The Quality of the Catalan and Spanish Education Systems: A Perspective from PISA

by

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Abstract

We use standard statistical techniques to ask the following question: How would the Catalan and Spanish PISA score have compared with other countries and regions if all had the same parental education levels and immigration levels.Spain's performance in education according to scores obtained by the Pisa assessment is rather poor to start out with and only rises to about average when accounting for parental education levels (somewhat above average in science and math and about average in reading). Immigration plays almost no role for Spain's comparative PISA performance, as the differences between Spain and the rest of Europe are small. Accounting for parental education levels leads to small improvements in the Catalan PISA score. Compared to other Spanish regions, Flanders, Lombardy, and Denmark, Catalonia continues to be below average in science and math. In reading, Catalonia starts only slightly below average and rises just above the average when parental education is controlled for. Moreover, the below average performance of Catalonia in science and math is not due to immigration or the concentration of immigrants at some schools.

1. Introduction

The OECD coordinated *Programme for International Student Assessment* (PISA) has made the public aware that teenagers have much better science, math, and reading skills in some places than others. For Catalonia and Spain, public perception is that the PISA reports show that their education systems are underperforming. Their 2006 average scores have been below the OECD average in all three subject areas, and did not improve with respect to the 2000 and 2003 reports. This should be an important concern as there is a consensus that the skills of the labor force are key for high productivity and wages.[1] But to what extent does the responsibility for the PISA performance of Catalan and Spanish teenagers lie within the education system?

In a meeting organized by *The Economist*, Spain's Prime Minister Zapatero argued that "the main determinant of the education of each generation is the education of the parents, together with the education received in the educational system". He added that in the recent history of Spain there were many generations with low education levels.[2] These remarks came shortly after publication of the 2006 PISA results and it seems probable that the Prime Minister was suggesting that the poor performance of Spain was partly due to the still relatively low education levels of Spanish parents. Spain's Minister of Education, Mercedes Cabrera, even argued that the Spanish education system was doing well once teenagers' family background was taken into account.[3] When commenting on the Catalan PISA results, the Catalan Secretary of Education, Ernest Maragall, argued "that Catalonia is a changing region due to the growth, mobility and diversity of its population".[4] This probably reflects the perception that the large immigration flows between 1996 and 2006 period could have affected the Catalan PISA performance.

Education also takes place at home and it is therefore not surprising that many studies have found that the educational attainment of parents and immigration status plays a role for individual performance. Our goal here is to quantify how much of the Catalan and Spanish PISA

[1] For a quantitative analysis of the economic effects of improvements in school quality see Hanushek, E. (2005), "The Economics of School Quality". *German Economic Review*, 6 (3): 269-286.
[2] La Vanguardia, 4 December 2007.
[3] El País, 5 December 2007.
[4] Generalitat de Catalunya, "Presentació de l'Informe PISA", December 4, 2007.

score can be attributed to the education levels of parents and what part must instead be explained by other factors. To do so we use standard statistical techniques to ask the following question: How would the Catalan and Spanish PISA score have compared with other countries and regions if all had the same parental education levels and immigration levels.

For Spain our comparisons are within Europe. The starting position is that Spain performed 11 points below average in science, 14 points below average in math, and 24 points below average in reading. Among the 23 European countries in our sample, this puts Spain in the bottom third in science and the bottom quartile in math; in reading, only two countries did worse. But the situation changes when we consider teenagers from a similar family background. For example, if we consider teenagers whose parents have left school with a lower secondary school degree and have been born in the country, Spain is 13.9 points above average in science, 13 points above average in math, and 7.7 points above average in reading. These comparisons cannot be generalized of course as they concern just one specific group of students. But they do indicate that the Spanish PISA score may be below average partly because of the low educational attainments of parents. In fact we find that accounting for the low education levels of Spanish parents, Spanish PISA performance is somewhat above average in science and math, and approximately average in reading.

Hence, low education levels of Spanish parents play a role for Spain's poor PISA performance. But it is important to note that, compared to the European average, Spain does relatively worse when we consider teenagers with college educated parents or parents with upper secondary school, than when we consider teenagers with parents that have a lower secondary education. For example, Spanish teenagers with parents that have completed upper secondary school perform 5.2 points above average in science and 7.6 points above average in math. The children of college educated parents are at or below the average in both science and math. This indicates that the Spanish PISA performance in science and math need not automatically rise above average as parental education levels catch up to the European average. In fact when we ask what Spain's PISA performance would be if parental education levels were equal to the European average, we find that more than half of the European countries in our sample would continue to do better than Spain in science and math.

For Catalonia our comparisons are with other Spanish regions that participated in PISA plus Lombardy, Flanders, and Denmark, which makes a group of 14 regions and countries. Catalonia

does poorly in this group, either 3rd or 4th from the bottom depending on the subject tested. Accounting for parental education levels does not change the comparative performance of Catalonia significantly. Catalonia scores 12 points less than average in science and 14 less in math. Accounting for parental education levels, the same gaps are around 10 and 12 points respectively. The comparison with some of the leading performers is especially interesting. For example, Catalonia does around 45 points worse than Flanders in science and math. Controlling for parental education levels, this gap shrinks but is still 35 points. La Rioja and Castile and Leon outperform Catalonia in science and math by around 35 and 27 points respectively although they have quite similar parental education levels. In reading, Catalonia is only somewhat worse than average to start out with and improves slightly when parental education is taken into account.

We also examine to what extent PISA scores vary across countries and regions because of differences in immigration levels. For the comparison of Spain with other European countries, accounting for immigration makes little difference. Basically, this is because levels of immigration are similar in many European countries. The same result holds for the comparison of Catalonia with other Spanish regions that participated in PISA and Lombardy, Flanders, and Denmark. For the case of Catalonia, the concentration of immigrants at some schools has been an important concern. We show that while concentration of immigrant students is greater in Catalonia than in many other countries and regions, this is not an important factor behind the poor Catalan PISA performance.

The academic literature tends to find weak effects of educational expenditures on school performance. Our analysis yields similar results. Across Spanish regions participating in PISA, there is only a very weak (and statistically insignificant) effect of secondary school expenditures and PISA performance adjusted for parental education and immigration status. Across European countries there is a statistically significant but very small effect of secondary school expenditures on adjusted PISA scores. The setting that according to the academic literature is most conducive to school quality is school autonomy subject to performance evaluation. There is insufficient data on school and student characteristics to evaluate these hypotheses specifically for Catalonia and Spain however. Making progress in understanding the determinants of school quality within Catalonia or Spain will require that policy makers decide to implement rigorously designed school evaluation programs.

2. Descriptive Statistics and Empirical Analysis

Parental education levels in Catalonia and Spain Table 1 shows the education levels of fathers and mothers in Spain and other European countries according to PISA 2006. 25% of fathers in Spain have at most a primary school education or less.[5] This share is very high by European standards—more than three times the European average—and only surpassed by Portugal. The situation for mothers can be seen to be very similar. Table 2 contains the same statistics for Catalonia, other Spanish autonomous communities for which there is data, and, to allow for further comparisons, Denmark, Flanders, and Lombardia. Maybe surprisingly, the share of fathers with less than primary school studies in Catalonia is above average and among the highest in Spain, only surpassed by Andalusia and the Rest of Spain (a residual category of Spanish regions that did not participate individually in PISA), see Table 2. The same is true for mothers. The differences with Denmark, Flanders, and Lombardia in parental education levels are quite large. But the differences with other Spanish regions are often small. For example, in Catalonia, the highest education level of 15% of fathers and 13% of mothers is primary schooling. In Spain's best-performing PISA region, La Rioja, the shares are not much smaller, 12% and 10% respectively.

Table 1 and 2 about here

Immigration in Catalonia and Spain Table 3 assesses immigration levels in Spain. It gives the share of teenagers with at least one of the parents born abroad who were themselves born abroad (group 1) or born in the country (group 2). Spain does not look exceptional. It is somewhat above average in group 1, probably because immigration has been a relatively recent phenomenon in Spain, and somewhat below average in group 2. Table 3 also contains the share of students who speak a non-official language at home, which in Spain is below the European average. The last two columns in Table 3 contain two statistics on the concentration of immigrant students in schools, the share of schools with more than 10% immigrant children, and the share of children

[5] The European countries included correspond to European Union countries that participated in the PISA assessment, except for Poland where the schooling coding is slightly different.

at schools with more than 10% immigrant children. Spain is above the average but not exceptional, especially if one considers Western Europe. In Table 4 it can be seen that Catalonia is close to the average in immigration statistics, except that it has one of the greatest shares of schools with more than 10% immigrants.

Tables 3 and 4 about here

Average effects of family background variables and aggregate PISA scores We first study how teenagers (individual) PISA scores depend on the education levels of their parents and immigration status. Our goal is to estimate average effects across all European countries.

The basic model that we estimate is the following:

$$P_{ik} = \sum_{k=1}^{K} AdjP_k + \sum_{p=1}^{P} \alpha_p Par_{ik} + \sum_{m=1}^{M} \beta_m Imm_{ik} + \epsilon_{ik}$$

Assumptions: ϵ_{ik} is a normally distributed i.i.d. error term

P_{ik}: Pisa score (Science, Math or Reading) for student i in country (region) k.

$AdjP_K$: Adjusted Pisa average score (intercept) for country k.

Par_{ik}: Parental education controls for student i in country k.

Imm_{ik}: Immigration controls for student i in country k.

Table 5 summarizes our findings on the effects of parental background variables.[6] It can be seen

[6] The underlying regression results are available at http://www.antoniociccone.com, Appendix Tables 1-3. OLS regressions based on the method suggested by PISA (2006), that is regression coefficients are the average of five separate regressions based on using the five plausible values for scores as the dependent variable, while standard errors are computed using 80 balanced repeated replications and 5 plausible values. Each table is organized in the same way. Column (1) contains the results of a regression of individual PISA scores on country dummies only. Hence, the results reflect countries' PISA scores. Column (2) adds controls for the education levels of fathers and mothers. The omitted category is upper-level secondary education; hence, all effects have to be read relative to this parental education level. Column (3) adds controls for

that the effects associated with low parental education levels are large. For example, having an illiterate mother lowers the science score by more than 60 points, close to the difference between the Spanish and Finish mean scores (Finland is the top performer in Europe). These results, combined with comparatively low Spanish parental education levels, therefore suggest that part of the low PISA score of Spain may be due to low parental education levels.

Table 6 summarizes our findings on the effects of immigration status on PISA scores (these effects are conditional on parental education levels). The effects are also quite large. For example, teenagers born abroad with one parent born abroad (group 1) score 28 points lower in science; and the score falls by a further 24 points if families do not speak an official language at home. But because European countries appear quite similar when it comes to immigrants, we expect immigration status variables to contribute less to cross-country PISA differences. The table also shows that teenagers in schools with more than 10% immigrants score more than 30 points lower in science, math, and reading. It seems very unlikely that this effect is causal as a greater concentration of immigrants at a school will probably lead some of the parents most concerned about education to take their children elsewhere.[7] But the effect is likely to be an upper bound on the causal effect and therefore useful for our analysis.

Tables 5 and 6 about here

3. Counterfactual Analysis of Aggregate PISA Scores

We will now ask how Catalonia's and Spain's scores would have compared to other countries and regions if all had the same parental education and immigration levels. For robustness we will do the counterfactual analysis in two different ways. Our first approach adjusts the unconditional PISA scores using the average effects of parental education levels and immigration status in the sample.[8] Our second approach makes the adjustment based on country and region specific effects of parental education and immigration.

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immigration status, and column (4) a dummy that is unity if and only if the teenager attends a school with more than 10% immigrants.

[7] Betts, J. R. and R. W. Fairlie (2003). "Does Immigration Induce 'Native Flight' from Public Schools into Private Schools". *Journal of Public Economics*, Vol. 87, pp. 987-1012.

[8] This approach is based directly on the regressions in Appendix Tables 1-6.

3.1. Counterfactual Analysis of Aggregate PISA Scores Based on Average Effects

Figure 1 illustrates how Spanish PISA scores in science, math, and reading would compare with other European countries if all had the same parental education levels. All figures are constructed in the same way. On the vertical axis we have put the difference between countries' (unconditional) PISA scores and the European average. On the horizontal axis, we have put the same difference after controlling for parental education. Countries that lie below the 45 degree line improve relative to the average when controlling for parental education; countries above do worse. The horizontal difference from the 45 degree line is a measure of how much the country improves (worsens) when parental education levels are accounted for.[9]

Figure 1 about here

The picture that emerges is quite clear. Spain is one of the two or three countries improving most when parental education is accounted for (only Portugal and sometimes Luxembourg show bigger improvements). For example, in science Spain goes from more than 11 points below average to more than 9 points above average. In math, from more than 14 points below average to more than 4 points above average. And in reading, from more than 24 points below average to 4 points below average. What these results indicate is that, if we compare teenagers whose parents have the same education levels across European countries, Spain is somewhat above average in science and math, and just below average in reading.

Figure 2 repeats the analysis controlling for parental education levels and immigration status. [10] This changes the overall picture little. For example, controlling for parental education and immigration status Spain lies 7.4 points above the average, compared to 9.3 points when controlling for parental education only. For math, the comparison is 2.5 above average vis-à-vis 4.2 points above average. And for reading 5.5 points below average compared to 4.2 below average. Overall, accounting for immigration status does not change the position of Spain relative to the average European country much.

[9] The numerical values are given in Appendix Tables 7, 10, and 13.
[10] The corresponding numerical values are given in Appendix Tables 8, 11, and 14.

Figure 3 about here

Figure 3 also accounts for schools with more than 10% immigrants.[11] Again, the results change little. The main conclusion from Figures 1-3 is therefore quite clear. While low education levels of parents did play a significant role—results in science and math go from clearly below average to somewhat above average when parental education are accounted for—immigration status is not a significant factor behind Spain comparatively poor PISA performance.

Figure 3 about here

Table 7 compares Spain with Finland, the Netherlands, Germany, Denmark, Italy, and Portugal. Consider the results for science for example. It is evident that low Spanish parental education levels account for a sizable part of the gaps between Spain on the one hand and Finland, the Netherlands, and Germany on the other hand. The (small) gap between Spain and Denmark actually changes sign and turns into a sizable advantage for Spain once one controls for parental education. And the lead with respect to Italy widens. Spain only worsens compared to Portugal, which has even lower parental education levels (see Table 1). Table 7 also analyzes the PISA math and reading scores. In the case of the math scores, the gap between Spain and Finland and between Spain and the Netherlands halves once parental education is accounted for. The gap with Germany diminishes by around 15 points and the gap with Denmark by around 25 points. The results for reading are similar. Tables 7 also shows that Spain's relative position changes little when immigration status is accounted for, especially compared to the changes when accounting for parental education levels.

Table 7 about here

Tables 8-9 summarize the effects of parental education and immigration status on individual PISA scores in our mixed regions/country sample.[12] The results for parental education levels in

[11] The corresponding numerical values are given in Appendix Tables 9, 12, and 15.
[12] They are taken from Appendix Tables 4-6.

Table 8 are qualitatively very similar to the European country sample. But the size of the effects tends to be somewhat smaller. For example, now a mother with a primary school degree only is associated with a 30 point lower score, while in the European sample the effect was 40 points. Table 9 contains the results for immigration status, which are also qualitatively similar to those we obtained in the European sample. For example, teenagers born abroad with one parent born abroad (group 1) score 47 points lower in science; if only the parents were born abroad the effect is 12 points. These estimates are somewhat larger than for the European sample (especially for group 1). On the other hand, the effect of not speaking an official language at home and of being in a school with more than 10% immigrants is somewhat smaller than in the European sample.

Tables 8 and 9 about here

Figure 4 plots the unconditional difference of each country/region's score with the average on the vertical axis against the difference accounting for parental education levels.[13] Catalonia is very close to the 45 degree line in all cases, which indicates that parental education levels cannot explain its performance relative to the average. Only Andalusia experiences a substantial improvement. Figure 5 adds immigration status controls.[14] Catalonia continues to be very close to the 45 degree line in all cases, which implies that immigration status variables also fail to explain its performance relative to the average. Finally, in Figure 6, we add controls for the share of schools with more than 10% immigrants.[15] That is, we ask how each country/region would compare to the average if it had the same parental education levels and immigration shares (including schools with more than 10% immigrants). Now Catalonia moves somewhat to the right of the 45 degree line, which indicates that immigrant concentration explains some of the gap with the average in other countries/regions. But it explains very little. For example, controlling for parental schooling Catalonia is 11.4 points below the average in science, and the gap shrinks to 7.5 when we control for immigration status and immigrant concentration. For the math and the reading score the results are very similar. This result is easily explained with the help of Tables 4 and 6. Compared to the average, Catalonia has about 10% more children in

[13] The corresponding numerical values are given in Appendix Tables 16, 19, and 22.
[14] The corresponding numerical values are given in Appendix Tables 17, 20, and 23.
[15] The corresponding numerical values are given in Appendix Tables 18, 21, and 24.

schools with more than 10% immigrants. Given that these children do about 25 points worse in the PISA tests, this can account for a 2.5 point gap with the average (10%*25 points). Moreover, Catalonia has 8% teenagers born abroad with a parent born abroad while the average across the country/region sample is 6%. These teenagers do about 50 points worse and therefore lower the Catalan average by 1 point relative to the average (2%*50 points). The sum of these two effects (3.5 points) gets us very close to the part of the performance gap that can be explained by immigration shares and immigrant concentration at some schools.

Figures 4, 5 and 6 about here

Table 10 compares the unconditional and adjusted PISA scores of Catalonia with Flanders, Denmark, Lombardia, La Rioja, and Castile and Leon (Flanders is the top performer in this group). Unconditionally, Catalonia is behind in almost all comparisons, with the exception of the math score where it does slightly better than Lombardy. Generally speaking, educational background helps in explaining around 8-12 points of the PISA gap with Flanders and Denmark. It is interesting to note that Catalonia is considerably behind La Rioja as well as Castile and Leon in science and math (the gap is almost 30 points in science and between 30 and 40 points in math). These gaps change very little when we control for parental education levels. Note also that in science, both La Rioja and Castile and Leon do as well as Flanders when parental education levels are accounted for. The results in Table 10 also show that adding immigration status and immigration concentration controls changes the results for Catalonia little compared to the other regions and countries.

Table 10 about here

The results of Figures 5-6 and Table 10 are quite clear. Parental education levels and immigration explain little of the gap between Catalonia and the average of the countries and regions considered. If we focus on pairwise comparisons between Catalonia and regions or countries outside Spain, a part of the gap can be explained by parental education but little by immigration. When we consider comparisons between Catalonia and the Spanish regions that did best (La Rioja and Castile and Leon), we find that little of the sizable gap in science and math

can be explained by parental education or immigration variables.

3.2. Counterfactual Analysis of Aggregate PISA Scores Based on Heterogeneous Effects

Our second approach is almost as straightforward as our first. We first estimate the effects of parental education levels, immigration status, and the dummy for schools with more than 10% immigration for each country/region separately. Based on these regressions, we predict the score in each country and region if it had the Catalan (Spanish) parental education levels, immigration levels, and concentration of immigrants at a subset of schools. For Catalonia (Spain), this prediction simply yields the average Catalan (Spanish) score. For all other countries and regions it yields how it would have performed at the Catalan (Spanish) composition, given the actual performance of each student group in the country or region (our previous approach used the average performance of the group in the entire sample to make this adjustment). This approach is often referred to as shift-share analysis.

Now estimate for each country (region) *k:*

$$P_{ik} = AdjP_k + \sum_{p=1}^{P} \alpha_{pk} Par_{ik} + \sum_{m=1}^{M} \beta_{mk} Imm_{ik} + \epsilon_{ik}$$

Then use the Spanish (Catalan) average for the controls and predict the Pisa score for each country using these shares:

$$P_k^* = AdjP_k + \sum_{p=1}^{P} \hat{\alpha}_{pk} \bar{Par}_S + \sum_{m=1}^{M} \beta_{mk} \bar{Imm}_S$$

Figure 7 contains the results for science, math, and reading in the European sample when we adjust for parental education levels only.[16] It can be seen that Spain is always among the three countries that improve most (the improvement is equal to the horizontal distance from the 45 degree line). Moreover, Spain moves from below the average to above the average in all three test categories. The situation changes little when we also control for immigration status in Figure

[16] The corresponding numerical values are given in Appendix Tables 25, 28, 31.

8 and immigrant concentration in Figure 9.[17]

Figures 7, 8 and 9 about here

The results for Catalonia in the mixed region/country sample are in Figures 10-12. In Figure 10—which looks at science, math, and reading results controlling for parental schooling only—it can be seen that Catalonia moves at most a few points away from the 45 degree line. Hence, the Catalan gap with average performance in the sample changes little when we control for parental education. The same is true when we control for immigration status and concentration at some schools (Figure 11 and Figure 12 respectively).

Figures 10, 11 and 12 about here

Comparing the two counterfactual methods Figures 13 and 14 compare the two methodologies to calculate counterfactual PISA scores. On the vertical axis, we measure the distance from the average in science, math, and reading using the regressions method (our first approach). On the horizontal axis we measure the same distance using the shift-share method (our second approach). There are a total of nine points in each figure because we undertake three counterfactual experiments: controlling for parental schooling only, adding immigration status, and adding the concentration of immigrants at some schools. In Figure 13 it can be seen that Spain does better compared to the average using the shift-share approach than the regression approach (all points lie to the right of the 45 degree line). But the results of the two methods are quite similar when schooling and immigration is accounted for. Figure 14 shows that both methods yield very similar results for Catalonia.

Figures 13 and 14 about here

4. Convergence in Parental Education Levels and the Future of PISA Scores

[17] The corresponding numerical values are given in Appendix Tables 26, 29, 32 and 27, 30, 33 respectively.

Controlling for education levels, Spanish PISA scores in science and math are more than 10 points above the European average. It is therefore natural to ask whether Spanish PISA scores will rise above the European average as parental education levels in Spain converge to the European Union average. Unfortunately, this is not to be expected. Table 11 contains the average performance in science of native teenagers who attend schools with less than 10% immigrants and have both parents with lower secondary school; upper secondary school; or college. Performance is relative to the European average of teenagers with the same family background characteristics attending schools with less than 10% immigration. It can be seen that teenagers with parents who only completed lower secondary school outperform the European average by almost 13 points. But teenagers with upper secondary school educated parents and college educated do not outperform the European average. Spain can therefore not be expected to rise above the European average of the PISA science scores as parental education levels increase. Table 12 repeats the analysis for math scores and Table 13 for the reading scores. The pattern is the same. What Tables 11-13 show is that the Spanish education system appears better at raising the performance of teenagers with low parental education levels than teenagers from more educated families. If this does not change in the future, rising parental education levels will not lead to Spanish PISA scores rising above the European average. In fact, when we ask what Spain's PISA performance would be if parental education levels were equal to the European average, we find that more than half of the European countries in our sample would continue to do better than Spain.[18] Hence, there is considerable room for improvement.

Tables 11, 12 and 13 about here

Tables 14-16 contain the average PISA scores of native Catalan teenagers who attend schools with less than 10% immigrants and have both parents with lower secondary school; upper secondary school; or college. The logic of the tables follows Tables 11-13 exactly. Regarding science and math, it can be seen that Catalonia does below the average in each group. It can therefore not be expected that Catalan PISA scores in science and math will converge to the average as parental education levels catch up. The pattern is different for reading, where Catalan

[18] In Appendix Figures A1-A3 and Tables A49-A57 we show the calculations for the shift-share analysis when we use the shares corresponding to the European average.

teenagers do better than average once parental education levels are controlled for. Hence, in reading, Catalan scores should rise above average as parental education levels catch up.

Tables 14, 15 and 16 about here

5. School Expenditures and School Quality

The academic literature tends to find weak effects of educational expenditures on school performance, and this remains true when examining the PISA data across countries.[19]

Figure 15 plots secondary school expenditures, adjusted for purchasing power differences, against the unconditional PISA results.[20] The figure averages the results in science, math, and reading and measures countries relative to the cross-country average. It can be seen that the relationship between school expenditures and PISA results is weak (in fact it is statistically insignificant). Figure 16 repeats the analysis but using PISA scores that are adjusted for parental education levels and immigration using the regression method (our first approach). Interestingly, now the relationship between school expenditures and PISA results becomes statistically significant at the 97.5% confidence level.[21] But the slope of the regression line is small, 0.0032. This implies that a 1000 dollar increase in expenditures per pupil only yields a 3.2 point increase in PISA scores.

Figures 15 and 16 about here

Figures 17 and 18 consider the relationship between secondary school expenditures and PISA scores across Spanish regions. The expenditure data come from De la Fuente, Domenech, and

[19] For reviews see Card, D. and A. B. Krueger (1996), "School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina", *Journal of Economic Perspectives*, American Economic Association, vol. 10(4), pp. 31-50, Fall; and Hanushek, E. (1996), "Measuring Investment in Education". *The Journal of Economic Perspectives*, American Economic Association, Vol. 10, No. 4, pp. 9-30, Autumn.

[20] The expenditure data come from "Education at a Glance" OECD (2006).

[21] This is consistent with Fuchs, T. and L. Woessmann (2004), "What Accounts for International Differences in Student Performance? A Re-Examination Using PISA Data", IZA Discussion Paper No. 1287.

Jimeno (2003).[22] Figure 17 considers the unconditional PISA score, while Figure 18 considers the PISA score controlling for parental education and immigration status. In both cases we are averaging across the science, math, and reading results. The data yields a positive correlation between expenditures and PISA scores in both cases but the link is never statistically significant at standard confidence levels.

Figures 17 and 18 about here

The setting that according to the academic literature is most conducive to school quality is school autonomy subject to performance evaluation.[23] Unfortunately, there is insufficient data on school and student characteristics to evaluate these hypotheses specifically for Catalonia and Spain however. Making progress in understanding the determinants of school quality within Catalonia or Spain will require that policy makers decide to implement rigorously designed school evaluation programs.

6. Conclusions

There is a sizable increase in the Spanish PISA scores relative to the rest of Europe when parental schooling is controlled for. But Spain's performance is rather poor to start out with and only rises to about average when accounting for parental education levels (somewhat above average in science and math and about average in reading). Another way to see that there is considerable room for improvement is to note that, compared to the European average, Spain does relatively poorly when we consider teenagers whose parents have an upper secondary or a college education. Immigration plays almost no role for Spain's comparative PISA performance, as the differences between Spain and the rest of Europe are small.

Accounting for parental education levels leads to small improvements in the Catalan PISA score. Compared to other Spanish regions, Flanders, Lombardy, and Denmark, Catalonia

[22] A. De la Fuente, R. Domenech, and J.F. Jimeno (2003), "Human capital as a factor of growth and employment at the regional level. The case of Spain," Working Papers, Institut d'Anàlisi Econòmica.

[23] Rivkin, S., E. Hanushek and J. F. Kain, (2005). "Teachers, Schools, and Academic Achievement". *Econometrica*, The Economic Society, Vol. 73(2), March, pp. 417-458.

continues to be below average in science and math. In reading, Catalonia starts only slightly below average and rises just above the average when parental education is controlled for. Moreover, the below average performance of Catalonia in science and math is not due to immigration or the concentration of immigrants at some schools. Making progress in understanding why Catalonia does worse than other Spanish regions that are similar in many respects will require a detailed evaluation of individual school data.

Table 1. Parental education levels (European sample)

	No degree		Primary School		Basic Secondary		Advanced Secondary		College	
	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
Austria	0.01	0.02	0.01	0.02	0.06	0.08	0.47	0.54	0.45	0.27
Belgium	0.03	0.04	0.03	0.03	0.07	0.07	0.40	0.35	0.46	0.47
Czech Republic	0.01	0.01	0.00	0.01	0.02	0.04	0.72	0.65	0.24	0.24
Denmark	0.02	0.02	0.03	0.02	0.10	0.10	0.42	0.28	0.43	0.55
Estonia	0.01	0.00	0.00	0.00	0.06	0.04	0.58	0.47	0.35	0.41
Finland	0.02	0.01	0.06	0.04	0.10	0.07	0.23	0.17	0.59	0.68
France	0.05	0.04	0.02	0.01	0.20	0.19	0.43	0.43	0.31	0.29
Germany	0.04	0.04	0.00	0.00	0.17	0.17	0.40	0.44	0.39	0.27
Greece	0.01	0.01	0.13	0.11	0.16	0.17	0.34	0.37	0.35	0.31
Hungary	0.01	0.01	0.00	0.01	0.09	0.14	0.65	0.54	0.24	0.28
Ireland	0.02	0.01	0.08	0.05	0.16	0.15	0.42	0.43	0.32	0.34
Italy	0.01	0.01	0.06	0.05	0.34	0.33	0.40	0.45	0.19	0.19
Latvia	0.01	0.01	0.01	0.00	0.05	0.03	0.61	0.47	0.33	0.43
Lithuania	0.01	0.00	0.00	0.00	0.02	0.02	0.60	0.42	0.38	0.51
Luxembourg	0.11	0.14	0.09	0.11	0.06	0.08	0.38	0.34	0.36	0.34
Netherlands	0.03	0.03	0.05	0.05	0.11	0.13	0.38	0.35	0.43	0.35
Portugal	0.31	0.30	0.18	0.18	0.14	0.16	0.21	0.23	0.16	0.18
Romania	0.01	0.01	0.02	0.02	0.08	0.11	0.51	0.43	0.38	0.40
Slovak Republic	0.01	0.01	0.00	0.00	0.03	0.05	0.75	0.68	0.20	0.20
Slovenia	0.01	0.01	0.01	0.01	0.11	0.14	0.64	0.55	0.24	0.28
Spain	0.09	0.08	0.16	0.16	0.22	0.25	0.26	0.27	0.27	0.24
Sweden	0.03	0.02	0.02	0.01	0.16	0.10	0.28	0.24	0.51	0.61
United Kingdom	0.02	0.02	0.02	0.01	0.10	0.06	0.48	0.46	0.38	0.41
Europe	0.04	0.04	0.04	0.03	0.16	0.16	0.43	0.42	0.34	0.32

Note: Proportion of individuals in each category. Source: PISA 2006.

Table 2. Parental education levels (regions/countries sample)

	No degree		Primary School		Basic Secondary		Advanced Secondary		College	
	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
Denmark	0.02	0.02	0.03	0.02	0.10	0.10	0.42	0.28	0.43	0.55
Flanders	0.03	0.03	0.03	0.02	0.07	0.06	0.44	0.38	0.44	0.46
Lombardia	0.01	0.02	0.06	0.04	0.37	0.36	0.40	0.48	0.15	0.15
Andalusia	0.16	0.15	0.23	0.24	0.18	0.23	0.21	0.24	0.22	0.16
Aragon	0.05	0.03	0.11	0.11	0.25	0.30	0.28	0.29	0.30	0.29
Asturias	0.05	0.03	0.10	0.08	0.22	0.25	0.33	0.35	0.31	0.28
Cantabria	0.03	0.03	0.09	0.09	0.26	0.27	0.32	0.34	0.29	0.26
Castile and Leon	0.05	0.04	0.13	0.11	0.26	0.27	0.29	0.30	0.28	0.28
Catalonia	0.07	0.07	0.15	0.13	0.20	0.24	0.25	0.27	0.33	0.31
Galicia	0.07	0.05	0.15	0.15	0.25	0.28	0.29	0.31	0.25	0.23
La Rioja	0.04	0.03	0.12	0.10	0.27	0.30	0.27	0.30	0.30	0.28
Navarre	0.06	0.04	0.12	0.10	0.22	0.25	0.26	0.30	0.34	0.30
Basque Country	0.05	0.03	0.09	0.10	0.17	0.21	0.30	0.30	0.39	0.34
Rest of Spain	0.09	0.07	0.15	0.16	0.23	0.26	0.27	0.28	0.25	0.23
All regions	0.07	0.06	0.12	0.12	0.21	0.23	0.31	0.31	0.29	0.28

Note: Proportion of individuals in each category. Source: PISA 2006.

Table 3. Immigration statistics (European sample)

	Group 1	Group 2	Other language spoken at home	% of students ending schoc with more than 10% of group 1	% of schools with more than 10% of group 1
Austria	0.09	0.12	0.10	0.26	0.30
Belgium	0.07	0.18	0.05	0.24	0.27
Czech Republic	0.02	0.07	0.01	0.05	0.07
Denmark	0.04	0.10	0.04	0.12	0.11
Estonia	0.02	0.21	0.00	0.02	0.03
Finland	0.02	0.03	0.01	0.04	0.05
France	0.04	0.21	0.05	0.14	0.15
Germany	0.07	0.12	0.08	0.25	0.27
Greece	0.08	0.07	0.04	0.20	0.36
Hungary	0.02	0.02	0.01	0.03	0.04
Ireland	0.08	0.12	0.02	0.32	0.32
Italy	0.04	0.05	0.03	0.11	0.15
Latvia	0.01	0.23	0.00	0.01	0.00
Lithuania	0.01	0.09	0.00	0.03	0.03
Luxembourg	0.18	0.34	0.21	0.74	0.65
Netherlands	0.04	0.15	0.06	0.11	0.11
Portugal	0.05	0.11	0.02	0.16	0.17
Romania	0.00	0.00	0.01	0.00	0.00
Slovak Republic	0.01	0.05	0.00	0.00	0.00
Slovenia	0.02	0.16	0.06	0.05	0.06
Spain	0.07	0.05	0.03	0.22	0.23
Sweden	0.05	0.16	0.08	0.19	0.21
United Kingdom	0.04	0.13	0.04	0.14	0.13
Europe	0.05	0.11	0.04	0.15	0.17

Group 1:
Students born abroad with at least one parent born abroad.
Group 2:
Students born in the country with at least one parent born abroad.
Other language:
The language spoken at home is not one of the official languages

Table 4: Immigration statistics (regions/countries sample)

	Group 1	Group 2	Other language spoken at home	% of students ending schoc with more than 10% of group 1	% of schools with more than 10% of group 1
Denmark	0.04	0.10	0.04	0.12	0.11
Flanders	0.04	0.11	0.03	0.13	0.15
Lombardia	0.06	0.05	0.04	0.22	0.29
Andalusia	0.03	0.03	0.02	0.09	0.08
Aragon	0.06	0.03	0.02	0.20	0.21
Asturias	0.03	0.05	0.05	0.09	0.12
Cantabria	0.05	0.04	0.01	0.19	0.23
Castile and Leon	0.04	0.02	0.01	0.11	0.12
Catalonia	0.08	0.06	0.04	0.28	0.30
Galicia	0.03	0.07	0.01	0.06	0.06
La Rioja	0.07	0.03	0.02	0.24	0.27
Navarre	0.08	0.04	0.02	0.33	0.33
Basque Country	0.04	0.03	0.01	0.09	0.13
Rest of Spain	0.10	0.05	0.03	0.31	0.32
All regions	0.06	0.06	0.03	0.20	0.21

Group 1:
Students born abroad with at least one parent born abroad.
Group 2:
Students born in the country with at least one parent born abroad.
Other language:
The language spoken at home is not one of the official languages

Table 5. Parental education effects (European sample)

	Science	Math	Reading
Father no degree	-42.9	-41.9	-42.2
Father primary school	-26.4	-25.8	-25.7
Father basic secondary	-19.9	-15.3	-18.1
Father college	16	15.7	12
Mother no degree	-62.6	-53.9	-61.5
Mother primary school	-40.2	-37.3	-43.4
Mother basic secondary	-25.4	-21.1	-28.5
Mother college	10.4	11.7	6.6

Note: Full regression results can be found in the Appendix
Deviations from the average

Table 6. Immigration status effects (European sample)

	Science	Math	Reading
Group 1	-28.2	-22.0	-22.1
Group 2	-10.4	-9.2	-4.7
Other language	-24.3	-19.3	-21.8
In a school with group 1 > 10%	-31.0	-32.2	-34.1

Group 1: Student born abroad with at least one parent born abroad
Group 2: Student native with at least one parent born abroad
Other language: language spoken at home is not official in the country
Deviations from the average

Table 7. PISA and adjusted PISA scores in Spain compared with selected European countries

	Unconditional average	Parental education controls only	Parental education nd immigratio controls	Parental education immigration and > 10% controls
		Science		
Finland - Spain	74.9	42	40.4	36.4
Netherlands - Spain	36.5	15.3	17.6	14.5
Germany - Spain	27.2	10.5	14.4	15.3
Denmark - Spain	7.5	-19.8	-18.3	-20.7
Italy - Spain	-13	-22.9	-22.5	-25.2
Portugal - Spain	-13.1	7.9	5.1	2.7
		Math		
Finland - Spain	68.4	38	36.7	32.6
Netherlands - Spain	50.7	31.7	33.8	30.5
Germany - Spain	23.8	9.5	12.8	13.8
Denmark - Spain	33	7.4	8.8	6.3
Italy - Spain	-18.3	-27.9	-27.6	-30.4
Portugal - Spain	-13.8	6.8	4.5	1.9
		Reading		
Finland - Spain	86.1	55.5	54.1	49.7
Netherlands - Spain	45.9	25.7	27.3	23.8
Germany - Spain	34.1	20.3	23.4	24.4
Denmark - Spain	33.7	7.3	8.3	5.6
Italy - Spain	7.7	-2.9	-2.7	-5.7
Portugal - Spain	11.5	33.1	30.5	27.8

> 10% : a dummy for students attending schools with more than 10% immigration

Table 8. Parental education effects (regions/countries sample)

	Science	Math	Reading
Father no degree	-26.1	-29.4	-28.3
Father primary school	-19.0	-18.0	-19.4
Father basic secondary	-6.6	-4.0	-2.1
Father college	17.6	17.3	11.3
Mother no degree	-52.1	-40.0	-44.3
Mother primary school	-30.8	-27.6	-31.2
Mother basic secondary	-9.7	-5.9	-7.6
Mother college	13.1	10.9	8.6

Note: Full regression results can be found in the Appendix
Deviations from the average

Table 9. Immigration status effect (regions/countries sample)

	Science	Math	Reading
Group 1	-47.0	-44.3	-38.5
Group 2	-12.9	-15.5	-12.3
Other language	-14.3	-3.9	-19.5
In a school with group 1 > 10%	-21.1	-23.2	-30.5

Group 1: Student born abroad with at least one parent born abroad
Group 2: Student native with at least one parent born abroad
Other language: language spoken at home is not official in the country
Deviations from the average

Table 10. PISA and adjusted PISA scores in Catalonia compared with selected European regions/countries

	Unconditional average	Parental education controls only	Parental education and immigration controls	Parental education immigration and > 10% controls
		Science		
Flanders - Catalonia	37.8	26.7	24.2	21.3
Denmark - Catalonia	4.5	-9.3	-11.4	-14.3
Lombardia - Catalonia	7.7	7.4	6.5	5.2
La Rioja - Catalonia	28.2	26.7	25.6	24.9
Castile and Leon - Catalor	28.4	26.8	23.3	20.3
		Math		
Flanders - Catalonia	55.7	47.4	45.3	42.2
Denmark - Catalonia	25.3	13.1	11.2	8.1
Lombardia - Catalonia	-1	-1.4	-2.2	-3.6
La Rioja - Catalonia	38.3	37.2	36.2	35.5
Castile and Leon - Catalor	27.4	26.2	23	19.8
		Reading		
Flanders - Catalonia	45.2	37.3	32.8	30.9
Denmark - Catalonia	17.7	5.9	1.9	-0.1
Lombardia - Catalonia	13.7	11.3	8.4	8.7
La Rioja - Catalonia	14.4	12.9	9.6	10.8
Castile and Leon - Catalor	1.3	-0.6	-6.1	-8.2

> 10% control: dummy for students attending schools with more than 10% immigration

Table 11. Average science scores of native students at schools with less than 10% immigrant students (European sample)

	Unconditional	Advanced secondary	Low secondary	College
Austria	11.2	19.3	7.2	1.7
Belgium	10.7	18.0	35.7	20.7
Czech Republic	13.2	9.7	-5.3	10.8
Denmark	-3.7	-15.1	-13.1	-5.9
Estonia	31.8	23.7	24.1	22.2
Finland	63.7	38.1	68.7	36.7
France	-4.4	7.7	1.2	12.8
Germany	16.0	36.6	17.0	40.8
Greece	-26.3	-21.8	-30.0	-24.4
Hungary	4.3	-7.7	-42.3	19.5
Ireland	8.7	-3.1	10.0	5.1
Italy	-24.2	-11.6	-16.1	-35.3
Latvia	-10.1	-23.5	-34.5	-28.9
Lithuania	-11.7	-38.9	-33.2	-23.0
Luxembourg	-13.3	39.2	102.9	4.2
Netherlands	25.2	19.6	47.3	27.5
Portugal	-25.3	-7.1	19.2	-14.1
Romania	-81.3	-85.5	-104.8	105.5
Slovak Republic	-11.2	-24.8	-91.1	4.4
Slovenia	19.2	8.1	-10.1	39.2
Spain	-11.2	-5.2	12.9	-0.1
Sweden	3.7	6.5	16.1	-18.3
United Kingdom	15.1	17.6	18.2	9.9

Unconditional: average overall score. Advanced secondary: student is native with both parents with advanced secondary education (reference group for the regressions). Low secondary: student is native with both parents with lower secondary education. College: student is native with both parents with college education

Deviations from the average

Table 12: Average math scores of native students at schools with less than 10% immigrant students (European sample)

	Unconditional	Advanced secondary	Low secondary	College
Austria	11.0	18.9	7.1	0.2
Belgium	25.9	39.9	50.6	39.7
Czech Republic	15.4	13.1	-26.9	19.1
Denmark	18.6	8.8	10.0	10.2
Estonia	20.1	12.3	-0.7	11.8
Finland	53.9	33.1	56.4	28.2
France	1.1	15.3	11.3	12.5
Germany	9.3	27.9	16.1	35.9
Greece	-35.3	-32.8	-47.1	-31.6
Hungary	-3.5	-16.6	-52.6	17.8
Ireland	7.0	-3.1	9.6	-0.5
Italy	-32.8	-23.8	-20.6	-43.1
Latvia	-8.3	-24.5	-15.3	-23.2
Lithuania	-8.0	-38.7	-30.9	-17.1
Luxembourg	-4.5	48.4	117.3	10.4
Netherlands	36.2	32.3	62.6	36.5
Portugal	-28.3	-10.4	14.8	-17.3
Romania	-79.7	-84.5	-98.9	-102.0
Slovak Republic	-2.4	-14.0	-105.8	13.3
Slovenia	10.0	-1.3	-17.7	27.4
Spain	-14.5	-7.6	12.2	-4.4
Sweden	7.9	6.2	25.3	-12.7
United Kingdom	1.0	1.2	23.1	-11.3

Unconditional: average overall score. Advanced secondary: student is native with both parents with advanced secondary education (reference group for the regressions). Low secondary: student is native with both parents with lower secondary education. College: student is native with both parents with college education

Deviations from the average

Table 13: Average reading scores of native students at schools with less than 10% immigrant students (European sample)

	Unconditional	Advanced secondary	Low secondary	College
Austria	5.2	9.7	6.8	-1.4
Belgium	15.9	30.5	41.4	28.5
Czech Republic	-2.3	-4.1	20.0	-3.1
Denmark	9.5	-2.1	-0.2	2.7
Estonia	15.8	12.6	8.0	7.0
Finland	61.9	33.1	57.2	38.1
France	2.7	11.4	11.5	13.4
Germany	10.0	38.9	3.9	29.0
Greece	-25.3	-22.4	-30.6	-26.0
Hungary	-2.6	-15.1	-46.8	13.1
Ireland	32.3	25.5	30.3	28.0
Italy	-16.4	-4.6	-9.5	-26.6
Latvia	-5.5	-17.2	-19.1	-15.2
Lithuania	-14.9	-41.7	-49.2	-22.9
Luxembourg	-5.6	41.8	92.2	15.7
Netherlands	21.8	17.3	46.0	20.4
Portugal	-12.7	4.1	29.4	3.8
Romania	-89.0	-90.6	-118.0	-116.0
Slovak Republic	-18.6	-33.1	-103.0	-1.9
Slovenia	9.4	-5.0	-22.2	24.6
Spain	-24.1	-16.6	7.9	-18.1
Sweden	22.3	19.8	27.1	1.7
United Kingdom	10.1	7.7	17.2	5.0

Unconditional: average overall score. Advanced secondary: student is native with both parents with advanced secondary education (reference group for the regressions). Low secondary: student is native with both parents with lower secondary education. College: student is native with both parents with college education

Deviations from the average

Table 14: Average science scores of native students at schools with less than 10% immigrant students (regions/countries sample)

	Unconditional	Advanced secondary	Low secondary	College
Denmark	-8.0	-21.5	-33.9	-10.5
Flanders	25.3	16.8	21.3	25.2
Lombardia	-4.8	17.0	-0.2	0.6
Andalusia	-30.1	-17.9	-11.6	-28.2
Aragon	9.5	13.6	5.2	10.8
Asturias	4.6	-6.0	-5.4	5.0
Cantabria	5.5	0.2	0.9	12.6
Castile and Leon	16.0	10.1	20.1	11.0
Catalonia	-12.5	-3.1	-14.7	-9.1
Galicia	0.6	-7.0	12.9	-14.2
La Rioja	15.7	34.8	13.3	6.6
Navarre	7.4	-0.7	10.1	1.4
Basque Country	-9.2	-17.1	-1.7	-17.9
Rest of Spain	-20.0	-19.2	-16.3	6.8

Unconditional: average overall score. Advanced secondary: student is native with both parents with advanced secondary education (reference group for the regressions). Low secondary: student is native with both parents with lower secondary education. College: student is native with both parents with college education

Deviations from the average

Table 15: Average math scores of native students at schools with less than 10% immigrant students (regions/countries sample)

	Unconditional	Advanced secondary	Low secondary	College
Denmark	11.0	-1.5	-14.8	2.6
Flanders	41.4	36.1	28.6	43.6
Lombardia	-15.3	2.8	-5.1	-0.2
Andalusia	-39.3	-25.4	-29.0	-43.4
Aragon	10.6	11.6	10.4	10.8
Asturias	-4.7	-18.5	-15.3	-7.6
Cantabria	-0.5	-2.0	-10.8	6.0
Castile and Leon	13.1	4.5	16.1	11.9
Catalonia	-14.3	-14.2	-11.7	-3.7
Galicia	-8.2	-13.5	-0.3	-23.3
La Rioja	23.9	38.1	30.7	5.4
Navarre	13.0	12.4	18.7	16.3
Basque Country	-1.0	-3.9	-1.9	-9.4
Rest of Spain	-29.5	-26.4	-15.5	-9.1

Unconditional: average overall score. Advanced secondary: student is native with both parents with advanced secondary education (reference group for the regressions). Low secondary: student is native with both parents with lower secondary education. College: student is native with both parents with college education

Deviations from the average

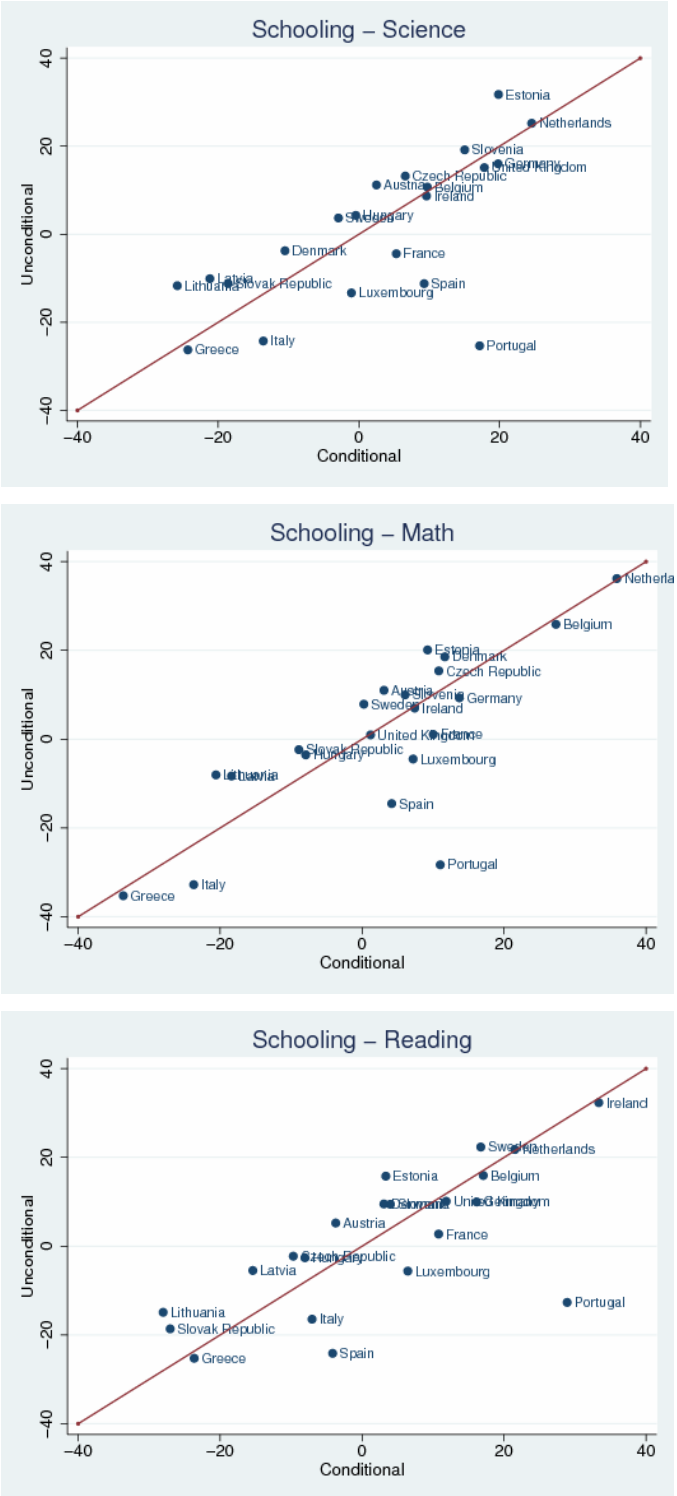
Table 16: Average reading scores of native students at schools with less than 10% immigrant students (regions/countries sample)

	Unconditional	Advanced secondary	Low secondary	College
Denmark	13.6	-0.6	-18.7	11.6
Flanders	41.1	38.6	23.6	48.5
Lombardia	9.6	29.7	14.1	12.8
Andalusia	-36.3	-25.9	-27.5	-38.8
Aragon	2.4	5.9	0.3	-1.0
Asturias	-3.7	-12.7	-0.4	-7.6
Cantabria	-6.2	-14.5	-14.2	2.4
Castile and Leon	-2.8	-10.1	-0.4	-12.0
Catalonia	-4.1	11.7	2.6	4.8
Galicia	-2.2	-15.6	-2.0	-16.6
La Rioja	10.7	30.4	19.7	2.3
Navarre	-0.4	-11.2	9.4	-5.8
Basque Country	6.5	-2.1	5.6	5.0
Rest of Spain	-28.3	-23.7	-12.2	-5.3

Unconditional: average overall score. Advanced secondary: student is native with both parents with advanced secondary education (reference group for the regressions). Low secondary: student is native with both parents with lower secondary education. College: student is native with both parents with college education

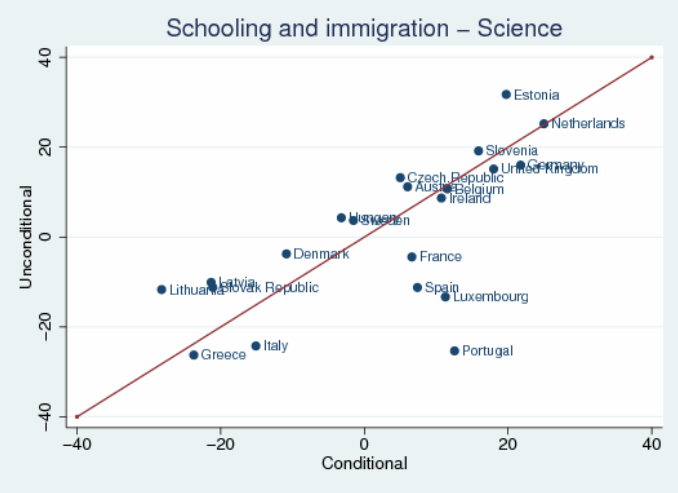
Deviations from the average

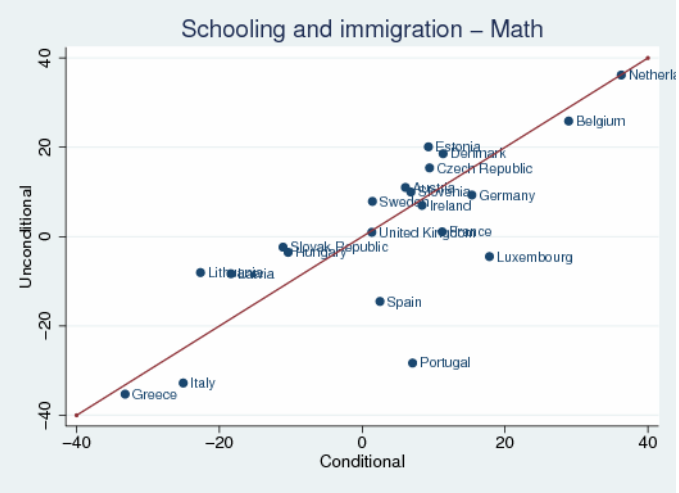
Figure 1. PISA versus adjusted PISA scores (European sample)

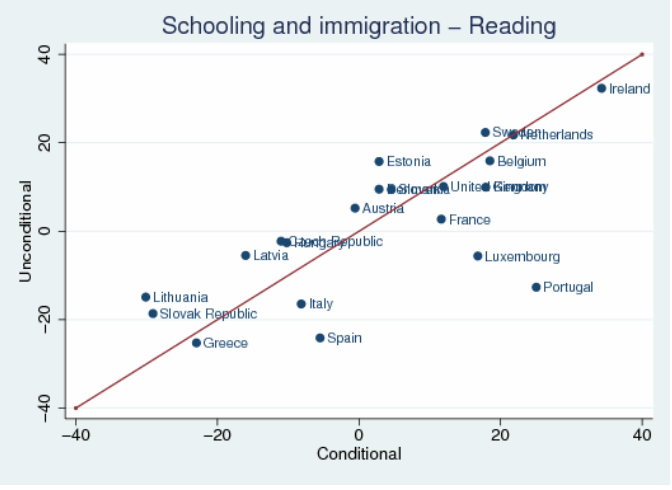


Note: Regression method. Deviations from the average.
Finland and Romania omitted from the graph.

Figure 2: Pisa vs. adjusted Pisa scores (European sample)







Note: Regression method. Deviations from the average.
Finland and Romania omitted from the graph.
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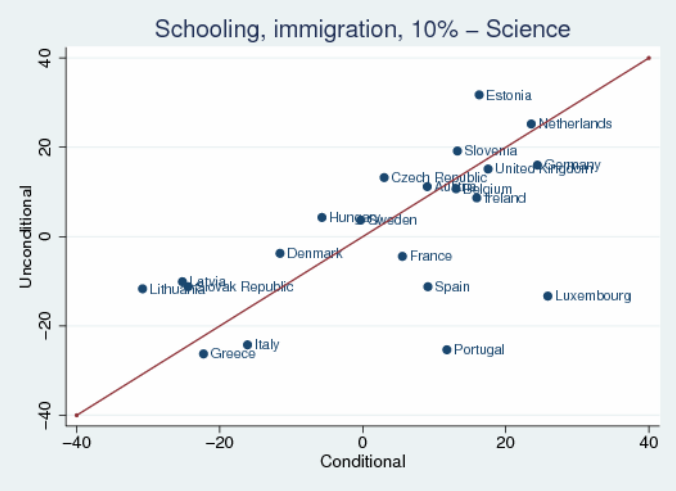
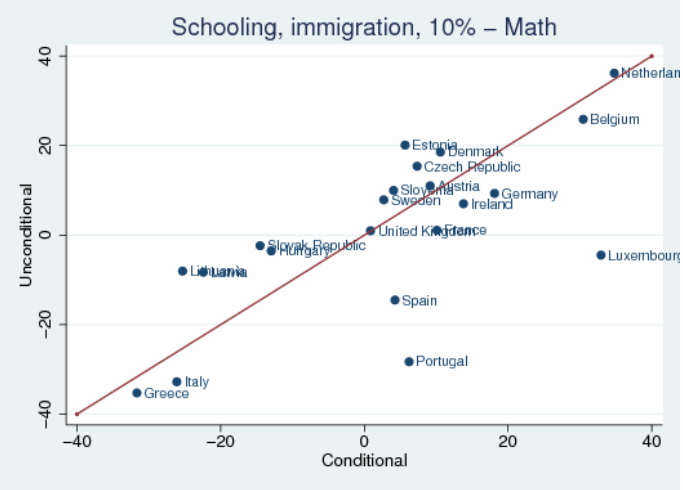
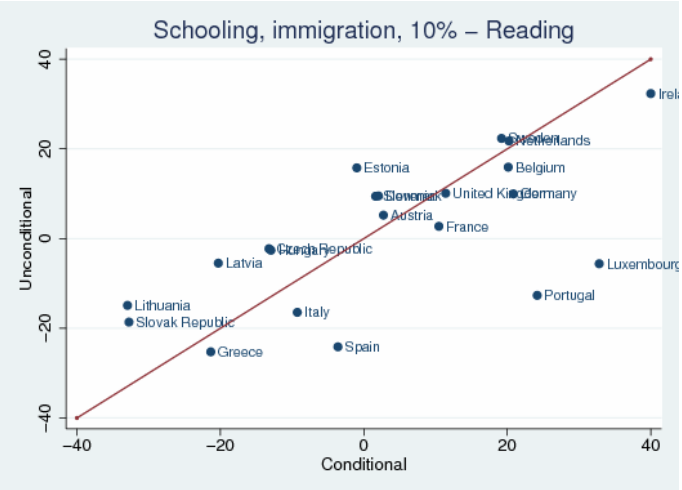
Figure 3: Pisa versus adjusted Pisa scores (European sample)

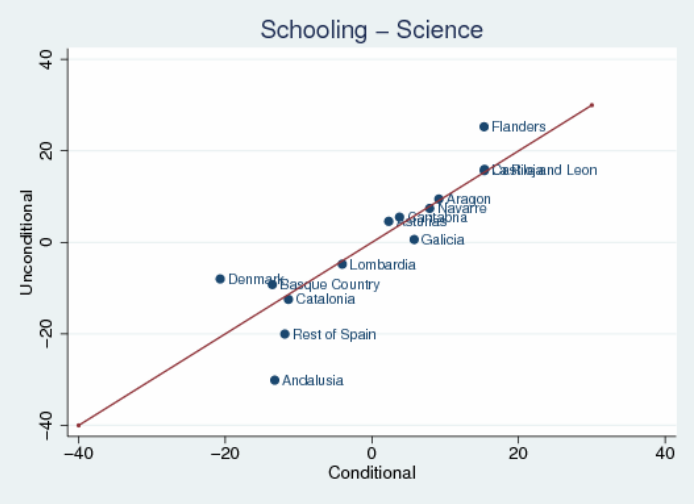


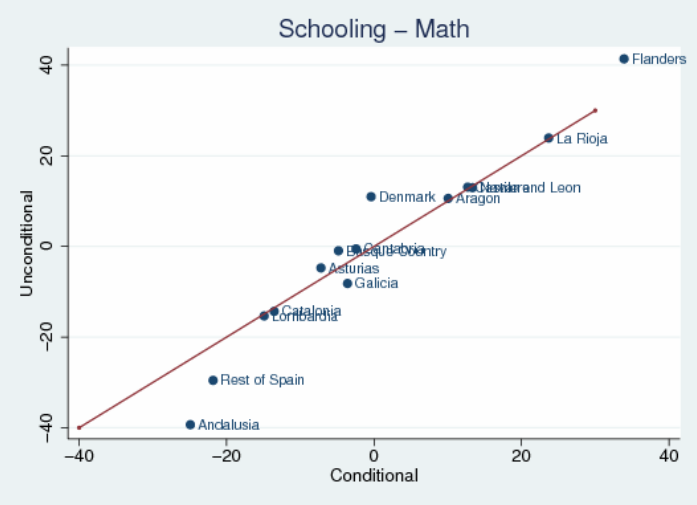


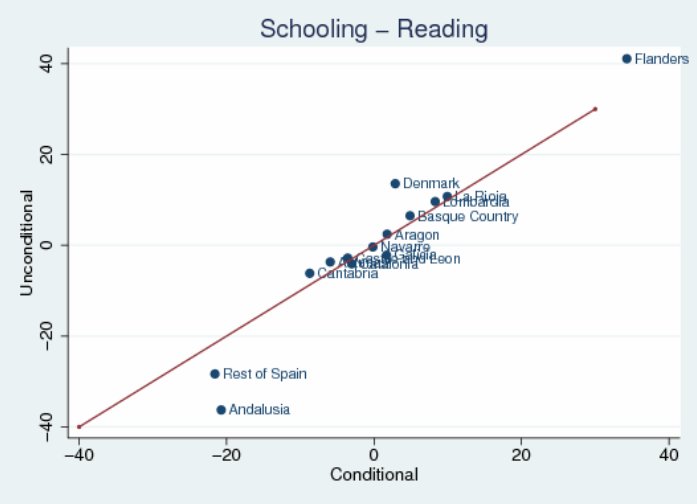


Note: Regression method. Deviations from the average.
Finland and Romania omitted from the graph.

Figure 4: Pisa versus adjusted Pisa scores (regions/countries sample)

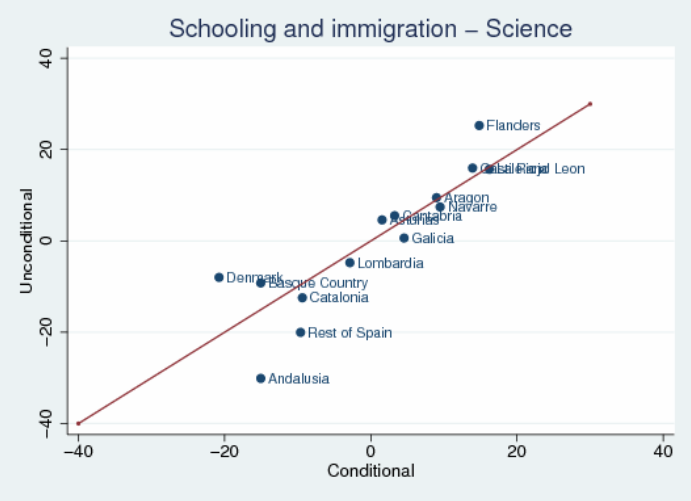


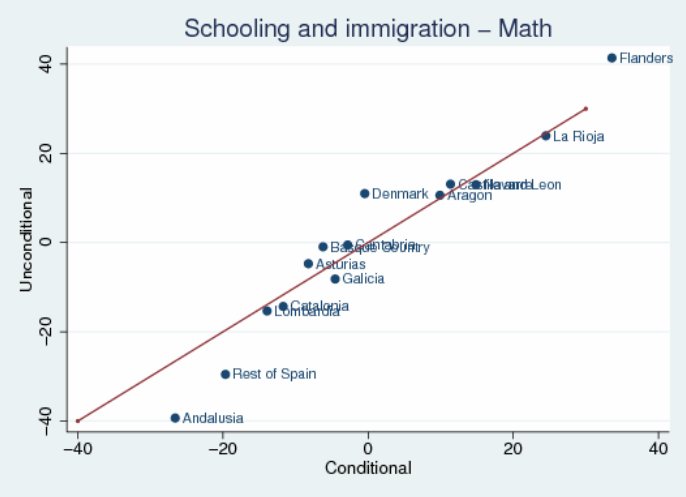


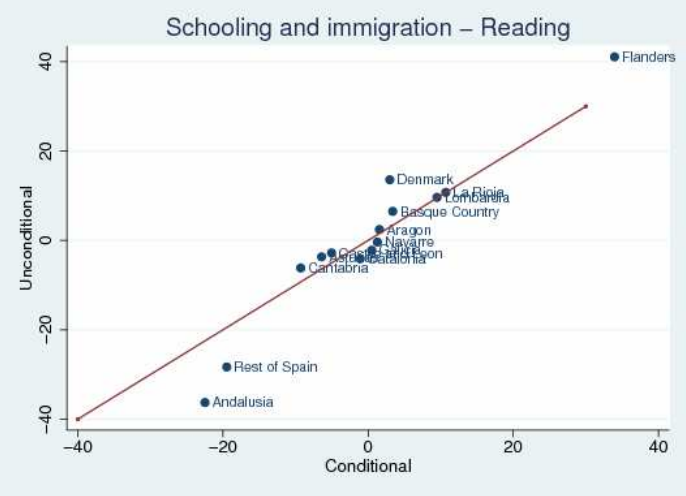


Note: Regression method. Deviations from the average.

Figure 5: Pisa versus adjusted Pisa scores (regions/countries sample)

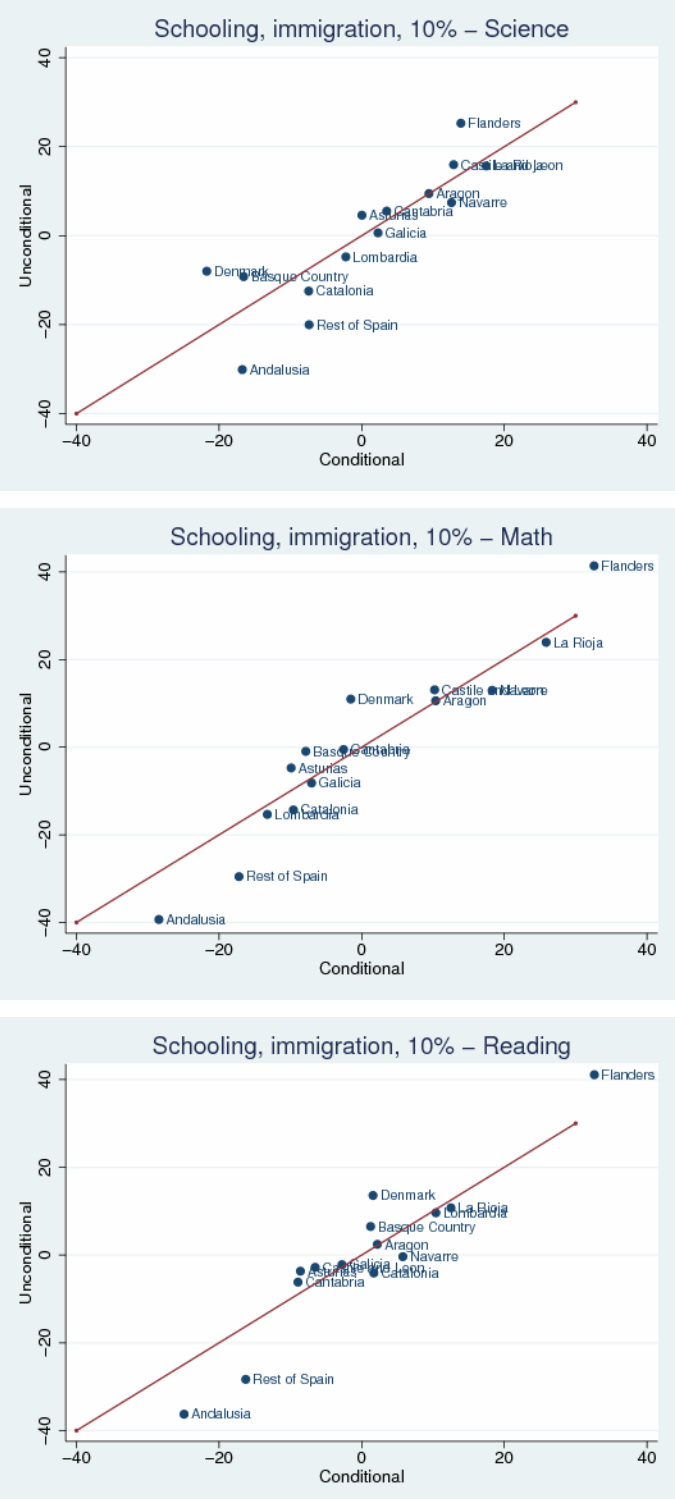






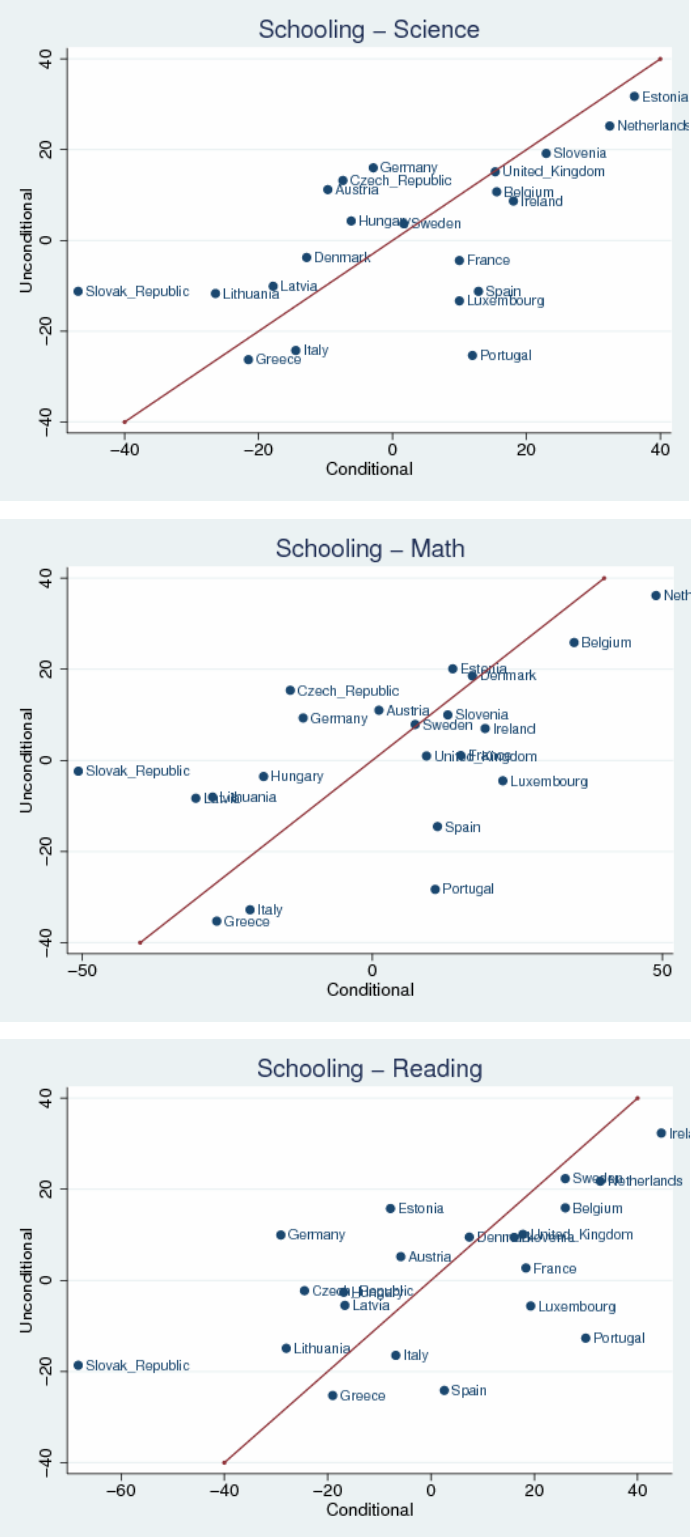
Note: Regression method. Deviations from the average.

Figure 6: Pisa versus adjusted Pisa scores (regions/countries sample)



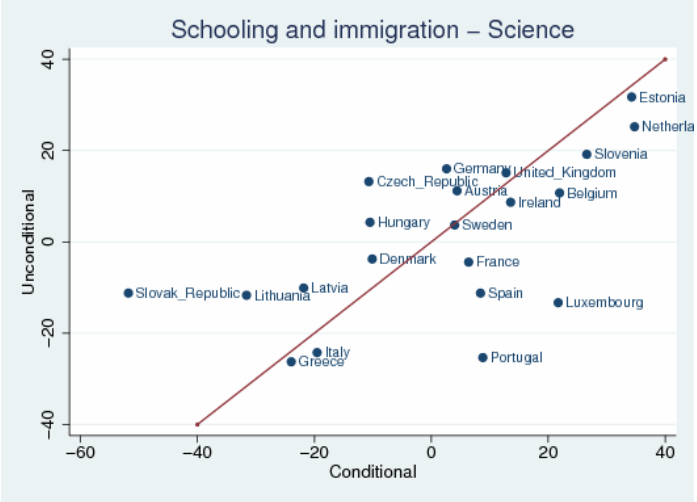
Note: Regression method. Deviations from the average.

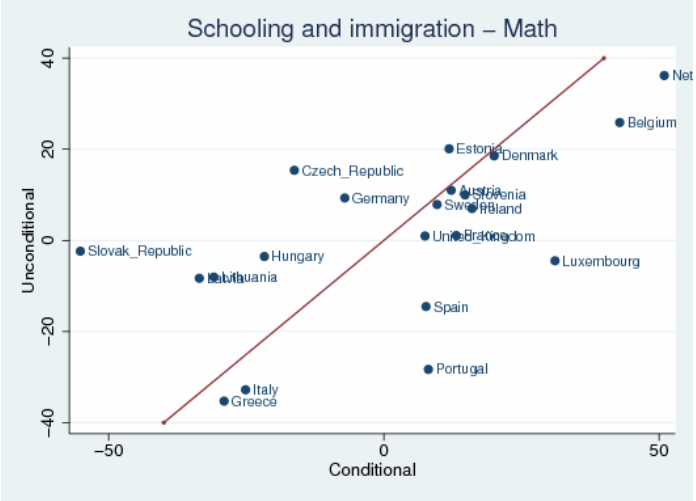
Figure 7: Pisa versus adjusted Pisa scores (European sample)

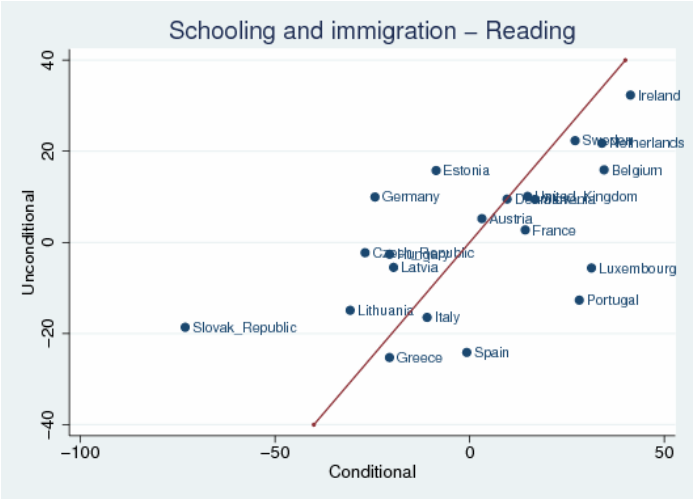


Note: Shift-share method. Deviations from the average.
Finland and Romania omitted from the graph.

Figure 8: PISA versus adjusted Pisa scores (European sample)

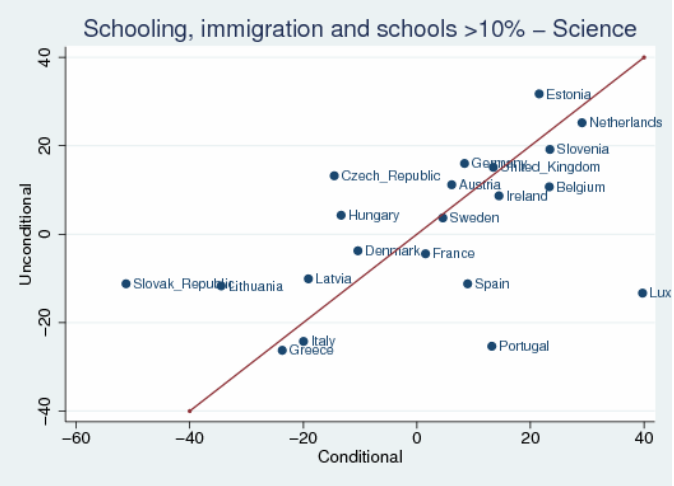


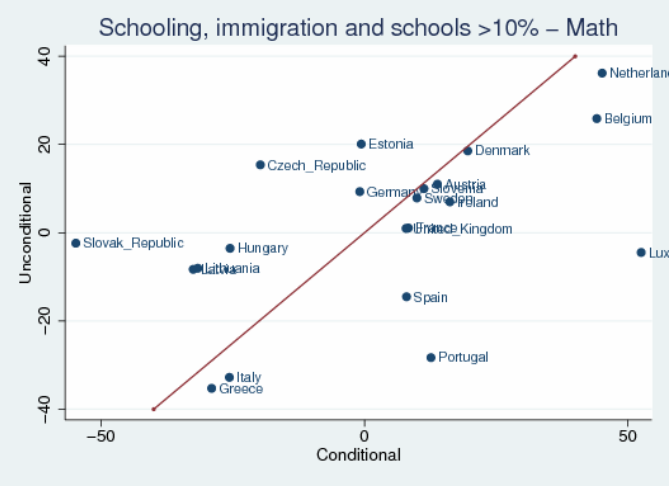


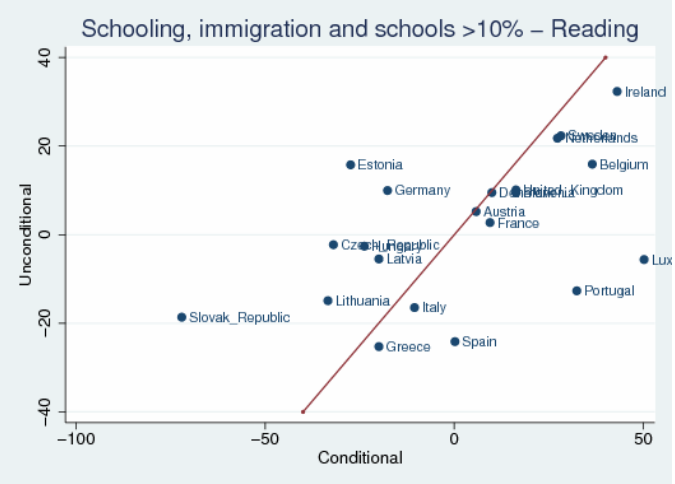


Note: Shift-share method. Deviations from the average.
Finland and Romania omitted from the graph.

Figure 9: Pisa versus adjusted Pisa scores (European sample)

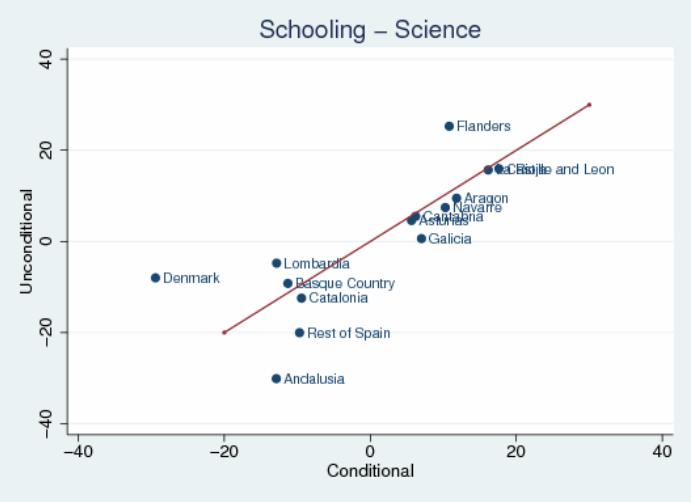


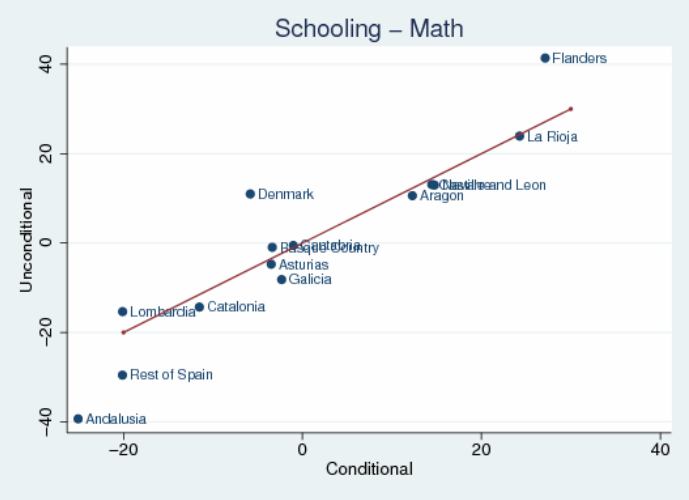


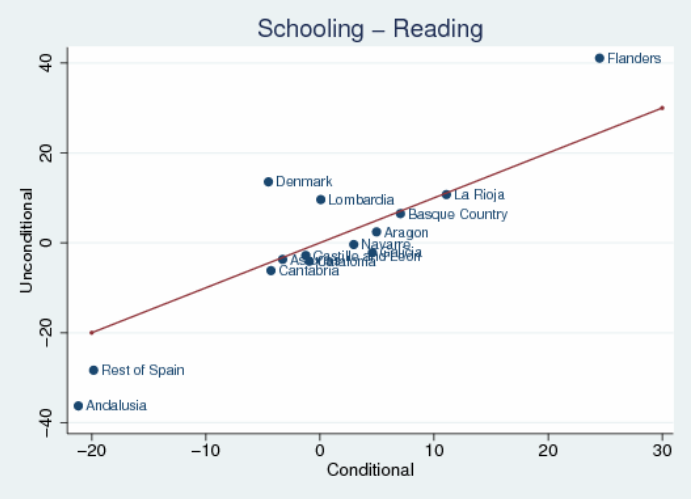


Note: Shift-share method. Deviations from the average.
Finland and Romania omitted from the graph.

Figure 10: Pisa versus adjusted Pisa scores (regions/countries sample)

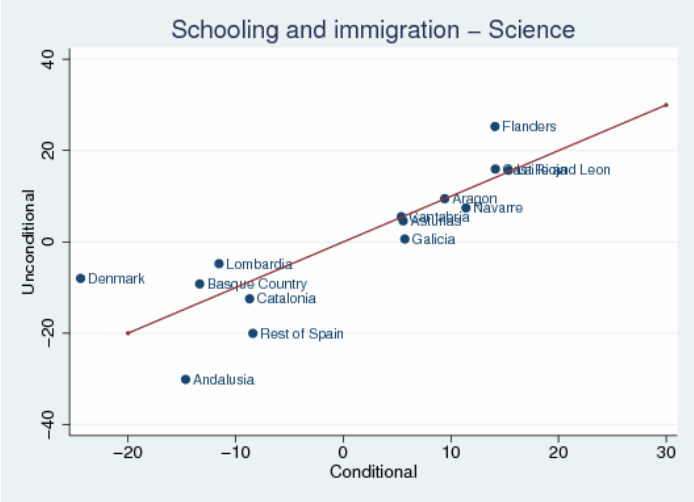


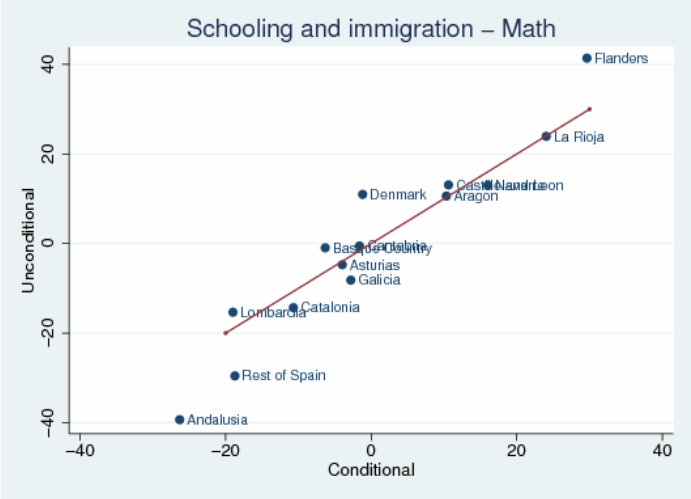


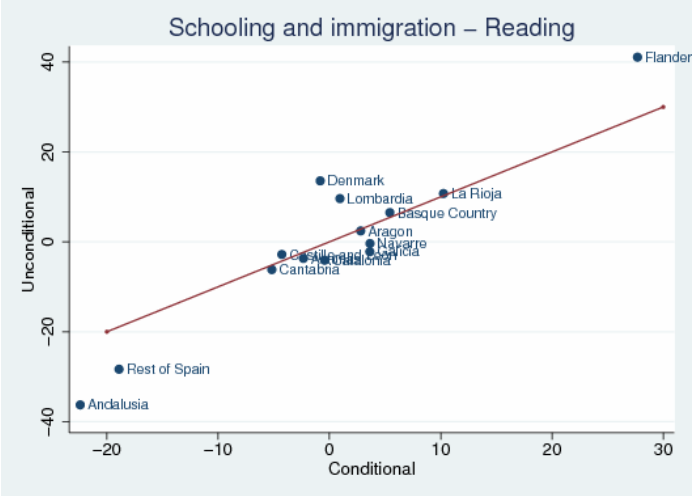


Note: Shift-share method. Deviations from the average.

Figure 11: Pisa versus adjusted Pisa scores (regions/countries sample)

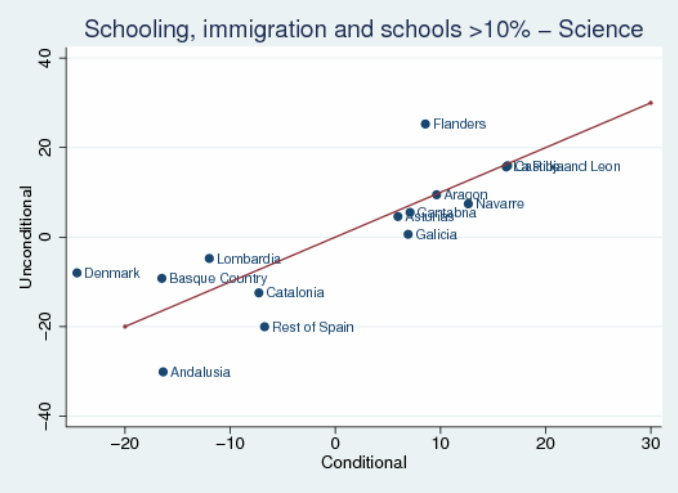


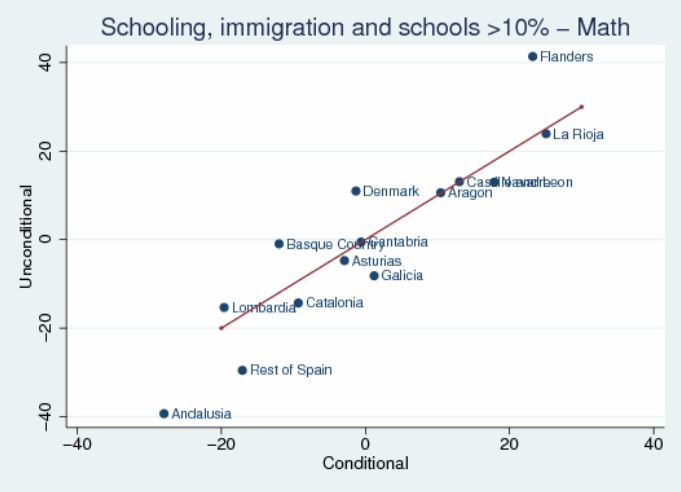


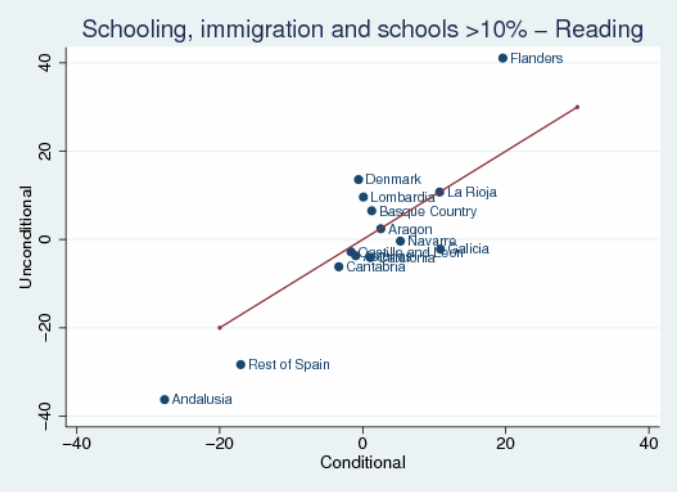


Note: Shift-share method. Deviations from the average.

Figure 12: Pisa versus adjusted Pisa scores (regions/countries sample)

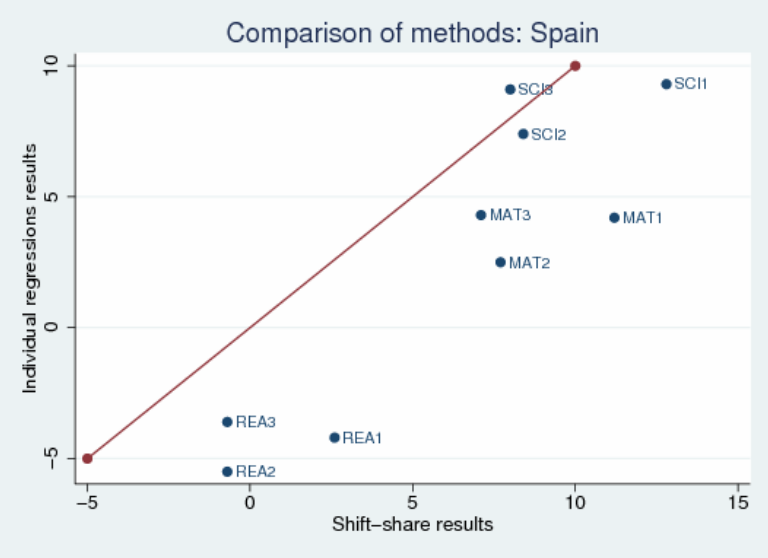






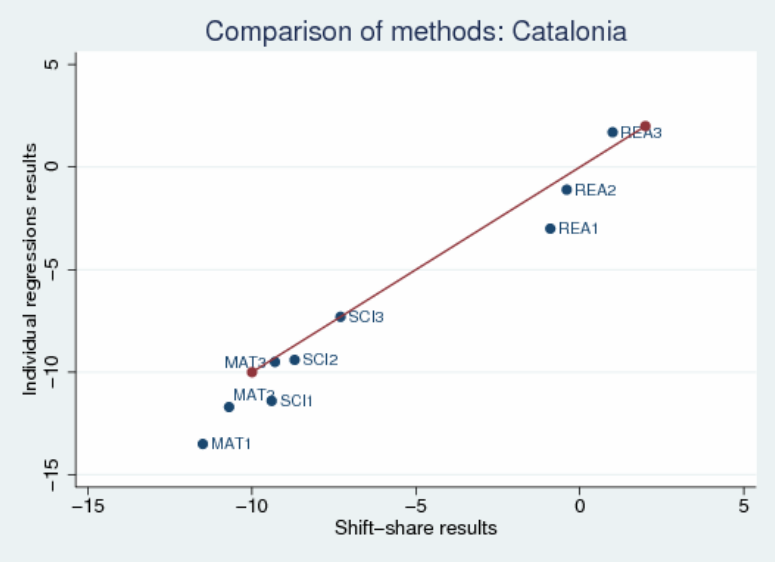
Note: Shift-share method. Deviations from the average.

Figure 13: Comparison of methods on Spain scores (European sample)



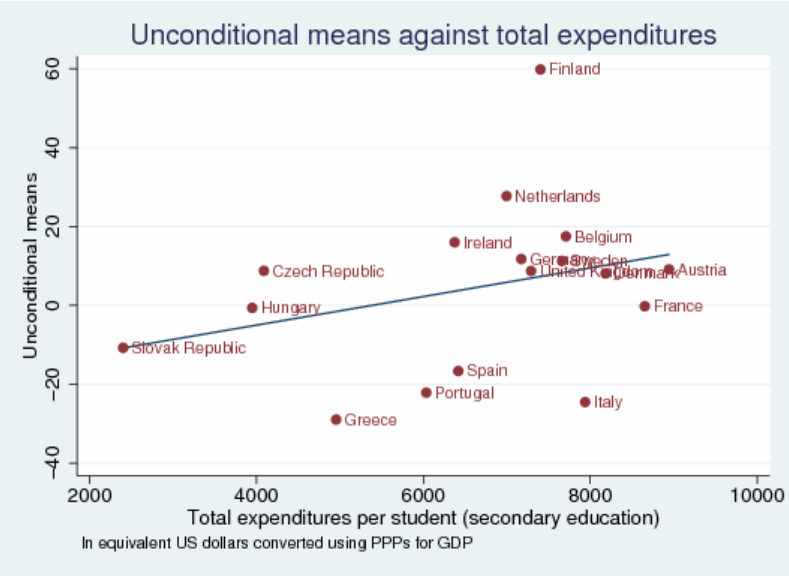
SCI: Science, MAT: Math, REA: Reading. 1: Schooling controls, 2: Schooling and immigration controls, 3: Schooling, immigration and dummy for students attending more than 10%

Figure 14: Comparison of methods on Catalan scores (regions/countries sample)



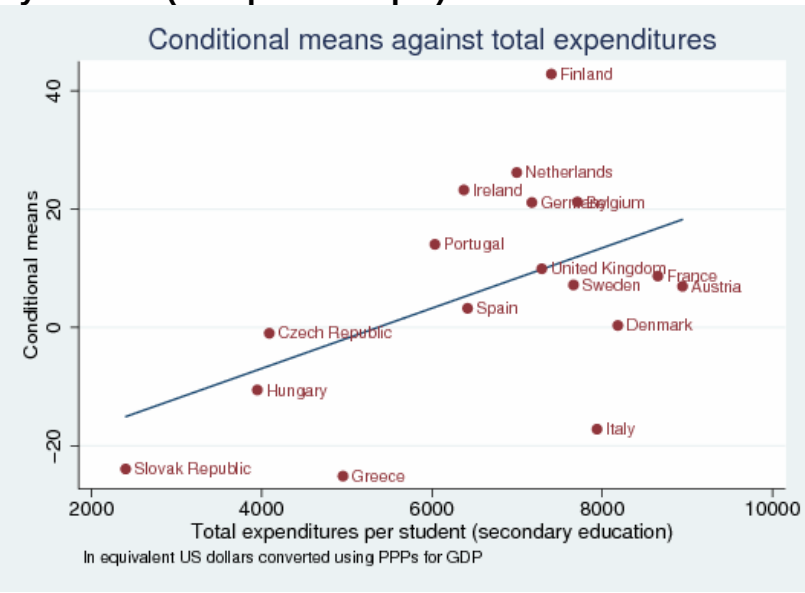
SCI: Science, MAT: Math, REA: Reading. 1: Schooling controls, 2: Schooling and immigration controls, 3: Schooling, immigration and dummy for students attending more than 10%

Figure 15: Pisa scores versus total secondary education expenditures by student (European sample)



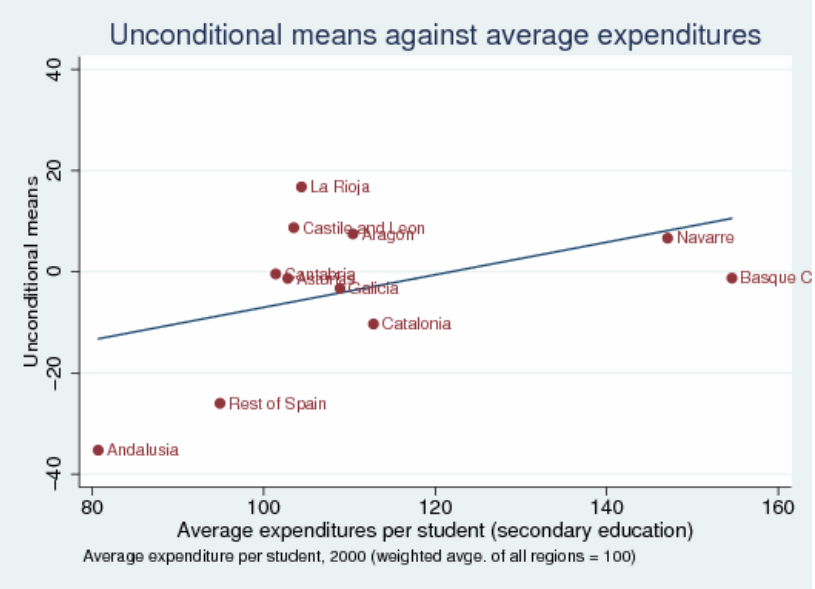
Note: For Portugal and Italy public institutions only.
OECD countries (Luxembourg has been omitted).

Figure 16: Adjusted Pisa scores versus total secondary education expenditures by student (European sample)



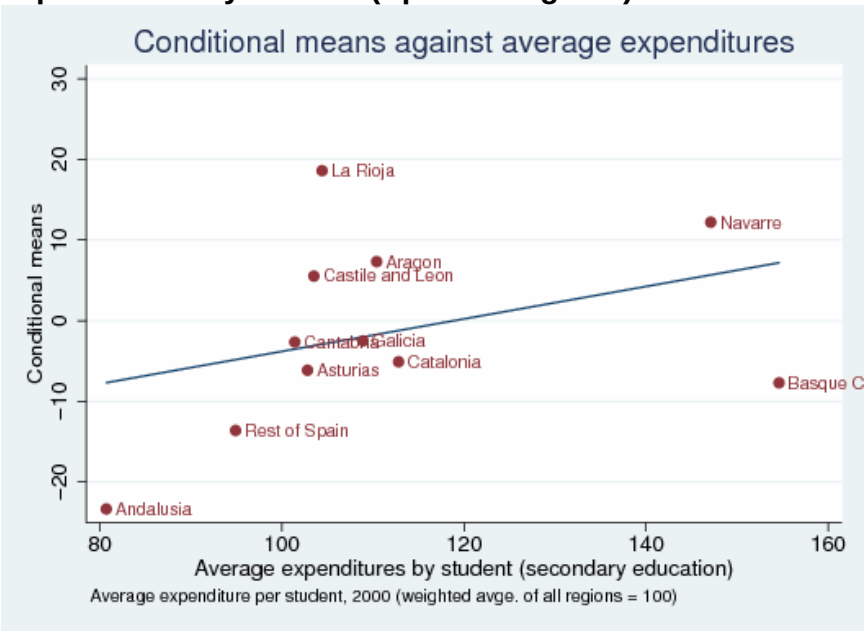
Note: For Portugal and Italy public institutions only.
OECD countries (Luxembourg has been omitted).

Figure 17: Pisa scores versus average secondary education expenditures by student (Spanish regions)



Source: Average expenditures from De la Fuente, Domenech, and Jimeno (2003)

Figure 18: Adjusted Pisa scores versus average secondary education expenditures by student (Spanish regions)



Source: Average expenditures from De la Fuente, Domenech, and Jimeno (2003)