Imagination | 0.285 | 0.351 | 0.300 | -0.068 | 0.379 | 0.195 | 0.248 |
| Tolerance | 0.063 | 0.228 | 0.374 | -0.343 | 0.218 | -0.250 | 0.218 |
| Thrift | 0.405 | 0.358 | 0.242 | 0.306 | 0.385 | 0.352 | 0.334 |
| Perseverance | 0.373 | 0.431 | 0.340 | 0.374 | 0.411 | 0.441 | 0.398 |
| Religious faith | -0.308 | -0.281 | -0.075 | -0.300 | -0.071 | -0.306 | -0.160 |
| Unselfishness | -0.163 | -0.035 | -0.351 | 0.274 | -0.350 | 0.119 | -0.338 |
| Obedience | -0.350 | -0.277 | -0.365 | -0.359 | -0.324 | -0.479 | -0.312 |
| | | | | | | | |
| Eigenvalue | 5.357 | 3.845 | 7.053 | 4.625 | 5.584 | 4.016 | 5.446 |
| % variance[a] | 48.7 | 35.0 | 64.1 | 42.1 | 50.8 | 36.5 | 49.5 |

Notes: [a] Share of variance in the relevance of the eleven child qualities across ancestries explained by the first principal component.

Table 6. Child qualities and student performance

| | Australia | | | Austria | | | Belgium | | | Finland | | | Luxembourg | | | Netherlands | | | Switzerland | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science |
| **A. Baseline estimates** | | | | | | | | | | | | | | | | | | | | | |
| Culture[a] | 10.18‡ | 12.81‡ | 9.94‡ | 4.52† | 5.30† | 6.87‡ | 5.78‡ | 6.76‡ | 6.78‡ | 5.84 | 4.43 | 6.20 | 4.43‡ | 3.45‡ | 4.77‡ | 5.08 | 6.18* | 6.57* | 2.88† | 4.81‡ | 5.01‡ |
| t-statistic | [7.47] | [8.61] | [7.11] | [2.10] | [2.43] | [2.82] | [3.41] | [3.81] | [3.56] | [1.07] | [0.91] | [0.92] | [3.40] | [2.83] | [3.24] | [1.51] | [1.93] | [1.89] | [2.47] | [3.87] | [4.67] |
| Adj. $R^2$ | (0.23) | (0.25) | (0.23) | (0.44) | (0.40) | (0.45) | (0.39) | (0.34) | (0.38) | (0.33) | (0.29) | (0.31) | (0.27) | (0.23) | (0.24) | (0.18) | (0.19) | (0.17) | (0.26) | (0.24) | (0.28) |
| Magnitude[b] | 85.4 | 75.2 | 64.7 | 23.5 | 28.3 | 31.6 | 26.0 | 31.5 | 27.9 | - | - | - | 21.1 | 18.1 | 21.2 | 36.2 | 28.6 | 41.6 | 14.9 | 21.9 | 20.1 |
| **B. Country dummies** | | | | | | | | | | | | | | | | | | | | | |
| Adj. $R^2$ | (0.24) | (0.27) | (0.24) | (0.46) | (0.42) | (0.47) | (0.40) | (0.36) | (0.40) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.25) | (0.29) | (0.25) | (0.30) | (0.27 | (0.25) | (0.29) |
| **C. Effect of culture heterogeneous in the student's sex** | | | | | | | | | | | | | | | | | | | | | |
| Culture | 13.22‡ | 14.87‡ | 12.49‡ | 3.79 | 5.67* | 6.61† | 7.93‡ | 9.97‡ | 8.88‡ | 9.22 | 6.62 | 11.04 | 4.71† | 4.03† | 5.59‡ | 7.49 | 8.46† | 8.28* | 2.01 | 3.51† | 3.39‡ |
| t-statistic | [7.08] | [8.03] | [6.17] | [1.16] | [1.90] | [1.96] | [3.03] | [3.60] | [2.86] | [1.30] | [1.04] | [1.44] | [2.32] | [2.33] | [2.69] | [1.56] | [2.17] | [1.84] | [1.39] | [1.99] | [2.36] |
| Cult.×Sex | -6.49‡ | -4.40* | -5.45† | 1.28 | -0.66 | 0.46 | -4.11 | -6.12* | -4.00 | -7.99 | -5.18 | -11.43 | -0.57 | -1.18 | -1.67 | -6.05 | -5.74 | -4.30 | 1.79 | 2.69 | 3.34* |
| t-statistic | [2.69] | [1.74] | [2.12] | [0.31] | [0.19] | [0.13] | [1.10] | [1.67] | [1.02] | [0.79] | [0.65] | [1.22] | [0.22] | [0.50] | [0.65] | [0.89] | [0.91] | [0.65] | [0.92] | [1.11] | [1.72] |
| Adj. $R^2$ | (0.24) | (0.25) | (0.23) | (0.44) | (0.40) | (0.45) | (0.39) | (0.35) | (0.38) | (0.30) | (0.34) | (0.28) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.26) | (0.24) | (0.28) |
| **D. Effect of culture heterogeneous in the mother's birthplace** | | | | | | | | | | | | | | | | | | | | | |
| Culture | 5.42‡ | 5.34‡ | 4.32‡ | 6.27† | 6.15† | 6.92† | 5.60‡ | 6.59‡ | 6.41‡ | 3.16 | 3.72 | 3.90 | 4.42‡ | 3.97‡ | 4.60‡ | 1.79 | 3.63 | 2.80 | 2.00 | 3.72‡ | 3.54‡ |
| t-statistic | [3.19] | [3.09] | [2.45] | [2.02] | [2.15] | [2.11] | [3.32] | [3.67] | [3.38] | [0.45] | [0.52] | [0.46] | [2.88] | [3.06] | [2.90] | [0.39] | [0.84] | [0.58] | [1.54] | [2.82] | [3.19] |
| Cult.×Same[c] | 7.09‡ | 11.44‡ | 8.93‡ | -5.02 | -1.27 | -1.71 | 2.18 | 6.39 | 3.75 | 11.64 | 12.07 | 15.74* | 0.86 | -0.62 | 1.25 | 8.05 | 5.78 | 7.16 | 4.91† | 5.21* | 6.88‡ |
| t-statistic | [3.21] | [5.30] | [3.82] | [0.81] | [0.23] | [0.25] | [0.31] | [0.74] | [0.44] | [1.16] | [1.41] | [1.70] | [0.32] | [0.22] | [0.48] | [1.15] | [0.85] | [1.00] | [2.02] | [1.69] | [2.69] |
| Adj. $R^2$ | (0.24) | (0.26) | (0.23) | (0.44) | (0.40) | (0.45) | (0.39) | (0.34) | (0.38) | (0.30) | (0.35) | (0.28) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.30) | (0.26) | (0.24) | (0.28) |
| **E. Using the mother's birthplace to determine the student's cultural heritage** | | | | | | | | | | | | | | | | | | | | | |
| Culture | 10.51‡ | 13.91‡ | 11.19‡ | 1.07 | 1.16 | 3.45 | 4.45‡ | 3.75‡ | 4.16‡ | 7.76 | 3.95 | 7.54 | 4.94‡ | 3.87‡ | 5.72‡ | 13.54‡ | 11.98‡ | 14.13‡ | 1.66* | 3.50‡ | 4.52‡ |
| t-statistic | [7.91] | [9.22] | [7.93] | [0.44] | [0.53] | [1.51] | [2.66] | [2.10] | [2.63] | [1.52] | [0.72] | [1.38] | [4.54] | [4.02] | [6.36] | [4.50] | [3.93] | [4.55] | [1.74] | [3.38] | [4.13] |
| Adj. $R^2$ | (0.23) | (0.27) | (0.22) | (0.45) | (0.41) | (0.47) | (0.34) | (0.30) | (0.33) | (0.22) | (0.17) | (0.18) | (0.26) | (0.23) | (0.26) | (0.35) | (0.31) | (0.36) | (0.27) | (0.25) | (0.29) |

Notes: The outcome variable is test achievement in PISA 2003-2012. We use the father's birthplace to determine the student's cultural heritage in Panels A to D. [a] First principal component of the valuation of child qualities in the student's country of ancestry in the first two waves of the WVS. [b] Informs on the percentage of the difference in student performance across ancestries that would be accounted for by a one standard deviation increase in the cultural variable. [c] Indicates whether the student's parents were born in the same foreign country or not. Standard errors are clustered at the country-of-ancestry level. We report t-statistics and the adjusted $R^2$ in brackets and parenthesis, respectively. The symbols *, † and ‡ denote significance at the 10%, 5% and 1% significance level, respectively. All coefficients and standard errors are estimated according to the "Unbiased Shortcut" procedure (OECD, 2009). All specifications include year dummies. The estimates for Australia include region dummies. We also control for students' personal, familiar and school characteristics in Table 7.

Table 7. Determinants of test achievement on reading

| Variable | Australia | Austria | Belgium | Finland | Luxembourg | Netherlands | Switzerland |
|---|---|---|---|---|---|---|---|
| Culture[a] | 10.18‡ | 4.52† | 5.78‡ | 5.84 | 4.43‡ | 5.08 | 2.88† |
| | [7.47] | [2.10] | [3.41] | [1.07] | [3.40] | [1.51] | [2.47] |
| Age | 17.30‡ | 40.23† | 9.69 | 32.90 | 24.79‡ | 18.88 | 25.29‡ |
| | [3.14] | [2.53] | [0.80] | [1.56] | [3.67] | [0.99] | [4.24] |
| Woman | 27.13‡ | 34.24‡ | 31.97‡ | 21.47* | 28.21‡ | 20.75† | 25.61‡ |
| | [7.95] | [3.58] | [5.11] | [1.70] | [8.40] | [2.00] | [7.54] |
| Father, university degree | 33.50‡ | 47.96‡ | -2.57 | 58.94† | 2.92 | 2.42 | -2.54 |
| | [3.13] | [3.55] | [0.20] | [2.27] | [0.48] | [0.17] | [0.31] |
| Father, high school | 19.40* | 45.80‡ | 4.99 | 61.49† | 4.87 | 2.45 | 1.37 |
| | [1.82] | [3.50] | [0.43] | [2.24] | [1.03] | [0.20] | [0.20] |
| Mother, university degree | 10.39 | 17.04 | 2.86 | 1.16 | -18.60‡ | -22.34 | -4.14 |
| | [0.76] | [1.12] | [0.24] | [0.03] | [2.92] | [1.12] | [0.51] |
| Mother, high school | 7.16 | 16.54 | 13.84 | -36.16 | -6.02 | -16.77 | -3.94 |
| | [0.56] | [1.38] | [1.51] | [0.87] | [1.25] | [1.14] | [0.55] |
| Occupation 1[b], father | 25.05‡ | 54.93† | 33.26† | -9.06 | 19.05† | 21.78 | 22.09† |
| | [4.22] | [2.51] | [2.46] | [0.44] | [2.17] | [0.92] | [2.50] |
| Occupation 2, father | 34.81‡ | 73.32‡ | 46.90‡ | -9.50 | 31.09‡ | 32.56 | 28.22‡ |
| | [4.63] | [2.60] | [3.27] | [0.47] | [3.63] | [1.39] | [3.65] |
| Occupation 3, father | 36.78‡ | 32.48 | 28.99* | -48.49† | 13.44* | 21.19 | 15.22* |
| | [4.43] | [1.36] | [1.77] | [2.19] | [1.88] | [0.89] | [1.83] |
| Occupation 4, father | 33.56‡ | 48.32* | 58.16‡ | -17.14 | 17.22† | 14.13 | 15.55* |
| | [3.99] | [1.92] | [4.57] | [0.47] | [2.09] | [0.58] | [1.73] |
| Occupation 5, father | 17.35† | 32.72 | 20.30 | -15.10 | -4.40 | 15.59 | 4.33 |
| | [2.31] | [1.41] | [1.59] | [0.60] | [0.67] | [0.77] | [0.64] |
| Occupation 6, father | 15.68 | 34.31 | 3.97 | -0.09 | -1.00 | 18.77 | -1.62 |
| | [1.63] | [1.60] | [0.25] | [0.00] | [0.14] | [0.80] | [0.15] |
| Occupation 7, father | 7.23 | -18.38 | 7.04 | -11.74 | -7.52 | -17.92 | 2.19 |
| | [0.86] | [0.85] | [0.61] | [0.42] | [1.26] | [0.75] | [0.29] |
| Occupation 1, mother | 26.04‡ | 2.25 | 33.16‡ | -22.51 | 22.32† | 51.30† | 21.89‡ |
| | [4.20] | [0.17] | [3.23] | [1.01] | [2.49] | [2.41] | [3.27] |
| Occupation 2, mother | 29.31‡ | 10.57 | 47.97‡ | -10.23 | 46.98‡ | 38.88† | 28.15‡ |
| | [5.14] | [0.33] | [3.39] | [0.58] | [5.36] | [2.02] | [3.66] |
| Occupation 3, mother | 25.78‡ | 28.55 | 33.38† | -39.23 | 39.83‡ | 60.25‡ | 23.31‡ |
| | [4.28] | [1.37] | [2.50] | [1.89] | [4.93] | [3.57] | [3.95] |
| Occupation 4, mother | 41.48‡ | -42.19 | 34.00† | -12.80 | 27.25‡ | 20.91 | 17.63† |
| | [5.20] | [1.59] | [2.11] | [0.42] | [4.00] | [0.62] | [2.20] |
| Occupation 5, mother | 12.75* | 7.72 | 0.88 | -21.06 | 6.02 | 20.26 | 7.48 |
| | [1.88] | [0.36] | [0.08] | [1.07] | [0.88] | [0.82] | [1.02] |
| Occupation 6, mother | 4.87 | 17.62 | 3.22 | -19.27 | 0.86 | 45.52† | 16.46† |
| | [0.49] | [1.16] | [0.24] | [0.58] | [0.12] | [2.25] | [1.96] |
| Occupation 7, mother | 5.15 | 1.29 | 6.22 | -49.01† | -1.90 | 20.65 | 2.80 |
| | [0.68] | [0.10] | [0.50] | [2.56] | [0.34] | [1.13] | [0.54] |
| Private school | 2.65 | 7.58 | 2.77 | 14.78 | 14.07‡ | 6.01 | -11.39* |
| | [0.45] | [0.54] | [0.22] | [0.95] | [2.58] | [0.34] | [1.84] |
| School located in town | -2.65 | -16.93 | 20.62 | 12.38 | -3.34 | -13.64 | 0.07 |
| | [0.57] | [1.19] | [1.95] | [0.75] | [0.77] | [0.74] | [0.01] |
| School located in city | -3.66 | 4.04 | 7.76 | 16.20 | -14.20‡ | -14.10 | 8.29 |
| | [0.77] | [0.38] | [0.80] | [1.23] | [3.19] | [0.84] | [1.34] |

Table 7. Determinants of test achievement on reading (contd.)

| Variable | Australia | Austria | Belgium | Finland | Luxembourg | Netherlands | Switzerland |
|---|---|---|---|---|---|---|---|
| Books at home, 11-25 | 28.20‡ | 20.55† | 21.18* | -4.07 | 21.56‡ | 11.36 | 18.91‡ |
| | [2.65] | [2.06] | [1.87] | [0.16] | [3.20] | [0.69] | [3.60] |
| Books at home, 26-100 | 56.70‡ | 48.57‡ | 46.78‡ | 8.92 | 45.23‡ | 41.81‡ | 45.13‡ |
| | [7.61] | [4.16] | [4.46] | [0.51] | [7.47] | [2.90] | [8.06] |
| Books at home, 101-200 | 62.68‡ | 74.12‡ | 76.20‡ | 38.25† | 59.75‡ | 62.24‡ | 58.11‡ |
| | [7.38] | [5.05] | [6.54] | [1.99] | [7.79] | [3.02] | [8.86] |
| Books at home, 201-500 | 86.82‡ | 82.27‡ | 89.14‡ | 76.97‡ | 71.66‡ | 90.40‡ | 79.71‡ |
| | [10.63] | [4.19] | [5.80] | [2.97] | [9.90] | [3.58] | [10.41] |
| Books at home, > 500 | 82.13‡ | 117.06‡ | 95.87‡ | 34.28 | 75.09‡ | 23.93 | 81.03‡ |
| | [9.70] | [5.97] | [5.53] | [1.23] | [9.16] | [0.52] | [8.73] |
| Language at home | 5.01 | 9.21 | 45.98‡ | 26.72 | 15.72‡ | 19.04 | 23.27‡ |
| | [0.62] | [0.75] | [6.48] | [1.47] | [3.27] | [1.56] | [4.81] |
| Lack of qualified teachers | 0.51 | 10.35 | 1.21 | -0.97 | -5.38 | -18.28 | 4.60 |
| | [0.12] | [0.98] | [0.11] | [0.07] | [1.27] | [1.33] | [0.85] |
| Lack of instruction materials | -2.42 | 19.52 | 1.62 | 16.83 | -13.57‡ | -8.66 | 1.62 |
| | [0.51] | [1.91] | [0.15] | [1.19] | [3.29] | [0.56] | [0.33] |
| Hire teachers[c] | -8.93 | 3.50 | -4.49 | -4.79 | -14.97‡ | 18.37 | 10.98 |
| | [1.64] | [0.34] | [0.51] | [0.29] | [3.46] | [0.91] | [1.70] |
| Teachers' salary increase[c] | 9.97* | -5.27 | -6.12 | 22.53* | 0.17 | 19.11 | 1.27 |
| | [1.75] | [0.46] | [0.60] | [1.76] | [0.04] | [1.14] | [0.21] |
| School budget[c] | -2.57 | 14.62 | 1.60 | 5.19 | 17.34‡ | -22.85 | -3.21 |
| | [0.53] | [1.34] | [0.16] | [0.42] | [3.74] | [1.40] | [0.61] |
| Grouped by ability[d] | -0.99 | -2.18 | -1.10 | -4.37 | 3.22 | -4.21 | -9.22 |
| | [0.21] | [0.18] | [0.13] | [0.29] | [0.93] | [0.34] | [1.60] |
| Av. socioeconomic, school[e] | 1.77† | -0.21 | -1.33 | 7.78† | -3.08‡ | 174.84† | -0.09 |
| | [1.99] | [0.24] | [0.61] | [2.03] | [3.35] | [2.12] | [0.21] |
| Constant term | 130.39 | -339.06 | 192.37 | -53.05 | 11.94 | 172.78 | -5.36 |
| | [1.53] | [1.33] | [1.00] | [0.16] | [0.11] | [0.59] | [0.06] |
| Adjusted $R^2$ | 0.23 | 0.44 | 0.39 | 0.33 | 0.27 | 0.18 | 0.26 |
| Observations | 3235 | 635 | 1007 | 372 | 2545 | 286 | 3955 |

Notes: The outcome variable is test achievement in reading in PISA 2003-2012. We use the father's birthplace to determine the student's cultural heritage. [a] First principal component of the variation across ancestries in the relevance of the eleven child qualities considered in the first two waves of the WVS. [b] Occupations 1 to 8 refer to managers, officials and legislators (1), professionals (2), technicians and associate professionals (3), clerks (4), service and sales workers (5), skilled agricultural, construction and sales workers (6), plant and machinery operators (7) and elementary occupation (8), respectively. [c] Indicates whether the principal, the department head or the teacers have the main responsibility for hiring teachers, determining teachers' salary increases or formulating the school budget, respectively. [d] Indicates whether students are grouped by ability or not in the school the student attends. [e] Average at the school level of the PISA index of economic, social and cultural status. Standard errors are clustered at the country-of-ancestry level. We report t-statistics and the adjusted-R2 in brackets and parenthesis, respectively. The symbols *, † and ‡ denote significance at the 10%, 5% and 1% significance level, respectively. All coefficients and standard errors are estimated according to the "Unbiased Shortcut" procedure (OECD, 2009). All specifications include year dummies. The estimates for Australia also include region dummies.

Table 8. Culture and student performance. Robustness checks

| | Australia | | | Austria | | | Belgium | | | Finland | | | Luxembourg | | | Netherlands | | | Switzerland | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science |
| A. Controlling for the total fertility rate in the student's country-of-ancestry | | | | | | | | | | | | | | | | | | | | | |
| Culture[a] | 10.09‡ | 12.73‡ | 9.84‡ | -5.56† | -4.37 | -2.53 | 3.33* | 4.31† | 3.64* | 5.98 | 4.48 | 6.21 | 5.38‡ | 4.76‡ | 5.36‡ | 2.20 | 4.08 | 3.16 | 2.01* | 4.12‡ | 4.15‡ |
| t-statistic | [7.43] | [8.54] | [7.02] | [2.01] | [1.52] | [0.87] | [1.90] | [2.27] | [1.74] | [1.09] | [0.92] | [0.91] | [3.49] | [3.08] | [2.85] | [0.60] | [1.23] | [0.85] | [1.69] | [3.28] | [3.80] |
| Fert. rate[b] | 2.11‡ | 1.97‡ | 2.43‡ | -25.53‡ | -24.51‡ | -23.82‡ | -12.22‡ | -12.28‡ | -15.69‡ | 3.28 | 1.15 | 0.19 | 11.80 | 16.19* | 7.24 | -7.90 | -5.74 | -9.33* | -7.73‡ | -6.13† | -7.69‡ |
| t-statistic | [3.25] | [3.03] | [3.60] | [4.86] | [5.56] | [5.19] | [3.52] | [3.79] | [4.46] | [0.50] | [0.17] | [0.03] | [1.26] | [1.80] | [0.64] | [1.49] | [1.10] | [1.74] | [3.11] | [2.44] | [2.87] |
| Adj. $R^2$ | (0.23) | (0.25) | (0.23) | (0.46) | (0.43) | (0.47) | (0.39) | (0.35) | (0.39) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.29) | (0.25) | (0.30) | (0.26) | (0.24) | (0.28) |
| Obs. | | 3235 | | | 635 | | | 1007 | | | 372 | | | 2545 | | | 286 | | | 3955 | |
| B. Controlling for the student's number of siblings[c] | | | | | | | | | | | | | | | | | | | | | |
| Culture | 11.37‡ | 13.24‡ | 11.80‡ | 8.58† | 8.93† | 14.00‡ | 4.06 | 5.50 | 6.46* | 27.63‡ | 16.70 | 21.87* | 2.47 | 1.60 | 1.81 | 7.25† | 9.59† | 12.17‡ | 3.42* | 3.09 | 4.60‡ |
| t-statistic | [2.97] | [4.64] | [2.90] | [2.19] | [2.05] | [3.17] | [1.31] | [1.43] | [1.69] | [2.91] | [1.62] | [1.84] | [1.07] | [0.61] | [0.79] | [2.00] | [2.44] | [2.69] | [1.70] | [1.41] | [2.66] |
| One sibling | 3.32 | 3.25 | 3.83 | -13.98 | -10.23 | -6.62 | 5.59 | 1.82 | 6.24 | 27.22 | 4.83 | 1.84 | -9.43 | -8.81 | -13.48 | -5.95 | 6.05 | -3.24 | 13.92 | 15.84 | 13.79 |
| t-statistic | [0.32] | [0.31] | [0.37] | [0.65] | [0.44] | [0.32] | [0.28] | [0.09] | [0.31] | [0.50] | [0.10] | [0.03] | [0.90] | [0.88 | [1.41] | [0.27] | [0.29] | [0.14] | [1.30] | [1.55] | [1.29] |
| Two/more siblings | -1.67 | 4.73 | 1.79 | -28.67 | -29.56 | -23.98 | 28.28 | 19.27 | 30.87 | 19.03 | 18.69 | 14.45 | -1.29 | -2.69 | -3.44 | 8.39 | 13.95 | 3.51 | 8.99 | 5.72 | 8.79 |
| t-statistic | [0.19] | [0.57] | [0.21] | [1.44] | [1.28] | [1.06] | [1.42] | [0.93] | [1.63] | [0.41] | [0.35] | [0.21] | [0.13] | [0.25] | [0.33] | [0.44] | [0.65] | [0.15] | [0.85] | [0.53] | [0.83] |
| Adj. $R^2$ | (0.23) | (0.31) | (0.26) | (0.43) | (0.35) | (0.45) | (0.44) | (0.36) | (0.44) | (0.60) | (0.50) | (0.54) | (0.29) | (0.23) | (0.27) | (0.37) | (0.28) | (0.35) | (0.28) | (0.28) | (0.30) |
| Obs. | | 778 | | | 245 | | | 235 | | | 56 | | | 701 | | | 159 | | | 1097 | |
| C. Excluding the largest ancestry from the estimation sample | | | | | | | | | | | | | | | | | | | | | |
| Culture | 7.53‡ | 9.92‡ | 7.73‡ | -1.25 | -0.08 | 2.03 | 2.42 | 3.73† | 2.90 | 4.57 | 5.34 | 9.08 | 4.20‡ | 3.14† | 4.10† | -4.55 | 1.35 | -1.31 | 2.10 | 4.07‡ | 4.76‡ |
| t-statistic | [4.91] | [5.76] | [4.91] | [0.42] | [0.03] | [0.62] | [1.37] | [2.05] | [1.47] | [0.90] | [0.99] | [1.59] | [2.98] | [2.24] | [2.53] | [1.09] | [0.43] | [0.33] | [1.53] | [2.85] | [3.52] |
| Adj. $R^2$ | (0.22) | (0.30) | (0.27) | (0.29) | (0.23) | (0.24) | (0.32) | (0.26) | (0.27) | (0.36) | (0.39) | (0.32) | (0.33) | (0.31) | (0.30) | (0.44) | (0.41) | (0.38) | (0.27) | (0.26) | (0.31) |
| Obs. | | 949 | | | 234 | | | 586 | | | 208 | | | 1105 | | | 98 | | | 2399 | |
| D. Controlling for the level of development of the student's country-of-ancestry | | | | | | | | | | | | | | | | | | | | | |
| Culture | 8.10‡ | 9.75‡ | 8.00‡ | 15.61 | 3.81 | 12.35 | 3.55† | 4.51† | 3.94* | 4.25 | 4.32 | 6.94 | 4.67‡ | 3.88‡ | 4.70‡ | 4.88 | 6.17† | 5.97* | 2.15* | 4.29‡ | 4.25‡ |
| t-statistic | [6.11] | [6.65] | [5.86] | [1.08] | [0.26] | [0.99] | [2.05] | [2.41] | [1.91] | [0.74] | [0.75] | [0.99] | [3.20] | [2.71] | [2.70] | [1.46] | [1.97] | [1.78] | [1.75] | [3.37] | [3.85] |
| GDPpc[c] | -1.00‡ | -1.47‡ | -0.93‡ | -3.25 | 0.44 | -1.6 | 1.95‡ | 1.97‡ | 2.49‡ | -0.43 | -0.03 | 0.20 | -0.27 | -0.47 | 0.08 | 0.30 | 0.01 | 0.87 | 0.79* | 0.55 | 0.81* |
| t-statistic | [3.99] | [5.13] | [3.22] | [0.78] | [0.11] | [0.44] | [3.67] | [3.96] | [4.62] | [0.43] | [0.03] | [0.18] | [0.45] | [0.85] | [0.12] | [0.27] | [0.01] | [0.82] | [1.93] | [1.31] | [1.85] |
| Adj. $R^2$ | (0.24) | (0.26) | (0.23) | (0.44) | (0.40) | (0.45) | (0.40) | (0.36) | (0.39) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.26) | (0.24) | (0.28) |
| Obs. | | 3235 | | | 635 | | | 1007 | | | 372 | | | 2545 | | | 286 | | | 3955 | |

Table 8. Culture and student performance. Robustness checks (contd.)

| | Australia | | | Austria | | | Belgium | | | Finland | | | Luxembourg | | | Netherlands | | | Switzerland | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science |
| E. Schooling ethnic composition | | | | | | | | | | | | | | | | | | | | | |
| Culture[a] | 6.39‡ | 7.87‡ | 6.66‡ | -3.14 | -0.95 | 1.06 | 3.37 | 4.46 | 4.65 | 6.03 | 2.98 | 4.63 | -3.17 | -5.00 | -3.98 | 6.91 | 9.52† | 10.65† | 2.13 | 4.31‡ | 3.79† |
| t-statistic | [4.43] | [4.98] | [4.51] | [0.80] | [0.27] | [0.30] | [1.12] | [1.58] | [1.55] | [0.92] | [0.44] | [0.60] | [0.99] | [1.55] | [1.18] | [1.32] | [2.01] | [1.99] | [1.33] | [2.59] | [2.44] |
| Density[d] | 1.69 | 2.16‡ | 1.19 | -12.99‡ | -10.70† | -8.93† | -1.11 | -2.80 | -1.37 | -2.17 | -0.13 | -4.70 | -0.92 | 0.98 | -0.56 | 2.76 | 1.75 | 2.31 | 0.42 | 0.25 | 0.88 |
| t-statistic | [2.28] | [3.23] | [1.47] | [2.62] | [2.28] | [2.37] | [0.35] | [0.86] | [0.46] | [0.40] | [0.02] | [0.66] | [0.32] | [0.32] | [0.24] | [0.35] | [0.25] | [0.26] | [0.39] | [0.26] | [0.93] |
| Cult×Dens. | 1.55‡ | 2.02‡ | 1.30‡ | 4.39† | 3.58† | 3.40† | 1.51 | 1.43 | 1.33 | 0.23 | 1.05 | 1.92 | 5.87† | 6.86† | 6.84† | -0.97 | -1.67 | -2.04 | 0.44 | 0.28 | 0.77 |
| t-statistic | [3.43] | [5.32] | [2.83] | [2.32] | [2.02] | [2.18] | [1.03] | [0.99] | [0.95] | [0.08] | [0.35] | [0.57] | [2.23] | [2.33] | [2.56] | [0.43] | [0.79] | [0.88] | [0.59] | [0.40] | [1.14] |
| Adj. $R^2$ | (0.24) | (0.26) | (0.23) | (0.46) | (0.42) | (0.46) | (0.39) | (0.35) | (0.38) | (0.29) | (0.34) | (0.27) | (0.28) | (0.24) | (0.25) | (0.28) | (0.25) | (0.29) | (0.26) | (0.24) | (0.28) |
| Obs. | | 3235 | | | 635 | | | 1007 | | | 372 | | | 2545 | | | 286 | | | 3955 | |
| F. Using men's responses to the first two waves of the World Values Survey (WVS) to obtain our cultural proxy | | | | | | | | | | | | | | | | | | | | | |
| Culture | 10.05‡ | 12.60‡ | 9.77‡ | 4.59† | 5.44† | 7.07‡ | 4.82‡ | 5.66‡ | 5.66‡ | 4.35 | 2.88 | 4.04 | 4.51‡ | 3.51‡ | 4.91‡ | 4.88 | 6.16* | 6.34* | 2.60† | 4.61‡ | 4.85‡ |
| t-statistic | [7.32] | [8.39] | [6.92] | [2.04] | [2.40] | [2.78] | [2.78] | [3.12] | [2.88] | [1.01] | [0.75] | [0.73] | [3.49] | [2.90] | [3.40] | [1.43] | [1.93] | [1.81] | [2.17] | [3.54] | [4.31] |
| Adj. $R^2$ | (0.23) | (0.25) | (0.23) | (0.44) | (0.40) | (0.45) | (0.38) | (0.34) | (0.37) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.25) | (0.24) | (0.28) |
| Obs. | | 3235 | | | 635 | | | 1007 | | | 372 | | | 2545 | | | 286 | | | 3955 | |
| G. Using women's responses to the first two waves of the WVS to obtain our cultural proxy | | | | | | | | | | | | | | | | | | | | | |
| Culture | 10.33‡ | 13.05‡ | 10.12‡ | 4.51† | 5.27† | 6.80‡ | 6.36‡ | 7.44‡ | 7.47‡ | -2.19 | -4.14 | -6.62 | 4.31‡ | 3.37‡ | 4.60‡ | 5.34 | 6.22* | 6.87† | 3.12‡ | 4.95‡ | 5.14‡ |
| t-statistic | [7.54] | [8.69] | [7.19] | [2.14] | [2.46] | [2.85] | [3.78] | [4.22] | [3.99] | [0.50] | [0.87] | [1.46] | [3.32] | [2.77] | [3.11] | [1.59] | [1.93] | [1.98] | [2.72] | [4.13] | [4.95] |
| Adj. $R^2$ | (0.23) | (0.25) | (0.23) | (0.44) | (0.40) | (0.45) | (0.39) | (0.35) | (0.38) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.26) | (0.24) | (0.28) |
| H. Using the responses of those aged below 30 years old to the first two waves of the WVS to obtain our cultural proxy | | | | | | | | | | | | | | | | | | | | | |
| Culture | 9.87‡ | 12.42‡ | 9.57‡ | 4.14* | 4.82† | 6.40‡ | 6.55‡ | 7.27‡ | 7.96‡ | -5.21 | -3.80 | -5.53 | 4.31‡ | 3.24‡ | 4.64‡ | 4.74 | 5.78* | 6.22* | 4.46‡ | 6.03‡ | 6.43‡ |
| t-statistic | [6.82] | [7.67] | [6.43] | [1.95] | [2.32] | [2.70] | [3.42] | [3.81] | [3.95] | [1.03] | [0.83] | [0.86] | [3.20] | [2.50] | [3.03] | [1.44] | [1.86] | [1.82] | [3.65] | [4.51] | [5.56] |
| Adj. $R^2$ | (0.23) | (0.24) | (0.23) | (0.44) | (0.40) | (0.45) | (0.39) | (0.34) | (0.38) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.26) | (0.24) | (0.28) |
| I. Using the responses of those aged 30 to 45 years old to the first two waves of the WVS to obtain our cultural proxy | | | | | | | | | | | | | | | | | | | | | |
| Culture | 10.23‡ | 12.83‡ | 10.01‡ | 4.68‡ | 5.35‡ | 6.52‡ | 7.35‡ | 8.45‡ | 8.74‡ | -5.41 | -4.67 | -6.40 | 4.03‡ | 3.06‡ | 4.46‡ | 5.01 | 5.65* | 6.52† | 2.72† | 4.61‡ | 4.87‡ |
| t-statistic | [6.80] | [7.56] | [6.46] | [2.60] | [2.94] | [3.24] | [4.18] | [4.65] | [4.60] | [0.96] | [0.88] | [0.92] | [3.29] | [2.72] | [3.30] | [1.62] | [1.89] | [2.03] | [2.39] | [3.81] | [4.59] |
| Adj. $R^2$ | (0.23) | (0.24) | (0.22) | (0.44) | (0.41) | (0.46) | (0.39) | (0.35) | (0.38) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.26) | (0.24) | (0.28) |

Table 8. Culture and student performance. Robustness checks (contd.)

| | Australia | | | Austria | | | Belgium | | | Finland | | | Luxembourg | | | Netherlands | | | Switzerland | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science | Read | Math | Science |
| J. Using the responses of those aged above 45 years old to the first two waves of the WVS to obtain our cultural proxy | | | | | | | | | | | | | | | | | | | | | |
| Culture[a] | 10.87‡ | 13.76‡ | 10.66‡ | 5.34† | 6.10‡ | 7.59‡ | 4.89‡ | 5.90‡ | 5.63‡ | 4.88 | 3.97 | 5.80 | 4.80‡ | 3.84‡ | 5.12‡ | 5.76 | 6.65† | 7.45† | 2.52† | 4.56‡ | 4.79‡ |
| t-statistic | [7.91] | [9.30] | [7.57] | [2.47] | [2.74] | [3.10] | [2.77] | [3.15] | [2.75] | [0.99] | [0.87] | [0.93] | [3.53] | [3.06] | [3.33] | [1.64] | [1.96] | [2.06] | [2.07] | [3.48] | [4.22] |
| Adj. $R^2$ | (0.24) | (0.26) | (0.23) | (0.44) | (0.41) | (0.46) | (0.38) | (0.34) | (0.37) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.25) | (0.29) | (0.25) | (0.24) | (0.28) |
| K. Using the third and fourth waves of the WVS to obtain our cultural proxy | | | | | | | | | | | | | | | | | | | | | |
| Culture | 3.59* | 4.61† | 3.47* | 7.27‡ | 7.82‡ | 8.91‡ | 8.78‡ | 9.55‡ | 10.79‡ | -2.00 | -0.55 | -0.25 | 2.79‡ | 1.93† | 3.39‡ | 4.94 | 4.35 | 6.99† | 2.99‡ | 4.12‡ | 4.69‡ |
| t-statistic | [1.92] | [2.08] | [1.64] | [3.50] | [4.06] | [4.10] | [4.90] | [5.67] | [6.35] | [0.73] | [0.22] | [0.07] | [2.68] | [2.20] | [3.16] | [1.53] | [1.36] | [2.14] | [2.64] | [3.24] | [3.84] |
| Adj. $R^2$ | (0.21) | (0.21) | (0.21) | (0.45) | (0.42) | (0.47) | (0.40) | (0.36) | (0.40) | (0.29) | (0.34) | (0.27) | (0.27) | (0.23) | (0.24) | (0.28) | (0.24) | (0.30) | (0.26) | (0.24) | (0.28) |

Notes: The outcome variable is test achievement in PISA 2003-2012. We use the father's birthplace to determine the student's cultural heritage. [a] First principal component of the valuation of child qualities in the student's country of ancestry in the first two waves of the WVS. [b] Total fertility rate in the student's country of ancestry by mid 1980s by using data by Barro and Lee (1994). [c] We only use data coming from the 2009 PISA report since information on students' number of siblings was not provided in the other reports. [d] Share of students of the same ancestry in the school the student attends. Standard errors are clustered at the country-of-ancestry level. We report t-statistics and the adjusted $R^2$ in brackets and parenthesis, respectively. The symbols *, † and ‡ denote significance at the 10%, 5% and 1% significance level, respectively. All coefficients and standard errors are estimated according to the "Unbiased Shortcut" procedure (OECD, 2009). All specifications include year dummies. The estimates for Australia also include region dummies. We also control for students' personal, familiar and school characteristics in Table 7.