Research Report DFE-RR183

Understanding school financial decisions

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With thanks to Aastha Mantri for additional research assistance, and to the DfE for providing access to the NPD, CFR and SWC datasets.

Department for Education

Contents

Executive Summary

With over £30bn of public money spent every year, English schools face complex financial decisions that relate almost exclusively to their spending. In this Report, we analyse the degree of variation in expenditure items between schools, and examine how much of that variation is due to their circumstances, and how much reflects specific decisions made by the school. Lastly, we consider the potential for improvements in resource utilisation. Although these issues have been addressed before, most of the existing literature focuses on overall school expenditure. Thus we contribute in a number of ways:

1. By exploiting a new dataset, we can examine schools at a very disaggregated level and isolate some of the real operational decisions that they make on how to allocate their budgets. The new School Workforce Census covers all employees in all schools in the country, and includes information such as age, pay and tenure;

2. We control in considerable detail for the schools' circumstances to ensure that we are focusing on schools that are facing the same operational environment;

3. To better understand discretion over expenditure, we analyse what schools do with their "residual" income. That is, income which is not accounted for by their circumstances;

4. We use data over two years to examine how schools adjust their spending in response to changes in their income.

Results – Commentary

Our results show that there is huge variation in the allocation of expenditure by schools. Even controlling in great detail for the specific individual circumstances of each school, much of that variation remains. For some components of expenditure, the decisions appear to be largely unexplained by any observable features of the school. The results show that even many of the important operational financial decisions of schools are largely idiosyncratic. The degree of difference in expenditure is such that it seems very hard to interpret this as optimal responses to the different perceived local rates of return to particular factors in the education production function. Of course many of our conclusions are reliant on the School Workforce Census, and our analysis emphasises the great importance of maintaining this new longitudinal database.

Why don't schools take a more strategic approach to their spending? There will be a number of answers to this question. One important factor is constraints that reduce freedom over what to spend income on. In the past, governments have earmarked money for specific initiatives, thereby allowing no opportunity for long-term planning on the part of schools. The interactive whiteboard funding and Excellence in Cities were examples of this. Implicit in the introduction of these schemes is that schools are not to be trusted in making choices about spending, and that policymakers know how best to spend the school's budget. It would indeed be interesting to compare the financial decisions of those schools, such as academies, that are now outside local authority control.

Another important set of restrictions comes from the institutional setting around teacher pay and conditions, negotiated between trade unions and government. While some of these restrictions have been relaxed in recent years for some schools, there has been little change to date in practice.

But perhaps more important than the constraints is the lack of incentive for school leaders to get spending decisions right. A careful and considered allocation of spending that approximates an optimal allocation makes little difference to a headteacher and her/his leadership team, who tend to be focused on overall pupil achievement – an outcome that we know reflects little on input decisions. Severe financial mismanagement is obviously a serious issue, but spending (say) three times as much as comparator schools on support staff is not.

The simplest answer to the question "How can we improve schools' financial decisions?" is "Make them matter". By using insights from economics, psychology and behavioural economics, we attempt to shed light on this question

Results – Summary

The results show that there is a very substantial amount of variation in some expenditure decisions taken by schools facing a similar operating environment. This appears to be the case in both primary and secondary phases. The results also show that the amount of variation and the degree to which these reflect real decisions differs across a wide range of operational decisions.

In the items that account for a large share of the budget there is rather less disparity, but it is still non-trivial. Taking teaching expenditure per pupil (which accounts for close to 60% of total) as an example, variation in this expenditure item translates into a gap of about £1000 per pupil between a school at the bottom quartile (25th percentile) and a school at the top quartile (75th percentile). 60% of this variation can be explained by the structural and demographic characteristics of the school, rising to 70% of variation if we include variation in total income. Nevertheless, this leaves some 30% of the variation in teaching expenditure unexplained or idiosyncratic.

We also analyse measures of detailed operational decisions that reveal the schools' decision-making. These are generally less budget-constrained giving the schools more scope for discretion. For example, we find that, controlling for the school context, three quarters of the variation in the number of senior managers is idiosyncratic. Essentially equivalent schools are making very different decisions on how many senior positions to have, also on the numbers of support staff, and so on. The more disaggregated the factor is, the more idiosyncratic the expenditure levels are. Accounting in great detail for the schools' circumstances, we can explain very little of the variations in expenditure on senior school leaders, support staff, Headteacher pay, teacher turnover, and the deployment of teachers by subject (that is, how many hours of a subject are taught by specialists).

This coincides with our analysis of 'unexplained' or 'residual' income, which suggests that discretion is principally associated with expenditure on teachers, educational support, the Headteacher's salary and the school-level pay premium.

Using data from 2008-2010, we find that schools react very differently to changes in income. Only 42% of secondary schools increase expenditure on teachers above any other item. The remaining

58% of schools choose to increase the majority of their expenditure on other items, or allow their budget balance to change the most.

Introduction

Each year schools in England spend over £30bn of public money. Put another way, the state spends over £50k per pupil over her or his time in school, and this expenditure is managed by schools. Schools are much more than simply a team of teachers in classrooms, with the typical secondary school employing over 100 people of whom only around half might be regular classroom teachers. In the private sector an organisation with 100 employees would count as a medium-sized firm, and just like such a firm, schools have complex managerial decisions to make.

The financial decisions that schools have to take are almost exclusively about their spending. To a large degree, schools simply receive income on the basis of the number and characteristics of their pupils (though to a small and decreasing extent they can also seek and receive specific grants to do specific things). Schools, by and large, then spend what they're given although as shown later in this report, some schools choose to build their balances rather than increase exenditures, in response to increases in their income. So an analysis of schools' financial decisions is essentially about how budgets are allocated between different items within a particular year.

It should be obvious that it matters how money is spent on additional resources. The Department's *Improving Efficiency in Schools* notes: "What matters isn't the amount of money spent per pupil, but how that money is spent" (para 11). Schools have a great deal of discretion over expenditure on capital and labour inputs, but are they spending the money effectively? There is a large literature on overall school expenditure and school outcomes, and on certain individual spending items such as number of teachers per pupil, but much less on analysing the details of school expenditure patterns and the extent of schools' discretion over expenditure.

This report is concerned with the variation in expenditure between schools and the potential for improvements in resource utilisation. It exploits a new data source to analyse at a very disaggregated level, how schools' allocate their financial budgets between different inputs. We are able to use this new data source to ask: How much variation is there in expenditure patterns for schools which appear to be in very similar operational circumstances? Do their actions reveal an implicit agreement on best practice? Or is diversity of response the key message?

We analyse the degree of variation in expenditure items between schools. This has been addressed before for some headline spending totals, for example in the Department's publication *Improving Efficiency in Schools* (DfE, undated), and by the Audit Commission (2011). We add to this evidence in a number of ways:

1. Most importantly, we exploit a new dataset that allows us to drill down to some of the real operational decisions that schools make on how to allocate their budgets. This is the first full sweep

of the School Workforce Census, covering all employees in all schools in the country. This means we can, for example, consider the following factors:

- Expenditure on classroom teachers and on senior managers per pupil;
- Proportion of support staff on short-term contracts;
- Proportion of teaching staff with tenure less than one year;
- Age and pay of the Headteacher;
- Proportion of teachers with qualification in their main teaching subject;
- Proportion of hours of maths taught by qualified subject teachers;
- Estimated school-level pay premium.

2. We control in considerable detail for the schools' circumstances so that we are confident we are focusing on schools that are facing the same operational environment;

3. We analyse what schools do with their "residual" income, explained below;

4. We look at how schools adjust their spending in response to changes in their income over time.

Can we use evidence on differences in expenditure to improve school efficiency? This is difficult because the evidence (briefly reviewed below) shows that there is at best a small and statistically weak relationship between schools' expenditure and their outcomes, the level of pupil attainment. This is a problem and a puzzle.

It is a problem because the allocation of larger government budgets is the usual means by which governments attempt to improve the public services they value most. For example, the first decade of the Labour government in the UK produced a 56 percent real increase in school budgets with very large rises for the most deprived schools; yet, the empirical evidence suggests that this attempt to improve schools and to close the social class gap in attainment may not reach its policy goals. Indeed, the increased expenditure has not seen outputs rise at the same rate, and so school productivity has fallen (Wild et al., 2009).

It is also a puzzle. Why does increased spending not necessarily raise outputs by much? It tends to in other contexts. By definition, schools must be spending the money ineffectively. Are they spending money on the wrong things? If so, why? Before this publication of the School Workforce Census it was not possible to analyse workforce composition properly, which is critical in organisations where staff spending accounts for almost 80% of current expenditure. This is why we believe this type of analysis is critical to understanding opportunities to influence the behaviour of school managers. This report contributes to the answer to this puzzle by analysing in great detail the things that schools buy, and considering the possible reasons behind the patterns that emerge.

Our results show that there is huge variation in the allocation of expenditure by schools. Even controlling in great detail for the specific individual circumstances of each school, much of that variation remains. For some components of expenditure the decisions appear to be largely

unexplained by any observable features of the school. The results therefore show that many of the important operational decisions are largely idiosyncratic. The degree of difference in expenditure are such that it seems very hard to interpret these as optimal responses to different perceived local rates of return to particular factors in the education production function. Of course we draw these conclusions on the basis of the data available to us and our analysis emphasises the great importance of maintaining the new longitudinal database on school workforce, the SWC.

If we are correct in asserting the importance of decisions made less reflectively, perhaps decisions are better understood as simply continuing to do things the way they have been in earlier years. If we see a school's expenditure pattern as a reflection of the accumulated and continued idiosyncratic decisions of its recent past, then it is easier to see how schools managed to diverge so much in their expenditure.

If schools are indeed spending money in a largely idiosyncratic fashion, then why don't they do something about this, such as taking a more strategic and optimising approach to their budgets and spending plans? There will be a number of answers to this question.

One important factor is constraints that reduce freedom over what to spend income on and that push schools towards ineffective expenditures. In the past governments have placed constraints on how money can be spent through piecemeal money earmarked for specific government initiatives with no opportunity for long-term planning on the part of schools. The interactive whiteboard funding and Excellence in Cities are examples of this. Implicit in the introduction of these schemes is that schools are not to be trusted in making choices about spending, and policymakers know better than school leaders how the school's budget is best spent.

Another important set of restrictions comes from the institutional setting around teacher pay and conditions, negotiated between trade unions and government. While some of these restrictions have been relaxed in recent years for some schools, there has not been a rush to exploit the release from those restrictions. That is possibly because there are institutional constraints on headteachers too, arising from the difficulty throughout the labour market of implementing nominal pay cuts or forcing staff to accept reduced hours, for example.

But perhaps more important than the constraints is the lack of incentive for school leaders to get spending decisions right. A careful and considered allocation of spending, approximating an optimal allocation, makes little difference to a headteacher and her/his leadership team who tend to be focused on overall pupil achievement – an outcome that seems very distant from resource input decisions. Severe financial mismanagement is obviously a serious issue, but spending (say) three times as much as comparator schools on support staff is not.

This issue has already been highlighted by The Audit Commission (2009), who note the lack of incentives for schools to be economical and efficient. They suggest schools could achieve better value for money as illustrated by the fact that schools often hold excessive balances (greater than 8% and 5% of total year funding for Primary and Secondary schools respectively), which they consider to be 'poor value for money'.

The simplest answer to the question "How can we improve schools' financial decisions?" is "Make them matter". We provide a more detailed commentary on this in the Conclusion, bringing in insights from economics, psychology and behavioural economics.

Review of the Evidence

The overall relationship between school income and quality

The impact of school resources on school outcomes is a complex and controversial one. It seems obvious that more resources for schools should improve pupil attainment, and an emphasis on providing greater funding for schools is almost a given for political platforms. And yet this "obvious" proposition is not in general strongly supported by the evidence. The relationship between money and school quality has been shown to be weak, both in the general case where schools are given more money to spend as they choose and in specific cases where governments dictate how the money should be spent. This statistically significant, yet notably small, association has been found in the few studies that do support causal statements.

The system of funding schools in England, with funding determined by pupil characteristics, makes it almost impossible to use observational data to estimate the causal impact of resources on pupil attainment. The simple correlation of funding levels and average school attainment is strongly negative, reflecting the greater resources diverted to more deprived schools. Even simple regression analysis that controls for prior attainment and social background of the pupils tends to report a negative effect of funding due to unobserved school characteristics. However, several studies in the UK and elsewhere have attempted to find and isolate some random or exogenous change in the level of school resources and use this to measure the resource effect.

The recent studies in the UK have found such effects to be small. Holmlund et al. (2008) exploit random differences in how local authorities distribute their funds to investigate the impact of extra resources on Key Stage 2 exams in primary schools. Overall, they find that an increase of £1,000 in average per pupil spending would increase the proportions of pupils achieving expected levels at KS2 by around 2 percentage points in English and maths. Levačić et al. (2005) and Jenkins et al. (2006) both use the political affiliation of the local authority as an instrument to predict variation in per pupil spending, arguing it is not related to the demographic characteristics of pupils in schools. They find that positive but very small impacts of resources on Key Stage 3 and Key Stage 4 attainment, respectively.

More broadly, in a series of literature summaries Hanushek (1986, 1989, 1996a, 1997, 1998, 2003) conducts a meta-analysis of over 400 estimates in more than 50 studies in the literature and invariably concludes that resource based policies have been ineffective, remarking in his 2003 study "By concentrating on inputs and ignoring the incentives, the resources have yielded little in the way of general improvement in student achievement". Hanushek (2004) suggests this lack of relationship may also be due to teacher quality and resources interacting in the education production function, with the result that there is no consistent best practice in the resourcing of schools. Krueger (2003) re-analyses the studies used in Hanushek (1997) but applies different weighting in his meta-analysis – essentially giving one vote to each study as opposed to one vote to each estimate in each study –

and concludes that reducing the teacher pupil ratio was an effective way to improve standards. The implications of Krueger's study are that resources can improve educational standards if utilised effectively.

For the remainder of this section, we focus on individual items of school expenditure. As will be evidence, for some types of input there are large literatures, and a much weaker evidence base for the effectiveness of expenditures on other types of input.

Class size, the quantity and deployment of teachers

The impact of pupil-teacher ratios on student performance has been extensively studied in many countries. Some studies have been able to use experimental data such as in the Tennessee STAR experiment. In the project, the performance of students in larger classes (24-25 students) was compared to that of students in smaller classes (15-17 students). Whilst there is still some controversy over the class size findings in the STAR experiment, one of the authors of the original study (Kreuger and Whitmore, 2001) argues that "Overall, Project STAR indicates that reducing class size is a reasonable economic investment: the benefits are sizeable and long-lasting, especially for black students, and the overall benefits outweigh the costs." (Schanzenbach, 2006). It is important to note that the experiment and the evidence relate only to young pupils, in junior elementary school. Some interesting new research however, suggests that the real lesson of project STAR might lie in teacher and peer group quality rather than class size (Chetty et al, 2010).

Turning specifically to UK evidence, a set of studies use the National Child Development Study (NCDS), a cohort of individuals born in 1958, to estimate the impact of class sizes on attainment and staying-on rates. The estimated impacts are all either zero (e.g. Feinstein and Symons, 1999; Dearden et al, 2002) or relatively small. For example, Dustmann, Rajah and van Soest, 2003, find a one standard deviation increase in average class size decreases the probability that pupils stay on in education by about 4 percentage points; Dearden et al., 2002, find some wage impact for women only.

There is a little evidence on the impact of learning support and individualised learning. Machin et al. (2007a) use a difference-in-difference framework to analyse the effects of the Excellence in Cities (EiC) programme in the UK on Key Stage 3 outcomes. The programme allocated additional resources to disadvantaged schools within participating Local Education Authorities (LEAs), with schools required to spend the money on one or more of three core areas: learning mentors to overcome educational or behaviour problems; Learning Support Units to provide short-term teaching and support for difficult students; a Gifted and Talented programme, to provide extra support for 5-10 per cent of pupils in each school. The authors find that over time the programme had a positive effect on school attendance as well performance in mathematics, although not in English.

Teacher quality

Evidence on the large variation in teacher effectiveness makes it clear that almost every school resourcing decision is marginal compared to large potential gains from improving teacher quality (for example Aaronson et al. 2007 and Rivkin et al. 2005 in the US and Slater et al. 2009 for the UK). The problem comes in trying to achieve those gains, since schools are unable to observe teacher quality; particularly at the time of hiring (Hanushek, 2010). How to attract effective teachers to a school is

one area where more research is clearly needed, but we do know that teachers, like all workers, are attracted to higher wage opportunities, with studies confirming that salaries and working conditions affect the probability of applying for a job and leaving a school (e.g., Dolton and Van der Klaauw 1999). Economists are now starting to quantify classroom practices and correlate these with measures of student attainment and teacher effectiveness (see Kane et al (2010) and Lavy, 2011).

Teaching Assistants

The number of Teaching Assistants (TAs) trebled from around 60,000 in 1997 over the next decade. A substantial fraction of the additional resources available to schools was spent on TAs, in part in response to the Workload Agreement aimed at removing some duties from teachers. While to our knowledge there have been no randomised control trials evaluating their role, a series of studies that have been carried by Blatchford and others have concluded that the presence of TAs has little direct impact on the grades achieved by their pupils (Blatchford et al (2007). There may be indirect effects on the effectiveness of teachers, for example "more individualised teacher attention" but it is unclear whether this has any measurable impact on attainment.

Resources

Machin et al. (2007b) uses an instrumental variable strategy to investigate the effect of ICT investment on educational standards and finds a positive impact of increased ICT expenditure on primary school performance in English and Science (but no effect in Maths). This contradicts the previous literature which tends to find no effect of extra ICT funding (Angrist and Lavy (2002), Fuchs and Woessman (2004), Goolsbee and Guryan (2006)). Of particular note is Leuven et al. (2004), which used a regression discontinuity design framework to analyse the effect of a policy in the Netherlands. The policy provided primary schools (where at least 70 per cent of ethnic minority pupils or 70 per cent were from different disadvantaged groups) with extra funding for personnel and computers (and software) respectively. They find no effect of the additional personnel funding on attainment and find evidence of negative effects of the computer subsidy. The authors do explain in their conclusion that the personnel funding was unlikely to reduce class sizes (due to low pupil-teacher ratios in predominantly minority schools already).

Data

Our analysis combines four datasets, Edubase, the National Pupil Database (NPD), the Consistent Financial Reporting (CFR) accounts database and the first full collection of the School Workforce Census (SWC). The data is linked using the school establishment number which is common across all datasets. Our criteria for inclusion is simply that the school must have either an SWC record in November 2010 or a CFR record for 2009/10. Many schools we include do not have both: notably academies are not required to submit CFR accounts and newly opened schools in September 2010 will not yet have CFR. We categorise all schools as either primary or secondary using the DfE-standard approach for non-standard entry schools. All special schools are excluded from the analysis.

National Pupil Database and Edubase

Edubase contains an administrative record for all schools, whether maintained or private, in England. We use this to construct information on the structural characteristics of each school so that we are able to compare schools to similar schools in our analysis. The distribution of the structural factors we use from Edubase are summarised in Data Appendix Table 1 and include:

- government region indicators (with additional indicators for the Inner, Outer and Fringe London pay regions since these are important unavoidable factors that determine costs for a school);
- four indicators for whether school is rural, in a village, town or dense urban area;
- school age span (highest and lowest ages of pupils);
- school governance type and whether it is a single-sex, grammar or boarding school;
- the number of full-time equivalent pupils (also squared, cubed and to power four) and also the official school capacity; and
- nursery school presence indicator and size, sixth form indicator and size.

We use the NPD, a DfE administrative database of all pupils in state-maintained schools in England, to measure the demographic background of the school. The NPD contains a wide range of information on pupil characteristics including test score histories, ethnicity and age. Pupil characteristics and test histories are aggregated at the school level to allow us to group similar schools together. The distribution of the demographic factors we use from the NPD are summarised in Data Appendix Table 2 and include:

- fractions of pupils with English as an additional language;
- the fraction and type of special educational needs of pupils at the school;
- the proportion female (also squared) and ethnic composition of the school;
- the fraction of pupils eligible for free school meals (also squared);
- measures of the average neighbourhood deprivation of the schools' pupils (also squared);
- the mean prior attainment of pupils in maths and English at the school (using Key Stage two scores for secondary schools and Foundation Stage profile measures for primary schools)

Consistent Financial Reporting 2009-10

DfE has publicly released the CFR accounts for 2009/10 in full for the first time. The data contains information on income and expenditure in all state-maintained primary and secondary schools in England with the exception of Academies. The income and expenditure data are split into 17 and 32 categories respectively; all expenditure or income of a school is included in exactly one category. Due to the limited number of streams of income schools receive, the income categories are generally specific (e.g. income delegated by the LA, SEN Funding, and so on), whereas the expenditure categories often comprise of many similar items grouped together (e.g. teaching assistants, learning mentors and behavioural managers staff costs are all grouped into the education support staff category).

Some items in the CFR are censored when there are small numbers of employees in a role in a school or when schools spend (or receive) less than some threshold in a staff related category. As a result of this there is a missing data problem for some primary schools but secondary schools remain largely unaffected. Due to the limitations of the data, when we wish to conduct analysis on specific roles (e.g. expenditure on teaching assistants or senior management staff) we must refer to the SWC dataset, described below.

We use CFR data in two ways in our analysis. Firstly, we often want to compare schools with similar incomes and where we do this we use the total income from all sources per pupil, with powers of two, three and four included where relevant. Secondly, we create a series of financial characteristics of the school that are summarised in Data Appendix Table 3 and include:

- Total income per pupil;
- Total expenditure per pupil;
- Teaching expenditure per pupil;Expenditure on education support per pupil.

School Workforce Census

The School Workforce Census (SWC) is individual level data on all staff from local authorities, state-maintained schools and academies in England. The census was taken in November 2010 and this is the first year in which the census has included all schools. The unit of observation is an individual-role, so it is possible for an individual who is both a classroom teacher and Deputy Head to have two observations in the data. However, there does not appear to be consistent treatment of the splitting of roles across schools.

The full SWC has 1,292,494 observations from 21,423 primary and secondary schools including information on over 400,000 teachers and 270,000 teaching assistants. The census includes contract information such as the start and end date, hours worked, annual pay and all roles an individual has within a school (teacher, head of department, lunch time supervisor etc.) as well as an indicator for whether the member of staff is employed by the local authority or the school they are working at. It also includes personal characteristics such as date of birth, gender and ethnicity. The data includes an indicator of whether a teacher has attained qualified teacher status (QTS); information on other qualifications such as subject studied and the level of the qualification (degree, PGCE etc.); and information on the amount of time spent in the classroom teaching each subject.

There are two major data quality problems with SWC: some variables are missing, and for other variables included, there are apparently missing observations. The missingness on variables is a particular problem for indicators such as teachers' qualification (65% missing) and subjects taught in the classroom (68% missing). Although the SWC includes information on all staff, detailed pay information was only made available for teachers (including head teachers) and teaching assistants. As a result of this pay information is missing for around 90% of support staff and 10% of teaching assistants. The very large variation in staff-pupil ratios across schools lead us to suspect that some schools have failed to submit a return for every member of staff and this should be borne in mind during the analysis section. This may also be an aspect for future waves of SWC to tighten up on.

We use SWC to create a series of financial and operating characteristics of the school that are summarised in Data Appendix Table 3 and include:

- Expenditure on classroom teachers per pupil, defined as the sum of gross pay, adjusted by full-time equivalent indicators, for classroom teachers who are not assistant, deputy or head teachers;
- Expenditure on senior management per pupil defined as the sum of gross pay, adjusted by full-time equivalent indicators, for assistant, deputy and head teachers;
- Number (FTE) of senior managers in school;
- Proportion of teaching staff under age 30;
- Proportion of teaching staff with qualified teacher status (QTS);
- Proportion of support staff on short-term contracts;
- Proportion of teaching staff with tenure less than one year;
- Age of the Headteacher;
- Pay of the Headteacher;
- Proportion of teachers with qualification in their main teaching subject;
- Proportion of hours of maths taught by qualified subject teachers;
- Proportion of hours of English taught by qualified subject teachers;
- Proportion of hours of science taught by qualified subject teachers; Estimated school-level pay premium, calculated by averaging across the school the residual from a teacher pay regression that controls for years of tenure (including squared and cubed), sex, age (in a very flexible form), whether QTS, whether part-time, phase of education.

Results – Summary

1. The focus of our analysis is on the degree of variation in expenditure decisions and on how much of that variation is due to the schools' operating environment, broadly defined, and how much reflects idiosyncratic decisions made by that school that cannot be explained by observable factors. We do this for seventeen different educational parameters that the school has leverage over and which might be expected to be important to the school's effectiveness in raising attainment.

2. The results below show that there is a very substantial amount of variation in some expenditure decisions taken by different schools. This is true in both primary and secondary phases. The results also show that the amount of variation and the degree to which these reflect real decisions are both different across the range of operational decisions we model.

3. In the items that account for a large share of the budget there is rather less variation, but it is still non-trivial. Taking teaching expenditure per pupil (which accounts for close to 60% of total) as an example, its standard deviation is 13.5% of the mean value of £3,043 in secondary schools. This translates into substantial variation with a gap of about £1000 per pupil between a school at the bottom quartile (25th percentile) and a school at the top quartile (75th percentile). 60% of this variation can be explained by the structural and demographic characteristics of the school, rising to 70% of variation if we include variation in total income. Nevertheless, this leaves some 30% of the variation in teaching expenditure unexplained or idiosyncratic.

4. At the other end of the scale, we analyse measures of detailed operational decisions that reveal the schools' decision-making. These are generally less budget-constrained giving the schools more scope for change. For example, the number of senior managers in a school varies enormously, with the inter-quartile range for all secondary schools exceeding the mean (of 17). Controlling for the school context, we find that three quarters of this variation is idiosyncratic. Essentially equivalent schools are making very different decisions on how many senior positions to have, also on how many support staff to have, and so on.

5. Our results show that the more disaggregated the factor is, the more idiosyncratic the expenditure levels are. Accounting in great detail for school context, we can explain very little of the variations in expenditure on senior school leaders, support staff, Headteacher pay, teacher turnover, and the deployment of teachers by subject (that is, how many hours of a subject are taught by specialists).

6. Our analysis of 'unexplained' or 'residual' income suggests that this is principally associated with expenditure on teachers, educational support, the Headteacher's salary and the school-level pay premium.

7. Schools react in very different ways to change in income between two years. Only 42% of secondary schools increase expenditure on teachers more than any other item. The remaining 58% of schools choose to increase expenditure the most on other items, or allow their budget balance to change the most. Essentially, almost every possible decision on expenditure change is observed somewhere in the data.

Detailed Results

We first characterise the differences in schools' decisions on their spending patterns. We supplement that with an analysis of how the 'residual' income schools receive is spent, and an analysis of how a change in income is allocated across spending items.

Part 1: How much variation in spending is there for 'like' schools?

In this main body of analysis for the report we analyse the variation in school expenditure patterns for schools facing very similar circumstances.. We analyse school expenditure patterns for the 17 variables derived from CFR and SWC that are described in the data section. The quality of the data in SWC restricts the indicators we are able to create from it. For example, the data on the gross pay of teaching assistants and on the number of teachers and teaching assistants was not of sufficiently good quality to use. Others such as the gross pay of teachers, senior staff and the qualifications of teachers are likely to have considerable inaccuracies and this should be borne in mind when inspecting the distribution of these variables.

Methodology

We describe the amount of variation in each variable of interest, separately for primary and secondary schools, through a box-plot and reports of the mean and standard deviation. In each chart we provide data on all schools taken together, and also on groups of schools. It needs to be emphasised that when we consider 'like schools' we control in far greater detail for the schools' circumstances within each of these groups. The groups are:

All schools

- Large and small schools; schools either side of the median size (separately for primary and secondary schools);
- Disadvantaged schools and non-disadvantaged schools; schools either side of the median percentage of students eligible for FSM (separately for primary and secondary schools);
- London schools and non-London schools.

We also considered a split by school performance, defined in terms of exam results. The key is that school size, location and degree of disadvantage are generally fixed for most schools and can be thoughts of as given. Obviously there is some year-to-year variation in the percentage of students eligible for FSM and in the number of pupils, but it is very rare for schools to dramatically change their category here. Thus we can use these groups as a sound basis for the brief of this study – trying to understand schools' financial decisions on the basis of the reasonably-fixed characteristics of the school. As we add further explanatory variables in the model, while we certainly do not make any strong claim of causality, these variables are not obviously outcome measures. However, a split by school performance is clearly an outcome, and is likely to depend directly on the expenditure variations we are analysing. This direct endogeneity would make any interpretation of such figures extremely problematic. It would be at least as much about understanding school academic performance as understanding school financial decisions. This is therefore completely different to our choice of the three groupings, and our view is that a performance split would not be helpful.

The box plot is a standard tool for giving a sense of the degree of variation. It displays the median, and the upper and lower quartiles of the distribution, thus showing both variation (the inter-quartile range, IQR) and location (where the middle half of the data lie). In addition the box plot also indicates the location of points further out from the bulk of the data. The lines extending from the box finish at the upper and lower adjacent values. The upper adjacent value is the largest observation that is less than or equal to the third quartile plus 1.5*IQR. The lower adjacent value is the smallest observation that is greater than or equal to the first quartile minus 1.5*IQR. Outliers are all values that fall outside either of these points, and the plot shows some outlier values too to illustrate very extreme outcomes.

Next to each box-plot we summarise how much variation in the variable of interest is explained by schools' structural factors, the demographic profile of the schools, and the schools actual income. We want to do this to assess how much variation is due to the schools' circumstances and how much is the result of discretion, decisions that schools have taken on how to deploy their resources. To do this, we present the R^2 statistic from a series of regressions, for each variable of interest, for each group and for primary and secondary schools. The R^2 statistic measures what percentage of the variation in the dependent variable is accounted for – explained by – the explanatory variable. A high value, close to 100%, shows that there is little discretion and most of the differences between schools in their spending in this particular category are simply driven by their observable characteristics. A value of the R^2 near zero suggests that differences in expenditure are essentially idiosyncratic – that schools in the same circumstances are spending very different amounts. These R^2 statistics are therefore key in answering the question we are addressing here. We use R^2 rather than $\bar{R}^2$ (Rbar^2) because we are interested in the total cumulated explanatory power of all the variables at our disposal.

For each expenditure variable and each school group we run three regressions. The first is conditional on what we call structural (S) factors, the second regression adds demographic (S & D) factors, and the third adds the schools income (S, D & I). As described in the data section, the structural factors are created from Edubase and include size and type of school. The demographic factors are created from NPD and include the average prior attainment and average social characteristics of the pupils. The school income from CFR is total income from all sources per pupil, with powers of two, three and four included.

The idea is that we want to isolate and remove variation conditional on unavoidable structural characteristics that impose costs on the school. Second, we want to also take out variation conditional on demographic characteristics that schools need resources to help deal with[1]. Finally, we want to condition on the income that schools actually receive, giving them the opportunity to spend money.

There are a number of preliminary points to make about these regressions that apply to all the charts below. First, we expect that in general the final regression, which adds actual income on top of structural and demographic factors, will not add a great deal of explanatory power. This may

[1] Obviously, these characteristics are not exogenous and are in part a function of the schools' decisions; so these are not to be thought of as fully causal cost function estimates.

seem counter-intuitive since income constrains expenditure, but the school's income depends quite heavily on these structural and demographic factors, and therefore implicitly the second regression is controlling for 'expected' income. So the interpretation of the final R^2 is how much more of the variation in expenditure can we explain if we know the schools 'residual' income as well. Because of the importance of this issue, we undertake a more explicit analysis of this in part 2 of the Results.

Second, adding further explanatory variables has to always increase explanatory power. In terms of the regressions then, the value of the R^2 should always increase from the first (S) to the third (S, D & I) regression. In practice this does not always happen as the sample varies, particularly when we add income (which is missing for new schools and academies). We chose to allow this to happen and to maintain the maximum sample per regression rather than use a restricted sample across all specifications.

Results

We present our analysis of variation in expenditure, demonstrating different approaches to measuring particular expenditure items. Our first results are for overall expenditure, and then show results for teaching staff, senior management teams and support staff.

Variation in total income and expenditure

Income is clearly not an expenditure item but we include it here to benchmark the overall amount of variation in the resources available to schools. Following the approach in the methodology, Figure 1 combines the box plots of total income and the R^2 results of 3 regressions per group.

Looking first at secondary schools, the levels of income are as expected: higher in poor, small and London schools (there is obviously some overlap between these categories). There is also much greater variation in income per head among small schools and schools with higher fractions of poor pupils. The regression analysis shows that about half of the variation in income is due to structural factors, rather less in large and non-deprived schools. Demographic factors add another 20 percentage points (ppts) or so. Overall about 30% of the variation in income per pupil is unrelated to structural or demographic factors (the third column is 100% by construction as income is regressed on income). Note that in low-FSM schools, demographics add very little explanatory power at all, and in general groups with higher variance of income per pupil also see a higher fraction explained by the factors. In primary schools we see much the same patterns though perhaps slightly less marked.

One reason the variation in income is so great and is unexplained by the school's current demographic and structural characteristics is that historical levels of school funding have always been used to determine current levels of funding. This has been particular true over the past decade because stability mechanisms were introduced to protect schools from large falls in income (Chowdry et al., 2010). Two mechanisms are responsible for increasing inertia and diminishing responsiveness of school funding to changing needs. The Minimum Funding Guarantee (MFG) guarantees each school a minimum increase in funding per pupil each year, thus reducing the impact of local authorities' fair-funding formulae. The 'spend-plus' methodology currently used by most local authorities to determine distribution of grants tends to favour a flat-rate increase on previous year distributions, plus an extra increase determined on the basis of a formula. While there is some

rationale for both MFG and 'spend-plus' in terms of financial stability and planning convenience, the negative aspects of these policies need to be acknowledged too.

Unsurprisingly given the similarity between total income and total expenditure, the pattern of results for total expenditure in Figure 2 are very similar. There are some extreme outliers of very high expenditure per pupil, particularly for primary schools. Almost all the variation is explained once income is included, the difference being driven by schools' decisions to allow the balance between income and expenditure to adjust (see also section 3 below).

Variation in teacher expenditure

Figure 3 shows the variation in all teaching expenditure (including senior management and teaching assistants) from the CFR. It does show considerable variation in teaching expenditure per pupil and again there is greater variation among small than large schools, among deprived rather than non-deprived schools and in London. But the differences in variation are less pronounced than for total expenditure. Between two-thirds and three-quarters of the variation is explained once we include income as a factor, so there remains a great deal of idiosyncratic variation in this key variable. This means a great deal of scope for schools to make independent decisions. Note that more of the variation is explained among poor and small schools than non-poor and large schools. So it may be that the amount of unexplained variation in money terms is about the same across categories.

We are able to use the SWC to measure expenditure on actual classroom teachers, i.e. teachers who are not also assistant, deputy or head teachers. This has the particular advantage over CFR of excluding teaching assistants, but we are a little concerned about data quality of variables that are aggregated from gross pay in SWC. Figure 5 shows that overall there is less variation within and across groups, but that there is a great deal of unexplained variation: even accounting for school income, less than a third of the variation in expenditure on teachers is explained. Note that the issue of the sample changing in the third column is quite prominent here, with the R^2 falling for most groups of secondary schools.

Unfortunately the data quality is not really sufficient to say much about teaching assistant expenditure (due to a very large amount of missingness on the pay data), so we move onto looking at variation in support staff expenditure. The data in Figure 4 shows variation in support staff expenditure in the CFR, so it does not allow us to differentiate between different categories of support staff. There is substantial variation in this category of expenditure, overall the standard deviation is about half the mean. About half of that variation is unaccounted for, and including the schools' actual total income adds little conditional on structure and demographics. Levels of expenditure per pupil are higher in primary schools where we also see more variation.

We now turn our attention to variables that might explain variation in teacher quality, rather than expenditure, per se. We are interested in whether the structural, demographic and income characteristics of the school are able to explain how successful the school is in recruiting a teacher workforce that has desirable characteristics. Perhaps most directly related to expenditure is the extent to which a school appears to be paying its teachers a relatively high wage, given their known individual characteristics. This is estimated by a regression over all teachers in a school and takes into account their characteristics, but does not take into account school characteristics or location.

(Note that in the regression sample, the overall mean effect is zero, but is not here as schools have had to be dropped from this analysis sample.)

Figure 18 shows that there is little difference in the average pay premium other than for London schools, but some variation within groups. The overall standard deviation of £2.5k is small relative to mean teacher pay of around £40k. This is perhaps not surprising given the very high use of the standard teacher pay scales. About half of this variation is explained by structural and demographic factors and by income, so there is evidence of some use of discretion in this.

There are a number of measures for the likely levels of qualifications and experience of the teacher workforce. Firstly, Figure 9 shows the proportion of teachers with qualified teacher status (QTS). There is very little variation in this across schools. The averages are all in the high 90s, and there are only outliers below 90%. This is slightly less true in London, and in deprived schools.

Figure 8 shows the proportion of teaching staff under age 30 and Figure 11 shows the proportion of teachers with tenure less than a year. Both these might act as good proxies for teachers' overall experience in the absence of a SWC variable that measures total number of years in teaching. In Figure 8 there are small differences between group averages and relatively less variation. There is more variation – and mostly unexplained – among primaries. These schools are smaller so more susceptible to random variation in teacher age.

Figure 10 shows the proportion of non-teaching staff on short-term contracts, but again we have concerns about the data quality here in the SWC as much of this information is not reported. The mean is 91% in all the groups in secondary schools and a little bit lower in primaries. Overall, there is little variation.

The short-tenure variable shown in Figure 11 includes senior management team teachers. Quite different to what might have been expected given received wisdom, we find very little variation in the averages between the groups of schools. For example, there are only slightly more short-tenure teachers in high poverty schools than low. This is a finding that we confirm in our more extended investigation of tenure distributions. There is also quite a lot of variation within groups and variation is marginally greater among small schools and poor schools. The variation is not explained by the structural factors, nor explained by demographics, nor income (again, note that the sample varies considerably in the final column explaining the 'fall' in the R^2).

Schools that have difficulty recruiting good teachers might be expected to have high proportions teaching in a subject that they do not possess a qualification in. Here we do not distinguish between the subject studied at undergraduate and the teacher training specialist subject. There are fewer observations for these variables because some schools did not fill in the qualifications and curriculum part of the Census (which applies to secondary schools only).

Figure 14 shows the proportion of teachers with a qualification in their main subject. There is a considerable range in the data – taking schools as a whole, the range between the upper and lower adjacent-values is over 60 percentage points. There is less difference in the mean between groups. This is not straightforward to interpret: it is not simply a statement about the qualifications of the teachers, but also about the choices the schools have made about their curriculum. For example, the

relative importance of core subjects against more specialist subjects (such as photography, or citizenship).

Figures 15, 16 and 17 show the proportion of pupil hours taught by specialist teachers in maths, English and science, respectively. Again there is a smaller sample of schools here. The levels are lower in small schools, typically they will need more flexible teachers and fewer specialists. Figure 17 shows that there are slightly more specialists in science. There is considerable variation within all the groups with the inter-quartile range covering much of the entire range of data. No more than a quarter of the variation is explained.

Variation in senior management deployment

We are able to use SWC to distinguish between standard classroom teachers and senior managers such as assistant, deputies and head teachers. The data quality is not as high as we would like it to be and as a result we cannot reliably assess how much time these senior teachers spend in the classroom as opposed to on management duties. Figure 6 shows the variation of expenditure on senior managers, calculated from the gross pay data in SWC. Unfortunately many individuals have pay data missing or at a figure of zero, which may explain why there is a great deal of variation between schools that is mostly unrelated to the schools' circumstances.

The measure of number of senior managers (full-time equivalents) shown in Figure 7 is possibly more reliable as it does not use the patchy pay data. It is not scaled – this is literally the (FTE) number of senior managers – so there are bound to be more in big schools, although size is controlled for in the structural factors. The results show very substantial variation, the standard deviation is approximately equal to the mean. Only about a quarter of the variation is explained, so again idiosyncratic decisions are very important. There are fewer senior managers and there is less variation in primary schools, principally as primaries are a lot smaller and have fewer management job titles to hand out.

We are interpreting age of headteacher as proxy for experience in Figure 12. Data quality is high with very few missing values here. However, there are a number of ambiguous cases on who is the school headteacher. In these cases we have taken the highest paid person designated as headteacher who is working at the school for at least 50% FTE. Remarkably, there are no differences in the mean age across these categories, nor a lot of variation within each group. It is the same story in primary schools. Essentially none of the variation is explained. This can be interpreted as saying that choosing to employ experienced or inexperienced headteachers seems to be a decision that schools take in an unsystematic way – they are not typically more experienced in bigger or poorer schools, or as explained by any of the factors included in our regressor groups.

There is a reasonable amount of discretion on the pay scale as to how much governors choose to pay their headteachers. Figure 13 shows the variation in this headteacher salary. It is a raw salary figure that does not control for the headteacher personal characteristics, age, qualifications, and so on. Nor do we control for school performance other than indirectly through the demographics. There are a number of interesting points here. There are big differences between groups: salaries are higher in large schools than small, higher in London than outside, though disadvantaged and non-disadvantaged schools pay about the same. There is considerable variation within groups too with a standard deviation of £16k in secondary schools, and many very high (and low) values.

Overall, about half of this variation is idiosyncratic, though this fraction is higher in the high-variation groups. For example, in large secondary schools, only 27% of the variation is explained. Again, the pattern is the same in primary schools, though the R^2 is higher.

Part 2: How is the 'residual' income that some schools receive spent?

A different way of conceptualising schools' discretion in spending is to consider how they spend the income that they have that is not accounted for by their circumstances. We describe this as their 'residual' income but it could equally be called unexpected income since the typical 'like' school does not receive this money. One reason that this residual income might be interesting is that it might tell us something about the marginal decisions schools make about spending their last pounds. So, it might help us understand what happens if a school is given a little extra money.

We calculate residual income by regressing each school's total income on the structural and demographic characteristics defined above, and extracting the residual from the regression estimates. We then regress each expenditure item we defined above on this residual income and all the structural and demographic characteristics defined above. In each regression we use the coefficient on residual income as a measure of how the extra pound of income is spent. As we noted, this exercise is similar to comparing the impact on the R^2 of adding income to the regressions above, but here we focus on which items see the greatest change in expenditure.

Table 1 column A presents the results of the relationship between residual income and expenditure items in secondary school. For each expenditure item, we present in the table the coefficient on residual income, the estimated standard error and the R^2. The remainder of the coefficients are not presented.

The top row – for total expenditure – has a coefficient close to 1, as it should have. This implies that almost all the residual income that is given to a school is spent in that year. Many other expenditure items have estimates close to zero, but the items with substantial and significant coefficients are:

Expenditure on teaching staff where the coefficient is 0.2, meaning that for every £1 of residual income a school gets, they spend about 20p on teaching staff;

Expenditure on educational support where the coefficient is 0.08 or 8p in every £1 of residual income received;

Expenditure on classroom teachers in the SWC has a coefficient of 0.1 implying that only 10p in a £1 of residual income is spent on classroom teachers;

Expenditure on senior management in the SWC has a coefficient of 0.01 implying that only 1p in £1 is spent here (though note our concerns about data quality);

School-level pay premium coefficient is 0.29, suggesting that about a third of the residual income is associated with a higher pay premium in the school.

The pay of the Headteacher coefficient is 1.9. Taken literally, this means that more than the extra is spent on the Headteacher's salary. However, these regressions are not intended to be understood as causal, they simply measure association. For example, it could be in part that highly paid Headteachers can attract more income. Also, both current residual income and current staffing structures might be explained by historical income and staffing structures.

Table 1 column B presents the same analysis for primary schools. We see a similar pattern here, though with some interesting differences. The more substantial coefficients are:

Expenditure on teachers (0.32)

Expenditure on education support (0.18)

Expenditure on classroom teachers in the SWC (0.13)

Expenditure on senior management (0.07)

The pay of the Headteacher (1.38)

School-level pay premium (0.28).

In both cases, the pay of the Headteacher is the most highly associated with the residual income.

Part 3: Where income changes between two years, how is it spent?

We compared school income and expenditure in 2008/9 and 2009/10. Only a few schools see stable income; for example, only 11% of schools experienced an absolute change in income of less than 1%, while 22% saw a fall in income and 61% had a rise greater than 5% (all in nominal terms). We are not chiefly concerned about how or why the income increased, but we will use the CFR data to analyse how the change is deployed. Note that as we only have one SWC, we can only consider changes in the CFR data. This analysis relates only to secondary schools.

To make things manageable we group the CFR expenditure items as follows:

- Group 1, "Teachers": Teaching staff costs
- Group 2, "Ed Support": Education support staff costs
- Group 3, "Other staff and staff-related": Supply staff costs, Premises staff costs, Administrative and Clerical staff costs, Catering staff costs, Costs of other staff, Indirect employee expenses, Development and training costs, Supply teacher insurance costs, and Staff related insurance costs.
- Group 4, "Buildings related": Building maintenance and improvement costs, Grounds maintenance and improvement costs, Cleaning and caretaking costs, Water and sewage costs, Energy costs, Non domestic rates expenditure, and Other occupation costs.
- Group 5, "Learning and ICT resources": Learning resources costs (not ICT equipment)and ICT Learning resources costs.
- Group 6, “Other”: Exam Fees, Administrative supply costs, Other insurance premiums, Special facility costs, Catering supply costs, Agency supply teaching staff costs, Bought professional services – curriculum, Bought professional services – other, Community focused extended school staff and Community focused extended school costs.
- Group 7, “Balance”: Total income minus total expenditure

We focus first on average responses, before considering the heterogeneity of decisions made. Table 2 looks at average changes in school income and expenditure items. In order to make all the items add up to the change in income, we measure the change in expenditure on group K as follows:

(expenditure on K in 2010 – expenditure on K in 2009)*100/(income in 2009). Summing up over all these items plus the residual balance adds up to the percentage income change: (income in 2010 – income in 2009)*100/(income in 2009). We split schools up into quintiles of income change and display the results separately for these quintiles.

Change in expenditure on teachers is the biggest single item, but is by no means the whole story. The difference in the percentage change on teachers shows the biggest gradient between Q5 and Q1 at about 4 percentage points, but is considerably smaller than the gradient in income changes of about 15 percentage points. Schools also use their residual balance to take the strain of increases and decreases. Expenditure on resources and on buildings falls, even in some schools with rising income. All quintile groups show an average increase in spending on educational support staff, though somewhat greater in the quintiles with rising income. Spending on teachers does fall in the schools with the largest falls in income, but not by a great deal.

It is interesting that there is an asymmetry between schools with substantial increases in income and those with substantial falls. The former on average increase expenditure on teachers quite substantially, the latter do not decrease it on average. This is both a major total of expenditure and also one that is difficult to cut.

We now look at the range of different responses schools make to changes in their income. Table 3 explores which expenditure items schools choose to make the biggest change in. For each income change quintile, we report the percentage of schools that make the biggest increase in expenditure for each group. For example, looking at the bottom left number in the table, 27.85% of the schools in the bottom quintile made their largest increase in expenditure on teachers.

Table 3a reveals some interesting facts. In particular it shows a huge range of different decisions taken by schools. Fewer than half of schools, 42% on average, made an increase in spending on teachers their largest change. This percentage is constant across all the top four quintiles. The next most popular decision in each quintile and overall was to let the budget balance adjust, 22% of schools overall. Note that given the definition of the expenditure change (as a fraction of 2009 income level) they are all in the same units. Between a half and a third of schools in each quintile made other decisions on what to increase spending on the most, with no overall pattern among the other groups of items. It is worth repeating that only 41% of schools with the biggest rise in income chose to make the biggest spending increase on teachers. The pattern again fits the emerging findings of a lot of variation in schools' decisions.

Table 3b shows the expenditure items with the lowest rise or biggest fall, i.e. which item each school makes the lowest increase in expenditure on. For the top three quintiles, the most common decisions are for resources, buildings and other staff costs, but the distribution is fairly flat: there is a wide set of decisions made.

Figure 19 shows the full variation in the decisions taken by schools in response to a change in income. It uses the box plots introduced above to show the distribution of the change in expenditure (as defined above) for each of the expenditure groups across the five income-change quintiles.

As we have seen from Table 3, expenditure on teachers shows the biggest average across all quintiles. But it also shows the biggest variation in terms of the inter-quartile range and the biggest range between the upper and lower adjacent values. As Table 4 shows, around 60% of schools increase expenditure by more on other factors than on teachers. In particular, the variation on teacher expenditure is greatest in the top and bottom quintiles. Looking at Q1 schools, the median change is about zero, but there is very substantial variation around that.

Figure 20 adopts the same overall layout as Figure 19, but plots the distribution of the change in expenditure on an item relative to the change in income: (expenditure on K in 2010 – expenditure on K in 2009)*100/(income in 2010 – income in 2009). It is likely that some elements will be subject to "denominator effects": when the denominator (income in 2010 – income in 2009) is approximately zero, the variable will become very large. Note that negative numbers are perfectly possible here, and indeed the figure shows to be very common. These arise for example if a school sees a rise in income but reduces expenditure on a certain item.

The message of the figure is again that there is great variation in the decisions that schools take on how to deploy the increase in their budget. Focussing on the top two quintiles where denominator effects are less of an issue, we see no real commonality of response in the shares accorded to the different groups. Some schools with the biggest increases spend it all on teachers while others reduce teacher spending. The even greater range of variation in the lower quintiles reflects wider differences in decisions but probably also derive from the denominator effect.

Figure 21 plots the normalised percentage expenditure change, (expenditure on K in 2010 – expenditure on K in 2009)*100/(income in 2009), against the percentage change in income, (income in 2010 – income in 2009)*100/(income in 2009) for each K, along with the best linear fit. Each observation represents one secondary school. There are strong positive relationships for expenditure on teachers, and for the residual budget balance. There are only weak positive relationships for other staff expenditure and for buildings related expenditure. These linear fit lines capture the average relationship, but again perhaps the main finding of these charts is the variety of relationships between budget changes and spending changes. There are many schools in 'off-diagonal' cells for teacher expenditure and others.

Conclusions

Money does matter to schools because they buy the resources that allow teaching and learning to take place and this report we have studied the spending decisions of schools. One of the main contributions is to exploit a new dataset, the first full sweep of the School Workforce Census, which enables us to identify very specific staff expenditure decisions made by schools. We have shown very substantial variations in operational decisions, and also shown that much of this variation is idiosyncratic rather than explained by the schools' circumstances. This high variability in resource utilisation has also been shown internationally (OECD, 2008).

In this final section we consider whether there are policy responses to this known variation in spending patterns that might be more effective in improving schools' financial decisions. The current policy approach is to provide schools with information to compare spending patterns with 'like'

schools and to use policy briefings to disseminate best practice. We believe there are a number of problems with this approach and suggest how a behavioural economics approach might be capable of improving school financial decisions.

Difficulties with current policy approach of dissemination of best practice

The current approach to helping schools make efficient financial decisions consists of a two-fold approach of benchmarking and best practice advice. The DfE School Financial Benchmarking website[2] allows schools to compare their CFR returns to those of similar schools across the country to see where their own spending is significantly different from peers. However, the website's usefulness to schools is clearly limited because it cannot disaggregate teaching staff expenditure between management and classroom teachers, and is silent on which of these comparison schools is a successful school.

The website does not allow users to easily relate these high level expenditure data to school outcomes. It is therefore an inadequate tool for giving any explicit advice on best practice on spending patterns. Perhaps this lack of directed advice explains why only a minority of headteachers and managers have ever accessed this website; in a sample of 38 schools, Dodd (2008, p. 38) finds that: "Few of the schools take a genuine interest in or see much value in benchmarking their performance using either parent local authority data or the DfES benchmarking web-site. This is slightly surprising as one of the characteristics of the sample schools is a refusal to accept that current levels of performance cannot be improved." The DfE reports that usage has picked up in more recent years (2010-11).

There are many sources of ideas available to schools on how to spend their money (although some are more firmly backed by evidence than others), in the UK and further afield[3]. Some recent examples which are based on analysis include a series of briefs released by the Audit Commission (2011a, 2011b, 2011c, 2011d) outlining potential areas for cost savings and efficiencies. The reports covered areas including classroom deployment, the curriculum, and managing staff absence and cover. Although the reports suggested there were many areas in which savings may be made, the authors concluded most areas held limited scope for cost reduction and suggested better utilisation of teaching assistants was the area which may hold the most scope for savings.

In a second example, the Sutton Trust released detailed guidance (Higgins et al, 2011) on "how to spend the pupil premium", which cited research findings. The document listed possible choices with an evaluation of the likely impact on test scores and the cost effectiveness.

These guidance documents on best practice are necessarily limited by the lack of a strong and robust evidence base from which we can specify what best practice is, either in general or varying with circumstances. This is a serious impediment to improving schools' financial decisions. As we noted above, while it seems unlikely that the patterns of substantial and largely idiosyncratic variation we see are optimal decisions, there is no agreed and well-supported view of what would be optimal.

[2] http://www.education.gov.uk/sfb

[3] For example, some explicit quantified guidance for US schools in "Improving Teaching and Learning When Budgets Are Tight": http://www.edweek.org/ew/articles/2011/09/01/kappan_odden.html.

The lack of any firm recommendations at an aggregate is compounded by the fact that schools do face very different operational environments. The quality of instruction and a school's climate are complex and abstract. Whereas centralized systems are good at imparting simple spending rules, it is not obvious that remotely-designed rules are effective in dealing with complex resource use. Government agencies do have a role in facilitating analysis of aggregated schools' data and implementing careful studies, both of which should influence understanding on best practice. However, they are likely to be less good at understanding that complex resource development is necessarily sensitive to specific contexts, so the learnt experiences of schools will always be critical. ''Bottom-up'' development of knowledge in this way also holds the potential of substantial long-run productivity growth through radical innovation at schools. Furthermore, teachers may respond more positively to a system that empowers them to make choices rather than imposes restrictions.

Using behavioural economics to help improve financial decisions

The behavioural economics tradition is well suited to analysing how to encourage headteachers and financial managers to take a more proactive role in improving school efficiency. Interestingly, Dodd (2006) reports that the majority of headteachers believe their school is efficient, but this seems unlikely giving that many heads devolve school resource planning to bursars who simply produce budgets based on rolling-forward historical expenditure.

Dolan et al (2010) characterise the innovations provided by behavioural economics as: "*Drawing on psychology and the behavioural sciences, the basic insight of behavioural economics is that our behaviour is guided not by the perfect logic of a super-computer that can analyse the cost-benefits of every action. Instead, it is led by our very human, sociable, emotional and sometimes fallible brain.*"

It is now clear that we make decisions in two ways: reflective and automatic (see Thaler and Sunstein, 2008). The first is what traditional economics focuses on and we described towards the start of this report, based on information, constraints and incentives. The second is based on more immediate stimuli and reflects much more automatic and seemingly irrational and inconsistent decisions. It has been described as "changing behaviour without changing minds".

There is a difficulty here, mentioned above, in that the research base does not provide a "best allocation" that we can use the tools of behavioural economics to 'nudge' people towards. Unlike, for example, in trying to affect obesity, there is no obvious best behaviour to adopt. The goal instead has to be to get schools to be more reflective and thoughtful in deciding their spending patterns. This trend towards encouraging schools to think more about spending is evident in the School Financial Benchmarking website. Here we make five suggestions (drawing on Dolan et al., 2010) as to how behavioural economics can help take this approach further:

1. Get the right messenger

The reception that people give a message, such as suggestions on school spending, depends on the nature of the messenger. People are generally more open to information from others with demographic and behavioural similarities, and who are credible experts. This suggests that headteachers of similar schools – people grappling with the same daily problems – might be potent messengers. Of course, headteachers are not credible experts in the research evidence on best

practice. However, where a school is required to cut its budget, the headteacher of the very similar school that already operates on the lower budget is a credible expert in how this is achievable.

2. Give explicit incentives for schools to save money

The current financial system for schools offers no incentives to save money. Indeed, for local authority maintained schools it is important to spend all income received to avoid the budget being reduced in future years. While there are reasonably important incentives for improving outcomes (via school performance tables etc), they are rather distant from the financial decisions – and may even be disconnected in the minds of school leaders. While we do not want to encourage a 'race to the bottom' to provide the cheapest education possible, school governors might be encouraged to offer bonus payments to headteachers and financial managers under certain circumstances. One situation might be where a school is identified as having higher costs than other schools in identical structural and demographic circumstances, and so a share of any cost reduction achieved could be passed to school leaders in bonus payments. Another situation where bonus payments might be appropriate is where a school is running a deficit and so has little option but to reduce costs. It may sound counterintuitive to pay bonuses in this situation, and would be politically difficult in a time of austerity, but by aligning the incentives of school leaders and governors it may encourage difficult or even innovative cuts to be made.

3. Schools are attracted to following typical behaviour or norms

School ought to be interested in what other schools do, and reporting positive norms has been found to encourage individuals in achieving desirable outcomes. Once again, our problem is a lack of understanding as to what constitutes best practice in schools. However, encouraging high cost schools (given their circumstances) to explore data on spending in similar schools is likely to improve the efficiency of the system overall. This may not happen automatically because the benchmarking website is not currently very heavily used. One approach could be to use data to identify schools with unexpectedly high costs and pro-actively transmit with information to their school leadership teams, with the requirement that they be considered by school governors. All schools could also be encouraged to carry out routine "waste audits" to see whether funds are being spent inefficiently (see for example, Grubb and Tredway, 2010, and the Audit Commission, 2009). Clearly, these suggestions rely somewhat on traditional regulation rather than behavioural nudges.

4. Prevent rolling forward historical spending being the default budget plan

Almost all school bursars set a tentative budget for the following year by rolling forward current spending (adjusting for inflation and known pay increments). This traditional incremental budgeting approach means that managers only need to justify variances versus past years to the governing body, based on the assumption that the baseline is automatically approved. Changing this default budget to some other budget has been shown in behavioural economics, and indeed in the world of business, to be an effective device for forcing individuals to optimise their spending decisions. The problem is deciding what the new default budget should be. The most popular alternative is zero-based budgeting where every line item must be approved with reference to previous levels of expenditure, but this approach can be very time consuming. An alternative would be to tweak the budget software to encourage schools to take a more reflective attitude to their spending. For example, the software could report the average for pre-set comparator schools alongside the

school's own data. This has dangers of course: showing the average for comparator schools may undermine a high performing school doing something very well.

5. Nurture the self-image of headteachers as outstanding financial managers

Like the rest of us, the headteacher's ego makes them want to have a good reputation in their school. Ego drives some headteachers to improve their league table position year after year; others want to increase school capacity as a signal of success or take over other schools. Ego makes some headteachers nurture an image as a radical innovator or a game changer, but currently there are few plaudits upholding the efforts of those who achieve excellence on relatively modest budgets or who find innovative ways to reduce costs in a particular area. Given confidence by their governors, it may be that attempts to nurture such a self-image can help support greater pro-active care being taken with financial decisions.

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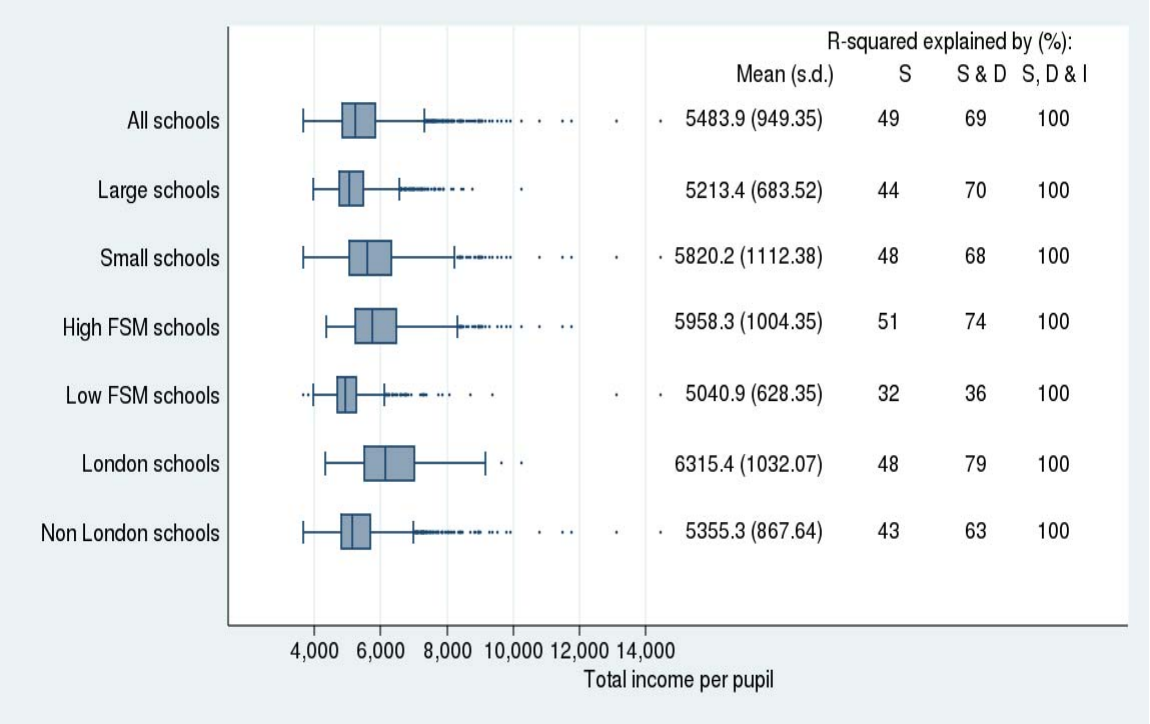
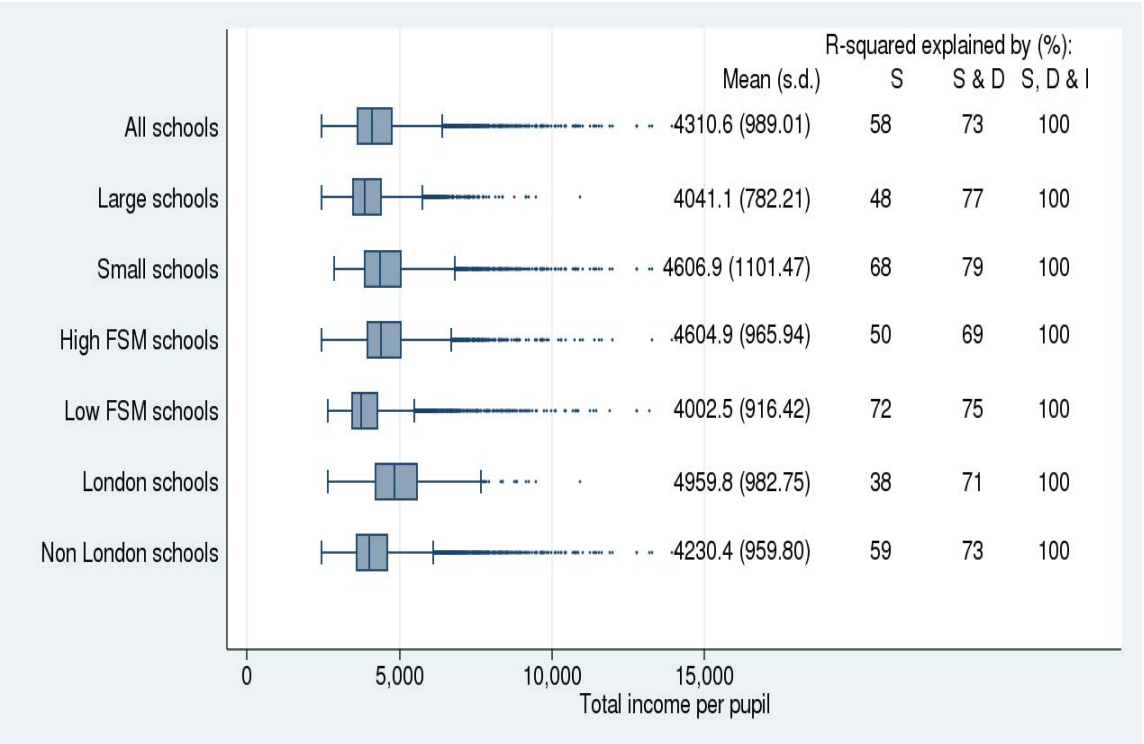
Fig.1 Box-graph showing the variation in total income per pupil

(a) Secondary



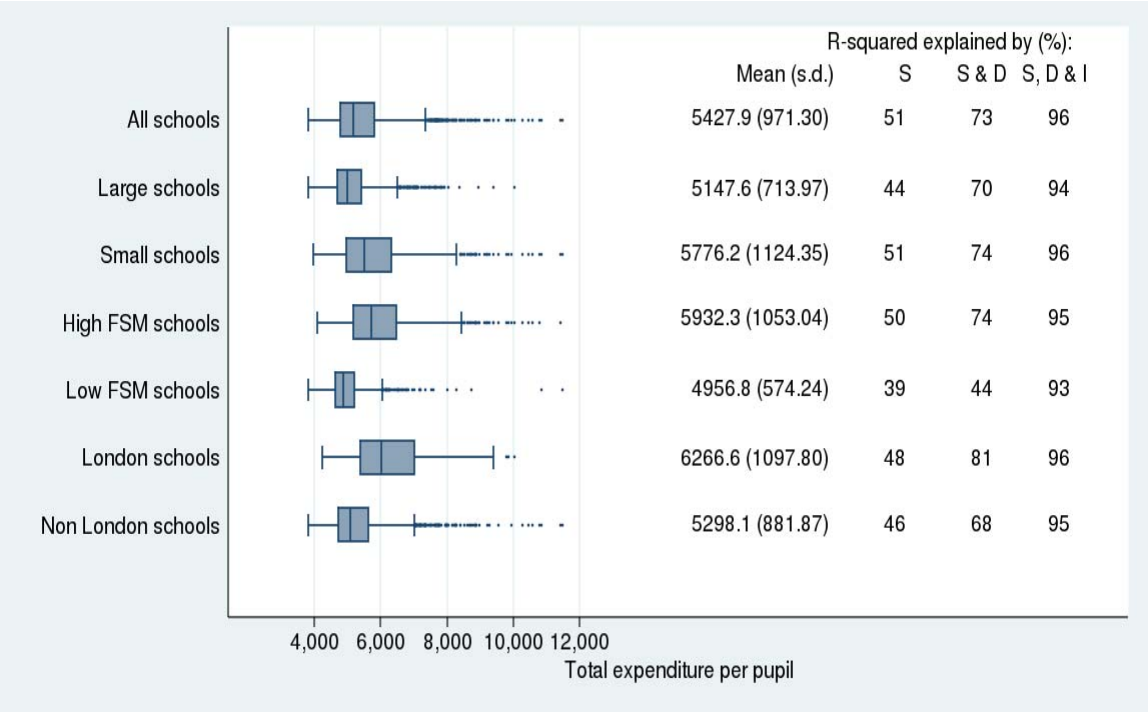
(b) Primary



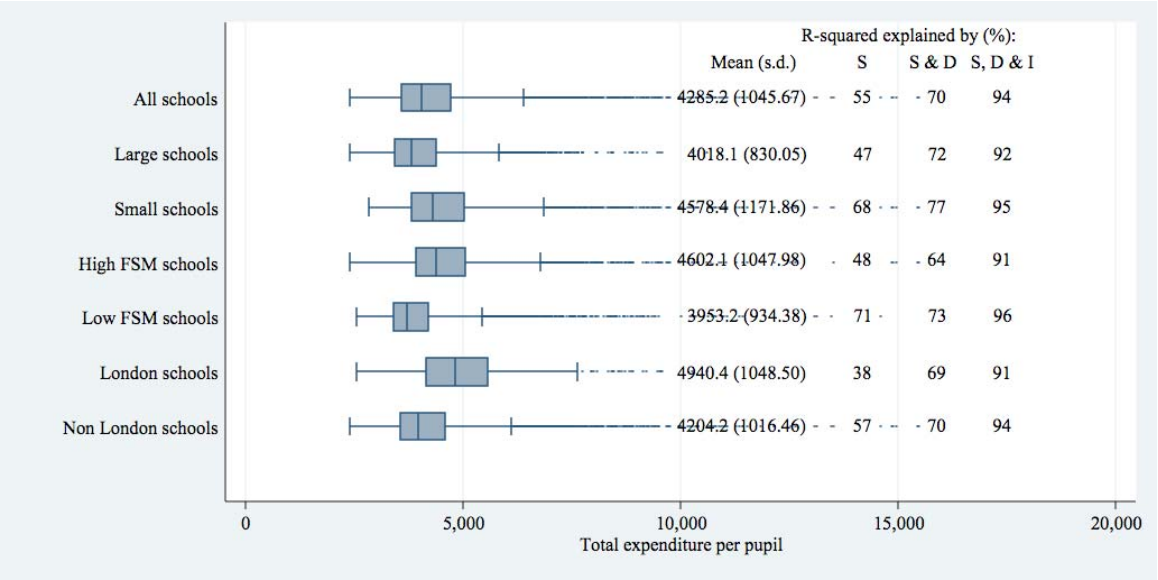
Note: Data on dependent variable from CFR

Fig.2 Box-graph showing the variation in total expenditure per pupil

(a) Secondary



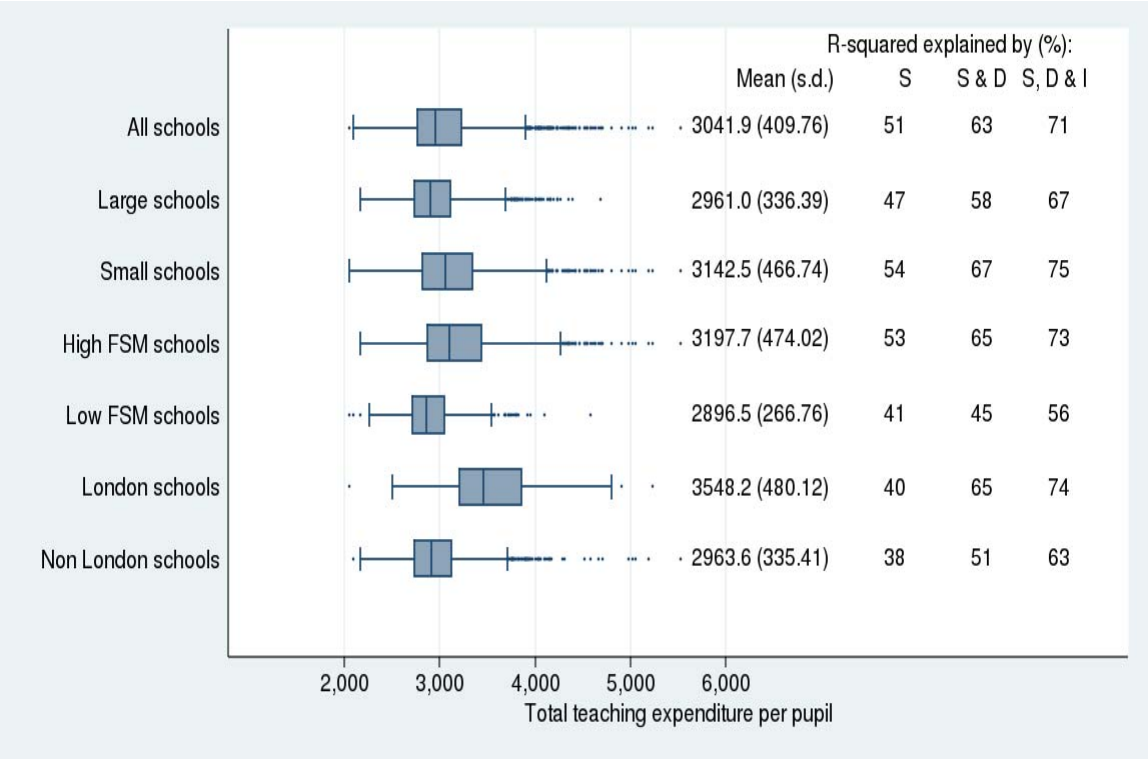
(b) Primary



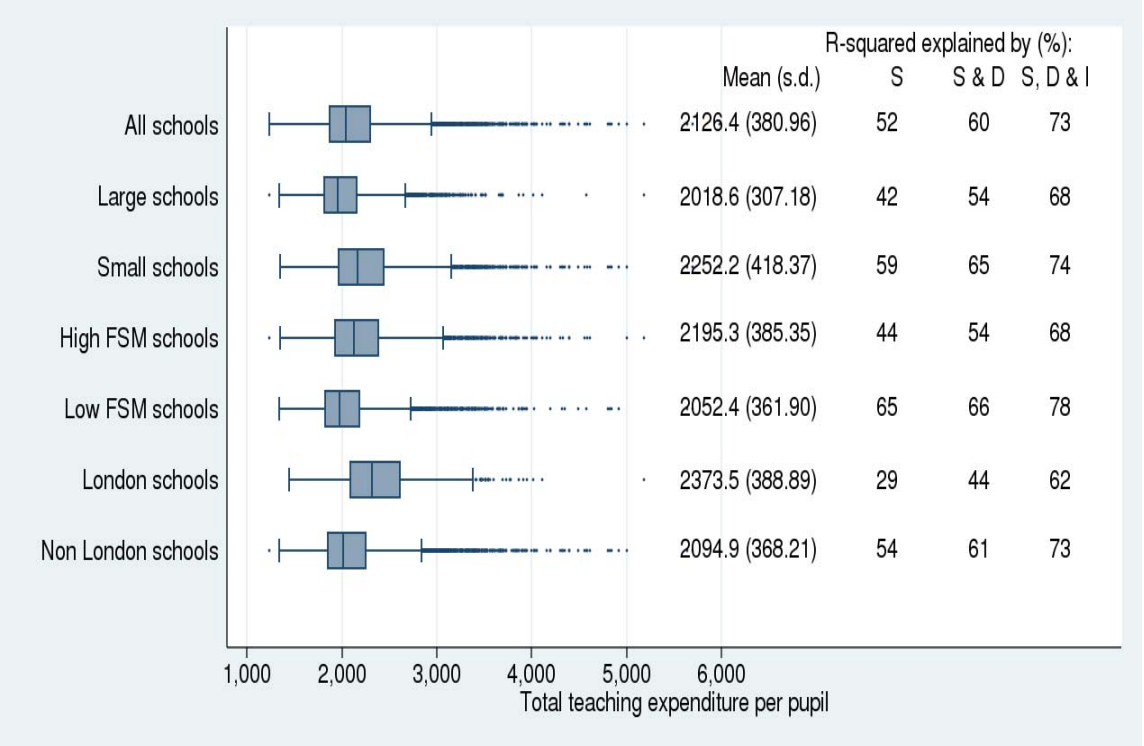
Note: Data on dependent variable from CFR

Fig.3 Box-graph showing the variation in total expenditure on teachers per pupil

(a) Secondary



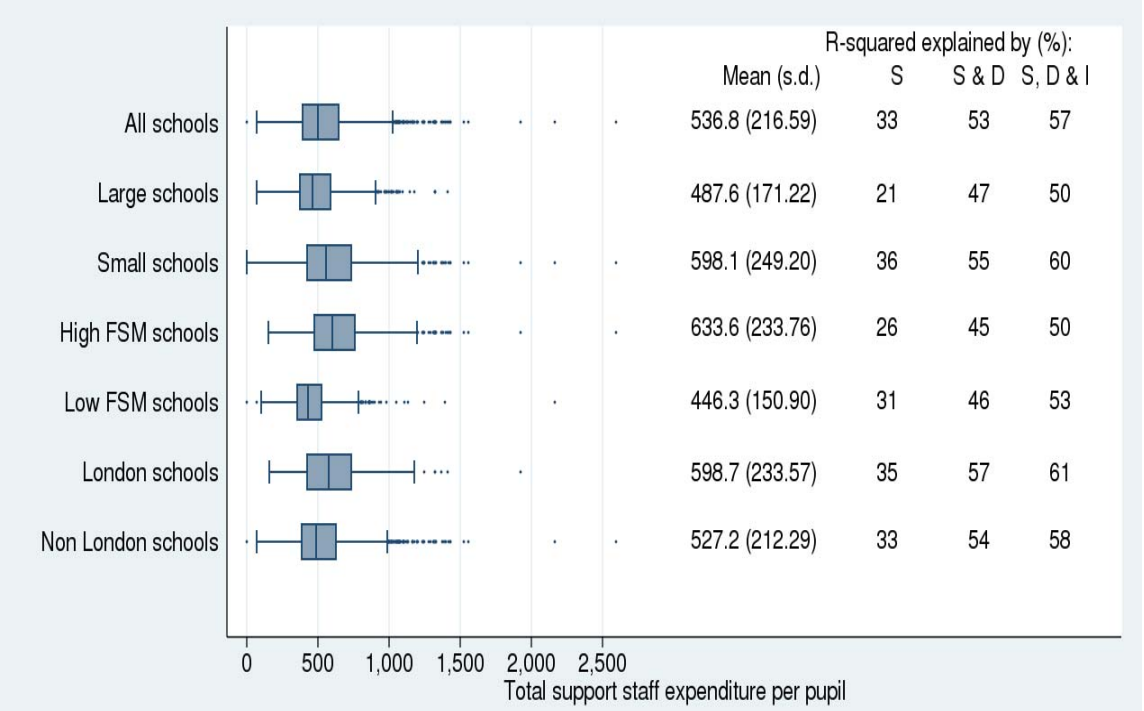
(b) Primary



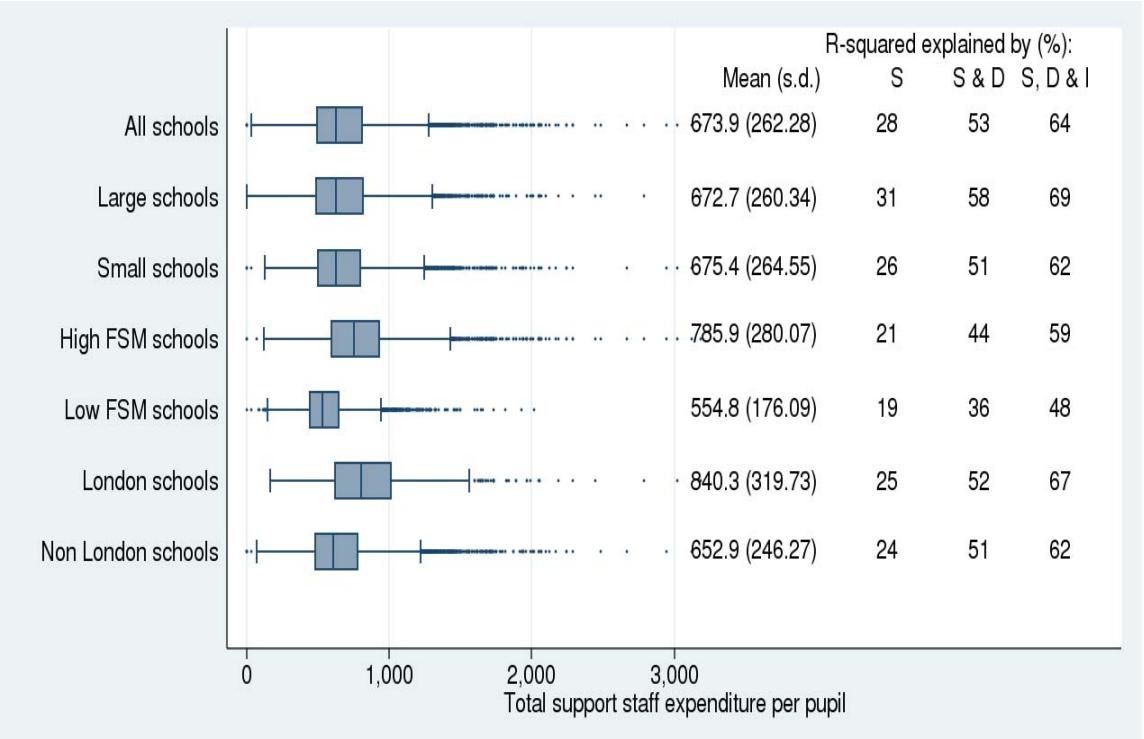
Note: Data on dependent variable from CFR

Fig.4 Box-graph showing the variation in Total Expenditure on support staff per pupil

(a) Secondary



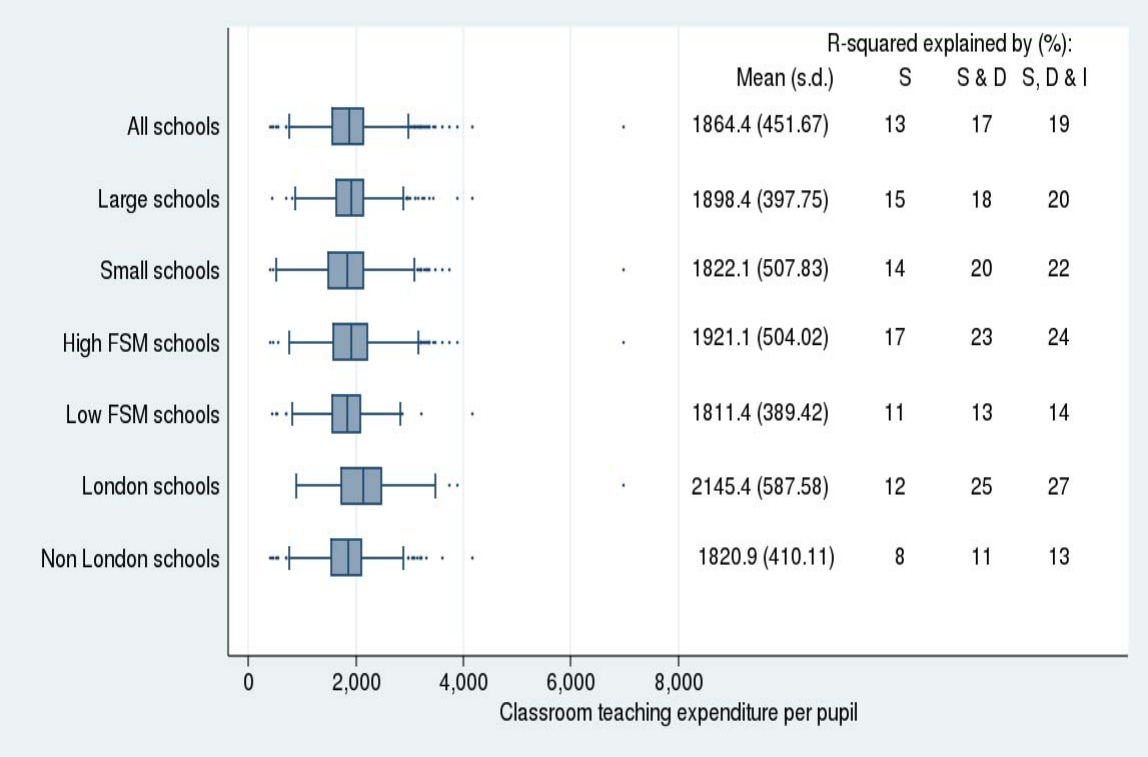
(b) Primary



Note: Data on dependent variable from CFR

Fig.5 Box-graph showing the variation in Total Expenditure on teachers per pupil

(a) Secondary



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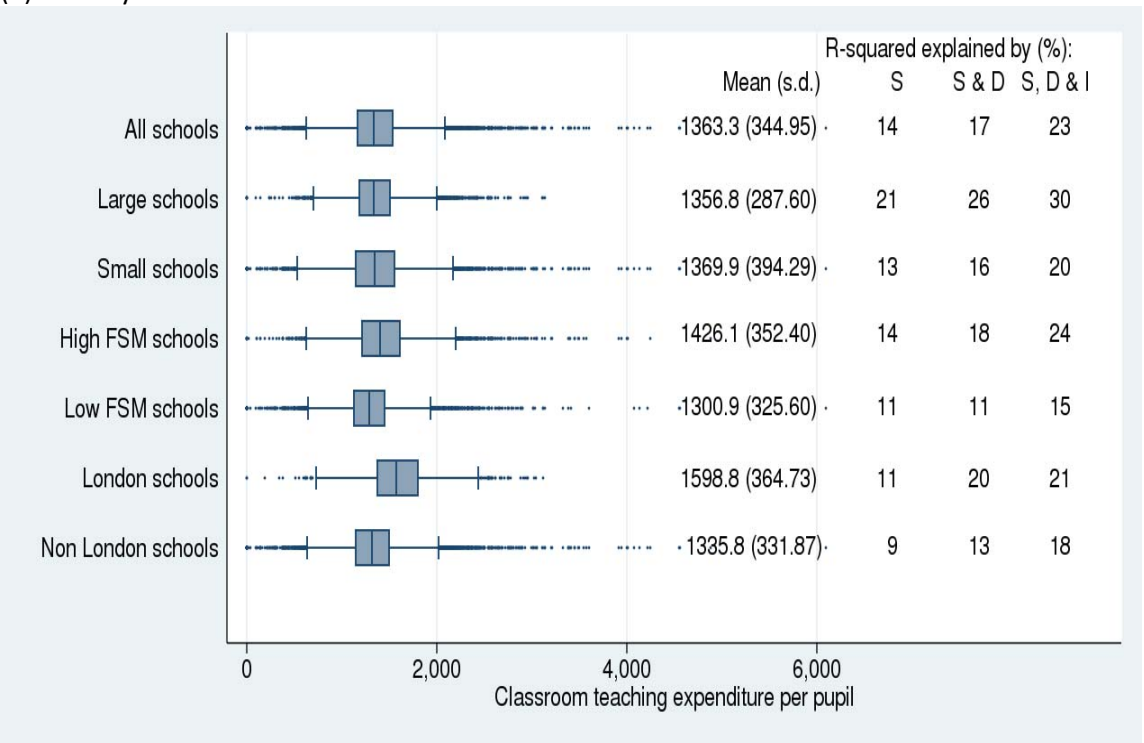
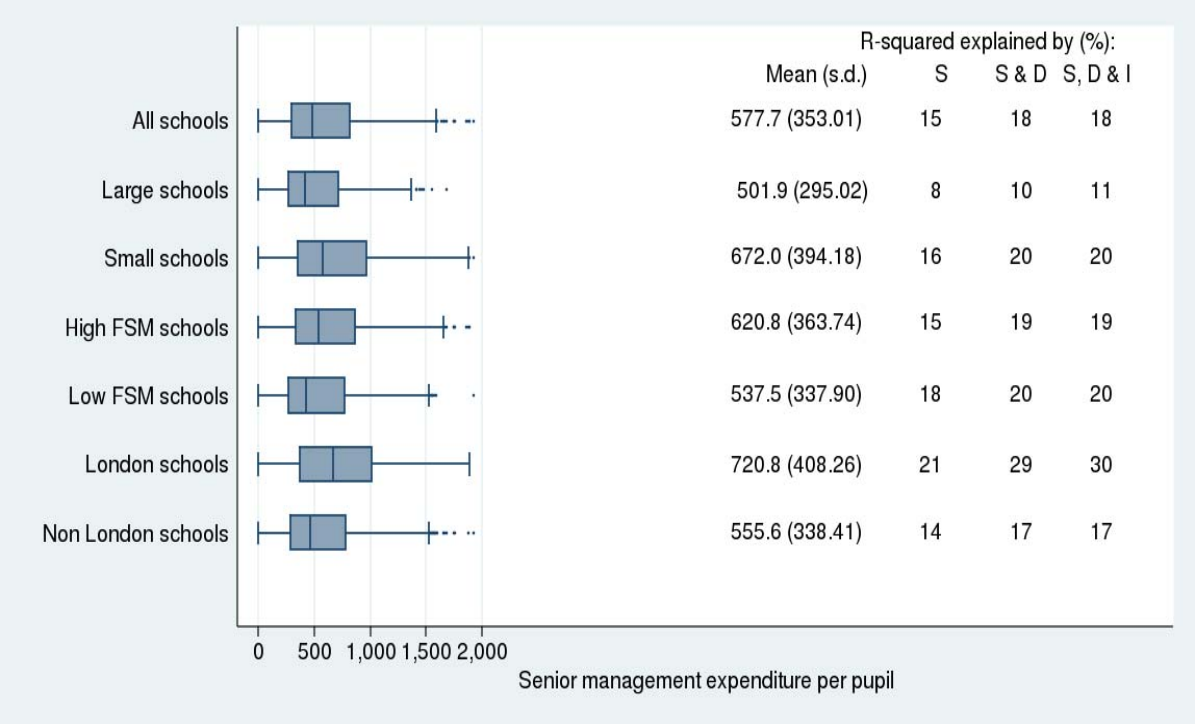


Note: Data on dependent variable from SWC

Fig.6 Box-graph showing the variation in Total Expenditure on senior management per pupil

(a) Secondary



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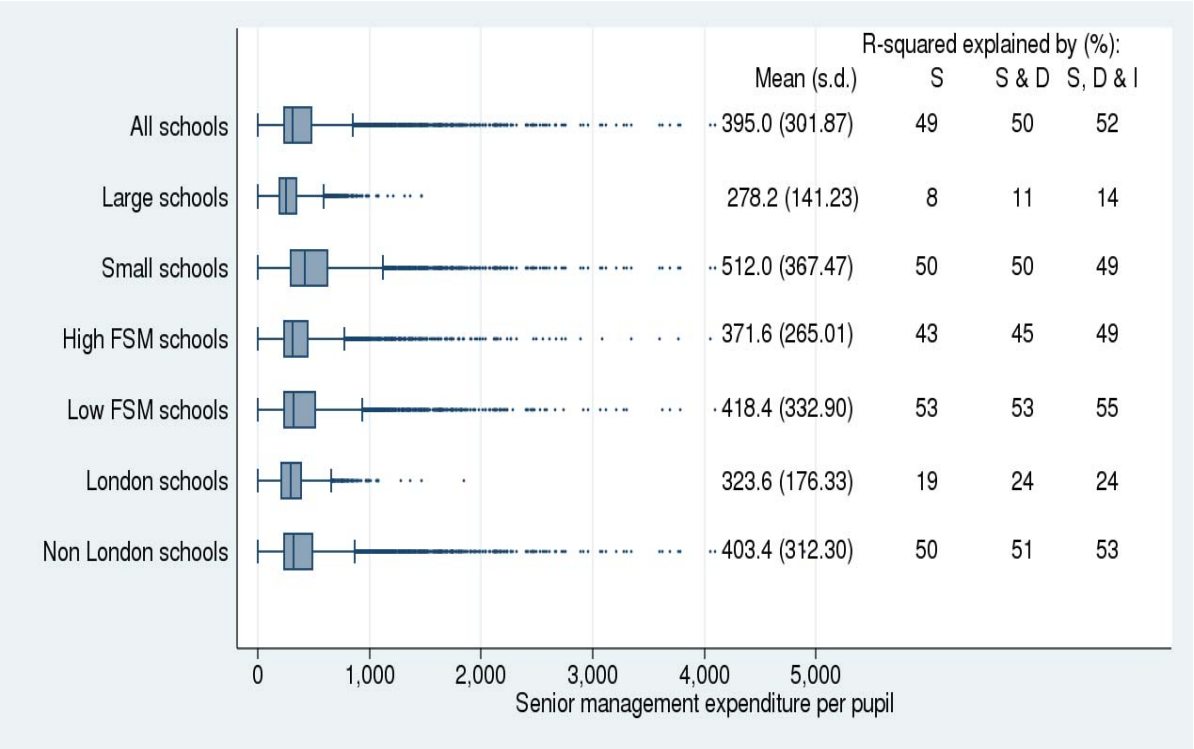
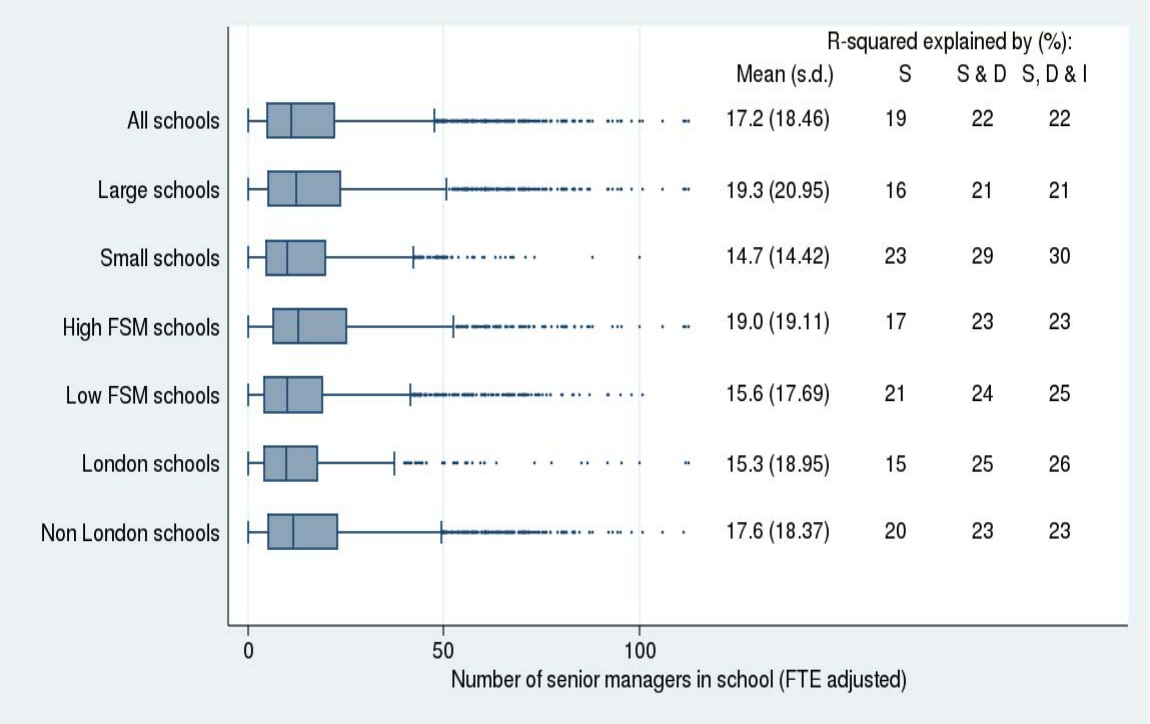


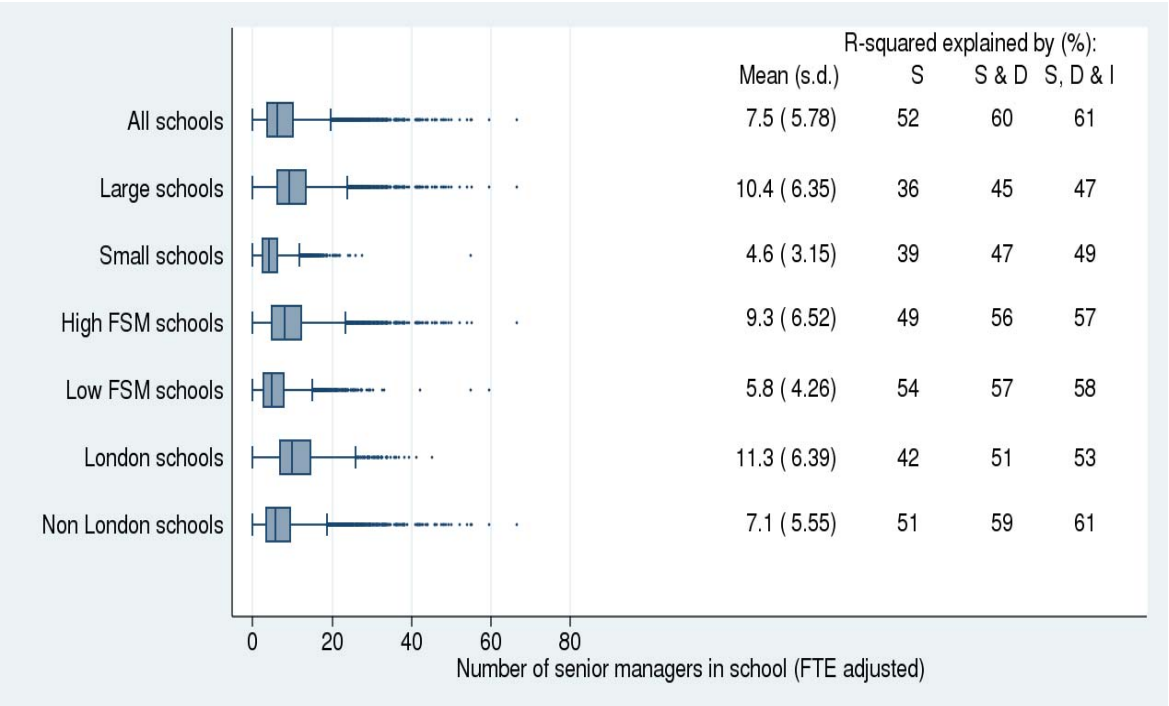
Note: Data on dependent variable from SWC

Fig.7 Box-graph showing the variation in number of senior managers

(a) Secondary



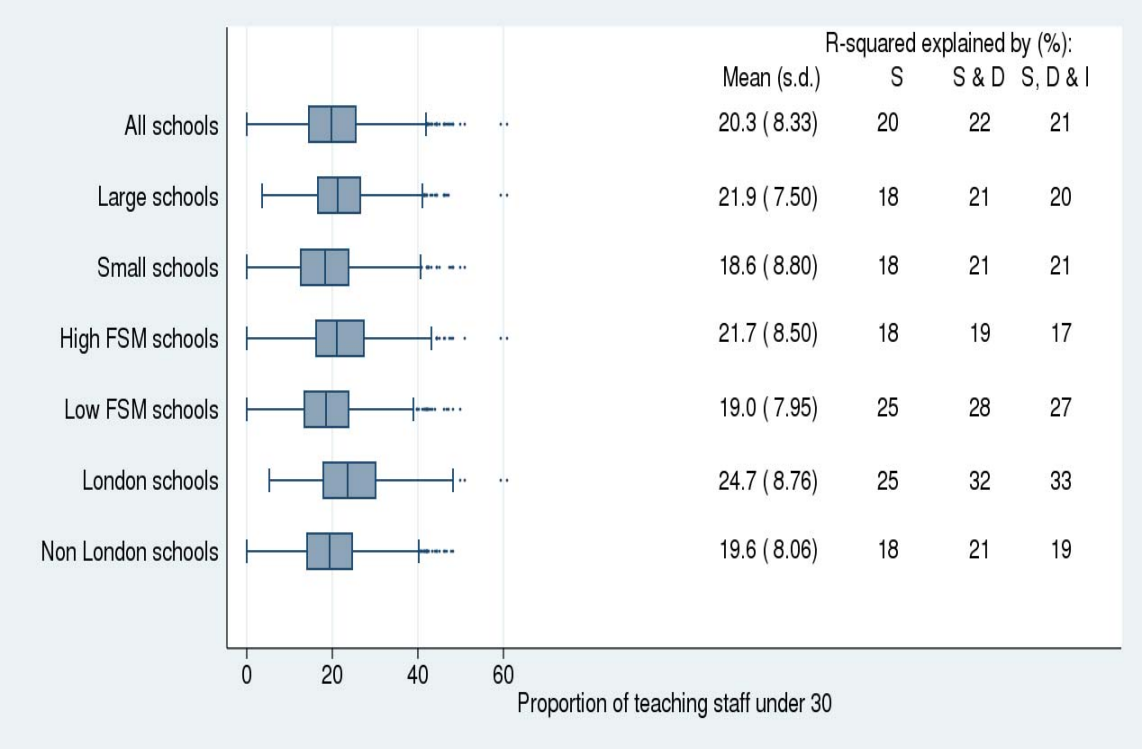
(b)Primary



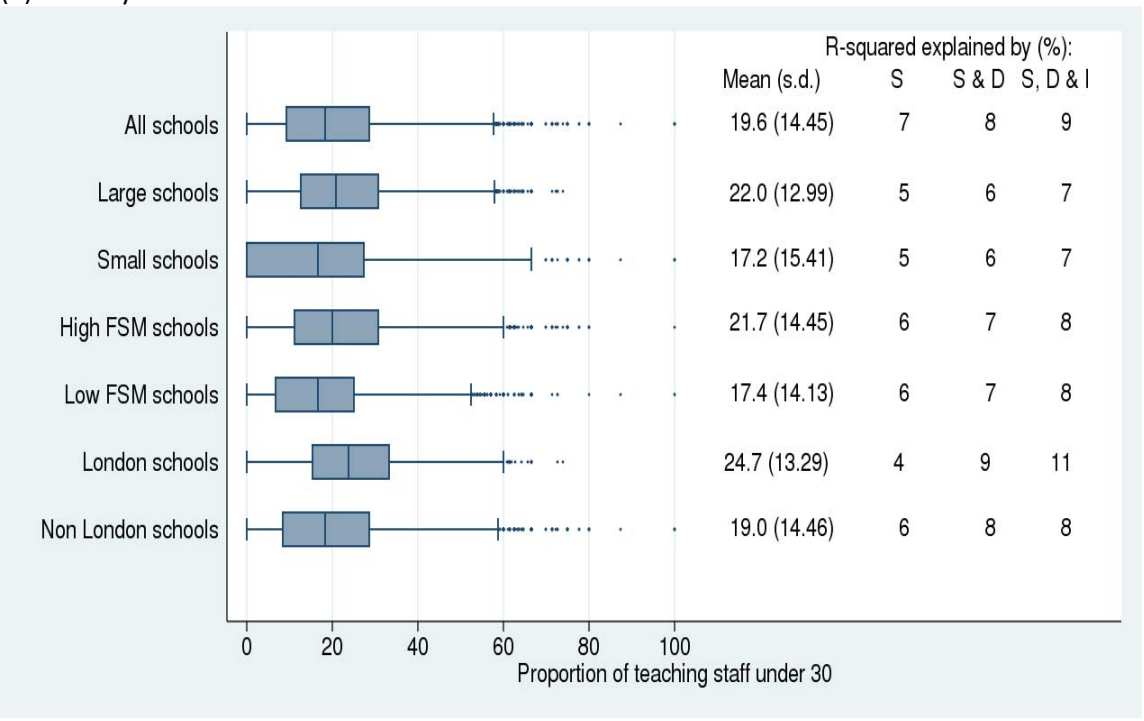
Note: Data on dependent variable from SWC

Fig.8 Box-graph showing the variation in proportion of teaching staff under 30

(a) Secondary



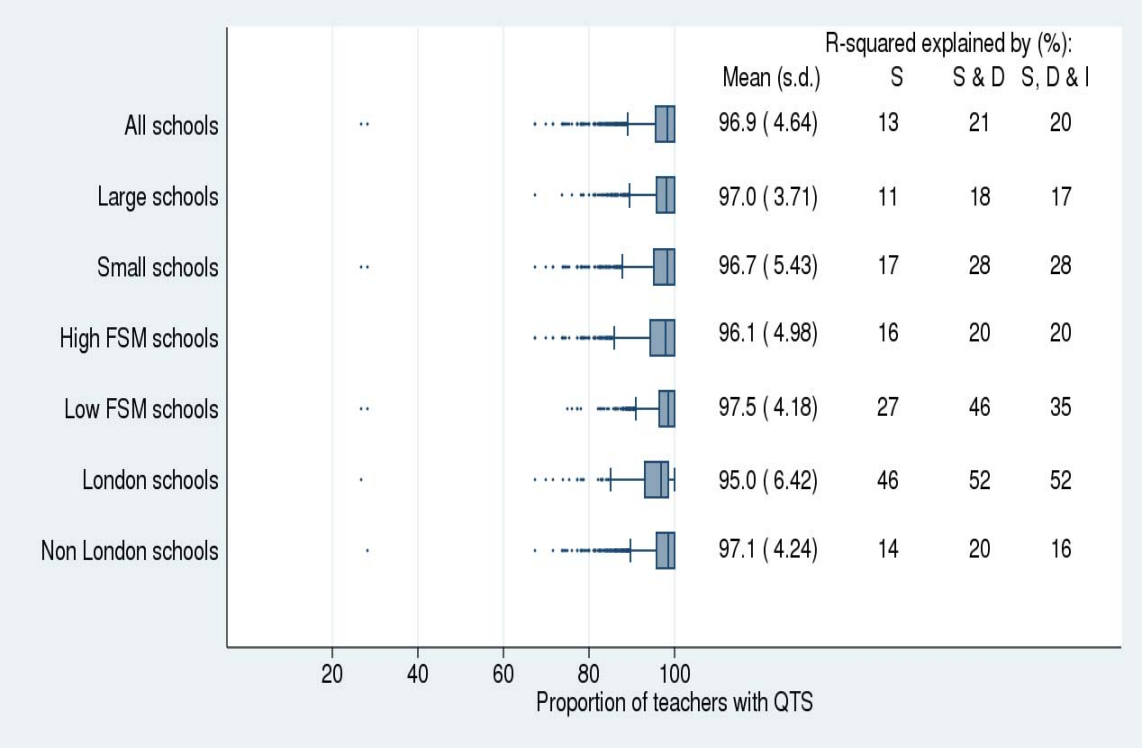
(b) Primary



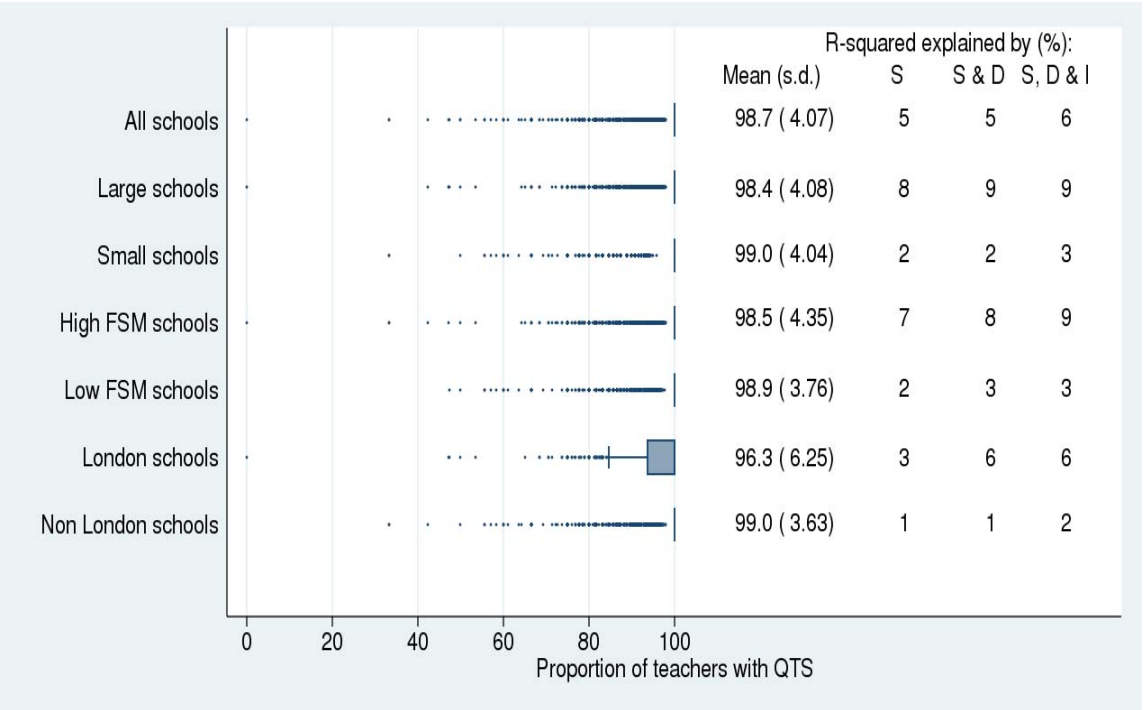
Note: Data on dependent variable from SWC

Fig.9 Box-graph showing the variation in proportion of teachers with QTS

(a) Secondary



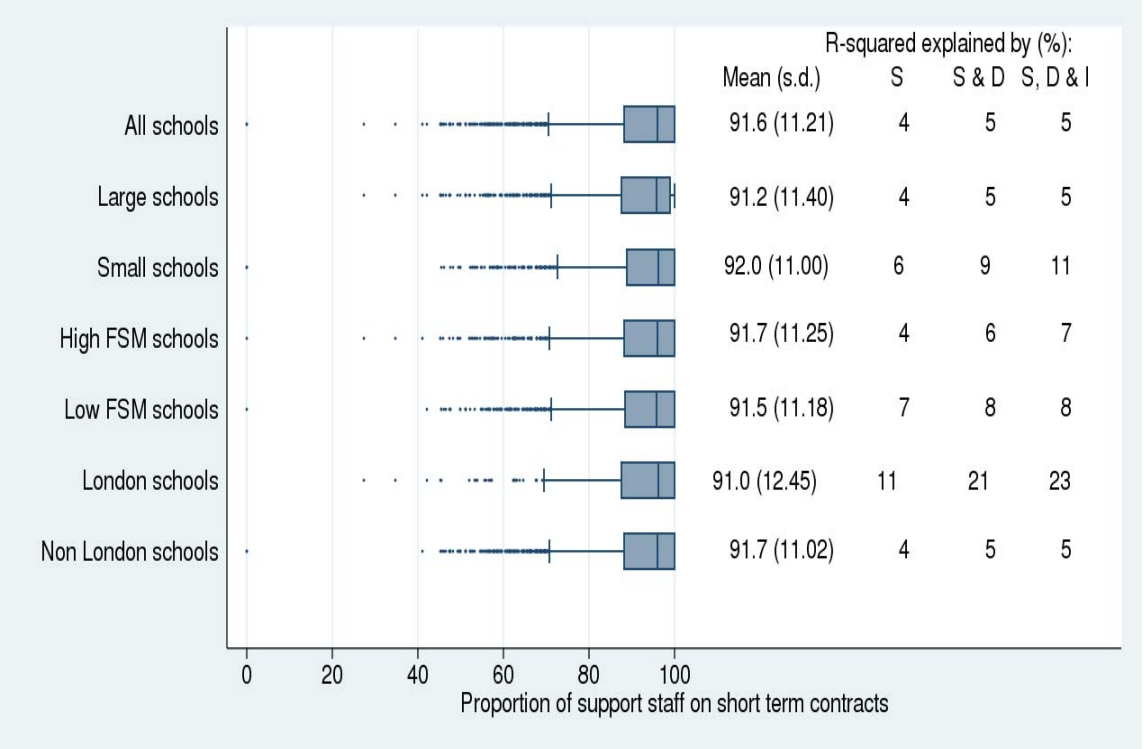
(b) Primary



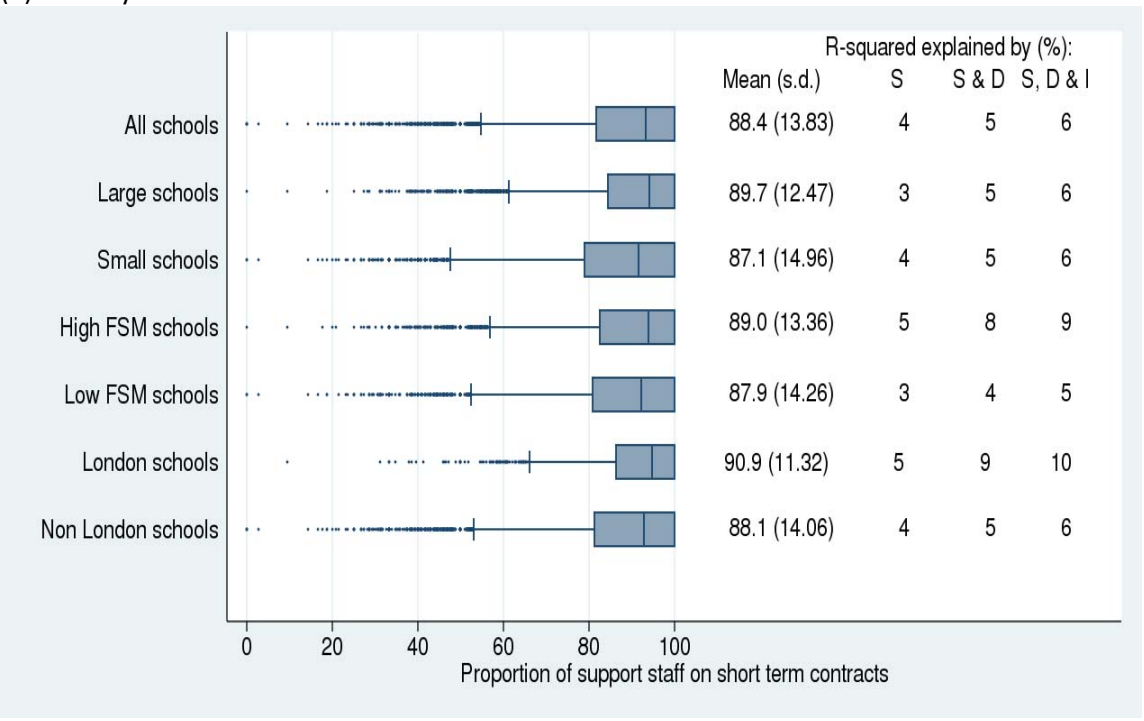
Note: Data on dependent variable from SWC

Fig.10 Box-graph showing the variation in proportion of support staff on short-term contracts

(a) Secondary



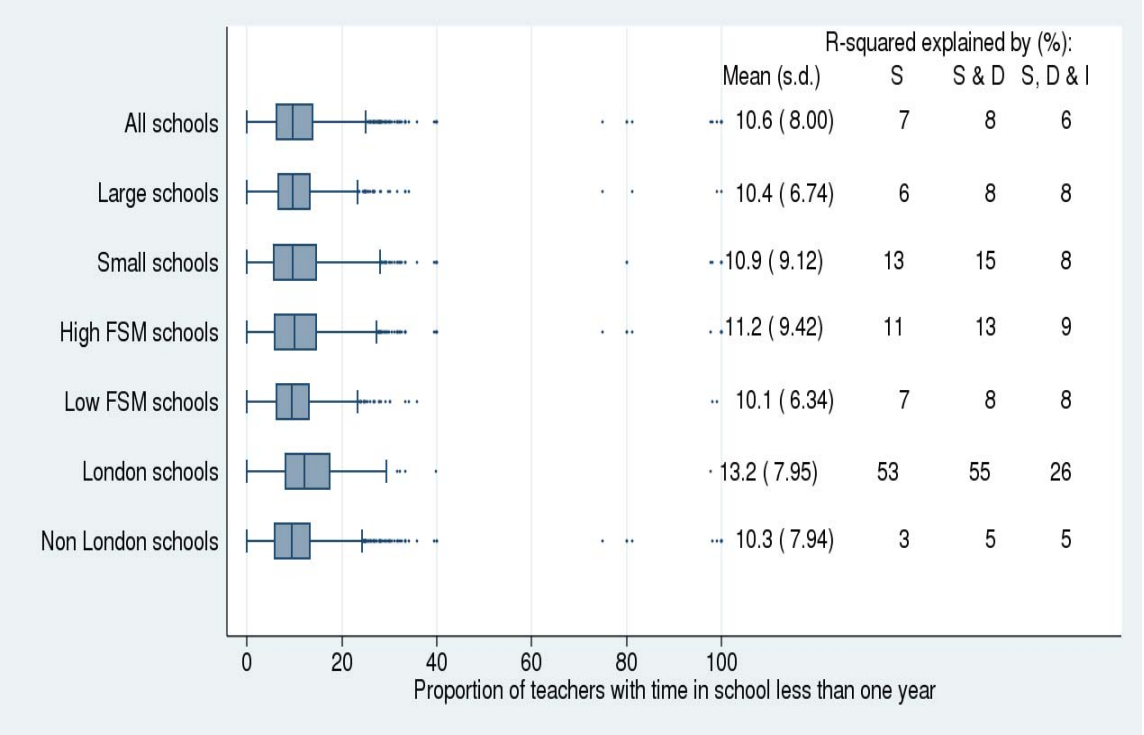
(b) Primary



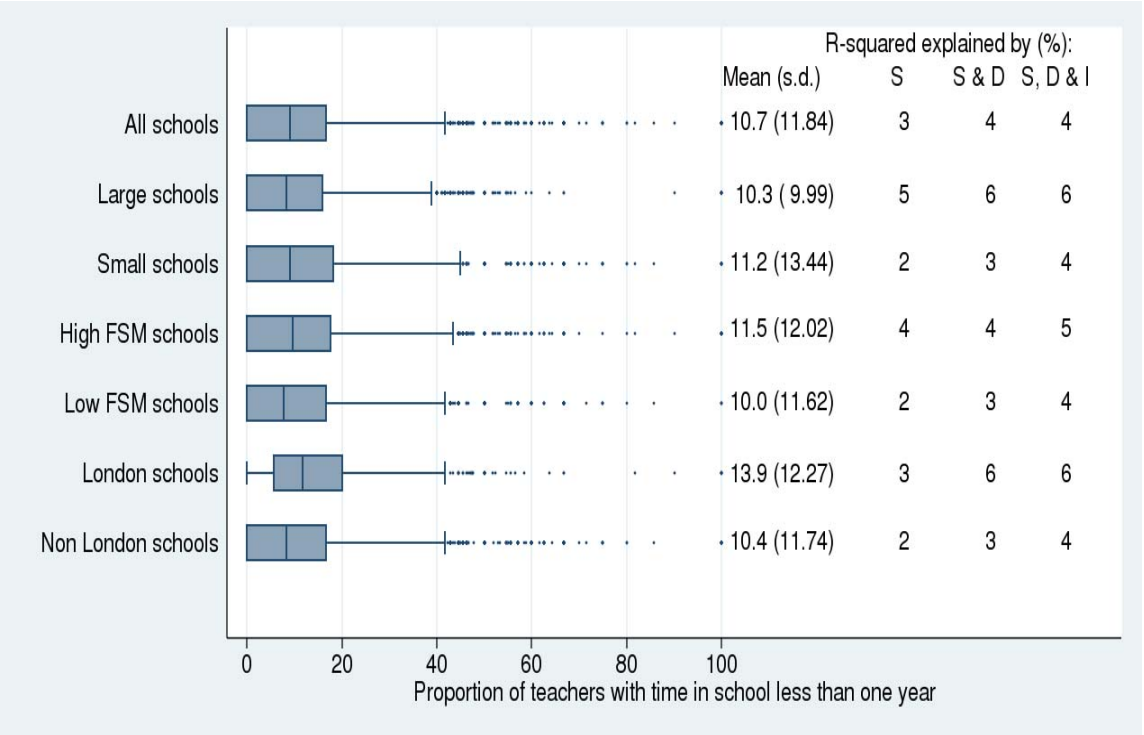
Note: Data on dependent variable from SWC

Fig.11 Box-graph showing the variation in proportion of teachers with tenure less than a year

(a) Secondary



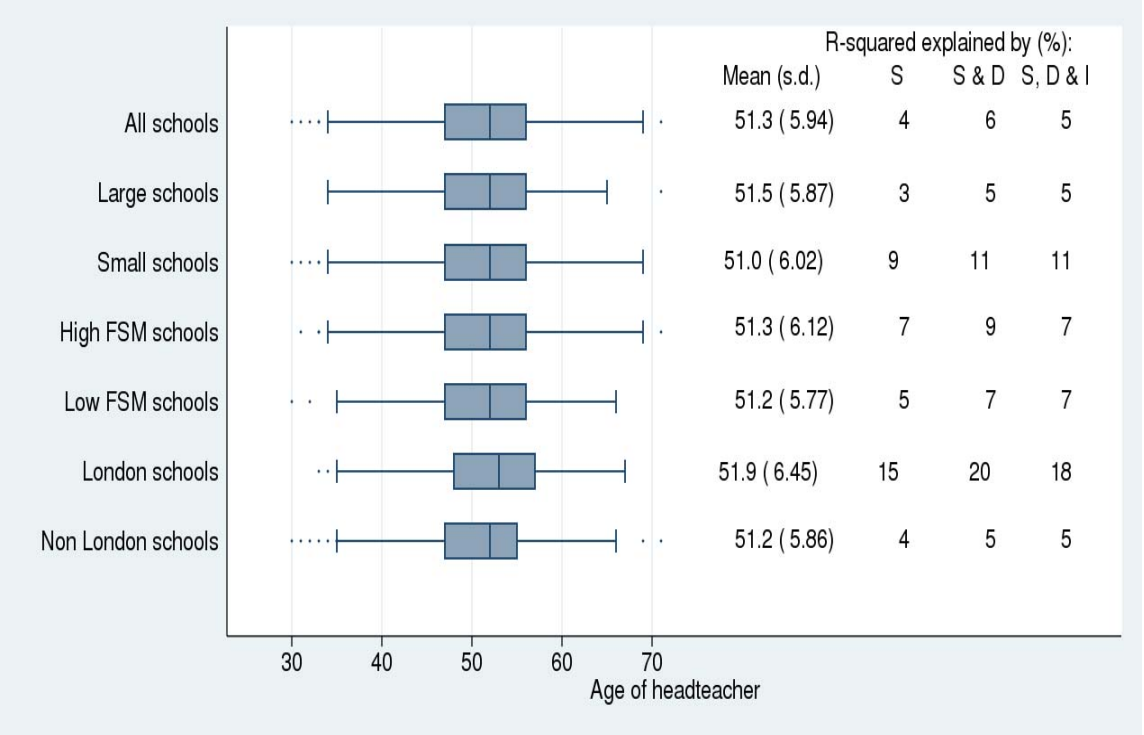
(b) Primary



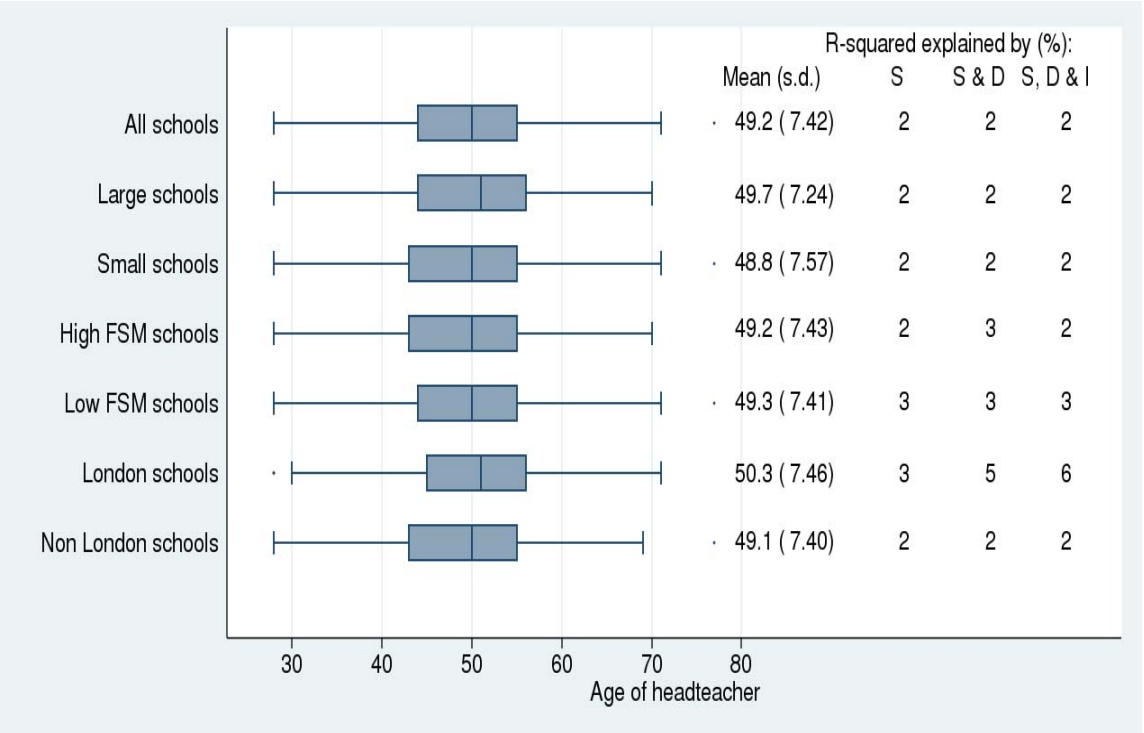
Note: Data on dependent variable from SWC

Fig.12 Box-graph showing the variation in age of head teacher

(a) Secondary



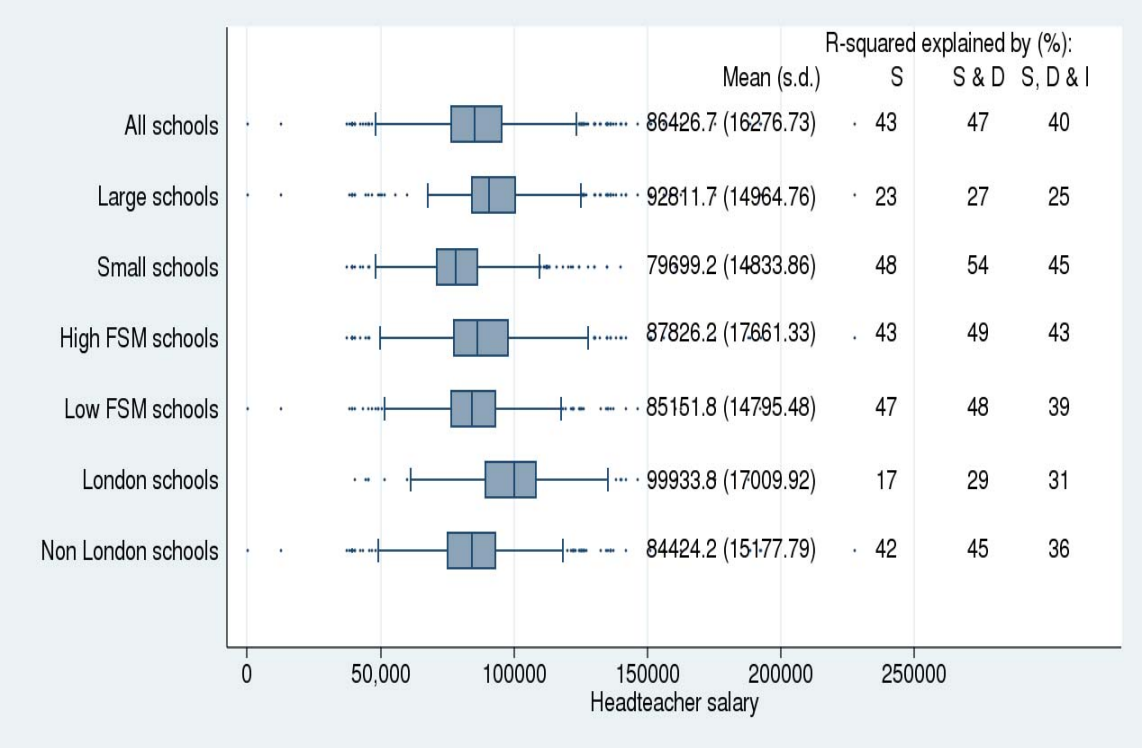
(b) Primary



Note: Data on dependent variable from SWC

Fig.13 Box-graph showing the variation in salary of head teacher

(a) Secondary



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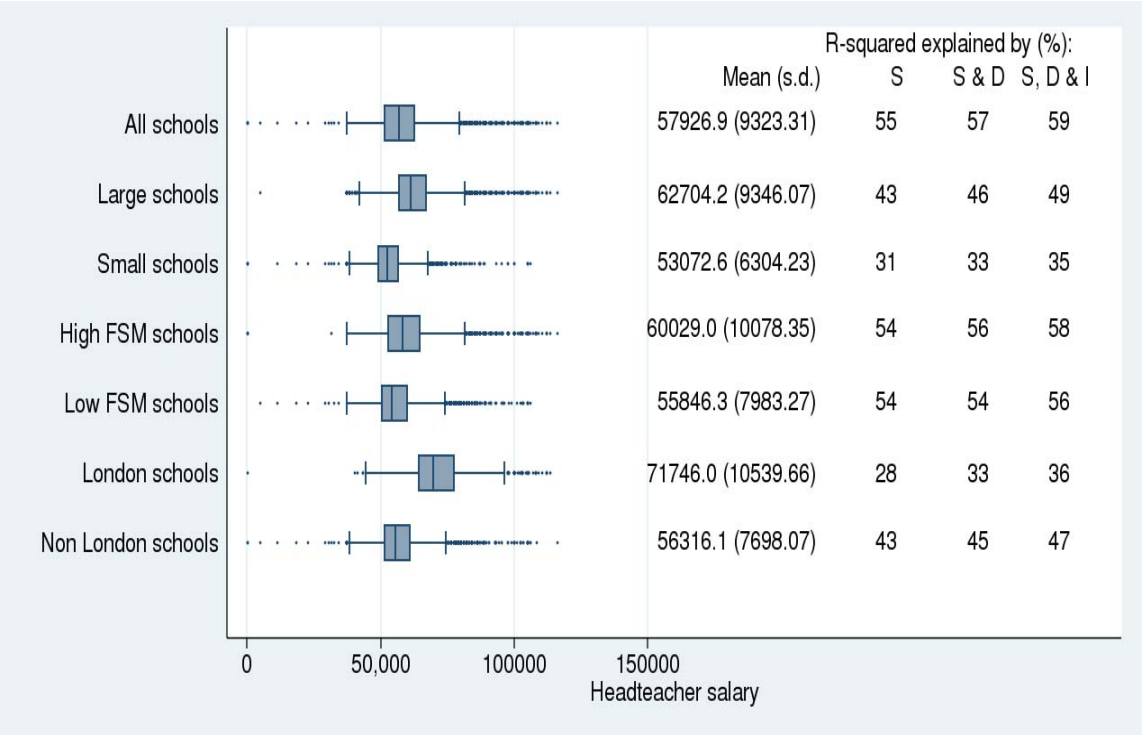
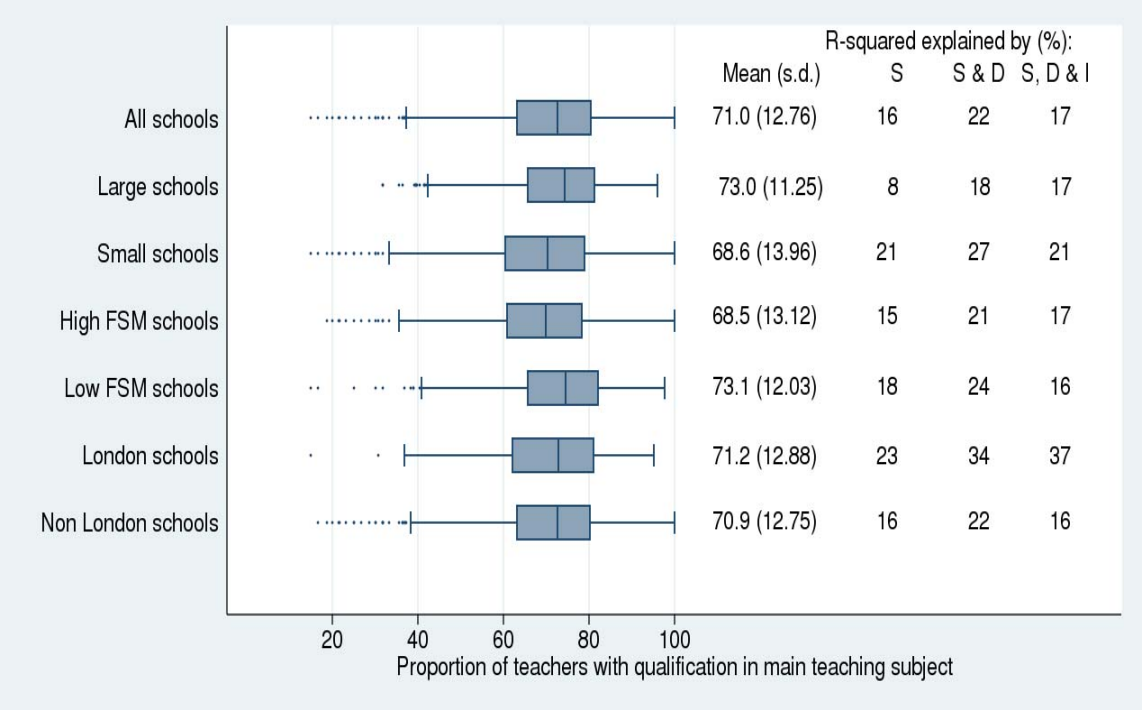


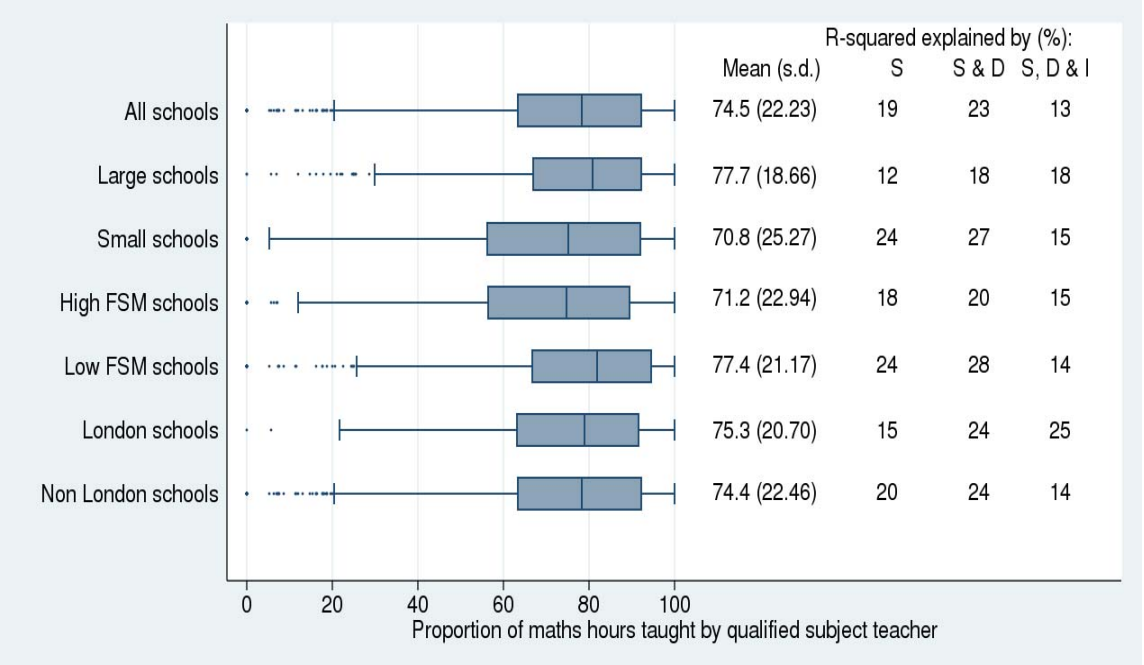
Note: Data on dependent variable from SWC

Fig.14 Box-graph showing the variation in proportion of teachers with qualification in main teaching subject



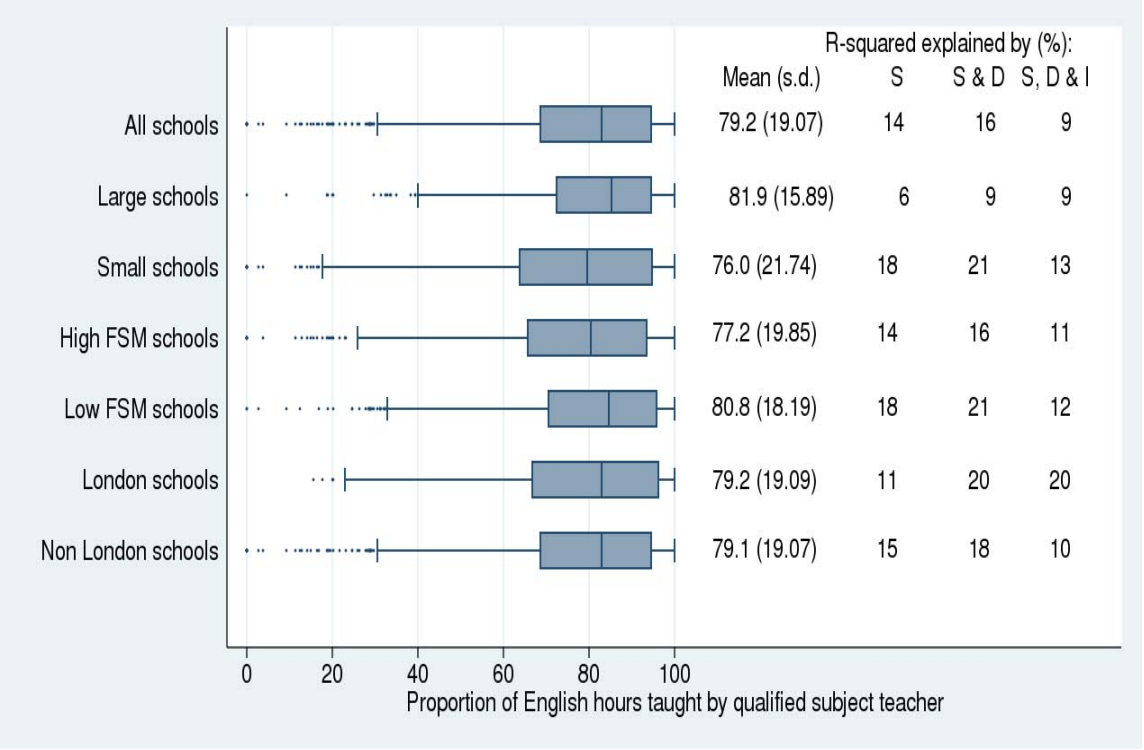
Note: Data on dependent variable from SWC (secondary schools only)

Fig.15 Box-graph showing the variation in proportion of maths teachers with qualification in maths



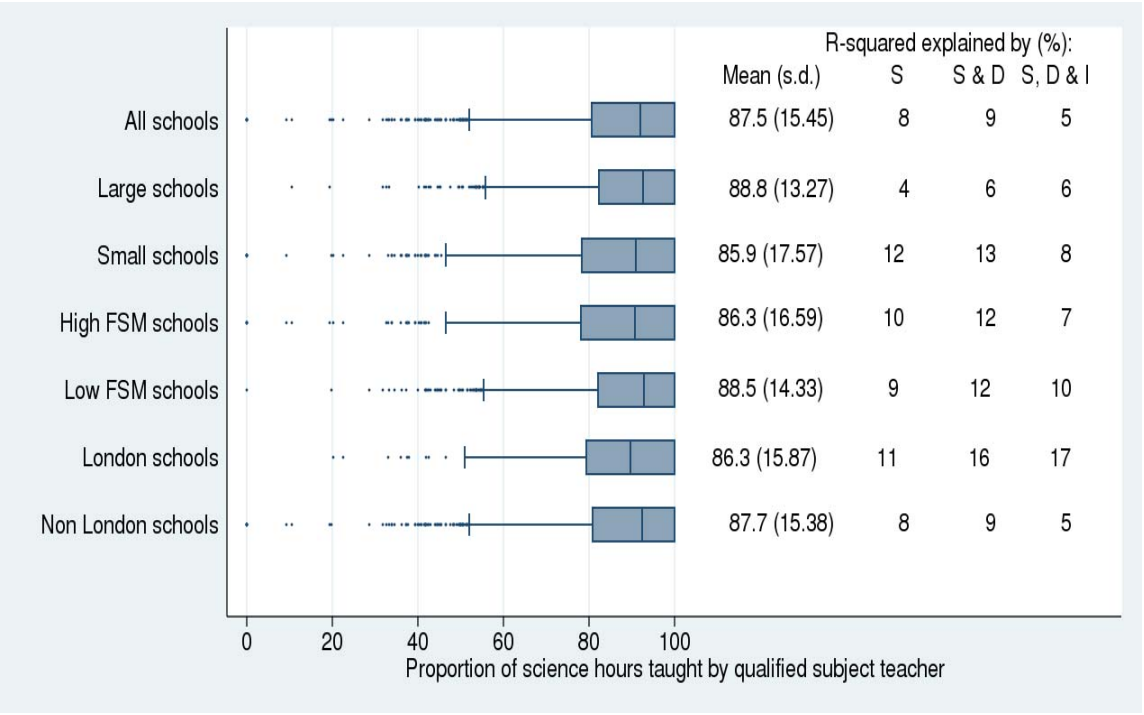
Note: Data on dependent variable from SWC (secondary schools only)

Fig.16 Box-graph showing the variation in proportion of English teachers with qualification in English



Note: Data on dependent variable from SWC (secondary schools only)

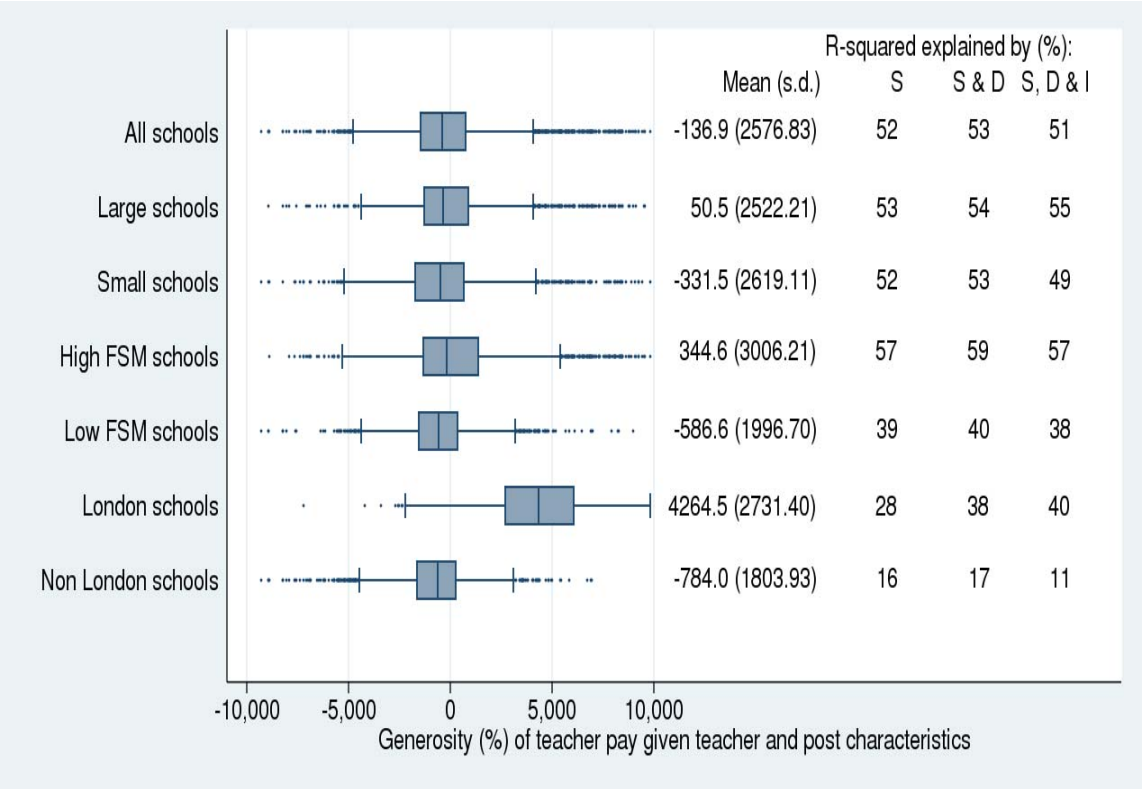
Fig.17 Box-graph showing the variation in proportion of science teachers with qualification in science



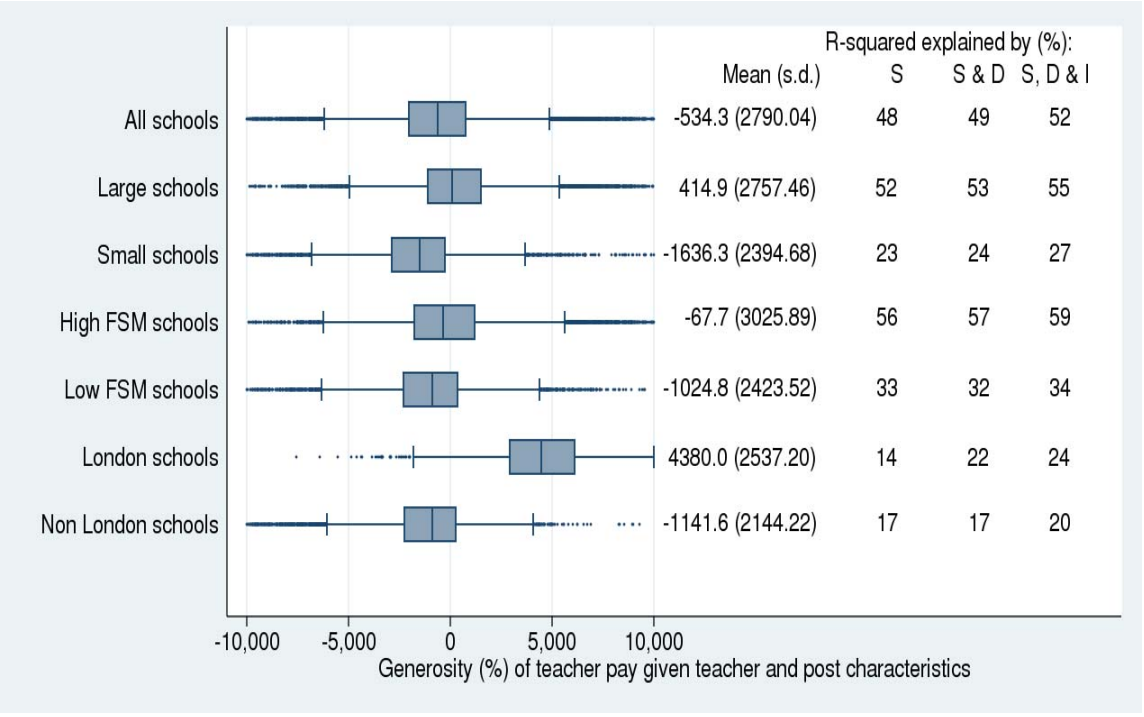
Note: Data on dependent variable from SWC (secondary schools only)

Fig.18 Box-graph showing the variation in generosity of teacher pay

(a) Secondary



(b) Primary



Note: Data on dependent variable from SWC

Figure 19: Details of the variation in percentage change in expenditure on different categories across the quintiles of income growth

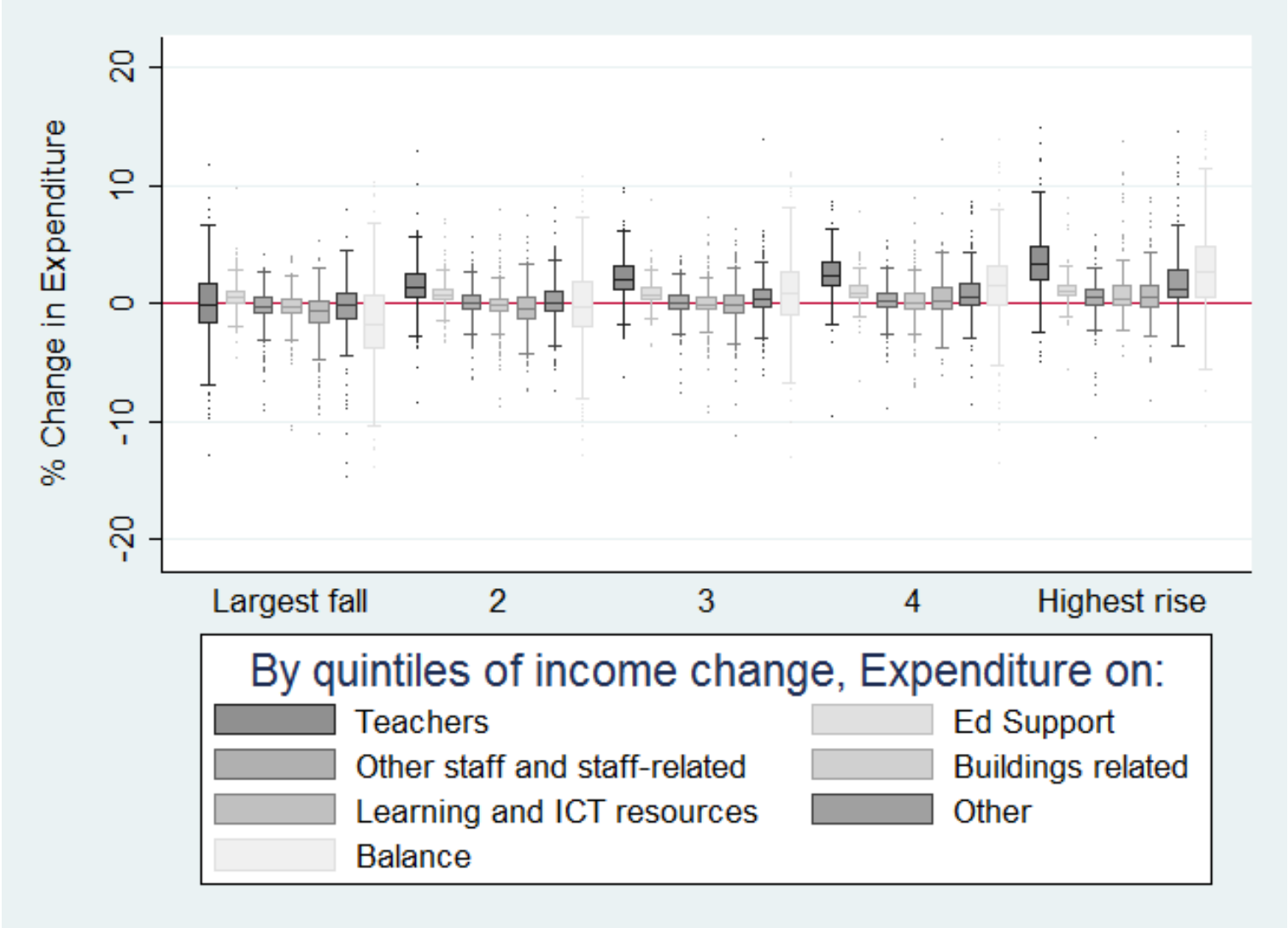


Figure 20: Details of the variation in the percentage share of the change in income across the quintiles of income growth:

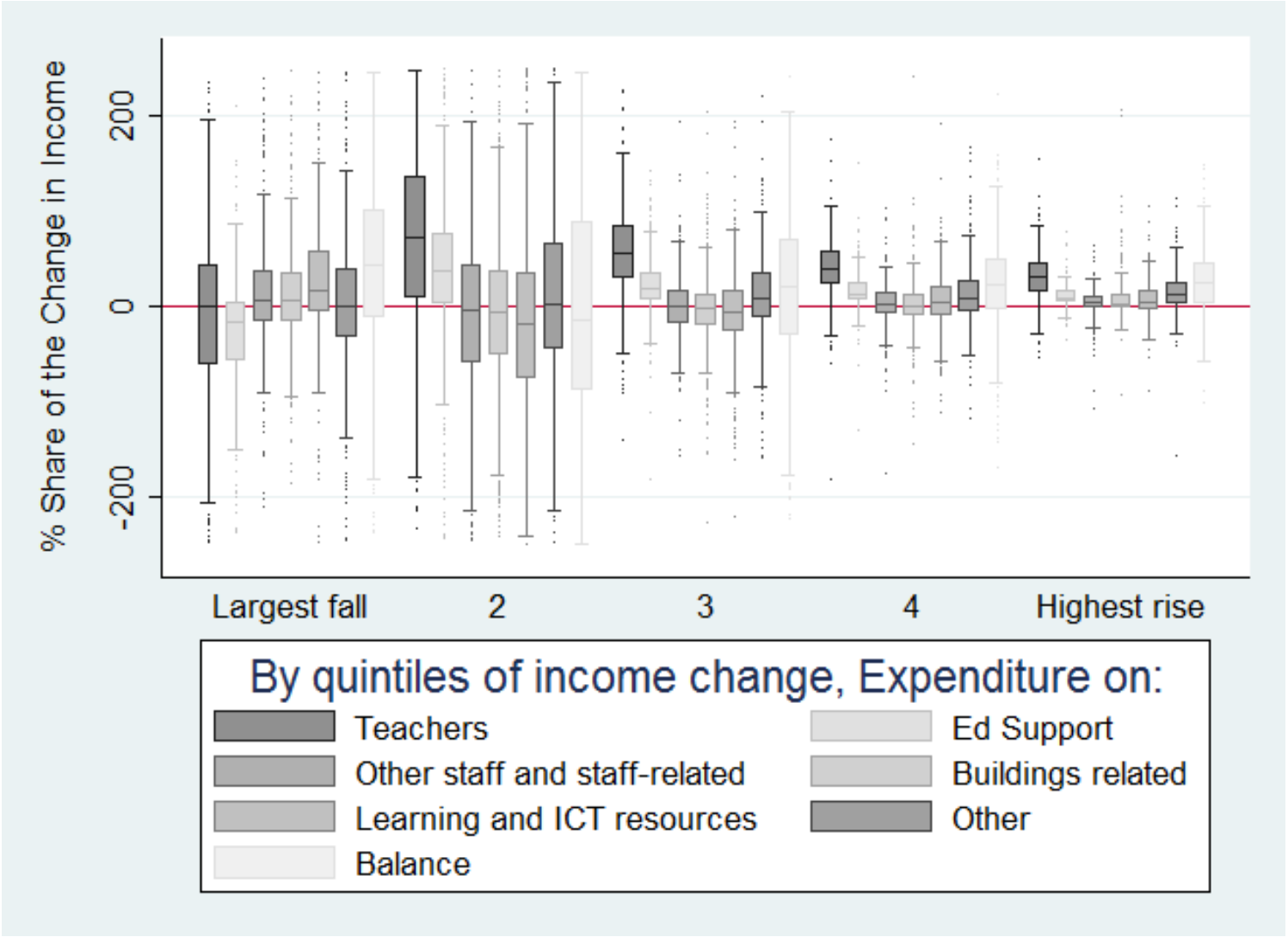


Figure 21: Expenditure category change against Income change

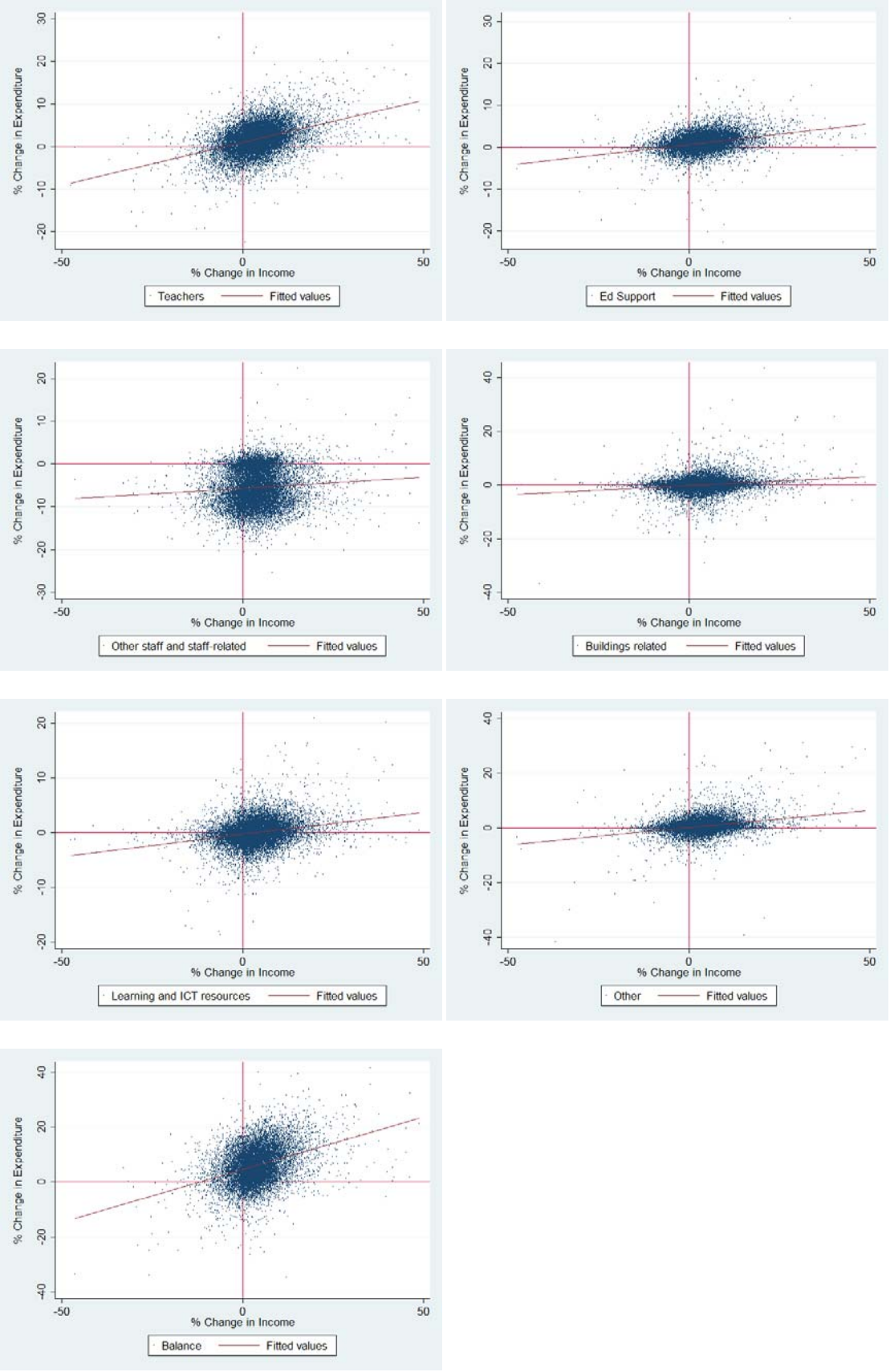


Table 1: Relationship between Residual Income and Expenditure

	Secondary Schools			Primary Schools		
	Coeff (SE)	**R-sqd**	**No. Of obs**	**Coeff (SE)**	**R-sqd**	**No. Of obs**
Expenditure total	0.886 (0.009)	0.941	2680	0.949 (0.004)	0.939	12994
Expenditure teachers	0.204 (0.008)	0.710	2680	0.325 (0.004)	0.735	12592
Expenditure support	0.082 (.005)	0.571	2680	0.184 (0.003)	0.638	12592
Teaching assistant	-0.005 (.005)	0.687	81	0.000 (0.001)	0.500	335
Teacher expenditure	0.102 (0.015)	0.769	2585	0.129 (0.005)	0.226	12690
Senior management expenditure	0.008 (0.012)	0.184	2534	0.073 (0.003)	0.508	12832
Number of managers	0.001 (0.001)	0.215	2680	0.001 (0.000)	0.601	12994
Age of young teachers	0.000 (0.000)	0.202	2680	-0.001 (0.000)	0.096	12983
Proportion with QTS	0.000 (0.000)	0.173	2674	-0.000 (0.000)	0.061	12978
Non-teacher permanent staff	0.000 (0.000)	0.054	2676	0.001 (0.000)	0.061	12974
Short tenured	0.000 (0.000)	0.054	2680	-0.000 (0.000)	0.045	12983
Age of Head teacher	0.000 (0.000)	0.051	2581	0.000 (0.000)	0.019	12486
Pay of Head teacher	1.927 (0.447)	0.385	2522	1.384 (0.104)	0.595	12375
Teacher relative pay	0.288 (0.065)	0.505	2628	0.276 (0.065)	0.509	11934
Qualification main subject	0.000 (0.000)	0.164	2125			
Qualification maths	0.000 (0.000)	0.137	2122			
Qualification english	0.000 (0.000)	0.095	2107			
Qualification science	0.000 (0.000)	0.051	2124			

Table 2: Change in total school income and expenditure items

Quintiles of % Change in Total Income	Mean % Change in Total Income	Mean % Change in Expenditure on: Teachers	Ed Support	Other staff and staff-related	Buildings related	Learning and ICT resources	Other	Balance
Largest fall	-3.675	-0.206	0.519	-0.484	-0.484	-0.923	-0.393	-1.598
2	1.227	1.296	0.765	-0.13	-0.23	-0.396	0.096	-0.281
3	3.688	2.076	0.834	-0.021	-0.159	-0.213	0.452	0.753
4	6.166	2.442	0.955	0.178	0.072	0.333	0.701	1.432
Highest rise	12.172	3.719	1.183	0.453	1.226	0.912	1.843	2.913

Table 3: What items school change the most:

(a) Percentage of schools for which each item had the highest increase in expenditure

	Percentage of schools for which this item had the highest increase in expenditure:							
Quintiles of % Change in Total Income	**Teachers**	**Ed Support**	**Other staff and staff-related**	**Buildings related**	**Learning and ICT resources**	**Other**	**Balance**	**N**
Largest fall	27.85	15.7	7.85	6.58	7.34	16.71	17.97	395
2	41.06	12.74	4.42	5.84	6.02	11.86	18.05	565
3	48.71	6.83	2.58	3.69	5.9	8.67	23.62	542
4	46.36	7.51	1.99	3.53	7.95	9.05	23.62	453
Highest rise	41.37	2.16	1.8	7.19	8.27	12.59	26.62	278
Total	41.69	9.45	3.76	5.15	6.9	11.46	21.59	2233

(b) Percentage of schools for which each item had the biggest fall/lowest rise in expenditure

	Percentage of schools for which this item had the biggest fall/lowest increase in expenditure:							
Quintiles of % Change in Total Income	**Teachers**	**Ed Support**	**Other staff and staff-related**	**Buildings related**	**Learning and ICT resources**	**Other**	**Balance**	**N**
Largest fall	19.49	1.27	8.1	9.11	18.23	12.15	31.65	395
2	9.03	2.83	10.97	15.4	21.59	10.62	29.56	565
3	4.24	2.03	14.76	18.27	26.75	11.99	21.96	542
4	3.09	4.19	18.32	19.65	20.09	17.88	16.78	453
Highest rise	4.68	4.32	18.35	22.66	22.66	13.31	14.03	278
Total	7.97	2.82	13.79	16.75	22.08	13.03	23.56	2233

Data Appendix

Data Appendix Table 1: Descriptive statistics for structural factors from Edubase

	N	Mean	SD	Min	Max
Inner London Pay region	19722	0.022	0.145	0	1
Outer London Pay region	19722	0.020	0.139	0	1
Fringe London Pay region	19722	0.009	0.095	0	1
Boys only school	19722	0.008	0.090	0	1
Girls only school	19722	0.011	0.104	0	1
Selective admissions policy	19722	0.008	0.090	0	1
School has boarders	19722	0.003	0.053	0	1
School has nursery aged children	19722	0.335	0.472	0	1
School has at least 10 over 16s	19722	0.084	0.278	0	1
Official school capacity	19674	374.153	346.431	19	2740
Number of 2 and 3 year olds in school	19722	13.584	22.090	0	155
Number of 17, 18 and 19 year olds in school	19722	8.317	31.648	0	514
Number of year groups in school (implied by ASC)	19722	5.993	1.716	2	17
Pupils take KS2 (primary) or GCSEs (secondary) in the School	19722	0.864	0.343	0	1
East Midlands	19722	0.097	0.295	0	1
East of England	19722	0.121	0.326	0	1
North East	19722	0.053	0.225	0	1
North West	19722	0.142	0.349	0	1
South East	19722	0.154	0.361	0	1
South West	19722	0.109	0.312	0	1
West Midlands	19722	0.108	0.310	0	1
Yorkshire and the Humber	19722	0.106	0.308	0	1
Town and Fringe	19704	0.110	0.312	0	1
Village	19704	0.141	0.348	0	1
Rural	19704	0.037	0.188	0	1
Academies	19722	0.006	0.077	0	1
Foundation School	19722	0.060	0.237	0	1
Voluntary Aided School	19722	0.211	0.408	0	1
Voluntary Controlled School	19722	0.131	0.338	0	1
FTE pupils from CFR summary	19722	352.3	334.8	2.0	2620.0
FTE pupils from CFR summary, squared	19722	236k	510k	4.0	6.9E+6
FTE pupils from CFR summary, cubed	19722	2.45E+8	8.16E+8	8.091	1.8E+10
FTE pupils from CFR summary, to power 4	19722	3.2E+11	1.44E+12	16.24449	4.71E+13

Data Appendix Table 2: Descriptive statistics for demographic factors from NPD

	N	Mean	SD	Min	Max
Proportion of pupils with EAL	19722	11.604	20.039	0	100
Mean school IDACI score	19722	21.670	14.288	2.109	94.885
Mean school IDACI score, squared	19722	673.711	886.365	4.449	9003.251
Proportion of pupils with other ethnicity	19722	1.064	2.862	0	100
Proportion of pupils with Asian ethnicity	19722	6.584	14.779	0	100
Proportion of pupils with Black ethnicity	19722	3.752	9.192	0	93.496
Proportion of pupils with Chinese ethnicity	19722	0.302	0.616	0	11.765
Proportion of pupils with mixed ethnicity	19722	3.554	3.503	0	54.667
Proportion of pupils with White ethnicity	19722	81.112	23.740	0	100
Proportion of pupils with SEN, statemented	19722	1.574	1.666	0	23.474
Proportion of pupils with SEN, non-statemented	19722	18.237	9.152	0	75.573
Proportion of pupils eligible for FSM	19722	14.378	13.047	0	79.752
Proportion of pupils eligible for FSM, squared	19722	376.927	641.050	0	6360.391
Proportion of pupils who are female	19722	49.014	7.907	0	100
Proportion of pupils who are female, squared	19722	2464.838	898.366	0	10000
School mean intake ability, 1	18314	-0.003	0.997	-7.981	3.604
School mean intake ability, 2	18314	-0.002	0.997	-8.560	3.673
School mean intake ability, 3	18314	0.001	0.997	-7.500	3.593

Data Appendix Table 3: Descriptive statistics for key outcome variables from SWC and CFR

	N	Mean	SD	Min	Max
Total income per pupil	17071	4504.082	1104.564	2433.47	16808.54
Total income per pupil, squared	17071	2.15E+07	1.30E+07	5921802	2.83E+08
Total income per pupil, cubed	17071	1.11E+11	1.44E+11	1.44E+10	4.75E+12
Total income per pupil, to power 4	17071	6.30E+14	1.83E+15	3.51E+13	7.98E+16
Total expenditure per pupil	17071	4469.390	1125.201	2396.73	18808.730
Total teaching expenditure per pupil	16666	2275.429	518.667	1232.94	9184.065
Total support staff expenditure per pupil	16666	653.198	260.881	0	3184.264
Teaching assistant expenditure per pupil	581	2.064	22.017	0	388.388
Classroom teaching expenditure per pupil	19230	1439.549	453.504	0	25142.150
Senior management expenditure per pupil	19349	424.086	342.507	0	14459.510
Number of senior managers in school (FTE adjusted)	19722	9.179	10.310	0	211.169
Proportion of teaching staff under 30	19710	19.715	13.718	0	100
Proportion of teachers with QTS	19696	98.298	4.458	0	100
Proportion of support staff on short term contracts	19687	88.827	13.576	0	100
Proportion of teachers with time in school less than one year	19710	10.833	11.461	0	100
Age of headteacher	18885	49.552	7.251	28	77
Headteacher salary	18663	62248.39	14758.50	33	227613.0
Proportion of teachers with qualification in main teaching subject	2317	70.651	12.977	14.815	100
Proportion of maths hours taught by qualified subject teacher	2316	74.110	22.417	0	100
Proportion of English hours taught by qualified subject teacher	2305	78.943	19.281	0	100
Proportion of science hours taught by qualified subject teacher	2315	87.302	15.512	0	100
Generosity (%) of teacher pay given teacher and post characteristics	18331	-461.462	2776.150	-9996.12	9980.219

Ref: DFE-RR183

ISBN: 978-1-78105-056-9

March 2012