

Sibieta, Luke

Working Paper

The distribution of school funding and inputs in England: 1993-2013

IFS Working Papers, No. W15/10

Provided in Cooperation with:

The Institute for Fiscal Studies (IFS), London

Suggested Citation: Sibieta, Luke (2015) : The distribution of school funding and inputs in England: 1993-2013, IFS Working Papers, No. W15/10, Institute for Fiscal Studies (IFS), London, <https://doi.org/10.1920/wp.ifs.2015.1510>

This Version is available at:

<https://hdl.handle.net/10419/119579>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

The distribution of school funding and inputs in England: 1993-2013

IFS Working Paper W15/10

Luke Sibieta

The Institute for Fiscal Studies (IFS) is an independent research institute whose remit is to carry out rigorous economic research into public policy and to disseminate the findings of this research. IFS receives generous support from the Economic and Social Research Council, in particular via the ESRC Centre for the Microeconomic Analysis of Public Policy (CPP).

The authors gratefully acknowledge a grant from the Nuffield Foundation (EDU/41701). The Nuffield Foundation is an endowed charitable trust that aims to improve social well-being in the widest sense. It funds research and innovation in education and social policy and also works to build capacity in education, science and social science research. More information is available at <http://www.nuffieldfoundation.org>.

The views expressed and conclusions drawn are those of the authors, and not necessarily those of the Nuffield Foundation or any other individuals or institutions mentioned here, including the Institute for Fiscal Studies, which has no corporate view. All remaining errors and omissions are the responsibility of the authors.

The distribution of school funding and inputs in England: 1993-2013*

Luke Sibieta[†]

March 2015

Abstract

School funding per pupil increased substantially between 1999-00 and 2012-13 in England. It also became more varied across schools with higher levels of funds targeted at more deprived schools. Real-terms increases in funding per pupil were much larger for the most deprived group of primary and secondary schools (83% and 93%, respectively) as compared with the least deprived primary and secondary schools (56% and 59%). In this paper, we decompose these increases in funding per pupil into the amount explained by quantities of different types of staff per pupil, their price and changes in non-staffing costs. We find that some of these increases in funding per pupil translated into larger numbers of teachers per pupil and a higher real-terms cost per teacher (about 20-30% of the increase in funding per pupil). However, a much larger portion of the increases in funding can be accounted for by higher levels and increased variation in the use of teaching assistants (largely lower skilled staff), other non-teaching staff and non-staff inputs (such as learning resources, professional services and energy). Furthermore, there is also evidence to suggest that differences in expenditure between the most and least deprived schools are smaller than differences in funding, with more deprived secondary schools running slightly larger surpluses. Increased use of non-teaching staff was partly an intended policy shift by policymakers at the time. However, we argue that the scale of the changes in inputs are more likely to reflect rigidities, the flexibility of contracts and uncertainty over future funding allocations.

JEL Classifications: H52, I20, I22

Keywords: School Finance

1 Introduction

Spending on schools represents a large and growing share of public service spending in England. In 2012-13, total spending on schools represented £57 billion or about 23% of total service spending in England

*We are grateful to the Nuffield Foundation for financial support (grant reference EDU/41701) as well as the ESRC Centre for the Microeconomic Analysis of Public Policy at IFS (grant number RES-544-28-0001). We thank Damon Clark, Carl Emmerson, Ellen Greaves, Tyrone Bynoe, members of the project advisory group and participants at the Journal of Education Finance Symposium on the Financing of Education for comments and feedback. The provision of data from the Department for Education is much appreciated. This work was based on data from the Annual Survey of Hours and Earnings, produced by the Office for National Statistics (ONS) and supplied by the Secure Data Service at the UK Data Archive. The Labour Force Survey data were supplied through the UK Data Archive. The use of the data in this work does not imply the endorsement of ONS or the Secure Data Service at the UK Data Archive in relation to the interpretation or analysis of the data. All errors remain our own.

[†]Institute for Fiscal Studies and University College London, 7 Ridgmount Street, London. WC1E 7AE, luke_s@ifs.org.uk.

excluding social protection (the 2nd largest component of public service spending behind health)¹. School spending per pupil grew by an average of over 5% per year in real-terms between 1999-00 and 2009-10 (Chowdry et al. (2010)). Since 2010, it has been protected in real-terms, in spite of large cuts to other areas of public expenditure. Understanding how this extra spending translated into funding for different types of schools and overall inputs can provide valuable insights. First, from a taxpayer perspective, it is important to understand what the large increase in spending delivered in terms of extra inputs and whether this represented value for money. Second, the extent to which different types of schools received different levels of funding shows us how the shape of the state education system in England is changing, particularly as the increases were targeted at more disadvantaged schools. Third, as schools in England possess relatively large levels of budgetary autonomy², it can provide valuable lessons for the way schools - and public sector bodies more generally - make financial decisions within a highly decentralised decision-making system.

The main contribution of this paper is to link together two decades worth of data on school characteristics, funding and inputs for schools in England to show how the distribution of funding and inputs has changed across schools over time. We find that funding per pupil increased substantially between 1999-00 and 2012-13. However, it also became more varied across schools, with higher levels of funds targeted at deprived pupils. Real-terms increases in funding per pupil were much larger for the most deprived quintile of primary and secondary schools (83% and 93%, respectively) as compared with the least deprived quintile of primary and secondary schools (56% and 59%). We decompose these increases in funding per pupil into the amount explained by quantities of different types of staff per pupil, their price and changes in non-staffing costs. We find that some of these increases in funding per pupil translated into larger numbers of teachers per pupil and a higher real-terms cost per teacher (about 20-30% of the increase in funding per pupil). However, a much larger portion of the increases in funding can be accounted for by higher levels and increased variation in the use of teaching assistants (largely lower skilled staff), other non-teaching staff and non-staff inputs (such as learning resources, professional services and energy). Furthermore, there is also evidence to suggest that differences in expenditure between more deprived and less deprived schools are smaller than differences in funding, with more deprived secondary schools running slightly larger surpluses.

What drove these changes and what lessons do they provide for the way schools make financial decisions? Policymakers actively encouraged schools to make more use of non-teaching staff over this period in the belief that it could help achieve educational or wider social objectives, and changes in educational need may have required increased use of teaching assistants (such as greater numbers of pupils with English as an Additional Language). However, it is not clear that policymakers ever intended the scale of the shift we observe and it is unlikely to have been driven by robust empirical evidence, as little was available at the time. Indeed, the evidence that now exists suggests that teaching assistants have had a weak effect on pupil attainment (at best), though this could be due to poor training and deployment. We instead argue that the main factors driving increased use of non-teaching staff and non-staff expenditures are the various rigidities schools face when making financial decisions and the short-run nature of funding allocations that encourages greater use of flexible inputs. Furthermore, schools are now likely to be better informed on the empirical evidence with regards to teachers and teaching assistants, but have yet to respond either in terms of staff composition or the way teaching assistants are used.

¹ Author's calculations using PESA (2014), Table 10.1

² OECD Education at a Glance (2012)

These findings are highly relevant to present policy debates in schools. The pupil premium represents a fixed amount of extra funding targeted at disadvantaged pupils. As such, it represents a continuation of the long-term trend of targeting more funding at schools containing larger numbers of disadvantaged pupils. Schools have also been granted more autonomy. Indeed, schools that have converted to Academy status (over half of all secondary schools) have the freedom to deviate from national pay and conditions. However, academies have made limited use of these freedoms to date and there remains uncertainty with respect to future levels of funding. This might lead us to expect the pupil premium to be used in similar ways to previous increases in deprivation funding, with some uncertainty as to how academies may have responded.

This work fits into a number literatures on school finance, the effects of school resources and the way schools make financial decisions. A number of previous papers have documented the extent to which school funding is targeted at deprived schools in England (West et al. (2001); West (2009); Chowdry and Sibieta (2011)). We show how these patterns have changed dramatically over a long time frame. Other countries such as the Netherlands have also chosen to focus funding on deprived schools (de Haan (2014); Leuven et al. (2007)). However, there is a large difference with the US school finance literature, which has focused on equity issues that arise from differences in tax bases across school districts (principally property tax bases) and the effects of school finance equalization programmes on resources and attainment (Silva and Sonstelie (1995); Hoxby (2001); Card and Payne (2002); Fernandez and Rogerson (2003); Verstegen and Jordan (2009)). This issue is less relevant in England as funding for schools is almost entirely covered by grants from central government to local government (i.e. schools are financed through general taxation).

There is a large literature on the effects of resources on pupil attainment. Hanushek (2003) reviews this literature and argues that there is no strong or consistent relationship between school resources and student achievement. He further argues that the lack of a consistent relationship almost certainly reflects rigidities and a lack of strong incentives. This is consistent with our view that increased employment of non-teaching staff was driven by such rigidities and that this may have limited the impact of the increase in resources on pupil attainment. In their review, Verstegen and King (1998) argue that fine resource decisions may matter more than overall levels of resources. Deploying teaching assistants in better ways may be one way to improve their impact. Grubb and Allen (2011) further argue that schools might not possess sufficient information and empirical evidence in order to make efficient decisions and this may also be an important determinant of the inconsistent relationship between resources and attainment. This was certainly the case in the late 1990s, but may be less so since the emergence of empirical evidence on the importance of teachers in the education production function over the 2000s.

The rest of this paper proceeds as follows. Section 2 provides an institutional background and the likely effects of these on the distribution of school funding and inputs. Section 3 describes the data. Section 4 presents some summary statistics detailing how the distribution of funding and inputs across schools have changed over time. Section 5 provides a decomposition of how changes in funding have translated into changes in pay-per head and quantities of different staff, as well as non-staff costs. Section 6 concludes with the implications of the findings for policymakers and future research.

2 Institutional Background

This section provides some key details about the school funding system in England and how specific rules and constraints may affect resource decisions.

In England, the school funding system is a two-stage process. In the first stage, central government allocates grants to local authorities based on the number of pupils in the local authority and measures of educational need (with funds raised through general taxation). However, from 2004 onwards the main grant provided to local authorities (now the Dedicated School Grant) was largely updated by a set percentage in per pupil terms. As a result, differences in funding per pupil across local authorities largely reflected historical differences in funding per pupil from 2004 onwards (and probably earlier given the features of the previous system). In the second stage, local authorities use their own 'fair funding' formulae to allocate funds to schools in their area. These formulae often contain measures of deprivation and educational need (local authorities were obliged to include these from 2002-03 onwards (West, 2009), though many already did). In addition to this, increasing use was made of specific grants over the 2000s. These were grants provided directly from central government to individual schools on the basis of a set formula. They tended to be very focused on deprived schools, making the funding system more targeted at deprivation than it otherwise would have been (Chowdry et al. (2010)). From 2010-11 onwards, these specific grants have been rolled into the main Dedicated Schools Grant. Since 2010-11, the coalition government has also introduced a disadvantaged pupil premium, which provides a fixed amount of extra funding for pupil classified as disadvantaged (in 2014-15, these were £1,300 for pupils in primary schools who had been eligible for free school meals in the past six years and £935 for pupils in secondary schools). This has further added to funding targeted at deprivation.

This system gives rise to a number of key features. First, funding is strongly targeted at measures of social deprivation, which is the result of grants to local authorities accounting for social deprivation and local authorities' own formulae also including social deprivation as a factor. As we shall see later in section 3, this level of redistribution can be quite significant. Furthermore, the addition of specific grants in the 2000s made the funding system more targeted at deprivation (Chowdry and Sibieta (2011)). This contrasts quite sharply with the US system of school finance, which (historically at least) was largely financed by local property taxes and resulted in differences in funding based on local property values. This has given rise to a number of school finance equalization programmes and increases in state and federal grants (Hoxby (2001)).

Second, the fact that funding is allocated to individual schools gives them significant levels of budgetary autonomy. Indeed, schools in England have some of the highest levels of autonomy across OECD countries (OECD, 2012). Schools began to be granted such autonomy after the introduction of Local Management in Schools in 1991, which for the first time gave schools individual budgets and the freedom to make their own budgetary decisions. This was justified on the basis that individual schools are best placed to allocate resources in order to maximise educational performance. This autonomy has gradually been extended over time as more and more responsibilities were transferred from local authorities to schools. Importantly, it is schools themselves who make decisions on how many and which staff to hire (subject to some conditions, see below) and they also determine which other resources they purchase (e.g. books, ICT and professional services). This system therefore provides an ideal context for which to study how schools make their resources choices, especially given the large increases in funding seen over the 2000s.

However, the decisions on how to spend resources are not unconstrained. There are a number of

rigidities and constraints that might sway resource decisions. The cost of employing teachers is the main cost incurred by schools, with about 440,000 full-time equivalent teachers in England in 2012, making up about 50% of the total school workforce and about a half of schools budgets. Furthermore, there are national pay and conditions for teachers in England, which govern their salary levels, other benefits and contractual terms. In principle, schools have discretion about how quickly their teachers move up the pay scale. In practice, during our period of interest, position on the pay scale was largely determined by years of experience. In addition, schools can choose to use some additional payments to pay teachers above the salary scales if they wish³, but these flexibilities are relatively under-used by schools. The financial and legal costs of making a teacher redundant are also significant. One further limit on schools' ability to hire extra teachers is physical space. Most schools are close to physical capacity in terms of the number of pupils they can admit⁴, such that employing an extra teacher would often involve having to find an additional classroom. However, capital spending is set by local and central government and at a relatively long lag. Taking on an extra teacher is thus a significant and binding financial decision for a school, and sometimes not even possible given physical space. This might discourage schools from using additional funding to expand expenditure on teachers.

There is much greater flexibility with regards to the employment of non-teaching staff. The pay and conditions of non-teaching staff is determined locally and schools have freedom to employ staff on fixed or temporary contracts. The previous Labour government established the School Support Staff Negotiating Body (SSSNB) in 2009 to review and establish national pay and conditions. However, this was quickly abolished by the coalition government, with pay and conditions remaining a local responsibility. Given the relative flexibility with which they can be employed, it would not be surprising if schools used much of their increase in funding to expand the numbers of non-teaching staff.

The two main types of staff covered here are teaching assistants and other staff. Teaching assistants have varying roles, including: providing one-to-one support to individual pupils; providing support during lessons; and, providing administrative support for teachers. They are generally lower-skilled compared with teachers, with around two-thirds having qualifications below degree-level (Cribb et al. (2014)), and are generally paid less than teachers and the national average (median salary of around £16,000 for full-time staff in 2012 according to ASHE, compared with £30,000 and £37,000 for primary and secondary school teachers, respectively and a national median of £26,000⁵). As we shall see, their numbers have also increased in recent years and there were about 230,000 full-time equivalent teaching assistants in 2012 (or about 25% of the school workforce). Other staff includes a combination of administrative staff, technicians, other education support staff and auxiliary staff⁶. Their numbers have also grown in recent years, with about 220,000 full-time equivalent staff in 2012 or just under 25% of the total school workforce.

A further important constraint on school decision-making is the timing of funding decisions. Over most of the period of study (the early 1990s through to present day), school funding levels were determined annually by central and local government. Many of the specific grants introduced during the 2000s were often temporary and regularly restructured, giving rise to further uncertainty. The main exception is 2007-

³ Additional payments include recruitment and retention payments, teaching and learning responsibility payments and payments for teachers working with children with special educational needs.

⁴ <https://www.gov.uk/government/collections/statistics-school-capacity>

⁵ <http://www.ons.gov.uk/ons/rel/ashes/annual-survey-of-hours-and-earnings/2012-revised-results/index.html>

⁶ According to the the School Workforce Census (<https://www.gov.uk/government/statistics/school-workforce-in-england-november-2013>), in 2012 there were approximately 83,000 staff in administrative roles, 25,000 technicians, 30,000 other education support staff (such as matrons or childcare staff) and 87,000 auxiliary staff (such as catering or school maintenance staff). All figures here are expressed in FTE terms.

2010 when schools were given three-year budgets. With this exception in mind, schools generally have little certainty over their budgets from year to year. Although various mechanisms were in place to give schools greater stability (such as the minimum funding guarantee, which guaranteed schools a minimum increase in per pupil funding), the frequency of reforms and changes to the school funding system means that schools have limited ability to predict their budgets in future years and the level of the minimum funding guarantee has also varied a lot from year to year. This uncertainty could further encourage schools to employ resources that allow more flexibility, such as non-teaching staff and non-staff resources. It may also encourage them to build up precautionary savings and thus not spend their full allocation from government

Similarly, an additional source of uncertainty concerns pupil numbers. Schools need to be confident pupil numbers will not fall if they choose to employ an extra teacher. However, variations in cohort size from year to year and parental preferences (partly driven by results and OFSTED ratings) may create uncertainty from the point of view of schools.

Finally, one very important recent change to the school system has been the very rapid expansion of the Academies programme. The number of Academies has expanded from around 200 schools in 2010 to reach over 3,800 schools in 2014 (and accounting for over half of all secondary schools). These are like US charter schools and have significant freedom, both in terms of resources and curriculum. For instance, they do not have to follow national pay and conditions for teachers, though these freedoms have rarely been used in practice. Moreover, Academies face the same uncertainties over funding. Therefore, there are reasons to think Academies might make different decisions, but there are also similar constraints over funding as for maintained schools.

3 Data

Our main interest lies in analysing how funding and inputs have changed across different types of schools in England over time. This requires us to link together various administrative datasets on funding, inputs and school characteristics. We also use employee-level data in order to calculate average pay levels of different types of school staff. Here, we describe the different datasets we use, how they are linked together and some summary statistics based on the linked data.

3.1 Data sources

Data on school characteristics are taken from a combination of two different sources. The Local Education Authority School Information Service (LEASIS) contains data on school phase, governance and average pupil characteristics (number of pupils, proportion of pupils eligible for free school meals, proportion of pupil with special education needs, proportion of pupils with English as an additional language and other characteristics) and is available from January 1993 to January 2009. From January 2010 to January 2013, we make use of similar raw school-level data underlying annual statistics on pupils, schools and their characteristics⁷); the only difference with LEASIS is that small numbers are suppressed to prevent disclosure of personal data.

LEASIS also contains data on staffing levels between January 1993 through to January 2010. For later years, we then make use of publicly available school-level data taken from the new School Workforce

⁷e.g. <https://www.gov.uk/government/statistics/schools-pupils-and-their-characteristics-january-2013>

Census⁸, which relates to November 2010 to November 2012. As we shall see, the figures for staff levels in 2010 are oddly low, which seems likely to be the result of the fact that the survey was still experimental. Staffing levels appear to be return to their pre-2010 trends from 2011 onwards.

In both data sources, we define three different staff categories: teachers; teaching assistants; and, other staff. All statistics are reported on a full-time equivalent basis. Teachers are defined as the number of qualified teachers. Teaching assistants are defined to be as consistent as possible over time given changing definitions within the data over time. For 1993-2004 and 2008-10, teaching assistants are defined as the sum of a number of different staff types⁹. For 2005-2007 and 2011 onwards, we must instead rely on the total number of teaching assistants as defined within the data, to which we add unqualified/student teachers¹⁰. These changing definitions do not appear to lead to major discontinuities in trends for the numbers of teaching assistants over time. We also define other staff to be as consistent as possible over time. Before 2011, other staff are defined as the residual between total staff, teachers and teaching assistants. For 2011 and 2012, this is defined as a separate category and additionally includes auxiliary staff (such as caretakers). This change in 2011 does lead to a small jump in numbers of other staff for primary schools, which we show in section 4 and account for in the decomposition in section 5.

Data on funding and expenditure per pupil is primarily taken from Section 251 (formerly Section 52) outturn data for schools from financial years 1999-00 through to 2012-13. These data list the total income and expenditure of all maintained schools in England, and from 2009-10 give spending on major categories at the school-level. Our main measure of funding is total funding from government grants (i.e. it excludes any self-generated income). Academies are missing from the data up to 2010, which is not major problem up to 2010 as their numbers were relatively small and were often brand new schools. However, this is a potential problem from 2010 onwards. Therefore, from academic year (September to August) 2011-12 onwards we supplement this with similar data listing the funding and expenditure of academies¹¹. Unfortunately, many schools that are part way through the conversion process are not listed in either the section 251 or academy data. This reduces the sample size of schools with known financial data from 2010-11 onwards. Although not ideal, this does not seem to affect the average characteristics of schools within the sample each year (see next sub-section).

In order to decompose the change in funding into the amount explained by changes in staffing levels and cost per head, we must also calculate the employer costs of different types of school staff over time. We do this using the Annual Survey of Hours of Earnings for 1999-00 through to 2012-13. Within each year of the data, we identify four types of school staff within the public sector: primary school teachers; secondary school teachers; teaching assistants; and, other school staff (based on anonymous employer identifiers where there are more than two teachers). For all individuals included here, we then calculate their total employer cost as gross salary plus employer national insurance contributions based on the prevailing system during the year in question and reported employer pension contributions (2005-06 onwards, before 2005-06 this is based on scheme rules for teachers and the average employer contribution across other types of staff in the

⁸<https://www.gov.uk/government/collections/statistics-school-workforce>

⁹In the case of 1993-2004 it is the sum of student/unqualified teachers, nursery assistants, language assistants, technical assistants, special needs support staff, other assistants. For 2008-2010, it is defined as the sum of student/unqualified teachers, teaching assistants, higher level teaching assistants, special needs support staff, bilingual support support, other ethnic minority support staff.

¹⁰The pay levels of this latter group are more similar to that of teaching assistants than teachers, which is why they are grouped as such

¹¹<https://www.gov.uk/government/statistics/income-and-expenditure-in-academies-in-england-academic-year-2011-to-2012>

local government pension scheme as seen in 2005). These are then averaged across all four staff types each year, giving us a time series for the employer cost of each staff type.

3.2 Linkage and sample selection

Our starting point for data linkage is the LEASIS and pupil characteristics for each academic year (as measured from January 1993 to January 2013). To this, we link financial data for maintained schools for the financial year covering the January in question (i.e. financial year 2007-08 is linked to January 2008 and academic year 2007-08). For academies from 2010-11, financial data is for academic years, which we link to the January in question (i.e. academic year 2010-11 is linked to January 2011). Data from the School Workforce relates to November each year, which is linked to the January within the same academic year (i.e. November 2010 is linked to January 2011 and academic year 2010-11).

We focus on state-funded primary and secondary mainstream schools (ages 5-11 and 11-16, respectively). Middle schools are grouped with either primary or secondary schools; depending on whether more pupils are of primary or secondary age. We exclude special schools and pupil referral units (which together accounted for about 7% of local authority funding for schools in 2012-13) and independent schools, whose numbers were broadly stable over this period. We also exclude schools that are newly opened or have the smallest numbers of pupils as these are likely to have very different staffing/funding levels (the 1% of primary and secondary schools with the lowest numbers of pupils).

The linked school-level data over time is summarised in Table 1 for both primary schools (panel (a)) and secondary schools (panel (b)), which give the number of schools seen in LEASIS or its equivalent, the numbers with missing funding data, the numbers of Academies and some characteristics of the schools in the sample (average numbers of pupils, pupils eligible for free school meals, pupil: teacher ratios and funding per pupil).

As can be seen, the numbers of primary and secondary schools has been declining over time, reflecting a more general decline in the pupil population. The number of schools with missing funding data is generally very small up to the late 2000s. The number is clearly higher for secondary schools, but this is mainly newly established Academies and which are missing from the funding data. The number with missing data rises quite strongly in 2011-12 and 2012-13, reflecting lots of schools being mid-way through the Academy conversion process. However, the average characteristics of pupils within the linked data do not appear to show a jump or discontinuity in 2011-12. The average size of both primary and secondary schools has been rising gradually over time, whilst the proportion of children eligible for FSM declined prior to the Great Recession and has gradually increased since then. Pupil:Teacher Ratios have declined slightly over time for both primary and secondary schools. Funding per pupil rose substantially over the 2000s, rising by 69% in real-terms for primary schools and 72% for secondary schools between 1999-00 and 2012-13.

4 Changes in the distribution of funding and inputs over time

We now discuss changes in the distribution of funding over time and how this has fed through into changes in the distribution of staffing inputs. In the next section, we present a more precise decomposition of how increases in funding across different groups of schools can be accounted for by changes in the quantity and prices of inputs over time.

In Figure 1, we show the distribution of funding per pupil for selected years between 1999-00 and 2012-13, which is shown separately for primary (panel (a)) and secondary schools (panel (b)). Two things become immediately clear. Firstly, the distributions have shifted rightwards over time as funding per pupil has risen strongly in real-terms over time. Secondly, there has been an increase in the dispersion of funding per pupil for both primary and secondary schools. In 1999-00, there was quite a tight distribution of funding per pupil. This has become much more varied by 2012-13.

With expenditure on teachers being the largest component of schools spending, to what extent have these changes in funding per pupil translated into changes in the pupil:teacher ratio? As can be seen in Figure 2, pupil:teacher ratios have fallen slightly over time for both primary and secondary schools (by about 11% and 12% at the mean, respectively). However, the falls are clearly a lot smaller than the increases in funding over this time and there is almost no increase in the dispersion of pupil:teacher ratios. The question is therefore which other inputs can account for the increases in overall funding and increased dispersion.

Figure 3(a) and (b) show the median levels of different staffing inputs per 100 pupils over time for primary and secondary schools, together with the 25th and 75th percentiles. We divide staff into three categories (teachers, teaching assistants and other staff). Rather than pupil:staff ratios, we use staff per pupil as this allows for easier comparisons between the three staff types. As we have already seen, the numbers of teachers per pupil has increased slightly over time, but there has been no substantial increase in variation across schools. However, there have been very large increases in average levels and variation in the use of teaching assistants and other staff. Amongst primary schools, the number of teaching assistants has risen from around 1 per 100 pupils in the late 1990s to reach around 3.4 per 100 pupils in 2012-13, with substantial variation across primary schools in terms of the numbers of teaching assistants as well. For secondary schools, the average levels and growth in the number of teaching assistants has been lower. However, the numbers of teaching assistants has still grown from 0.4 to 1.8 teaching assistants per pupil between 1999-00 and 2012-13.

For secondary schools, there has been a larger increase in other types of staff, which has risen from around 1 per 100 pupils to just over 3 per 100 pupils over the same period. There is also large variation across secondary schools in terms of their use of other staff, with 75th percentile being nearly 50% higher than the 25th percentile. Primary schools make less use of other staff, with around 2 per 100 pupils in 2012-13, though these numbers have clearly also grown over time. However, there is also a clear discontinuity in 2011-12 when auxiliary staff were explicitly included in staff counts (it is uncertain how and whether they were counted before this date). This is particularly clear for primary schools and less so for secondary schools. To account for this discontinuity in later analysis, we assume that the growth in auxiliary staff has been the same as the growth in other staff for primary schools (excluding teachers and teaching assistants). We do not perform this adjustment for secondary schools as it implies a very large drop in other staff in 2011-12, making it likely that auxiliary staff were at least partially covered in earlier data. As we mentioned earlier, there is a noticeable drop in teaching assistants and other staff in 2010-11, which seems likely to result from the experimental nature of the School Workforce Census in that year and data returns to pre 2010-11 shortly afterward.

Therefore, it seems as if a large part of the increased level and variation in funding can be accounted for by greater use and variation in the numbers of teaching assistants and other non-teaching staff. The former play a more important role for primary schools and the latter being more important for secondary

schools.

We can also examine how the increased dispersion in funding translated into differences across different groups of schools. Here, we see that the increased dispersion in funding per pupil can be in a large part explained by increased targeting of funding at more deprived schools. In Figure 4(a) and (b) we split primary and secondary schools into quintiles of school-level deprivation based on the proportion of children eligible for free school meals each year. We then calculate how funding per pupil differs across these five quintiles for selected years between 1999-00 and 2012-13. In 1999-00, there was already some degree of funding targeted at deprivation, with funding per pupil in the most deprived primary (secondary) schools being 17% (15%) greater than in the least deprived ones. However, between 1999-00 and 2012-13, funding per pupil rose much more strongly amongst the most deprived primary and secondary schools. Funding per pupil in the most deprived primary schools rose by 83% in real-terms between 1999-00 and 2012-13 and by 93% amongst the most deprived secondary schools. This is much higher than the equivalent, though also large, growth in funding per pupil at the least deprived primary (56%) and secondary (59%) schools. As a result, funding per pupil in the most deprived primary (secondary) schools was 38% (39%) greater than in the least deprived ones in 2012-13, a very substantial increase in the level of funds targeted at school deprivation. As can be seen, this increase in funding targeted at deprivation occurred both during the 2000s and after 2010-11 when the pupil premium was increased. The pupil premium seems to represent a continuation of this long-run trend, rather than a major shift.

Of course, the level of deprivation is not the only way in which schools differ. However, even if we account for other differences in pupil intakes, regional differences and school characteristics, we still see a very large increase in funding targeted at deprivation. Figure 5 shows the estimated increase in funding per pupil resulting from a one standard deviation increase in the proportion of pupils eligible for free school meals, after controlling for other characteristics of the school and pupil population. The responsiveness of school funding to deprivation clearly increases substantially over time, again particularly during the early 2000s and since the introduction of the pupil premium in 2010-11. At this point, it is worth noting that this may actually have caused additional uncertainty over funding for schools as more funding is determined by the types of pupils attending the school, which may change from year to year.

5 Decomposition of increase in funding

We now seek to decompose the extent to which increases in funding can be explained by changes in the quantities of staffing inputs and changes in pay-per-head. We focus on changes in funding per pupil over the whole period covered by our data from 1999-00 through to 2012-13. This is largely data driven as school-level data on funding is not available before 1999-00. However, there was little average growth in staff inputs in the 1990s (as seen in Figure 3) and there was little growth in overall education spending grew little over the 1990s (Chowdry et al, 2010). We are thus focusing on the period when schools spending rose markedly. We focus on the overall change between 1999-00 and 2012-13 in the main results and compare results across schools facing different levels of deprivation (given that this is a major explanation for the increased variation in funding).

5.1 Methodology

We assume there are three staff types (s), each with a different cost to the school of P_t^s per year. We can then decompose the change in funding per pupil over time across schools in quintile j ($\Delta Y_{j,t}$) into the following components:

$$\Delta Y_{j,t} = \sum_{s=1}^S (\Delta Q_{j,t}^s \bar{P}^s) + \sum_{s=1}^S (\Delta P_t^s \bar{Q}_j^s) + \Delta X_{j,t}$$

where $\Delta Q_{j,t}^s$ represents the change in the quantity of staff type (s) per pupil for schools in quintile (j) between (t) and ($t-1$) and \bar{Q}_j^s represents the average across the two years. ΔP_t^s represents the change in the average pay-per-head of staff type (s) and \bar{P}^s represents the average cost-per-head of each staff type over time. The first term gives the change in funding per pupil that can be explained by increasing quantities of staff types and the second term how much can be explained by changes in cost per head. The third term ($\Delta X_{j,t}$) is the residual and represents the change in expenditure on non-staffing inputs for schools in quintile (j) in this simple illustration.

This decomposition builds in a number of assumptions required for estimation. First, the cost-per-head values are assumed constant within each staff type. These are then estimated from ASHE as the mean employer cost of each staff type (teachers, teaching assistants and other staff) incorporating salary costs, social security contributions and employer pension contributions. The fact that these values are estimated and assumed constant within each staff type clearly introduces error and means that $\Delta X_{j,t}$ must partly be interpreted as including such errors. However, the figures implied by our estimation give broadly similar figures for staffing costs as a share of total funding as per national figures, suggesting the estimates are relatively accurate.

Second, we assume that pay-per-head is constant across deprivation quintiles for each staff type. This is a necessary assumption given data on average teacher salaries by school is not available until 2010-11. It is a plausible assumption given national pay and conditions. However, pay and conditions do allow for some geographic variation to reflect higher costs of living in the London area (Greaves and Sibieta, 2014) and schools tend to be more deprived in London. Salaries also vary with experience, particularly for teachers, and more deprived schools have historically had younger teachers, on average. However, in the robustness checks, we show that average teacher salary levels do not vary substantially across deprivation quintiles, suggesting that the geographic and experience effects on teacher salaries largely cancel each other out in practice in terms of differences across quintiles. We also present changes in teacher characteristics over time, which shows that teachers are gradually getting slightly younger and less experienced over time. This suggests that we might be under-stating the rise in pay-per-head over time and over-stating the role of other factors. However, this is likely to be small given the relatively small changes in average teacher characteristics over time.

Third, we assume that all funding is spent on schooling inputs within the given year (i.e. no savings or borrowing by schools). This is plausible as schools are not able to borrow funds. However, they are able to carry surpluses over from one year to the next and these accumulated balances have become relatively significant in recent years. In the robustness check, we show that these surpluses are relatively small for

primary schools, but are slightly larger for secondary schools.

5.2 Results

Table 2 and 3 show the results of this decomposition for the changes in funding per pupil between 1999-00 and 2012-13 for primary and secondary schools across quintiles of school deprivation, respectively. We already saw the large change in funding per pupil for primary and secondary schools, with much larger increases in funding per pupil for the most deprived set of schools. The most deprived primary schools saw a real-terms (in 2012-13 prices based on the GDP deflator) increase in funding of £2,300 (83%), whilst the most deprived secondary schools saw an increase of £3,400 (93%) Here, we show how much can be attributed to changes in the quantities of teachers, teaching assistants and other staff, their cost per head and non-staffing costs.

Starting with primary schools, although the increases in numbers of teachers seen earlier was relatively small, the fact that they are relatively expensive means that even a small increase accounts for a noticeable share of the increase in funding. Across quintiles, increased numbers of teachers account for about 12-15% of the increase in funding per pupil, with slightly larger absolute amounts for the more deprived primary schools. However, a much larger amount is explained by increased numbers of teaching assistants and other staff. For the most deprived primary schools, the amount explained by increased numbers of teaching assistants is just over £500 per pupil, while increased numbers of other staff per pupil explain just over £400 per pupil. Collectively, these two changes explain about 40% of the increase in funding per pupil between 1999-00 and 2012-13 for the most deprived schools. For less deprived schools, the share explained by non-teaching staff is higher, but the absolute amount is a lot lower, about £560 per pupil for the least deprived schools for non-teaching staff considered together. Increases in the real-terms cost-per-head of teachers explain a small but important amount of the increase in funding (about £200 across quintiles). The figures for other staff are relatively small as these are still fewer in number.

Considered together, increases in the quantity and price-per-head of these three staff types explain about 82% of the increase in funding per pupil for the least deprived primary schools and about 69% for the most deprived ones. The remainders are interpreted as reflecting increases in non-staff costs, which are clearly most significant for the most deprived primary schools. In summary, increases in the numbers and the cost of teachers explain a small, but noticeable amount of the increases in funding for primary schools. However, a much larger amount can be explained by increases in the numbers of non-teaching staff and in non-staff expenditure. These latter factors can also explain a good deal of the increased targeting of funding at deprivation.

The results for secondary schools are generally similar, though there are some important differences. Firstly, the amount explained by higher quantities of teachers is slightly higher (about 13-17%). The absolute amount explained by higher numbers of teachers per pupil is also clearly higher for the most deprived secondary schools (about £550) than for the least deprived ones (£250), showing that some of the increase targeting of funding at deprivation is being reflected in higher numbers of teachers per pupil for secondary schools. However, we still see a much larger share and amount spent on non-teaching staff, particularly other staff (explaining 20-29% of the increase in funding per pupil). Collectively, increased numbers of non-teaching staff explain about £1,060 of the increased funding per pupil for deprived secondary schools (or around one third), with the majority explained by other staff rather than teaching assistants. For the least deprived secondary schools, this is lower at around £720, suggesting a large amount of the increase targeting

of funds at deprivation is being reflected in higher numbers of non-teaching staff for secondary schools.

Increases in the cost of staff per head explain a similar amount in absolute terms for secondary schools as was the case for primary schools, with increases in the cost of teachers explaining the most here, reflecting their higher numbers. The figures explained by increases in the cost-per-head of non-teaching staff play a very small role.

In total, a much smaller share of the increase in funding per pupil is explained by staff-costs than was the case for primary schools. About 61% for the most deprived secondary schools and about 74% for the least deprived ones. This would suggest that a much larger amount is explained by non-staffing costs for secondary schools and that this also explains a large amount of the increases in funding for the most deprived secondary schools. We provide further detail in the next section to help interpret whether these results are plausible and the factors included in non-staffing costs.

In summary, there have been large increases in funding per pupil over this period, particularly for the most deprived set of schools. A good proportion of these increases can be explained by increased numbers and costs of teachers. However, a much larger share can be explained by increased numbers of non-teaching staff (teaching assistants and other staff) and expenditure on non-staff costs. Increases in expenditure on non-teaching staff and non-staff costs are also strongly graded by school deprivation, suggesting that it is these factors that explain the lion's share of the increased targeting of funding towards school deprivation.

5.3 Robustness checks

In order to aid interpretation of these results and test their robustness, we now present some further analysis of overall staff costs, expenditures and trends in teacher characteristics over time. Table 4, in particular, presents how a number of different factors vary across school deprivation quintiles in 2012-13.

It is not currently possible to precisely calculate staffing costs as a share of funding per pupil at the school-level. However, national average figures are available for primary and secondary schools, which we can compare against the figures for staffing costs as a share of funding implied by our decomposition (actual staff levels multiplied by our estimated cost per head values). Table 4 thus shows the implied levels of staffing costs as a share of funding as calculated in our decomposition, and how they vary across quintiles. For secondary schools, the figures across quintiles are similar to the average figure of 78%. For primary schools, the implied results are slightly higher than the average figure of 79%. However, in both cases, we seem more likely to over-stating rather than under-stating staffing costs and thus probably under-stating non-staff costs. Unfortunately, it is not possible to verify the variation across quintiles. The table also shows the actual teacher salary levels do not vary substantially across quintiles, suggesting that our assumption of no variation across quintiles is plausible.

In order to help understand the differences in non-staffing costs, we present five major items of non-staffing expenditure (energy, learning resources, ICT, services and other). Note that this is not the complete set of non-staffing expenditure as items like catering and back-office expenditure cannot be separated into staffing and non-staffing components. For both primary and secondary schools, learning resources (such as books) are clearly a large component of non-staffing costs, with a bigger deprivation gradient for secondary than primary schools. Energy expenditure is also a relatively large component, with deprived primary schools spending noticeably more per pupil than less deprived ones (these differences perhaps reflecting the nature or age of the buildings). ICT and professional services are smaller components, with both showing a small

deprivation gradient across primary and secondary schools. Other expenditure (not classified elsewhere) is then much larger for secondary schools, though is not particularly graded by deprivation for primary or secondary schools. In summary, non-staffing costs includes a range of different expenditures, with all clearly graded by deprivation to some extent. The differences by deprivation are largest for learning resources and professional services for both primary and secondary schools, with additional evidence of a clear difference in energy costs for the most and least deprived primary schools.

Another potential concern is that the composition of the workforce is changing over time and this is biasing our estimates of the changes in pay-per-head over time. For example, if most of the increase in staff quantities can be accounted for by staff at below average cost (e.g. lots of young, inexperienced teachers) then our estimates of the change in cost-per-head will be biased downwards and we would not pick up as much of the increased quantity of young staff. Figure 6 shows the average age and tenure of teachers over time from Labour Force Survey. This shows that teachers have been getting slightly younger and less experienced over time. However, the changes are relatively small, with the average age of teachers falling from 42 in the late 1990s to 40 by 2013. This suggest that any bias is likely to be equally small.

One alternative explanation for the changes in non-staffing costs by schools is that surpluses have increased, particularly for more deprived schools. Table 4 therefore shows differences in total income per pupil (including self-generated income, around £200 per pupil), expenditure per pupil and implied surpluses per pupil across deprivation quintiles in 2012-13. As can be seen, there is evidence of small surpluses for primary schools, which do not vary substantially across quintiles. There is evidence of larger variation across secondary schools, with a surplus of around £100 per pupil for the least deprived schools and about £250 per pupil for the most deprived secondary schools. This suggests that differences in surpluses do not play much of a role for primary schools. However, there are clear differences between the least and most deprived secondary schools.

5.4 Summary and discussion of results

In summary, there were much larger increases in funding per pupil for the most deprived primary and secondary schools (£2,300 and £3,400, respectively) over this period than was the case for least deprived primary and secondary schools (£1,300 and £1,900, respectively). The decomposition has shown that that higher numbers of teachers per pupil and higher real-terms costs of teachers can account for a small, but notable, proportion of the increase in funding per pupil across primary and secondary schools (about 20-30% in total). However, these increases have not differed in absolute value by school deprivation, with the exception of a slightly larger amount explained by higher quantities of teachers per pupil for the most deprived secondary schools. A much larger proportion of the increase in funding per pupil across quintiles of social deprivation can be explained by increasing quantities of teaching-assistants and other staff per pupil (explaining about 40-44% of the increase in funding per pupil across primary schools and 31-38% across secondary schools). There are also strong differences across quintiles in terms of the absolute amount, with increasing quantities of non-teaching staff accounting for about £930 of the increase in funding per pupil for the most deprived primary schools compared with £560 for the least deprived ones, and equivalent figures of £1,060 and £720 for the most and least deprived secondary schools. A large amount of the increase in overall funding, and in deprivation funding, translated into greater numbers of non-teaching staff per pupil. In addition to this, a substantial proportion of the increase in funding per pupil seems to have

been reflected in higher expenditures on non-staffing inputs (such as ICT, energy, professional services and learning resources), with our robustness checks confirming that this is likely to represent a genuine increase. Furthermore, for secondary schools, we think that some of the increasing difference in funding in per pupil between the most and least deprived schools is not actually being reflected in differences in expenditure per pupil (the difference in funding per pupil between the most and least deprived secondary schools was £2,000 per pupil in 2012-13, as compared with £1,800 in expenditure per pupil).

What drove these changes and what lessons do they provide for the way schools make financial decisions? There are a number of possible explanations, which we think differ in their plausibility.

First, this may have been an optimal response to changes in the education production function or measures of educational need. This was certainly part of the motivation for the shift, with policymakers strongly encouraging the increased use of non-teaching staff. A government consultation on developing the role of support staff in 2002 states that “support staff can release significant amounts of time for teachers and headteachers to focus on their core professional role [and that] better trained support staff will in their own right enrich the experience of pupils¹².” This consultation also states that schools were given sufficient funding to employ an extra 50,000 support staff over the course of the parliament. In reality, the number of teaching assistants grew from 80,000 in 2000 to 150,000 in 2005 and to 190,000 by 2010, while the number of other non-teaching staff grew from 80,000 in 2000 to 120,000 by 2005 and 170,000 by 2010¹³. The number of teachers also grew, but by much less (growing from 400,000 in 2000 to reach 450,000 by 2010). It is not clear whether policymakers ever intended a shift in the workforce of this scale. Furthermore, the recent international TALIS survey shows that schools in England are relatively unusual in their high reliance on non-teaching staff as compared with other countries¹⁴.

Changes in educational need are likely to form part of the explanation. For instance, amongst the schools in our sample, the proportion of pupils with English as an Additional Language increased from 9% to 18% in primary schools between 1999-00 and 2012-13, and from 8% to 14% in secondary schools. Teaching assistants and other staff are used to support children with English as an Additional Language. However, this is certainly not their sole or main role. As a result, we think changes in educational need are also unlikely to explain the full scale of the change we observe.

In any case, it seems unlikely that this change in the composition of the school workforce was driven by robust empirical evidence, as there was little available at the time. Indeed, a body of empirical evidence developed over the 2000s showing the importance of teachers in the education production function (Rockoff (2004); Rivkin et al. (2005); Aaronson et al. (2007); Slater et al. (2009)) as well as evidence to suggest small effects of reducing class sizes (Krueger and Whitmore (2001); Angrist and Lavy (1999)), though this finding is not universal (Hanushek (2003)). There is less evidence on the effectiveness of teaching assistants. The evidence that does exist suggests they have had relatively weak effects on pupil attainment (Blatchford et al. (2011); Farrell et al. (2010)), with Blatchford et al. further arguing that this may have been due to poor training and inefficient deployment. In hindsight, the empirical evidence now suggests that the shift towards non-teaching staff is unlikely to have been the most efficient resource choice in terms of improving pupil attainment. Furthermore, schools are now better informed on the empirical evidence with regards to teachers and teaching assistants, but have yet to respond either in terms of staff composition or the way

¹²http://dera.ioe.ac.uk/4756/12/Standards1_Redacted.pdf

¹³<https://www.gov.uk/government/collections/statistics-school-workforce>

¹⁴<https://www.gov.uk/government/publications/teachers-in-secondary-schools-evidence-from-talis-2013>

teaching assistants are used.

However, it is important to acknowledge that increases and changes in school resources can be still be valuable even if they do not increase attainment (Cellini et al. (2010)). Non-teaching staff could have helped schools achieve wider social objectives, such as improved behaviour, attendance or health. It is beyond the scope of this paper to analyse the extent to which non-teaching staff actually helped schools achieve such wider objectives.

A much more plausible explanation in our view is that the scale of the change is likely to have been driven by the various rigidities that schools face when making financial decisions, as well as the the timing of funding allocations. Teachers in England are employed on relatively inflexible contracts with national pay and conditions and a high financial cost of redundancy. Furthermore, capital spending on such factors as an extra classroom is still the responsibility of local and central government, which might make it difficult for schools to employ extra teachers. Other staff such as teaching assistants and administrative can be employed on relatively flexible, sometimes temporary, contracts. Non-staffing inputs can also be changed at relatively short notice, with the exception of some running costs like energy expenditure.

The timing of funding allocations also seems likely to have increased the desirability of flexible inputs. School funding tends to be determined annually, giving schools little certainty with regard to their long-run budget, increasing the incentive to employ flexible inputs. Moreover, the uncertainty with regards to future budgets may have created an incentive to engage in precautionary savings, which we observe in the form of surpluses on current budgets. This incentive is particularly strong in the present climate of expected (and uncertain) future cuts to public spending as well as planned reforms to school funding (which have not been set out in any great detail¹⁵).

In summary, policymakers actively encouraged schools to make more use of non-teaching staff over this period in the belief that it could help achieve educational or wider social objectives, and changes in educational need may have required increased use of teaching assistants (such as greater numbers of pupils with English as an Additional Language). However, it is not clear that policymakers ever intended the scale of the shift we observe and it is unlikely to have been driven by robust empirical evidence, as little was available at the time. We believe that the main factors driving increased use of non-teaching staff and non-staff expenditures are the various rigidities and that schools face when making financial decisions and the short-run nature of funding allocations that encourages greater use of flexible inputs. Furthermore, schools are now likely to be better informed on the empirical evidence with regards to teachers and teaching assistants, but have yet to respond either in terms of staff composition or the way teaching assistants are used.

6 Conclusion

We have argued that a large part of the increased variation and targeting of school funding towards deprivation has mostly translated into higher quantities of non-teaching staff and non-staff expenditure. These choices are more likely to reflect rigidities, the nature of contracts and the timing of funding allocations, rather than representing optimal responses to changes in the education production function. These findings

¹⁵Details of the limited reforms announced for 2015 can be found here: <https://www.gov.uk/government/publications/fairer-schools-funding-arrangements-for-2015-to-2016>

have a number of implications for policy and future research.

First, when allocating extra funding to schools, policymakers should consider the incentives and rigidities schools face and what these might mean for resource decisions. If they do not like those expected resource decisions, then they should seek to change the incentives schools face. Second, Academies have more flexibility on pay and conditions of teachers than maintained schools do. It will be important to understand whether these extra flexibilities have led academies to make difference resource decisions. Sufficient years of data will soon be available to permit such analysis.

Third, we have argued that uncertainty on future funding allocations can also sway resource decisions, both in terms of spending more on flexible inputs and encouraging precautionary savings. This is in spite of this period being characterised by large increases in funding across all types of schools. If these increases had been fully anticipated, then resource decisions may well have looked different. The government has stated that it plans to reform the school funding system to make it simpler and rationalise allocations to schools and local authorities (and has already undertaken some reforms in this direction). However, there is significant uncertainty as to what reforms will come in over the next few years. Such uncertainty seems likely to be encouraging schools to make greater use of flexible inputs.

Finally, it will be important to understand what the implications of these resource choices have been for the attainment of different groups of pupils. To date, the UK literature on school resources have used quasi-experimental evidence to find modest, positive effects of overall resources, largely focusing on the late 2000s. As we have shown, the changes in resources were probably even more dramatic over the early 2000s and after the coalition came to power in 2010. Furthermore, it will be important to understand whether differences in actual input choices across have had different implications for pupil attainment.

7 Bibliography

- Aaronson, D., L. Barrow, and W. Sander (2007): “Teachers and Student Achievement in the Chicago Public High Schools,” *Journal of Labor Economics*, vol. 25(1), 95–135.
- Angrist, J. D. and V. Lavy (1999): “Using Maimonides’ Rule To Estimate The Effect Of Class Size On Scholastic Achievement,” *The Quarterly Journal of Economics*, vol. 114(2), 533–575.
- Blatchford, P., P. Bassett, P. Brown, C. Marti, A. Russell, and R. Webster (2011): “The impact of support staff on pupils positive approaches to learning and their academic progress,” *British Educational Research Journal*, vol. 37(3), 443–464.
- Card, D. and A. A. Payne (2002): “School finance reform, the distribution of school spending, and the distribution of student test scores,” *Journal of Public Economics*, vol. 83(1), 49–82.
- Cellini, S. R., F. Ferreira, and J. Rothstein (2010): “The Value of School Facility Investments: Evidence from a Dynamic Regression Discontinuity Design,” *The Quarterly Journal of Economics*, vol. 125(1), 215–261.
- Chowdry, H., A. Muriel, and L. Sibieta (2010): “Education Policy,” Technical report, IFS Election Briefing Notes.
- Chowdry, H. and L. Sibieta (2011): “School Funding Reform: an Empirical Analysis of Options for a National Funding Formula,” Technical report, Institute for Fiscal Studies.
- Cribb, J., R. Disney, and L. Sibieta (2014): “Public Sector Workforce: Past, Present and Future,” Technical report, Institute for Fiscal Studies.
- de Haan, M. (2014): “The effect of additional funds for low-ability pupils: A nonparametric bounds analysis,” *Economic Journal*.
- Farrell, P., A. Alborz, A. Howes, and D. Pearson (2010): “The impact of teaching assistants on improving pupils’ academic achievement in mainstream schools: a review of the literature,” *Educational Review*, vol. 62(4), 435–448.
- Fernandez, R. and R. Rogerson (2003): “Equity and Resources: An Analysis of Education Finance Systems,” *Journal of Political Economy*, vol. 111(4), 858–897.
- Grubb, W. and R. Allen (2011): “Rethinking school funding, resources, incentives, and outcomes,” *Journal of Educational Change*, vol. 12(1), 121–130.
- Hanushek, E. A. (2003): “The Failure of Input-Based Schooling Policies,” *Economic Journal*, vol. 113(485), F64–F98.
- Hoxby, C. M. (2001): “All School Finance Equalizations Are Not Created Equal,” *The Quarterly Journal of Economics*, vol. 116(4), 1189–1231.
- Krueger, A. B. and D. M. Whitmore (2001): “The Effect of Attending a Small Class in the Early Grades on College-Test Taking and Middle School Test Results: Evidence from Project STAR,” *Economic Journal*, vol. 111(468), 1–28.

- Leuven, E., M. Lindahl, H. Oosterbeek, and D. Webbink (2007): “The Effect of Extra Funding for Disadvantaged Pupils on Achievement,” *The Review of Economics and Statistics*, vol. 89(4), 721–736.
- Rivkin, S. G., E. A. Hanushek, and J. F. Kain (2005): “Teacher, Schools and Academic Achievement,” *Econometrica*, vol. 73(2), 417–458.
- Rockoff, J. E. (2004): “The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data,” *American Economic Review*, vol. 94(2), 247–252.
- Silva, F. and J. Sonstelie (1995): “Did Serrano Cause a Decline in School Spending,” *National Tax Journal*, vol. 48(2), 199–215.
- Slater, H., N. Davies, and S. Burgess (2009): “Do teachers matter?: measuring the variation in teacher effectiveness in England,” Working paper 09/212, Bristol: Centre for Market and Public Organisation.
- Verstegen, D. A. and T. S. Jordan (2009): “A Fifty-State Survey of School Finance Policies And Programs: An Overview,” *Journal of Education Finance*, vol. 34(3), 213–230.
- Verstegen, D. A. and R. King (1998): “The Relationship Between School Spending and Student Achievement: A Review and Analysis of 35 Years of Production-Function,” *Research. Journal of Education Finance*, vol. 24(1), 243–262.
- West, A. (2009): “Redistribution and financing schools in England under Labour: are resources going where needs are greatest?” *Education Management, Administration and Leadership*, vol. 37(2), 158–179.
- West, A., R. West, H. Pennell, and T. Travers (2001): “Financing school-based education in England: Poverty, examination results and expenditure,” *Environment and Planning C: Government and Policy*, vol. 19(3), 461–471.

Figures and Tables

Table 1: Summary statistics over time for primary and secondary schools

(a) Primary Schools

Year	Schools	No Funding Data	Academies	Average School Size	% FSM	Pupil:Teacher Ratio	Funding per pupil
1993-94	18610	n/a	0	271	21.2	22.8	
1994-95	18469	n/a	0	278	22.1	23.0	
1995-96	18349	n/a	0	284	22.1	23.2	
1996-97	18283	n/a	0	290	22.1	23.5	
1997-98	18202	n/a	0	294	21.1	23.8	
1998-99	18127	n/a	0	297	19.8	24.1	
1999-00	17964	0	0	299	18.3	23.6	£2513
2000-01	17873	5	0	300	17.6	23.3	£2800
2001-02	17799	0	0	299	17.1	22.9	£3065
2002-03	17672	6	0	298	16.8	23.1	£3252
2003-04	17562	0	0	297	17.2	23.2	£3451
2004-05	17454	0	0	296	16.9	23.0	£3573
2005-06	17310	0	0	296	16.0	22.5	£3739
2006-07	17171	0	0	296	15.8	22.3	£3869
2007-08	16816	0	0	299	15.5	22.1	£4009
2008-09	16891	1	0	300	15.9	21.8	£4086
2009-10	16797	0	0	303	17.3	21.8	£4125
2010-11	16702	36	37	308	18.0	21.0	£4175
2011-12	16566	80	372	316	18.1	21.0	£4275
2012-13	16501	419	1013	325	17.7	21.0	£4255

(b) Secondary Schools

Year	Schools	No Funding Data	Academies	Average School Size	% FSM	Pupil:Teacher Ratio	Funding per pupil
1993-94	3305	n/a	0	949	15.8	16.1	
1994-95	3176	n/a	0	975	17.4	16.4	
1995-96	3166	n/a	0	998	18.0	16.5	
1996-97	3557	n/a	0	978	18.3	16.8	
1997-98	3528	n/a	0	993	18.2	16.9	
1998-99	3525	0	0	1003	17.5	17.0	
1999-00	3520	15	0	1044	16.5	17.3	£3320
2000-01	3458	16	0	1072	15.8	17.2	£3608
2001-02	3433	14	0	1087	14.9	17.1	£3878
2002-03	3416	24	3	1105	14.5	17.2	£4146
2003-04	3395	25	11	1118	14.4	17.2	£4477
2004-05	3378	29	15	1122	14.1	16.9	£4659
2005-06	3366	38	27	1125	13.7	16.7	£4835
2006-07	3360	55	45	1123	13.4	16.6	£5005
2007-08	3274	85	80	1124	13.1	16.3	£5227
2008-09	3326	132	129	1121	13.4	16.0	£5328
2009-10	3296	201	198	1128	14.1	15.8	£5372
2010-11	3267	359	366	1140	14.6	15.1	£5376
2011-12	3138	123	1154	1140	14.4	15.3	£5785
2012-13	3202	289	1614	1145	14.3	15.2	£5728

Note: Number of schools refers to number of schools observed in LEASIS. FSM refers to proportion of pupils eligible and registered for Free School Meals, funding per pupil represents total grant funding from central and local government, figures presented in 2012-13 prices. Sources: LEASIS (1993-2010); Schools, Pupils and their Characteristics (January 2011 to 2013); Section 251 Returns (1999-00 to 2012-13); Academies Income and Expenditure Data (2011-12 to 2012-13); School Workforce Census School-Level Data (November 2010 to 2012).

Table 2: Decomposition of change in funding per pupil between 1999-00 and 2012-13 by quintile of school deprivation, primary schools

	Quintile of School Deprivation				
	Least deprived	2nd	Middle	4th	Most Deprived
Funding per pupil - 1999-00	£2,374	£2,380	£2,411	£2,539	£2,788
Funding per pupil - 2012-13	£3,712	£3,798	£4,005	£4,445	£5,108
Change over time	£1,338	£1,418	£1,595	£1,906	£2,320
<i>% change over time</i>	56%	60%	66%	75%	83%
<i>Amount explained by staff quantities (Q)</i>					
Teachers	£202	£213	£223	£257	£279
<i>% of change over time</i>	15%	15%	14%	13%	12%
Teaching Assistants	£356	£366	£408	£457	£512
<i>% of change over time</i>	27%	26%	26%	24%	22%
Other Staff	£199	£240	£293	£359	£413
<i>% of change over time</i>	15%	17%	18%	19%	18%
<i>Amount explained by cost of staff (P)</i>					
Teachers	£190	£189	£192	£199	£211
<i>% of change over time</i>	14%	13%	12%	10%	9%
Teaching Assistants	£68	£73	£80	£92	£105
<i>% of change over time</i>	5%	5%	5%	5%	5%
Other Staff	£77	£79	£81	£86	£91
<i>% of change over time</i>	6%	6%	5%	5%	4%
Total Explained	£1,094	£1,160	£1,277	£1,450	£1,612
<i>% of change over time</i>	82%	82%	80%	76%	69%
Total Unexplained	£245	£258	£318	£456	£708
<i>% of change over time</i>	18%	18%	20%	24%	31%

Note: Quintile of school deprivation defined in terms of the proportion of children eligible for Free School Meals. Figures are presented in 2012-13 prices. Sources: LEASIS (1999,2012), Section 251 Returns (1999-00,2012-13); Academies Funding Data (2012-13); ASHE (1999,2012).

Table 3: Decomposition of change in funding per pupil between 1999-00 and 2012-13 by quintile of school deprivation, secondary schools

	Quintile of School Deprivation				
	Least deprived	2nd	Middle	4th	Most Deprived
Funding per pupil - 1999-00	£3,210	£3,191	£3,249	£3,339	£3,676
Funding per pupil - 2012-13	£5,096	£5,245	£5,569	£6,082	£7,109
Change over time	£1,886	£2,054	£2,320	£2,743	£3,433
<i>% change over time</i>	59%	64%	71%	82%	93%
<i>Amount explained by staffing quantities (Q)</i>					
Teachers	£254	£307	£358	£468	£552
<i>% of change over time</i>	13%	15%	15%	17%	16%
Teaching Assistants	£172	£223	£261	£310	£377
<i>% of change over time</i>	9%	11%	11%	11%	11%
Other Staff	£549	£564	£622	£631	£688
<i>% of change over time</i>	29%	27%	27%	23%	20%
<i>Amount explained by cost of staff (P)</i>					
Teachers	£282	£282	£287	£297	£317
<i>% of change over time</i>	15%	14%	12%	11%	9%
Teaching Assistants	£29	£38	£43	£48	£58
<i>% of change over time</i>	2%	2%	2%	2%	2%
Other Staff	£103	£103	£107	£108	£118
<i>% of change over time</i>	5%	5%	5%	4%	3%
Total Explained	£1,390	£1,518	£1,677	£1,862	£2,109
<i>% of change over time</i>	74%	74%	72%	68%	61%
Total Unexplained	£496	£536	£643	£881	£1,324
<i>% of change over time</i>	26%	26%	28%	32%	39%

Note: Quintile of school deprivation defined in terms of the proportion of children eligible for Free School Meals. Figures are presented in 2012-13 prices. Sources: LEASIS (1999,2012), Section 251 Returns (1999-00,2012-13); Academies Funding Data (2012-13); ASHE (1999,2012).

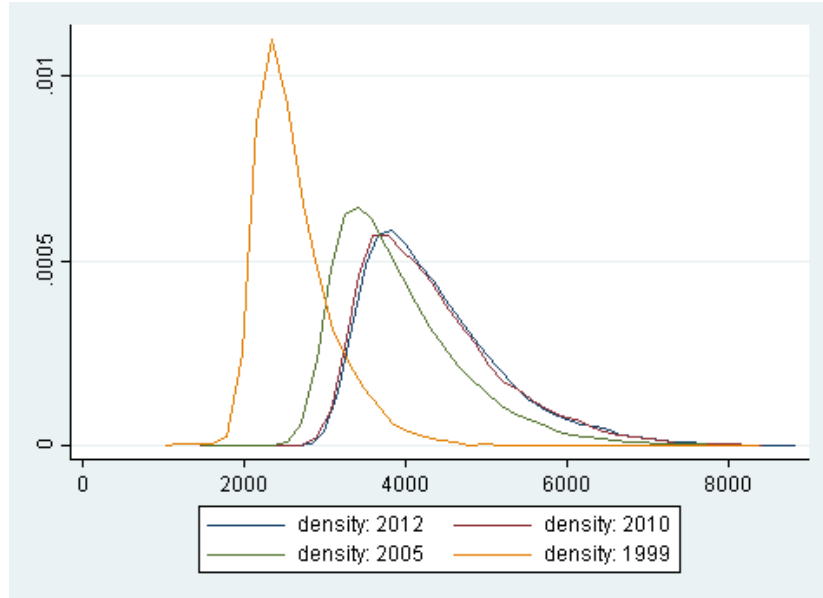
Table 4: Additional information on financial and staffing differences across schools by quintile of school deprivation, 2012-13

Primary Schools	Quintile of School Deprivation				
	Least deprived	2nd	Middle	4th	Most Deprived
<i>Staffing costs as share of total funding</i>					
Implied by decomposition - 2012-13	86%	86%	85%	82%	77%
Actual level -2012-13			79%		
Actual Teacher Salaries	£36,269	£36,126	£35,998	£36,254	£36,513
<i>Income and expenditure figures - 2012-13</i>					
Funding per pupil	£3,712	£3,798	£4,005	£4,445	£5,108
Total Income per pupil	£3,903	£3,958	£4,151	£4,578	£5,240
Total Expenditure per pupil	£3,770	£3,864	£4,056	£4,497	£5,144
Surplus per pupil	£134	£94	£95	£80	£97
<i>Expenditure on non-staffing inputs</i>					
Learning resources exp per pupil	£167	£164	£167	£185	£214
Energy exp per pupil	£59	£62	£66	£76	£167
ICT exp per pupil	£60	£58	£64	£73	£82
Professional services exp per pupil	£46	£47	£52	£66	£96
Other exp per pupil	£93	£95	£94	£101	£110
<i>Staffing Levels - 2012-13</i>					
Teachers per 100 pupils	4.7	4.7	4.7	4.9	5.3
Teaching Assistants per 100 pupils	2.9	3.1	3.4	3.9	4.4
Other Staff per 100 pupils	1.9	2.0	2.1	2.3	2.5
Secondary Schools	Quintile of School Deprivation				
	Least deprived	2nd	Middle	4th	Most Deprived
<i>Staffing costs as share of total funding</i>					
Implied by decomposition - 2012-13	82%	81%	80%	77%	72%
Actual level -2012-13			78%		
Actual Teacher Salaries	£38,270	£37,947	£38,013	£38,810	£39,906
<i>Income and expenditure figures - 2012-13</i>					
Funding per pupil	£5,096	£5,245	£5,569	£6,082	£7,109
Total Income per pupil	£5,379	£5,462	£5,773	£6,286	£7,385
Total Expenditure per pupil	£5,293	£5,377	£5,669	£6,168	£7,121
Surplus per pupil	£86	£86	£105	£118	£263
<i>Expenditure on non-staffing inputs</i>					
Learning resources exp per pupil	£291	£276	£262	£300	£367
Energy exp per pupil	£85	£88	£97	£100	£115
ICT exp per pupil	£47	£54	£68	£79	£86
Professional services exp per pupil	£29	£38	£53	£75	£104
Other exp per pupil	£364	£294	£323	£318	£372
<i>Staffing Levels - 2012-13</i>					
Teachers per 100 pupils	6.3	6.4	6.6	6.9	7.5
Teaching Assistants per 100 pupils	1.3	1.7	1.9	2.2	2.7
Other Staff per 100 pupils	2.9	3.0	3.1	3.2	3.4

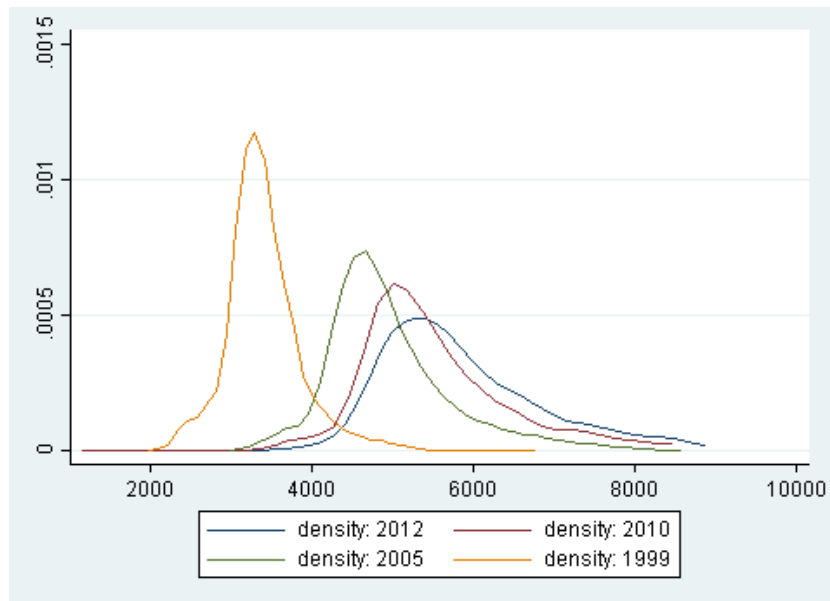
Note: Quintile of school deprivation defined in terms of the proportion of children eligible for Free School Meals. Figures are presented in 2012-13 prices. Sources: LEASIS (12012), Section 251 Returns (2012-13); Academies Funding Data (2012-13); School Workforce Census school-level data November 2012.

Figure 1: Distribution of funding per pupil in 2012-13 prices, selected years

a) Primary Schools



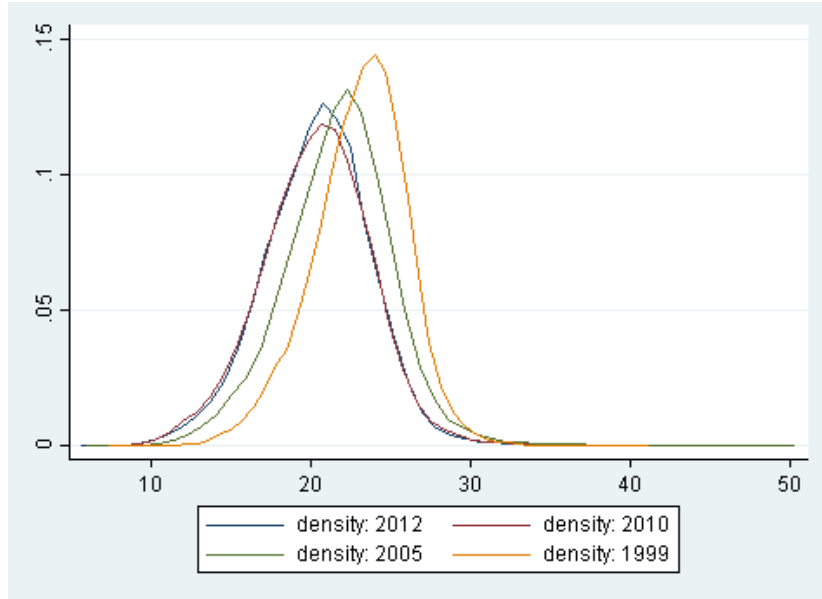
b) Secondary Schools



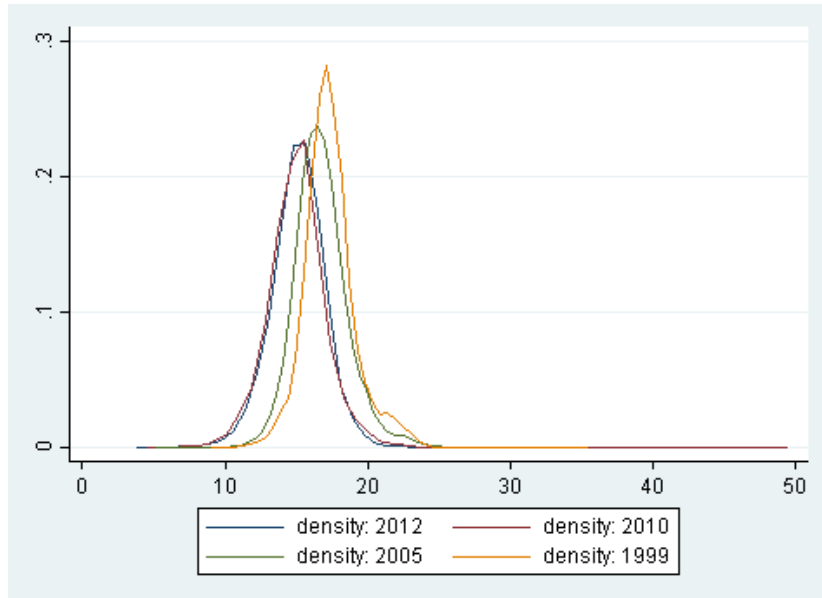
Sources: LEASIS (1999-2012), Section 251 Returns (1999-00 to 2012-13); Academies Funding Data (2012-13). Figures are presented in 2012-13 prices.

Figure 2: Distribution of pupil:teacher ratios, selected years

a) Primary Schools

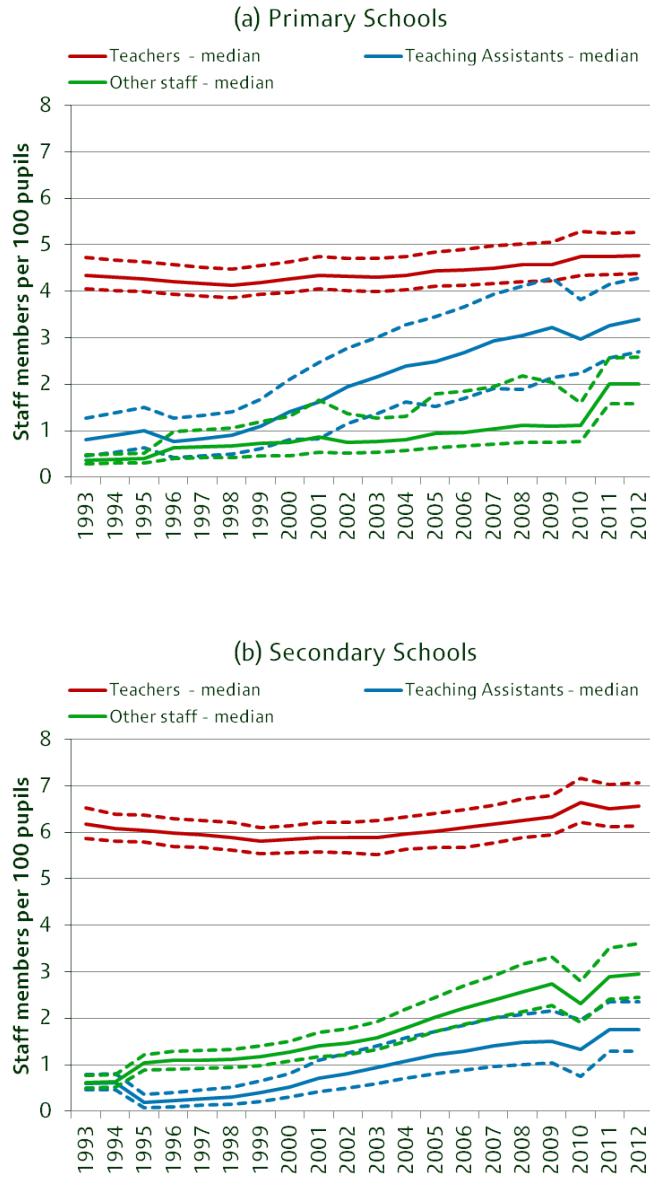


b) Secondary Schools



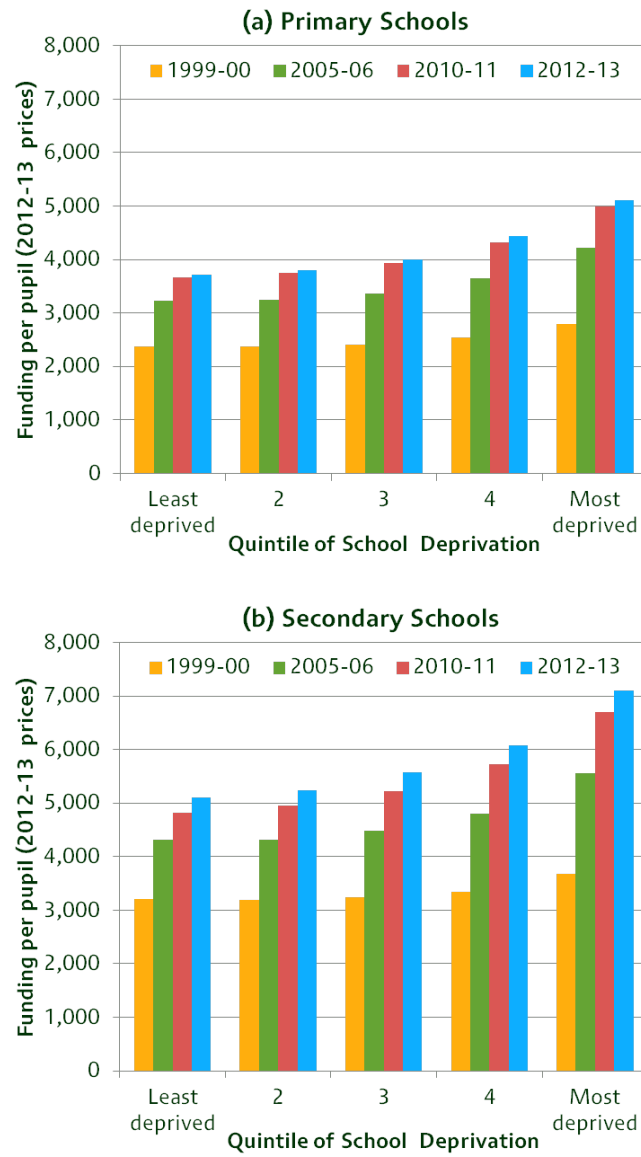
Note: Sources: LEASIS (1999-2012) School Workforce Census School-Level Data (2010, 2012).

Figure 3: Level and variation in different staff types over time



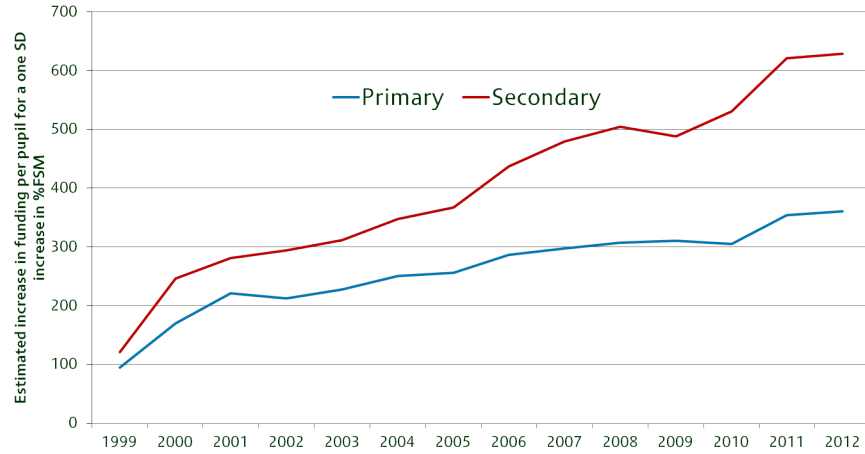
Note: Dashed lines represent 25th and 75th percentiles. Significant number of schools with missing workforce data in 2010-11. Sources: LEASIS (1999-2012) School Workforce Census School-Level Data (2010-2012).

Figure 4: Funding per pupil by quintile of school deprivation



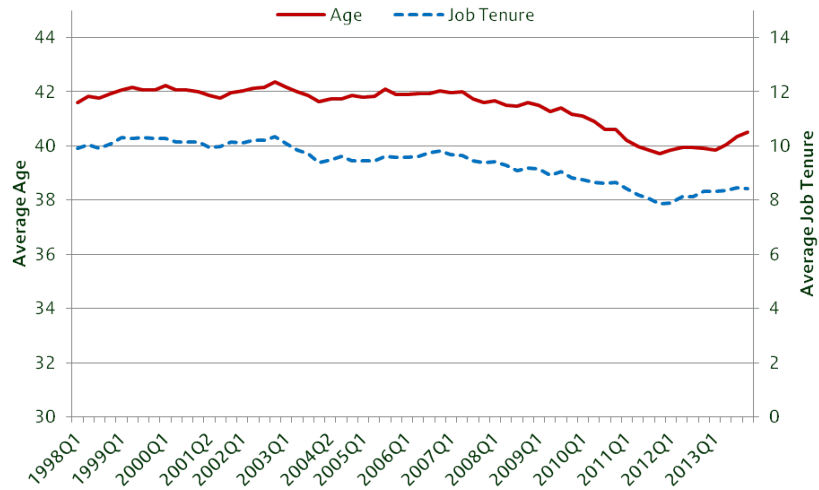
Note: Quintile of school deprivation calculated using percentage of pupils eligible for free school meals; quintiles are calculated separately for primary and secondary schools; funding includes all grant funding from central and local government; real-terms values calculated using GDP deflator and presented in 2012-13 prices. Sources: LEASIS (1999-2012); Section 251 Returns (1999-00 to 2012-13); Academies Funding Data (2012-13).

Figure 5: Responsiveness of funding per pupil to school deprivation levels



Note: Effects calculated as extra amount schools implicitly receive for a one standard deviation increase in percentage of pupils eligible for FSM (based on OLS regression of total funding per pupil on a range of school characteristics (total pupils, FSM, SEN, EAL, post-16 arrangements, governance and geography)). Figures presented in 2012-13 prices based on GDP deflator.

Figure 6: Average Teacher Characteristics over Time



Note: Source: Labour Force Survey.