A re-evaluation of the link between autonomy, accountability and achievement in PISA 2009

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Key Finding

- The often repeated finding that school performance tends to be highest where autonomy is combined with accountability is not supported by the data from PISA 2009. This finding, stated in the OECD's own analysis of the same data, turns out not to be statistically significant once we examine the data separately for public and private schools. This implies the assertion that the key to driving up standards is to combine greater school autonomy with sharper accountability is far from proven.

Background

When the results for PISA 2009 were first published in December 2010, a small section of the report noted the interaction between school autonomy, accountability through the publication of schools' exam results and the reading performance of pupils. Specifically it stated:

> "Within countries where schools are held to account for their results through posting achievement data publicly, schools that enjoy greater autonomy in resource allocation tend to do better than those with less autonomy. However, in countries where there are no such accountability arrangements, the reverse is true." (OECD, 2010, Page 105)[1]

This quote was noted by the government in England and has subsequently been referred to since, for instance in the government's consultation paper on school accountability which asserted:

> "The most effective education systems around the world are those that have high levels of autonomy along with clear and robust accountability." (DfE, Secondary School Accountability Consultation, 7th February 2013)

It should firstly be noted that in 2009 the UK was already one of the highest ranked nations both in terms of the level of autonomy afforded schools and the level of accountability to which they are subject. The UK ranked sixth in terms of curriculum autonomy, fifth in terms of resource autonomy (see OECD, 2011) and fourth in terms of school accountability (see OECD 2010, table IV.3.13). For this reason alone it would appear unlikely that the UK itself can gain very much relative to other countries through any further focus on either autonomy or accountability – possible increases in these measures relative to other countries are more or less exhausted even before beginning. However, in the light of the high level of interest in the OECD's findings relating to the relationship between autonomy, accountability and achievement it is also worth further examining the statistical basis of this evidence. This paper examines the extent to which the evidence holds up under further analysis. Specifically, we examine whether the above claim continues to be supported by the evidence once we restrict our analysis to public (that is, state-run) schools.

[1] This finding was further publicised in an edition of the OECD's policy-orientated *PISA in Focus* series specifically highlighting the purported link between autonomy, accountability and achievement (OECD, 2011).

Examining whether this relationship still exists within state schools is of substantive importance. Firstly, it is within such schools that any policy changes relating to granting autonomy whilst imposing accountability are most likely to take effect. Furthermore, the very nature of autonomy may be experienced in an entirely different way by state schools and private schools. In the context of PISA, resource autonomy refers to the extent to which schools have a say over which teachers they employ, how much they pay individual teachers and how they allocate their budget. It is worth noting that even if a public and a private school had equal levels of autonomy on these measures, this may still manifest itself in very different ways. Public schools may have a great deal of autonomy over who they employ and how they spend their budget but may still be operating within well-defined regulatory boundaries. For example, a state school may be free to choose who they employ as a teacher (so would appear autonomous in terms of the PISA questionnaire) but be legally required to ensure that they hold particular qualifications determined by the government. A private school may not be bound by such restrictions. As such, both schools may indicate that they have autonomy over hiring teachers, but the nature of the autonomy is somewhat different for state schools than private schools. Thus, the need for school accountability via publicly available performance data may be less important for state schools than private schools as the former's autonomy is already bound by regulation.

Analysis

The analysis of PISA 2009 underlying the initial OECD statement is described on page 42 of the OECD report with further statistical details given on page 171 (OECD, 2010, Table IV.2.5). Furthermore, the full international data set from PISA 2009 is freely available to anyone[2]. Initial analysis, therefore, focused on recreating the original analysis published by the OECD. The coefficients from the original results are presented alongside coefficients generated by our own recreation of the same analysis in Table 1.

Both analyses are the results of regression analysis of the reading achievement of students in PISA 2009 in OECD countries on a number of potentially influential variables. Regression analysis is a technique designed to allow us to simultaneously explore the relationship between a single outcome variable (in this case reading attainment) and a number of other (possibly interrelated) variables. The analysis is supposed to show us the effect of each of the variables when all of the other influences are taken into account. For example, this should mean we can compare the performance of public and private schools on a like-with-like basis.

In our case the analysis is chiefly concerned with estimating the relationship between autonomy, accountability and performance whilst taking account of the following background factors:

- Whether or not the school is a private school.
- The socio-economic status of pupils as measured by the index of Economic, Social and Cultural Status (ESCS)[3]. A squared version of this measure is also included to account for the potentially nonlinear relationship between ESCS and achievement.
- Gender.
- Whether the test language is the same as the language the student speaks at home.
- Immigrant status.
- The average socio-economic status of pupils within schools.
- School location (whether in a city, town or small town/village).
- School size. A squared version of school size is also included to account for the potentially non-linear relationship between school size and achievement.

The main results of interest are in the highlighted rows of Table 1. These concern the relationship between school autonomy for resource allocation[4,5] and achievement and how this relationship changes dependent upon the extent to which schools are required to publish achievement data. The original analysis indicated that in countries where no schools post achievement data publicly there is a negative relationship between school autonomy for resource allocation and achievement. Specifically, the analysis indicated that, every increase of one standard deviation in the level of school autonomy for resource allocation is associated with a drop of roughly 3.2 points in the average reading scores achieved by

[2] Available from http://pisa2009.acer.edu.au/downloads.php.
[3] This index is calculated for each student individually based upon their responses to various questions about parental occupation and education, as well as detailed questions about the possessions they have in their home.
[4] Derived from items in the questionnaire for school leaders concerning the extent to which schools have control over hiring teachers, firing teachers, establishing teacher salaries, determining salary increases, formulating the school budget and deciding upon budget allocations within the school.
[5] School autonomy for curriculum and assessment is also considered within the analysis but is not found to be statistically significantly related to achievement and is not discussed any further.

students. However, the positive interaction between autonomy and accountability (shown in the second of the highlighted rows) apparently changed the direction of this relationship so that if all schools in a country were posting achievement data publicly then every increase of one standard deviation in the level of school autonomy for resource allocation is associated with an increase of roughly 2.6 points in the average reading scores achieved by students. This led to the OECD's major conclusion stated earlier.

The last two columns of Table 1 show the results of our own attempt to recreate the same analysis. As can be seen, both the coefficients and the standard errors from our analysis are extremely close to those in the original report. It is likely that the very slight differences are purely due to minor updates in the international data between the release of the international report and the release of the version of data downloaded for the purposes of this analysis[6]. Importantly, this confirms that we are undertaking analysis in exactly the same way as was done for the original report, before we go on to develop this analysis further.

Table 1: Ratio of schools' posting achievement data publicly and the relationship between school autonomy in allocating resources and reading performance

	Original analysis (OECD, 2010, page 171)		**Recreated analysis**	
Variable	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
School autonomy for resource allocation	-3.24	1.45	-3.26	1.46
Interaction with percentage of students in schools that post achievement data publicly (additional 10%)	0.58	0.28	0.58	0.28
School autonomy for curriculum and assessment	0.04	0.59	0.05	0.59
Private school	-0.48	1.49	-0.48	1.49
PISA index of economic, social and cultural status of student (ESCS)	17.98	0.26	17.97	0.26
PISA index of economic, social and cultural status of student (ESCS squared)	2.06	0.22	2.10	0.21
Student is a female	36.23	0.51	36.20	0.50
Student's language at home is the same as the language of assessment	17.02	1.23	17.01	1.22
Student without an immigrant background	11.64	1.2	11.64	1.20
School average PISA index of economic, social and cultural status	58.13	0.97	58.07	0.97
School in a city (100 000 or more people)	-2.36	1.21	-2.36	1.21
School in a small town or village (15 000 or less people)	2.93	1.14	2.92	1.15
School size (100 students)	1.61	0.13	1.60	0.13
School size (100 students, squared)	-0.01	0.00	-0.01	0.00
N	**267,425**		**267,425**	

Having verified that we are able to recreate almost precisely the initial analysis published in the OECD's report, we now examine how the results of the analysis change if we separately

[6] The version of the data used for our recreation of the analysis was published in December 2011; one year after the original results are published.

fit the same regression model for public schools (that is, state schools) and private schools. The results of this analysis are shown in Table 2. Somewhat surprisingly, this analysis shows that, when the analysis is split by whether schools are public or private schools, the much publicised link between autonomy, accountability and achievement changes dramatically. For both public and private schools we see that the first of the coefficients of interest is now positive, that is, it is in a system with *no accountability* that schools with greater autonomy achieve better results. Furthermore, for public schools the interaction term is now negative, that is, the association between autonomy and achievement actually *weakens* in the presence of greater accountability.

It should also be noted that not one of the effects described in the previous paragraph is statistically significant. This means that in reality we cannot reach any definite conclusions about the direction of the relationship between autonomy and achievement and how this relationship changes in the presence of greater accountability, beyond the fact that any such relationship must be quite slight. More importantly, our re-analysis of achievement data from PISA 2009 shows that, contrary to the initial assertions by the OECD, there is no evidence of a link between autonomy, accountability and achievement.

Table 2: Ratio of schools' posting achievement data publicly and the relationship between school autonomy in allocating resources and reading performance (Analysis split by public and private schools).

	Public schools		**Private schools**	
Variable	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
School autonomy for resource allocation	2.12	2.08	2.59	3.87
Interaction with percentage of students in schools that post achievement data publicly (additional 10%)	-0.33	0.35	0.01	0.91
School autonomy for curriculum and assessment	0.12	0.62	0.70	1.23
PISA index of economic, social and cultural status of student (ESCS)	18.93	0.29	14.01	0.74
PISA index of economic, social and cultural status of student (ESCS squared)	2.40	0.22	1.05	0.47
Student is a female	37.49	0.56	29.19	1.57
Student's language at home is the same as the language of assessment	17.89	1.30	9.82	2.79
Student without an immigrant background	10.22	1.43	13.35	2.91
School average PISA index of economic, social and cultural status	63.01	1.09	54.5	2.45
School in a city (100 000 or more people)	-3.36	1.33	1.51	3.33
School in a small town or village (15 000 or less people)	2.74	1.19	7.33	3.93
School size (100 students)	1.23	0.14	3.91	0.59
School size (100 students, squared)	-0.01	0.00	-0.09	0.02
N[7]	**221,057**		**41,342**	

[7] Note that the number of students in public and private schools does not quite add up to the number included in the original analysis as a small number of students were in schools where the school type was not specified.

The reasons why splitting the analysis by public and private schools makes such a difference to findings are not straightforward. Further analysis has identified at least three probable causes:

- A very small number of schools of unspecified type (that is, where it is not known whether they are private or public schools) were included in the initial analysis and were found to have a surprisingly large impact on results. These schools were not included in the analysis separated by school type.
- The difference in achievement between public and private schools was found to vary significantly between countries. This fact was not accounted for in the initial analysis which instead assumed a constant difference between public and private schools across countries.
- The relationship between several of the other background variables was found to significantly vary between public and private schools. When this is taken into account the estimated relationship between autonomy and achievement changes.

The approach to analysis we have adopted here, that is, splitting the analysis into public and private schools could be criticised on the supposition that the greatest amount of variation in autonomy is likely to happen between public and private schools. That is, it might be argued, within any country private schools will have one level of autonomy, public schools will have another level of autonomy, and there will be little variance in autonomy within either type. Thus, by splitting our data into these two school types we will ensure that there is essentially no variation between schools in the levels of autonomy they are afforded and thus no realistic chance of detecting a relationship with achievement. However, whilst it is doubtless true that there is an association between school type and level of autonomy, empirical analysis of the data reveals that there is in fact a great deal of within-country variation in the level of autonomy enjoyed by state schools. In fact more than half of the variance in resource autonomy within countries (60 per cent) is retained once we restrict our analysis to public schools. Indeed, in some countries (including the UK) variance in school autonomy is nearly as large within public schools as it is across the country as a whole[8]. This variation in autonomy within a country may possibly be caused by differences in possible types of school governance (such as is possible within the UK) or by differences between administrative regions within a country. Whatever the cause, it is clear that there is sufficient variation in the autonomy of state schools to ensure that our intended analysis is viable.

Note that the above (revised) analysis was done using the same student weights as the original analysis. This means that, whilst in the original analysis all countries are given equal weight, in the analyses split by school type some countries may be given more weight than others depending upon how their student population splits between public and private schools. This approach is sensible because if a country has a larger proportion of its pupils in public schools then the relationship between autonomy and achievement within such schools can be more reliably estimated. It makes sense to give more weight to countries where we can reliably estimate the relationship than to those where we can't. The reverse approach, ensuring equal weight is given to all countries regardless of whether we are examining public or private schools has the serious drawback of leading to giving an

[8] Further analysis also reveals, perhaps surprisingly, that the variance in reported autonomy amongst private schools within countries is even greater than the variance in autonomy within countries as a whole.

enormous amount of weight to a very small number of pupils in countries studying in private schools where such schools are rare. Notwithstanding these difficulties, the analysis has been rerun using the alternative weights. In this re-weighted analysis the interaction between autonomy and accountability becomes even more negative for public schools than is shown in table 2[9]. The interaction coefficient for private schools becomes more positive but remains far from being statistically significant. This implies that the choice of weights does not have a large impact on our results and so cannot be considered a source of the differences from the OECD's original analysis.

Discussion

Our analysis has shown that the conclusions drawn from the PISA 2009 data regarding the link between autonomy, accountability and achievement are not supported once we separately examine the data for public and private schools. The reasons why splitting the data in this way makes such a difference to results are somewhat technical and as such the aim of this paper is not particularly to criticise the decisions made in the initial analysis. However, our analysis shows that when subjected to further scrutiny the conclusions drawn from a given data set can change dramatically. For this reason, we would recommend that, particularly in the case of international data, analyses should be independently scrutinised before being used to promote particular educational policies. Furthermore, it is crucial that sensitivity analyses should be undertaken for such important pieces of evidence to ensure that the nature of the evidence is not strongly dependent upon one particular approach to analysis.

Of course, the literature on the link between autonomy, accountability and achievement is not limited to analysis of PISA 2009. In particular, two further reports by the OECD, based on analysis of PISA 2000 and PISA 2003, are also frequently used to support this assertion; the studies by Fuchs and Wößmann (2007) and by Wößmann, Lüdemann, Schütz and West (2007). A full critique of these reports would take more time than is available here. However, it is worth briefly noting that, although the conclusions in these reports appear supportive of the purported link, detailed examination of the results presented in these papers reveals a less clear cut picture[10]. Furthermore, neither of these studies explored whether the link between autonomy, accountability and achievement remains statistically significant when we perform separate analyses of public and private schools. For this reason, we cannot be certain that the weakness present in the OECD analysis of PISA 2009 data is not also an issue in these earlier analyses.

With the above thoughts in mind, we conclude that the international evidence that freedom for schools, coupled with sharper public accountability, is the key to driving up standards is far from irrefutable.

[9] Although still falling short of statistical significance.

[10] For example, although both of these reports identify types of autonomy that are more strongly linked to achievement in the presence of accountability, they also identify types of autonomy where the relationship works in the reverse direction (for example, see the interaction between autonomy in hiring teachers and accountability shown in table 4 of Wößmann et al). Furthermore, both reports identify instances where schools with a greater degree of particular types of autonomy perform barely any better (and perhaps worse) than those with no autonomy, regardless of the degree of accountability (see for example figures 7 and 8 in Wößmann et al).

References

Fuchs, T., and Wößmann, L. (2007). What accounts for international differences in student performance? A re-examination using PISA data. *Empirical Economics,* 32, 433–464.

OECD (2010). *PISA 2009 Results: What Makes a School Successful? – Resources, Policies and Practices (Volume IV).* OECD, Paris, http://dx.doi.org/10.1787/9789264091559-en.

OECD (2011). *PISA in Focus 9. School autonomy and accountability: Are they related to student performance?* OECD, Paris. Downloaded from http://www.oecd.org/pisa/pisainfocus/.

Wößmann, L., Lüdemann, E., Schütz, G., and West, M. (2007) *School Accountability, Autonomy, Choice, and the Level of Student Achievement: International Evidence from PISA 2003*. OECD Education Working Paper No. 13. Downloaded from http://www.oecd.org/fr/edu/publicationsdocuments/workingpapers/6/.