Teacher shortages in England
Analysis and pay options

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Luke Sibieta is a Research Fellow at the Education Policy Institute. Luke has worked on the economics of education since 2005 when he joined the Institute for Fiscal Studies. He has produced numerous influential pieces of research on school funding, educational inequalities and has undertaken a range of impact evaluations. He led the Education and Skills research team at the Institute for Fiscal Studies from 2012 to 2017 and continues as a Research Fellow.

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Executive Summary

- The teacher labour market in England faces major challenges. In primary schools, growth in teacher numbers between 2007 and 2019 (13 per cent) fell behind growth in pupil numbers (16 per cent). Overall pupil numbers in secondary schools are about the same in 2019 as they were in 2007, but teacher numbers have fallen by 7 per cent. Whilst pupil numbers in primary schools are now stabilising, the challenges are likely to become greater in secondary schools, with further growth of 10 per cent in pupil numbers expected between 2019 and 2023.

- The challenges are even more pronounced in disadvantaged schools (as measured by the share of pupils eligible for free school meals). Teachers in disadvantaged schools are more likely to be sick or absent – a leading sign of stress or workload problems. Teachers in the most disadvantaged schools outside London are sick or absent 5.2 days per year, on average, which compares with 3.5 days per year in the least disadvantaged schools. Across a secondary school of 60 teachers, that equates to about 100 extra days lost due to sickness in disadvantaged schools. Inside London, days lost to sickness or absence are generally lower and comparable with levels seen for the least disadvantaged schools outside London.

- Disadvantaged schools also report greater difficulties filling teaching posts. Just over 20 per cent of schools in the least disadvantaged areas report vacancies or temporarily filled positions. This increases to about 30 per cent of schools in the most disadvantaged areas outside of London, and about 46 per cent of schools in disadvantaged areas in London. Whilst this could just be a more fluid labour market in London, high levels of turnover clearly represent a recurring challenge.

- Problems are most acute in shortage subjects, such as maths, sciences and languages, where recruitment targets have been persistently missed over time. As a result, only about 54 per cent of teachers in shortage subjects have a degree in a relevant subject, as compared with 68 per cent in other subjects, such as English, history and geography.

- The share of secondary teachers in shortage subjects with degrees in relevant subjects is lowest in the most disadvantaged schools outside of London. For example, fewer than 1 in 5 physics teachers in disadvantaged schools outside of London possess a physics degree, which compares with about 50 per cent for less disadvantaged schools and schools in London.

- Despite greater difficulties recruiting and retaining teachers in shortage subjects, differences in average salaries by subject are generally small. For teachers outside London, average salaries were around £38,000 for science teachers in November 2016, only about £1,000 above that seen in the lowest paid subjects of English, languages and maths.

- Average salary levels are lower in disadvantaged schools, but this can be explained by the fact that teachers at such schools tend to be younger and less experienced. Once we account for these factors, teacher pay is the same in the most disadvantaged schools as it is in the most affluent schools.

- This is despite the introduction of teacher pay freedoms for schools in 2013, and the expansion of the Pupil Premium since 2011, which can be used to increase teacher pay.

- In contrast, we estimate that teachers in the most disadvantaged schools in London are paid about £1,500 more than teachers in the least disadvantaged schools, after accounting for teachers' experience. Much of this effect is driven by differences in base salary levels for

classroom teachers, rather than the effects of any additional payments or promotion to leadership positions. It also appears longstanding, having remained at a similar or higher level since 2011, meaning that disadvantaged schools in London might have long ago recognised the potential value of offering higher salaries.

- Teachers, on average, are currently paid less than most other professional occupations. Amongst women in their 20s, average full-time salaries for professional occupations are about £28,000, with women of a similar age in teaching paid about £500 less. For men, the differences are even larger. Average full-time salaries for men in their 20s are about £32,000 for all professional occupations, male teachers in their 20s are paid about £3,000 less than that.

- Teachers are generally paid slightly more than other graduates with degrees in most subjects. For example, female teachers with five years of experience are currently paid about £31,000 as compared with £25,000 for all female graduates. Some of this effect will be driven by the fact that many graduates might not settle into professional occupations.

- There are big differences in graduate earnings by subject studied. Teachers are paid less than maths and physics graduates, particularly amongst men. Male teachers with five years of experience are paid about £32,000, about £3,000 less than male physics graduates with similar experience. It is therefore unsurprising to see greater recruitment and retention difficulties in these subjects.

- The government plans to increase teacher starting salaries to £30,000 by 2022. This will boost salaries for new teachers outside London by about 23 per cent or £6,000. Starting salaries in London are due to rise by a smaller, but still significant, amount of around 17 per cent. Depending on the economy, this could rank teachers amongst the best paid major professional occupations, on average, for individuals starting out in their careers.

- The government has also committed to deliver a pay rise for more experienced and other teachers. This will be lower than the 23 per cent increase in starting salaries, which will lead to a flatter salary schedule for teachers. This is well aligned to empirical evidence, which suggests that higher starting salaries and a flatter salary schedule can lead to significant improvements in teacher retention.

- The government has set out a range of possible options for teacher pay in 2020 as a first step to higher starting salaries and a flatter salary schedule by 2022. These options involve increases in starting salaries of 6-7.5 per cent, and of 2.25-2.75 per cent for more experienced teachers. All options would increase average teacher pay per head by about 3 per cent and cost schools about £455m in 2020-21 according to the government.

- All the options for 2020 would increase schools' costs per head by about 1.8 per cent, on average, in 2020-21. This exactly matches the minimum increase in funding per pupil for schools in 2020-21, which equates to an expected real terms freeze in funding per pupil. This is due to affect close to 50 per cent of the most disadvantaged schools and about 90 per cent of schools in inner London. Such schools rely more on new teachers and are thus likely to face a higher than 1.8 per cent increase in costs. To avoid such a mismatch, the government should consider using the existing Teacher Pay Grant to help compensate schools facing the largest increases in costs.

- Another option for 2020 would involve backloading more of the increase in starting salaries to take place between 2020 and 2022. This might be better aligned to the actual school funding settlement for 2020.

- The government has also set out an example schedule for 2022, which includes increases in starting salaries outside London of 23 per cent and about 7 per cent for more experienced teachers. This would increase average teacher pay per head by about 3 per cent per year, the same as expected growth in average earnings. We estimate this would cost schools £1.9bn in 2022-23. Ensuring pay for more experienced teachers keeps pace with average earnings would increase this cost by about £300m. This would lead to an increase in average teacher pay per head above that in average earnings and could help to generate recruitment gains, as is suggested by the empirical evidence.

- Looking to 2021 and 2022, the government should review the factors in the National Funding Formula to ensure that school budgets are not adversely affected purely as a result of the change in the salary schedule. Disadvantaged and London schools are particularly vulnerable to these changes as they have a higher turnover rate and a greater number of inexperienced teachers.

- There is also clear empirical evidence showing that offering higher salaries or payments can attract young teachers to disadvantaged schools. The government is already offering total retention payments of £6,000 for new teachers in shortage subjects (or £2,000 per year), with an extra £3,000 in total (or £1,000 per year) for teachers in more challenging areas.

- Given the scale of the problem, the government should consider expanding such payments and offering them to all existing early career teachers in shortage subjects to ensure they stay in the profession too. We estimate that doing this and doubling the extra payments for teachers in challenging schools or areas would cost less than £35m extra as compared with the current payments. This is less than one fifth of the existing budget for teacher training bursaries.

Introduction

Schools in England currently face profound recruitment and retention challenges. Overall recruitment targets in secondary schools have been persistently missed over time, and by even more so in subjects such as maths and science. About 1 in 10 secondary school teachers leave the state-sector teaching profession each year. Much of these exit decisions happen early on in teachers' careers with only about 60 per cent of trainees remaining in a teaching post five years after their training, and only about 50 per cent in shortage subjects like maths and physics.

In 2018, EPI published a report on teacher expertise and shortages. This illustrated that schools in disadvantaged areas find it even more difficult to recruit highly-qualified teachers in science and maths subjects, particularly outside London.[1] For example, fewer than 1 in 5 physics teachers in disadvantaged areas outside London have a physics degree. In contrast, about half of physics teachers in London and affluent areas outside London have a physics degree. Although a degree in the subject you teach might not always be necessary, empirical evidence suggests it can be a good predictor of teacher quality, particularly in maths and science subjects.[2] Such figures also illustrate the disparities across schools in recruiting and retaining teachers.

Whilst there is unlikely to be a single cause or solution to these problems, pay levels are likely to be central. Shortages are most acute in subjects where graduates can command higher salaries outside of teaching (mostly maths and science subjects) and less problematic in subjects where outside salaries are lower (e.g. arts, history and English). Such problems are not unique to England either, with similar problems in recruiting maths and science teachers to disadvantaged schools in the US as a result of high salaries for science and maths graduates. Evidence from the US has also shown paying salary supplements can be an effective means to attract teachers to high-poverty areas and to retain teachers in shortage subjects.[3] There is also evidence to suggest that a flatter salary schedule, with higher starting salaries but less growth with experience, can lead to improvements in teacher retention.[4]

The introduction of the Pupil Premium in 2011 and new freedoms over teacher pay since 2013 have given schools the opportunity to pay such salary supplements themselves. The initial evaluation of the teacher pay reforms suggested these were only being used in a limited way.[5] However, more recent analysis has suggested schools in areas with high outside wages have responded by increasing teacher salaries at a faster rate.[6] In this report, we go beyond this work by explicitly considering differences in teacher pay by school disadvantage over time, both inside and outside London given the differences in the graduate labour market between London and the rest of England.

The government has an ambitious strategy to improve teacher recruitment and retention. The new recruitment and retention strategy proposed a new Early Career Framework, which includes a wide range of new opportunities for professional development and salary supplements in shortage subjects (extending a pilot scheme that already exists for new maths teachers).[7]

Even more ambitiously, the government has committed to introducing starting salaries of £30,000 by 2022. This would represent an increase of 23 per cent or nearly £6,000 on current levels. The government has also recently submitted evidence to the School Teachers' Review Body detailing potential options on how this could be implemented in the short and long run.[8]

This report seeks to provide a full context for these reforms and the challenges for policymakers. We mainly focus on secondary schools, given the evidence of greater problems for the secondary sector. We start by detailing the current problems in recruitment and retention across different subjects and areas (section 1). We then analyse the extent to which schools have used the Pupil Premium and new teacher pay freedoms to introduce differential pay by subject and the level of disadvantage in the area (section 2). We also compare teachers' salaries during their early career phase with those received by graduates with degrees in different subjects and those working in other professional occupations. Finally, in section 4 we analyse the options and challenges for the introduction of higher starting salaries of £30,000, as well as salary supplements in shortage subjects and disadvantaged areas.

1. Recruitment and retention challenges

To fully illustrate the scale of the problem, this section shows overall trends in the teacher labour market, including teacher numbers and exit rates over time. We then show a range of indicators for recruitment and retention difficulties across areas and subjects. These indicators are based on a combination of publicly available data and raw School Workforce Census data.[9]

Overall state of teacher labour market

The teacher labour market in England is facing acute recruitment and retention challenges. This is partly driven by the fact that the number of pupils has been on the rise in recent years.

Between 2007 and 2019, the number of pupils in state-funded primary schools grew by 16 per cent, as shown in Figure 1.1(a). The number of primary school teachers failed to keep pace, growing by 13 per cent over the same period. As a result, the pupil/teacher ratio crept up from about 20 pupils per teacher in 2007 to around 21 pupils per teacher in 2019.

In secondary schools, pupil numbers fell by 7 per cent between 2007 and 2015, but have since risen back to their 2007 level. Teacher numbers, however, fell by 8 per cent between 2007 and 2019. As a result, the pupil/teacher ratio in secondary schools has risen from around 13 pupils per teacher in the late 2000s to 14 pupils per teacher by 2019.

Much of the concerning changes in teacher numbers have happened in recent years. Between 2016 and 2019, primary school teacher numbers were largely unchanged, despite growing pupil numbers. In secondary schools, things have been even more dramatic with a 5 per cent fall in teacher numbers at the same time as 7 per cent growth in pupil numbers.

These recent trends do not bode well for the future, particularly in secondary schools. Primary school pupil numbers are expected to be largely steady between 2019 and 2023, easing pressure on the primary school teacher labour market. By contrast, secondary school pupil numbers are expected to rise by 10 per cent between 2019 and 2023. This will place additional pressure on an already strained labour market for secondary school teachers.

Figure 1.1 – Number of pupils and teachers over time, 2007=1

   a) **Primary Schools**
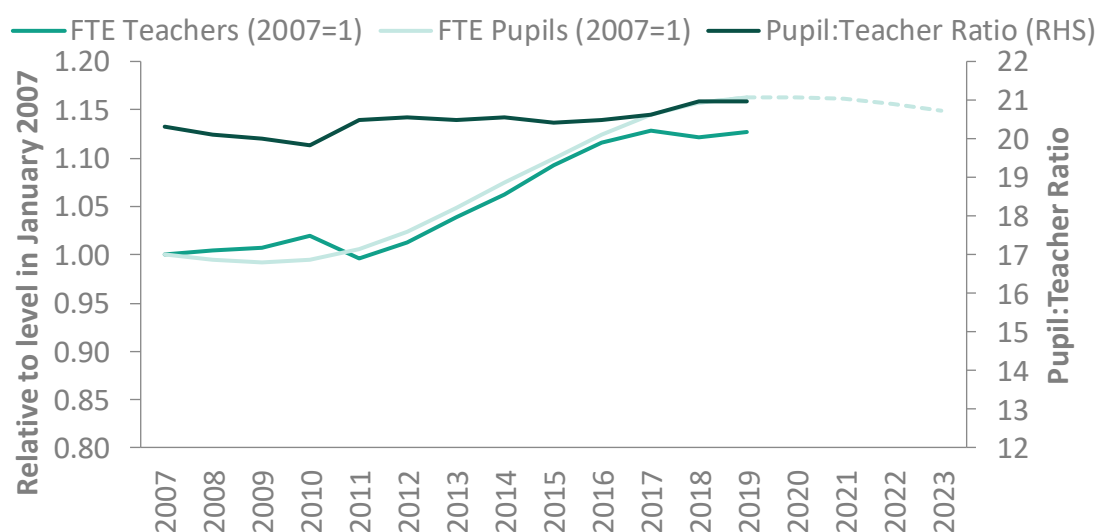
b) Secondary Schools
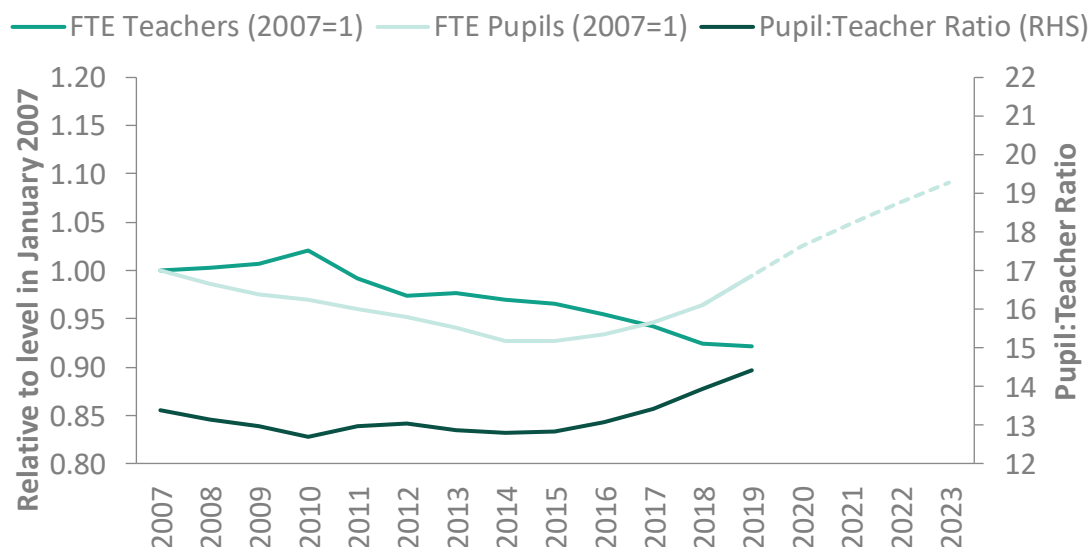
*Sources and Notes: Pupil counts refer to pupils aged under 16 and measured in January each year and taken from DfE Pupil Projections, July 2019 (2019 Update) (*https://www.gov.uk/government/statistics/national-pupil-projections-july-2018*). Teacher numbers are measured in January each year up to 2010 and then the preceding November from 2011 onwards. Teacher numbers taken from School Workforce Census Statistics, November 2018 (*https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018*).*

There has also been a small rise in the number of teachers leaving the state-sector teaching profession, as shown in Figure 1.2. Between November 2011 and 2018, exit rates increased from around 8.5 per cent to 9.3 per cent in primary schools, but have remained around 10 per cent in secondary schools. In special schools, the exit rates rose from 9.1 per cent in 2011 to 11.3 per cent in 2018.

Figure 1.2 – Percentage of teachers leaving state-funded schools in England over time
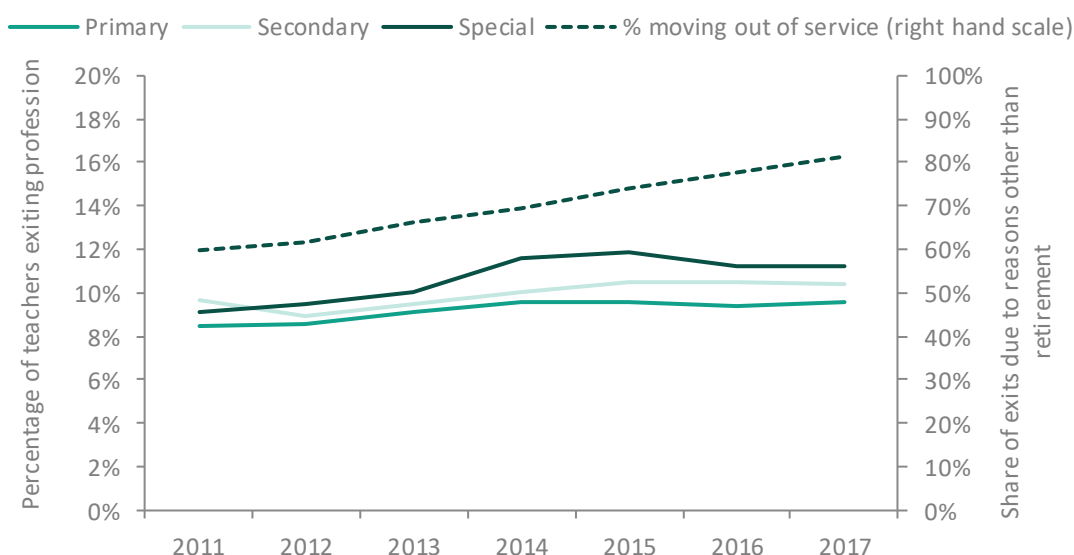
Notes and Sources: Figures taken from School Workforce Census Statistics, November 2018 (https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018). Percentage moving out of service represents the share of exits not due to death or retirement each year.

Exits from the profession are mainly driven by a combination of retirements or moves to other jobs outside of state-sector teaching. In recent years, the share of exits due to reasons other than retirement has increased, with around 85 per cent of exits in 2018 as compared with 60 per cent in 2011. This is concerning as it means a much larger share of exits are now driven by teachers moving to other jobs rather than because they are retiring. This is due to a combination of increases in the absolute numbers of teachers moving out of service (which rose from a total of just under 25,000 in 2011 to just over 35,000 in 2018) and a reduction in the number of teachers retiring following a period when large numbers of teachers reached retirement age (retirements fell from 16,000 to 6,000). If it had not been for a large reduction in retirements, the teacher exit rate would have risen even faster. Unfortunately, these figures cannot be traced back before 2011.

Figure 1.3 illustrates the extent to which exits from the teaching profession are concentrated in the early career phase and how exit rates have been increasing for successive cohorts. Each line shows the percentage of teachers in a given cohort (defined by the year in which they qualified) who have left the profession each year since qualification. The proportion of teachers remaining in the profession is lower for each successive cohort for a given number of years since qualification. For example, amongst the cohort who qualified in 2010, 87 per cent remained in the state-sector teaching profession one year after qualification, 71 per cent after five years and 63 per cent after eight years. For the 2012 cohort, exit rates were similar after one year, but now only 68 per cent remain after five years. For the 2016 cohort, only about 85 per cent remained after one year and 77 per cent after two years, the latter down from 82 per cent for 2010 cohort.

The overall picture is clear, teachers are highly likely to exit during their first few years of teaching and at an increasing rate over time. This is one of the motivations behind the government's new Early Career Framework, which seeks to provide teachers with more support during their first few years in the profession.

Figure 1.3 – Percentage of teachers leaving state-funded schools by year in which they qualified and years since qualification
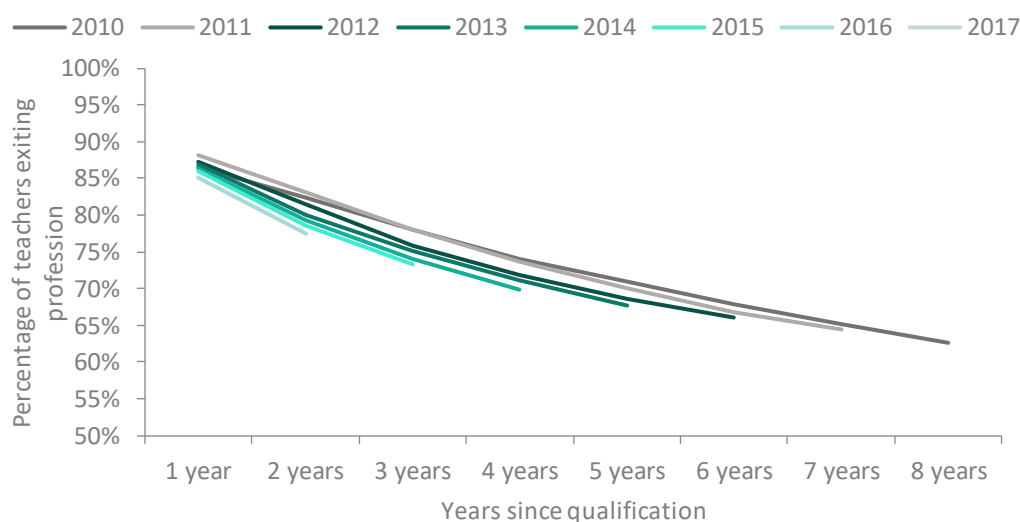

Notes and Sources: Figures taken from School Workforce Census Statistics, November 2018 (https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018). Each line represents a cohort who qualified in a given year.

Recruitment and retention difficulties by level of disadvantage and area

The previous subsection showed the overall difficulties in the teacher labour market in England. We now move on to discuss how the extent of these challenges varies across areas, particularly in terms of the level of disadvantage. We concentrate on secondary schools given the clear evidence from the previous subsection showing the greater difficulties and challenges facing the secondary sector.

In Table 1.1 we show the variation in the following indicators by quintile of school disadvantage (as measured by the proportion of pupils eligible for free school meals (FSM)) inside and outside of London, as well as the variation by local authority:

- Percentage of teachers with Qualified Teacher Status (QTS)
- Percentage of teachers in high-priority (or shortage) subjects who have a relevant degree[10]
- Percentage of teachers in other subjects who have a relevant degree
- Average teaching hours by subject
- Average working days lost to sickness
- Percentage of school with temporarily filled or vacant posts

The percentage of teachers with QTS and the percentage possessing a degree in the subject they teach are indicators of teachers' educational qualifications and their degree of specialist knowledge. Although a degree in the subject you teach might not always be necessary, empirical evidence suggests it is a good predictor of teacher quality, particularly in maths and science subjects.[11] Average hours taught by subject is an indirect measure of the extent to which teachers in high-priority subjects are being asked to teach longer hours due to teacher shortages and/or the extent to which schools are able to offer the same number of teaching hours across individual subjects. A high number of days lost to sickness is likely to be a leading indicator of stress and workload problems. The percentage of posts that are vacant or temporarily filled is a direct measure of difficulties filling posts and the fluidity of the teacher labour market.

We illustrate the patterns across these different indicators, with both the national level figures and the breakdowns by local authority provided in an online appendix.

The first row of Table 1.1 shows the level for all schools. We then break schools into five equal size groups, known as quintiles, based on the most widely used indicator of disadvantage (the proportion of pupils eligible for FSM), with Q1 representing schools with the lowest levels of disadvantage and Q5 representing the schools with the highest levels of disadvantage. We show indicators for schools in these five groups inside and outside of London to illustrate how the nature of the teacher labour market differs inside the capital.

The main differences are as follows:

- **Qualified Teacher Status** – Around 93 per cent of all teachers possess qualified teacher status (QTS) across schools in England. Teachers in the most disadvantaged schools are around 3 percentage points less likely to possess QTS. In London, teachers are less likely to possess QTS, which is likely to be due to teachers in London being younger and less experienced, on average.
- **Degree in a relevant subject** – As is well known, the share of teachers with a degree in a relevant subject is lower in high-priority subjects (54 per cent) as opposed to other subjects (68 per cent). There is also a clear socio-economic gradient across schools with a gap of 7 percentage points between the most and least disadvantaged schools in high-priority and other subjects outside London. Inside London, access to specialist teachers is slightly higher, but there remain socio-economic gaps in access to specialist teachers. We investigate these gaps in more detail by individual subjects later in this section.

- **Teaching hours –**In general, the differences by subject type, disadvantage and inside or outside London are small. Average teaching hours are around 18 hours across most schools. Inside London, average teaching hours for high-priority teachers are nearly 20 minutes greater for less disadvantaged schools than for more disadvantaged schools, and 45-50 minutes longer for other subjects. Outside London, the differences are generally smaller. There is no evidence to suggest that teachers are being asked to teach longer hours in more disadvantaged schools. If anything, teaching hours are slightly less in more disadvantaged schools.
- **Days lost to sickness –** Across all schools, about four days per teacher are lost to sickness or absence each year. This is notably higher amongst more disadvantaged schools outside London, where over 5.2 days per teacher are lost to sickness or absence each year as compared with 3.5 days per teacher in the least deprived schools. Assuming about 60 teachers per school, that equates to over 100 extra working days lost to sickness or absence in the most disadvantaged schools outside London. Inside London, days lost to sickness or absence are slightly lower on average, though there is still a socio-economic gap of about one extra day per teacher lost to sickness or absence.
- **Vacancies and temporarily filled positions –** Across all schools, about 27 per cent reported a vacancy or temporarily filled position in November 2016. This varies significantly across areas. Outside London, 29 per cent of the most disadvantaged schools reported a vacancy or temporarily filled position, compared with 22 per cent of the least disadvantaged schools, a gap of about 7 percentage points. There is an even larger socio-economic divide of 20 percentage points inside London, with around 46 per cent of disadvantaged schools inside London reporting a vacancy or temporarily filled position.

Table 1.1 – Summary of recruitment and retention difficulties by levels of disadvantage, inside and outside of London

Area	Qualified Teacher Status (%)	Relevant degree in high-priority subjects (%)	Relevant degree in other subjects (%)	Teaching hours (high-priority subject teachers)	Teaching hours (other subject teachers)	Average working days lost to sickness	Schools with vacant or temporary filled positions (%)
All schools	93%	54%	68%	18.38	18	4.23	27%
Inside London							
Least Disadvantaged Quintile (Q1)	91%	58%	76%	18.19	18.17	2.69	26%
FSM Q2	92%	65%	75%	18.21	18.11	3.52	33%
FSM Q3	93%	56%	70%	18.08	17.56	3.72	39%
FSM Q4	89%	56%	69%	17.67	16.9	3.89	43%
Most Disadvantaged Quintile (Q5)	88%	53%	68%	17.92	17.39	3.79	46%
Gap (Q5-Q1)	**-3%**	**-5%**	**-8%**	**-0.27**	**-0.78**	**1.10**	**20%**
Outside London							
Least Disadvantaged Quintile (Q1)	96%	57%	71%	18.47	18.13	3.51	22%
FSM Q2	95%	56%	70%	18.56	18.31	3.95	21%
FSM Q3	95%	53%	68%	18.44	18.09	4.35	25%
FSM Q4	92%	50%	64%	18.46	18.07	4.67	28%
Most Disadvantaged Quintile (Q5)	93%	50%	64%	18.29	17.75	5.19	29%
Gap (Q5-Q1)	**-3%**	**-7%**	**-7%**	**-0.18**	**-0.38**	**1.68**	**7%**

Sources and Notes: Author's calculations using School Workforce Census, November 2016. School Workforce Census Statistics, November 2016 (https://www.gov.uk/government/statistics/school-workforce-in-england-november-2016).

Figure 1.4 shows the levels of two key indicators of recruitment and retention difficulties across local authorities: a) the percentage of teachers in high-priority subjects with a degree in a relevant subject; b) average days lost to sickness and absence per teacher.

Across most local authorities, the proportion of teachers in high-priority subjects with a relevant degree varies between 50 and 70 per cent. However, there are several areas where this falls notably below 50 per cent. This includes areas on the south coast (Bournemouth, Hampshire and Portsmouth), areas in the West Midlands (Shropshire, Staffordshire, Walsall and Dudley) and parts of South and West Yorkshire (Barnsley, Rotherham and Doncaster). In contrast, the proportion of teachers with relevant degrees in high-priority subjects is generally high in London and the South East.

Local authorities with high levels of teacher absence and sickness are slightly different. Absence and sickness levels are generally low in London and the South East. It is higher, on average, in local authorities around Yorkshire and the Humber (North Yorkshire and Kirklees in particular), parts of the North West (Halton, Bury and St Helens) as well as some eastern cities (Nottingham and Peterborough).

Figure 1.4 – Maps of differences in teacher recruitment and retention difficulties by local authority

    a)   **Percentage of teachers in high-priority subjects with degrees in relevant areas**

	Over 70%		30-40%
	60-70%		Less than 30%
	50-60%		Low sample size
	40-50%		
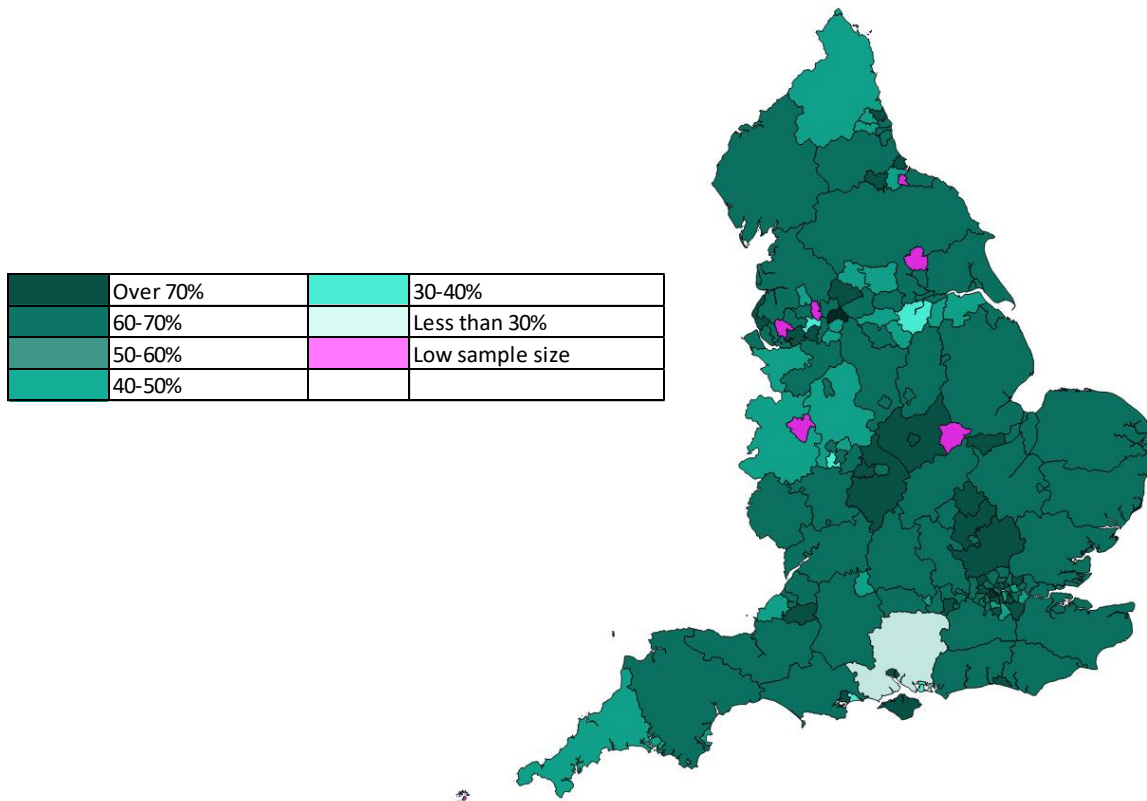
    b)   **Average days lost to sickness/absence per teacher**

	Less than 3 days
	3-4 days
	4-5 days
	5-6 days
	Over 6 days
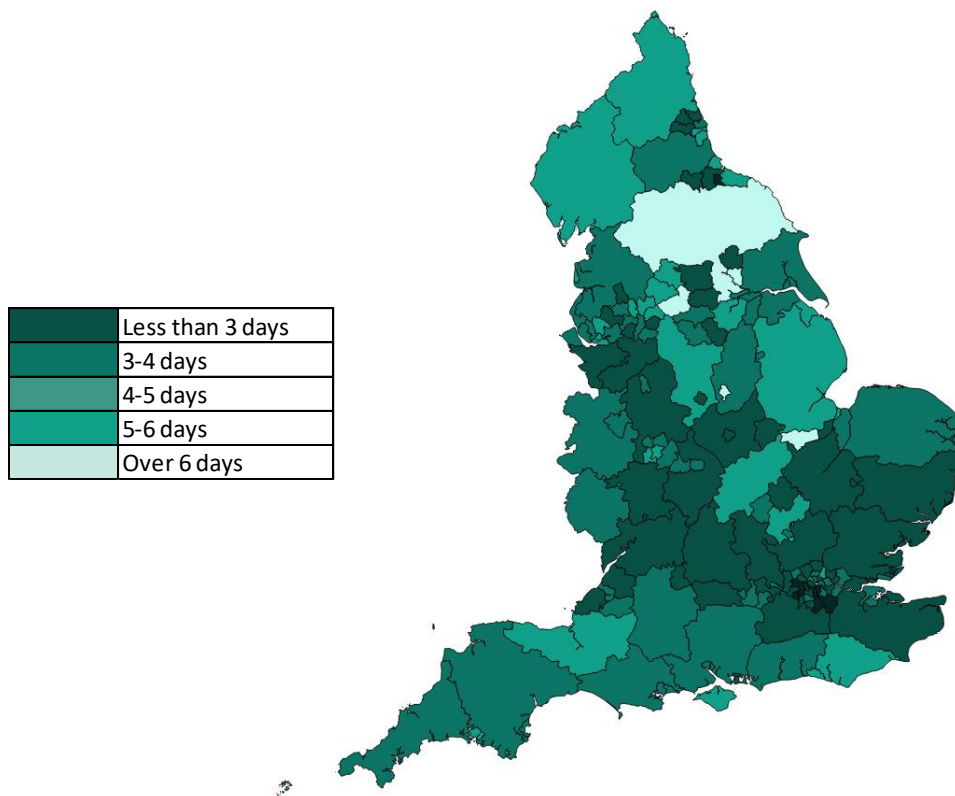
Differences for individual subjects by level of disadvantage and area

In this section, we show a detailed picture by individual subjects in terms of the proportion of secondary school pupils taught by teachers with a degree in a relevant subject. We show differences by the socio-economic background of pupils at each school. This is based on the same methods and assumptions as set out in our previous report, with numbers slightly corrected.[12] We extend this to consider the average hours worked by teachers in individual subjects.

We start by showing the proportion of Key Stage 4 hours taught by teachers with relevant degrees. In Figures 1.5 and 1.6, we show how this varies across subject by quintile of school disadvantage (Q1 being the least disadvantaged schools and Q5 being the most disadvantaged schools), as well as inside and outside of London (London shown in green and the rest of England in pink). Figure 1.5 shows the patterns for high-priority subjects receiving the highest teacher training bursaries due to shortages (maths, physics, chemistry, general science, languages) and Figure 1.6 for other subjects (English, biology, geography, history, art & design, design & technology), along with 95 per cent confidence intervals. It is important to note that the quintiles are defined across the whole of England, and not London and the rest of England separately.

Figure 1.5 Socio-economic differences in the proportion of teachers with a degree in a relevant subject by subject taught - high-priority subjects
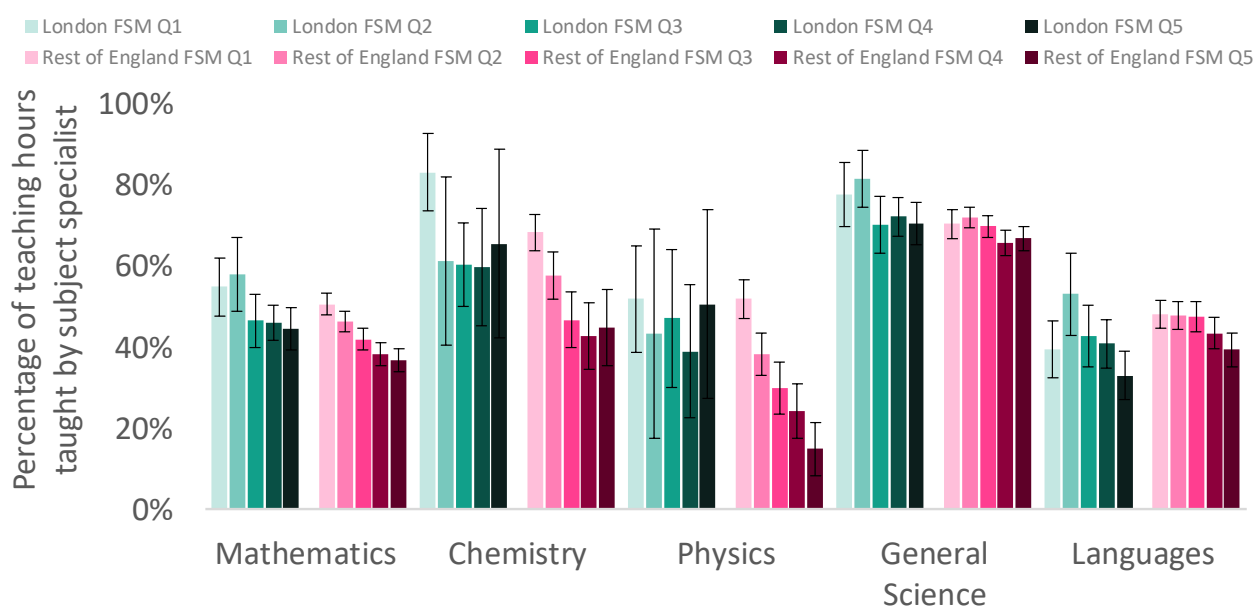
Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Errors bars show 95 per cent confidence intervals.

As is well known, there are pronounced differences across subjects. There are also differences by the level of disadvantage in the school, particularly for high-priority subjects. These socio-economic gradients are sharper outside of London. There are much wider confidence intervals for the quintiles inside London, reflecting the lower sample sizes. However, a number of clear patterns do emerge.

Starting with high-priority subjects, we see sharp socio-economic gradients in terms of access to teachers with relevant degrees in maths, physics and chemistry, but less evidence in languages:

▪ **Maths**: In London, 55 per cent of maths teaching hours are taught by teachers with a relevant degree in the least disadvantaged schools, compared with 44 per cent for the most disadvantaged group of schools, leaving a gap of around 11 percentage points. Outside of London, 51 per cent of Key Stage 4 maths hours are taught by teachers with a relevant degree in the least disadvantaged

schools outside, but only about 37 per cent in the most disadvantaged schools, a statistically significant gap of around 14 percentage points.

- **Chemistry**: Inside London, the share of Key Stage 4 chemistry hours taught by teachers with a relevant degree is above 60 per cent across all quintiles. Outside of London, 68 per cent of the hours are taught by teachers with a relevant degree in the least disadvantaged group of schools, about the same level we see for the most disadvantaged schools in London. This compares with 44 per cent in the most disadvantaged schools outside of London, a statistically significant gap of 24 percentage points.
- **Physics**: Inside London, the proportion of hours taught by teachers with a relevant degree is just over 50 per cent across all quintiles. Outside London, about 52 per cent of hours are taught by teachers with a relevant degree in the least disadvantaged schools, but only 15 per cent in the most disadvantaged schools outside of London, leaving a statistically significant gap of 37 percentage points.
- **Combined/general science**: There are slightly higher levels of access to teachers with relevant science degrees inside London (70-80 per cent) than outside London (65-70 per cent). However, there is no strong evidence of a socio-economic gradient.
- **Languages**: There is some evidence of a small socio-economic gradient outside London, but the overall levels are slightly higher outside London. For the most disadvantaged schools, about 34 per cent of hours are taught by teachers with a relevant degree inside London and 39 per cent outside of London.

Therefore, there are clear socio-economic gradients in terms of access to teachers with a relevant degree in high-priority subjects. With the exception of general science and languages, the overall levels of access to teachers with relevant degrees are generally lower in more disadvantaged schools and the socio-economic gradient sharper outside of London.

Figure 1.6 shows the equivalent figures for other subjects at Key Stage 4. Here, we see a greater proportion of hours taught by teachers with a relevant degree, much smaller socio-economic gradients and less difference inside and outside of London. In particular, we see:

- **English**: Outside London, about 72 per cent of English hours are taught by teachers with a relevant degree in the least disadvantaged schools, as compared with about 63 per cent in the most disadvantaged schools. These figures are around 5 percentage points higher inside London.
- **Biology**: There is no evidence of large socio-economic gaps inside or outside London. Around 70 per cent of Key Stage 4 biology hours are taught by teachers with a relevant degree across quintiles, though there is a large amount of statistical uncertainty in all cases.
- **History:** There is no evidence of any socio-economic gaps or London difference. The proportion of Key Stage 4 history hours taught by teachers with a relevant degree is generally around 70-80 per cent in all cases.
- **Geography:** There is evidence of a statistically significant socio-economic gap for geography, but no evidence of a London effect. In both London and the rest of England, the proportion of Key Stage 4 geography hours taught by teachers with a relevant degree was about 80 per cent for the least disadvantaged schools and 70 per cent amongst the most disadvantaged schools.
- **Art & design**: Inside London, the estimated proportion of hours taught by teachers with a relevant degree varies by levels of disadvantage but is generally high at between 70 and 90 per cent. Outside London, figures are lower at around 70 per cent and there is less evidence of large socio-economic differences.

- **Design & technology**: There is little evidence of a socio-economic gap or London effect, with the proportion of hours taught by teachers with a relevant degree generally around 50-60 per cent.

Figure 1.6 Socio-economic differences in the proportion of teachers with a degree in a relevant subject by subject taught - other subjects
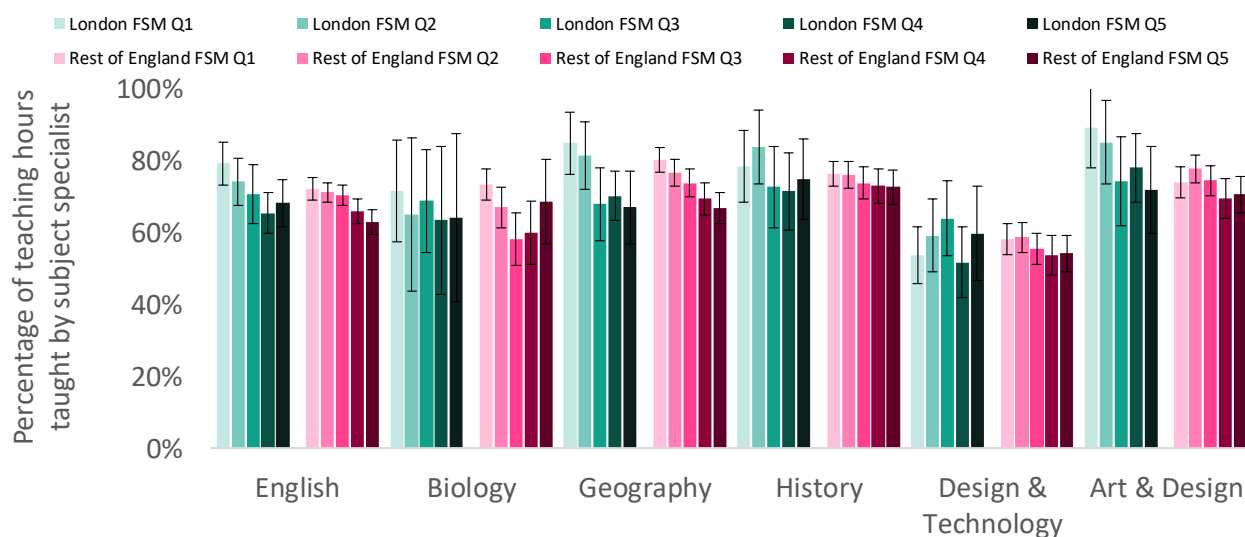
Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Errors bars show 95 per cent confidence intervals.

Appendix Figures B.1 and B.2 show the total hours taught by teachers who teach different subjects. This helps us understand whether shortages in particular subjects and areas are placing teachers in those schools under greater pressure. In general, hours taught are similar across teachers by subject, area and level of school disadvantage. Across high-priority subjects, there is almost no evidence of any differences among schools with different levels of disadvantage. The only exception is languages teachers in London, for whom teaching hours are about 2 hours longer in the least disadvantaged schools as compared with the most disadvantaged schools. Amongst other subjects, there is no evidence of any significant differences in teaching hours by subject taught.

Summary

In summary, the teacher labour market is currently facing profound challenges. Teacher numbers have been failing to keep pace with growth in pupil numbers, particularly in secondary schools where further growth in pupil numbers is expected over the next few years. There is also clear evidence to suggest that recruitment and retention difficulties are more significant for disadvantaged schools, where teachers are less likely to possess QTS and a degree in a relevant subject. These problems are worst in shortage subjects and in more disadvantaged schools outside London. For example, only about 15 per cent of physics teachers in disadvantaged schools outside of London have a physics degree. There is also clear evidence of more days lost to sickness or absence in disadvantaged schools, with an extra 1.5 days lost per teacher per year, which equates to over 100 days per school.

2. Current differences in teacher pay across subjects

The previous section illustrated that schools find it far harder to recruit teachers with a relevant degree in science and maths subjects, particularly in disadvantaged areas outside London. Whilst there is unlikely to be a single cause or solution to these problems, pay levels are likely to be central. Shortages are most acute in subjects where graduates can command higher salaries outside of teaching and less problematic in areas where outside salaries are lower.

Various proposals have been put forward to pay salary supplements to teachers in shortage subjects and/or high poverty areas to partly address such problems. [13] This is backed up by evidence from trials in the US. The government has also signalled an intention to introduce retention bonuses in shortage subjects as part of its recent recruitment and retention strategy.

The Pupil Premium and new freedoms over teacher pay have already given schools the opportunity to pay such salary supplements themselves. The initial empirical evaluation of the teacher pay reforms suggested these were only being used in a limited way.[14] However, more recent analysis has suggested schools in areas with high outside wages have responded by increasing teacher pay at a faster rate. [15] We extend this analysis by considering differences in teacher pay by the level of school disadvantage and the different picture inside and outside of London. We also consider the mechanisms driving some of the differences that do emerge. This provides crucial context for how teacher pay currently differs by subject and area.

Methods and assumptions

We start by analysing total teacher pay per full-time equivalent (FTE) teacher across subjects, both for all teachers and early career teachers (defined as those with less than five years' experience as a teacher). We then examine differences in pay by subject grouping (high-priority and other subjects) and by the level of school disadvantage (as captured by the proportion of pupils eligible for FSM). The next stage of our analysis is to estimate differences in pay levels by school disadvantage after controlling for teacher characteristics (such as gender, age and experience). All analysis is performed separately inside and outside of London, given the very different pay scales. Further specific details about our methods can be found in Appendix A.

Pay levels across subjects

There is little evidence of substantial differences in secondary school teacher pay across subjects. Figure 2.1 shows average teacher pay across subjects outside London, panel (a), and inside London, panel (b). Outside of London, the highest paid subjects are individual sciences (£38,000 on average), which are only about £1,000 above the lowest paid subjects of languages, mathematics, English, general science and art and design (average pay of £37,000). The scale and pattern of differences is very similar for early career teachers, with average pay of just over £29,000 for individual sciences and around £28,000 for most other subjects. The lowest pay levels amongst early career teachers, however, can be seen for language teachers, where average pay is about £27,000. This is slightly surprising given the shortages in these subjects.

In London, we clearly see higher overall levels of pay to reflect London weighting. Many of the same patterns by subject still emerge though. The highest paid subjects are individual sciences (£42,000 for all teachers), with the lowest paid subjects being English, general science, maths, art and design, and languages (around £41,000 for all teachers). There are, however, some hints of bigger differences amongst early career teachers in London, with average pay levels of £33,000-34,000 for individual science and geography teachers, pay levels of just under £33,000 for English, general science and maths teachers (around the average for early career teachers), and £32,000 or under for art and design, history, languages and, design and technology teachers. This suggests that schools in London are giving slightly higher priority to paying early career teachers more in science, maths and English.

Figure 2.1 also shows the average pay levels of primary school teachers, which is generally about £1,000 below that for secondary school teachers. This is likely linked to primary school teachers being younger and less experienced, on average. For example, in November 2016, about 27 per cent of primary school teachers were aged 30 or under, as compared with about 22 per cent of secondary school teachers.

Figure 2.1 – Average total teacher pay per FTE by subject and location, November 2016

   a)   Outside London
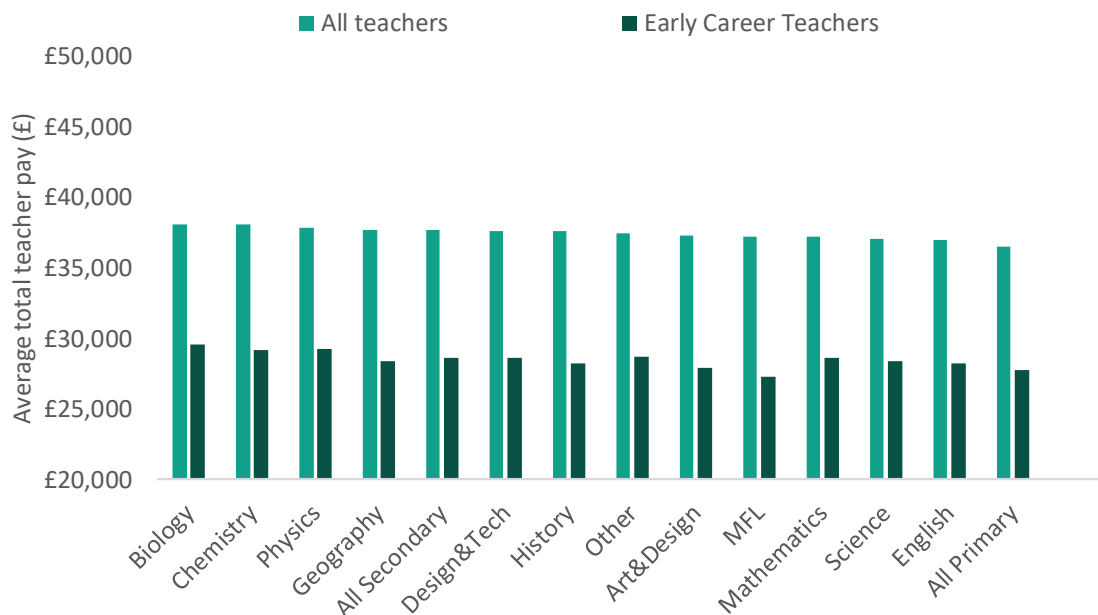
   b)   Inside London
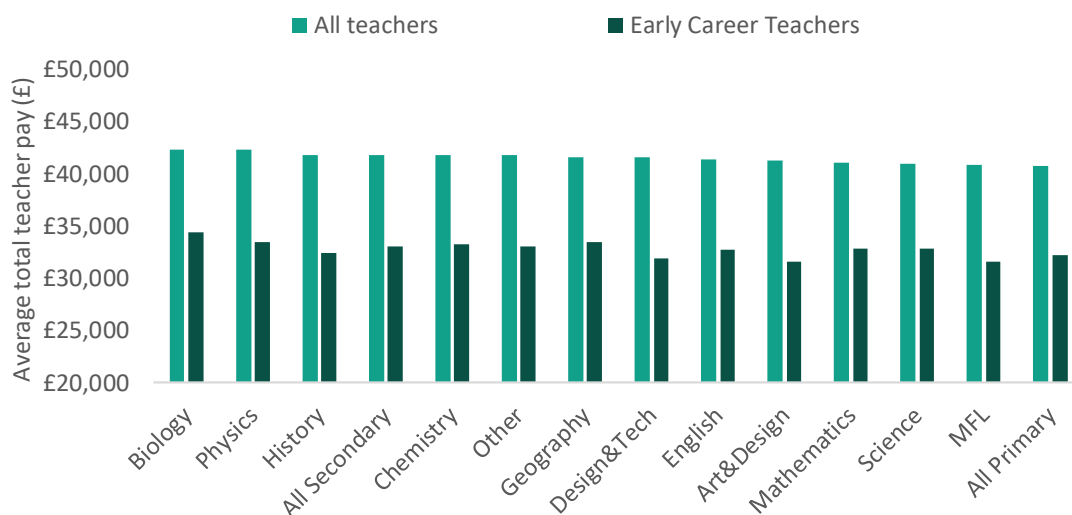
Sources and Notes: Author's calculations using School Workforce Census, November 2016. MFL refers to Modern Foreign Languages.

Differences by subject and level of disadvantage

The Pupil Premium and new freedoms on teacher pay give schools the opportunity to pay higher salaries in shortage subjects and in more disadvantaged areas. To what extent are schools using these freedoms to pay teachers more in deprived areas?

Figure 2.2 shows average levels of teacher pay by quintile of disadvantage between November 2011 and November 2016. This is shown separately for high-priority or shortage subjects (maths, physics, chemistry, languages and general science) and other subjects.

The upper two figures show the pattern by disadvantage outside of London. Teachers in the most disadvantaged quintile of schools are paid, on average, just over £36,000 in high-priority subjects. This is about £1,500 less than the average pay in the least disadvantaged groups of schools outside of London, where average pay is just under £38,000 in high priority subjects. The pay difference by disadvantage is similar in other subjects, but overall levels of pay are about £1,000 higher than in high-priority subjects (reflecting the differences by subject observed in Figure 2.1).

We see a somewhat different picture inside London. Teachers in the most disadvantaged quintile were paid just under £42,000 in high-priority subjects in London in 2016. This is about £1,000 higher than in London schools in the least disadvantaged quintile. A similar difference can be seen in other subjects, though average pay is a bit higher at £42,000 in the least disadvantaged schools and £43,000 in the most disadvantaged schools.

These figures represent raw, average levels of teacher pay. They do not control for the fact that teachers in highly disadvantaged schools in London are more likely to benefit from inner London weighting, or that teachers in London and more disadvantaged schools tend to be younger and less experienced, on average.

To better capture the true differences in teacher pay levels by area and disadvantage, we control for the age, gender, teaching experience (time since qualification), ethnicity and region of individual teachers (including an inner London premium within London). Figure 2.3 then shows the differences in teacher pay by quintile of disadvantage by subject group over time (split by inside and outside of London). A positive number indicates that teachers in that quintile are paid more than the least disadvantaged quintile, whilst a negative number indicates they are paid less.

Outside London, the estimated differences in pay after controlling for individual factors are close to zero and have not changed over time. This is true for shortage subjects and other subjects. Disadvantaged schools outside of London do not appear to have used their new teacher pay freedoms or Pupil Premium money to pay higher salaries. Lower average levels of teacher pay in disadvantaged schools outside London seem to reflect individual characteristics associated with lower pay (e.g. younger and less experienced teachers).

A very different picture emerges in London. Teachers in the most disadvantaged quintile of schools were paid about £1,700 more than those in the least disadvantaged quintile in 2016, both in high priority and other subjects. This pay premium also appears gradually higher with greater levels of disadvantage, e.g. teachers in the middle quintile are paid about £750 more than those in the least disadvantaged quintile. The premia for the most disadvantaged three quintiles are also statistically significant.

Looking over time, the actual value of the premium appears to have declined slightly from £2,500-£3,000 in 2011 and 2012. However, sample sizes are a lot lower in London and there is quite a lot of statistical uncertainty around these estimates and we cannot be sure that the premium has declined over time. That being said, the premium for the most disadvantaged quintile in London is always statistically significant and the pattern over time suggests this premium is more likely to be longstanding, rather than a result of changes in the form of the Pupil Premium or new teacher pay freedoms. In what follows, we seek to explain what could be driving these differences, in London in particular.

Figure 2.2 – Average total teacher pay by subject priority status, location and disadvantage over time
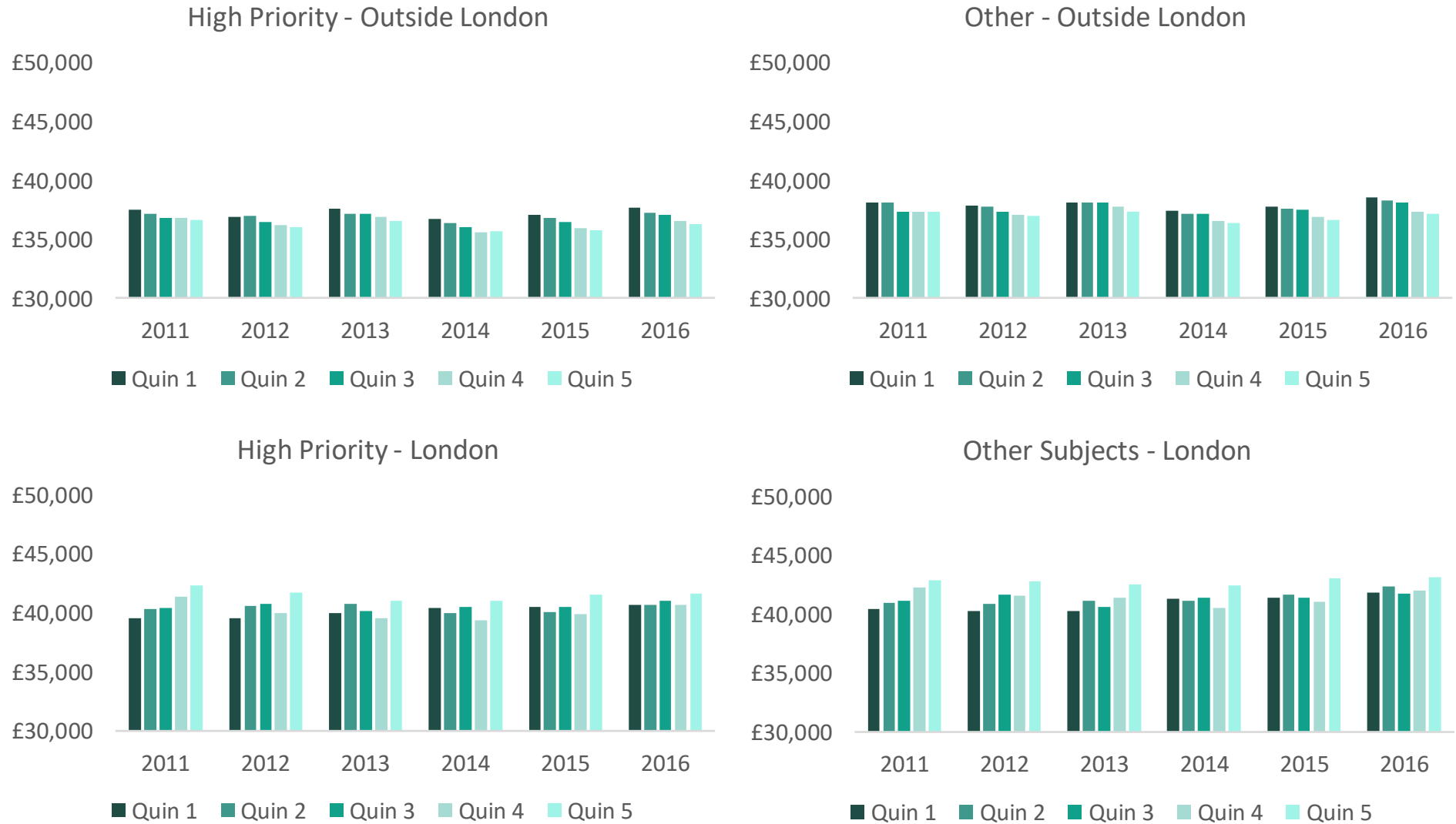
Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Quin 1 refers to schools with the lowest levels of disadvantage, Quin 5 refers to schools with the highest levels of disadvantage.

Figure 2.3 – Differences in teacher pay by subject, disadvantage and area after controlling for individual characteristics
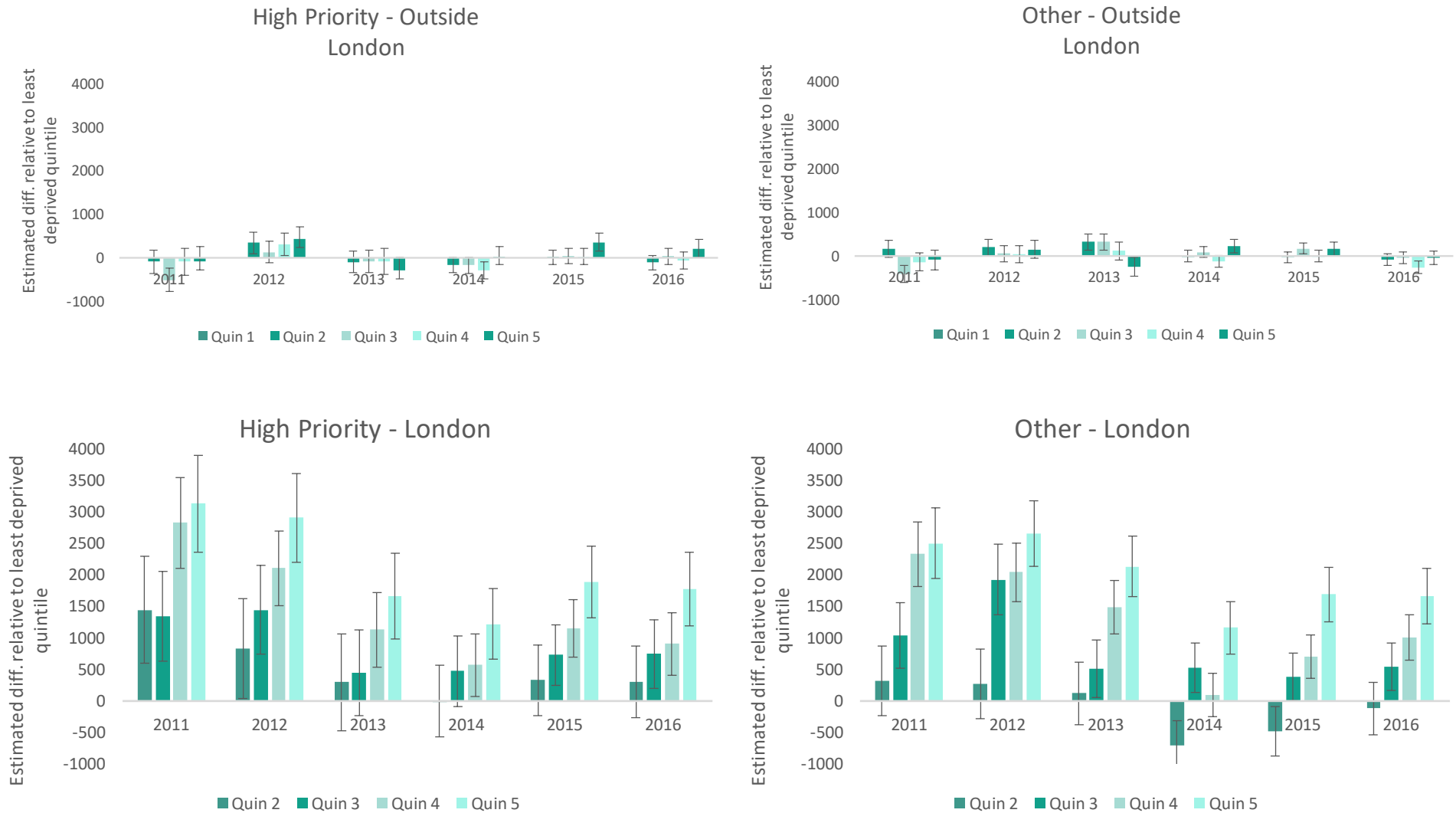
Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Quin 1 refers to schools with the lowest levels of deprivation, Quin 5 refers to schools with the highest levels of disadvantage. Error bars indicate 95% confidence intervals.

Explaining the poverty pay premium in London

In London, we saw higher levels of teacher pay, even after accounting for teacher characteristics. To explain this higher 'poverty pay premium' in London we start by grouping all subjects together (given the lack of difference observed in earlier figures). We then look at various sub-groups and definitions of teacher pay to understand the mechanisms driving this premium.

Figure 2.4 starts by showing the estimated differences in total teacher pay levels by levels of school disadvantage for all teachers in all subjects in London. This represents our baseline, with teachers in the most disadvantaged quintile paid around £1,700 more than those in the least disadvantaged quintile in November 2015 and 2016. This is down from around £2,700 in November 2011 and 2012.
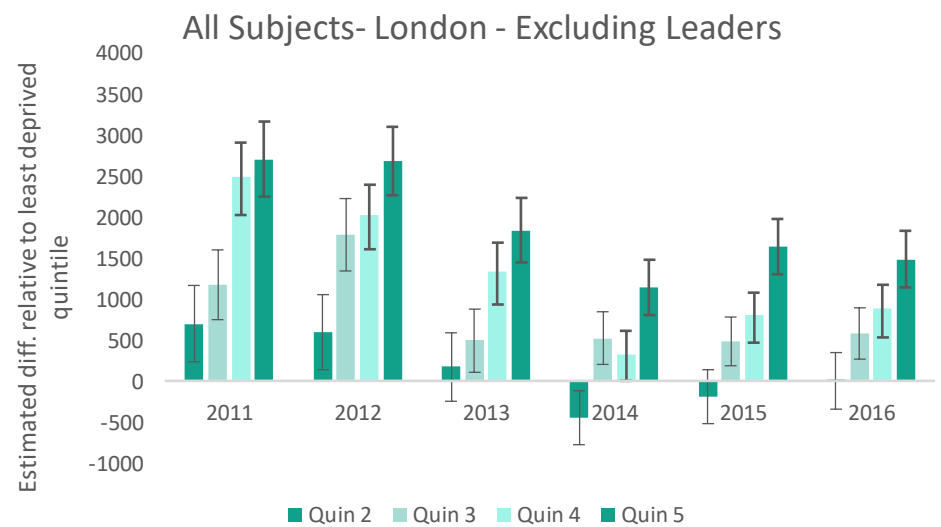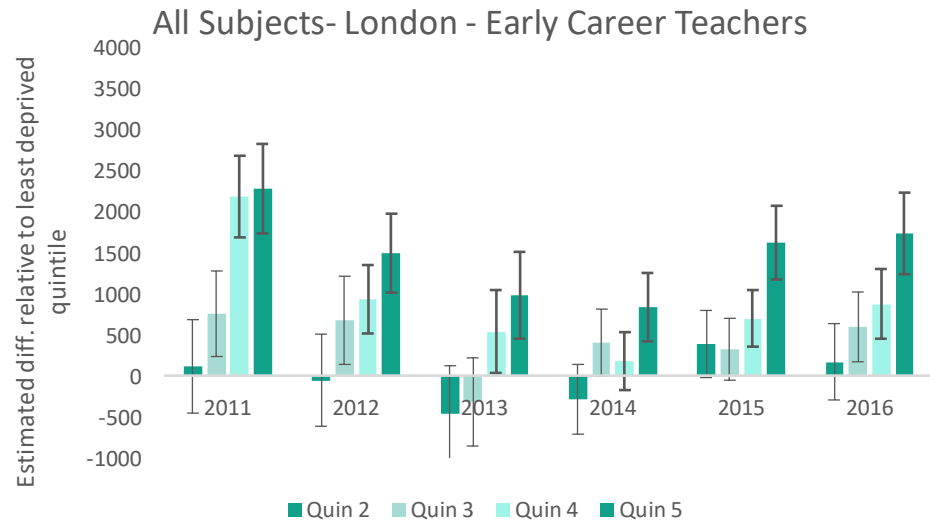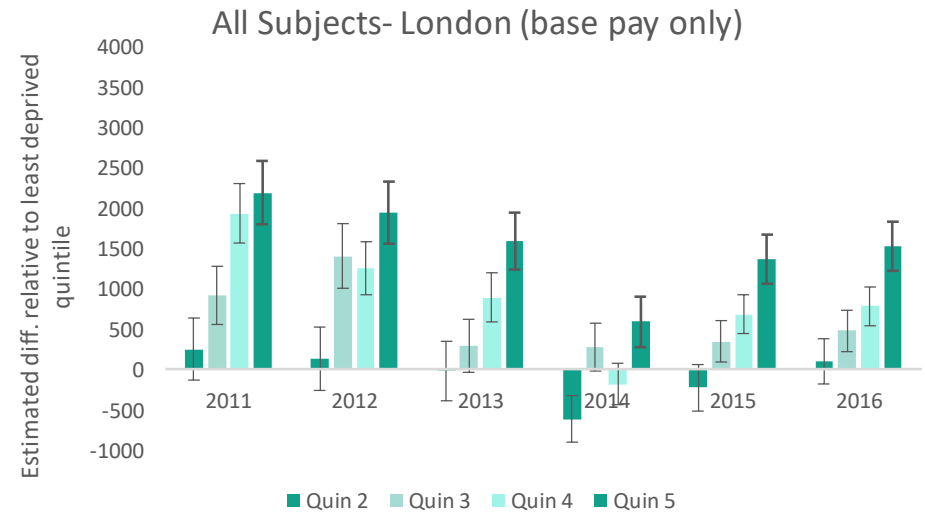
The panel in the top right illustrates that part of this premium (and its decline) is down to the role of additional payments over and above base salary. When we exclude these additional payments, the premium is reduced by around £200-300 in the most recent years. However, it falls by about £500-£750 in earlier years. This strongly suggests that part of the reason for a high poverty pay premium in London in 2011 and 2012 was down to greater use of additional payments, which added over £500 to the poverty pay premium. This is less true in recent years, with additional payments contributing about £200 to the poverty pay premium in London for the most disadvantaged schools.

In the bottom two sets of graphs, we re-estimate the differences in teacher pay levels solely for early career teachers and then for all teachers excluding leaders (those on the leadership pay scales). Amongst early career teachers, we see that the poverty pay premium is very similar to that amongst all teachers in the most recent two years in 2015 and 2016 (just over £1,500). However, this is not the case in earlier years, when the poverty pay premium appears lower for early career teachers (£1,500-£2,000) than for all teachers (£2,700). This suggests that higher pay in more disadvantaged schools in London was being targeted at more experienced teachers in earlier years. When we exclude leaders, the poverty pay premium is very similar to when we look at all teachers. This suggests that greater use of leadership roles and pay scales is not a big driver of the poverty pay premium in London.

Summary

In summary, there is no evidence of a poverty pay premium for schools outside of London. In contrast, we see evidence of a poverty pay premium of about £1,500 for teachers in the most disadvantaged schools in London. We can explain some of the higher poverty pay premia in London (and their decline over time). In earlier years, pay levels in disadvantaged schools seem to have been boosted by around £500 through greater use of additional payments. There is also evidence to suggest that higher pay was targeted more at experienced teachers. In more recent years, we still see additional payments boosting the poverty pay premium, but by only around £200. The reduced role of additional payments thus explains some of the decline over time. However, we also see that the poverty pay premium is widespread across London in more recent years. It is paid to early career and more experienced teachers, and to classroom and leaders alike. The fact that it is longstanding and widespread suggests that it is driven by other underlying factors, and not by more recent policy innovations on pay freedoms and the Pupil Premium. Indeed, it may be that disadvantaged schools in London long ago recognised the potential value of offering higher teacher salaries.

Figure 2.4 – Explaining the poverty pay premium in London

All Subjects- London

All Subjects- London (base pay only)

All Subjects- London - Early Career Teachers

All Subjects- London - Excluding Leaders

Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Quin 1 refers to schools with the lowest levels of disadvantage, Quin 5 refers to schools with the highest levels of disadvantage. Error bars indicate 95% confidence intervals.

3. Pay outside of the teaching profession

Teachers can undertake a range of alternative careers and come from a broad range of subject backgrounds. Some can attract higher salaries outside of teaching (e.g. maths and science graduates) whilst in other cases teaching offers higher salaries than in alternative careers (e.g. history and English graduates). In this section, we illustrate the full extent of these differences for men and women, and how they evolve over individuals' crucial early career phase. We start by comparing teacher salary levels with those in other major professional occupations, which will include managers, doctors, nurses, lawyers and engineers. We then compare teacher pay levels with those of graduates who have studied different subjects. In the next section, we consider choices and challenges facing policymakers over teacher pay, focusing particularly on the new government commitment of raising starting salaries to £30,000 for teachers from 2022.

Pay in alternative professional occupations

In Table 3.1, we show how early career, full-time earnings for men and women (aged 22-29) differ across major professional and associate professional occupations, compared with education and teaching. The figures are ordered by the median earnings for women.

Table 3.1 –Median full-time annual earnings amongst men and women aged 22-29 by professional occupational groups, 2017-18

Professional Occupations	Women			Men		
	25th percentile	Median	75th percentile	25th percentile	Median	75th percentile
Business, media & public service	£24,315	£30,000	£36,820	£25,461	£31,989	£42,912
Science, research, engineering & tech.	£23,661	£29,482	£35,000	£26,466	£32,619	£39,897
All professional occupations	**£24,406**	**£28,203**	**£33,246**	**£25,784**	**£31,759**	**£39,739**
Health professionals	£24,907	£27,968	£32,467	£26,077	£30,588	£39,749
Teaching & education	*£23,786*	*£27,697*	*£32,081*	*£24,547*	*£29,027*	*£33,716*
Business, media & public service associates	£22,000	£26,853	£34,228	£24,075	£31,000	£39,995
All associate professional & technical	**£21,073**	**£25,812**	**£32,825**	**£22,292**	**£28,000**	**£35,315**
Science, engineering & public service associate	£19,227	£22,843	£29,140	£19,802	£24,945	£30,974

Source: ASHE 2017-18
(https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/agegroupbyoccupation2digitsocashetable20)

Median earnings for women aged 22-29 working in education and teaching were about £27,700 in 2017-18, which is similar to that of health professionals, but about £500 below the median for all women professionals of a similar age. They are also around £2,000 lower than the highest paid professional occupations in business, media, other public services, science, technology, research and engineering.

Amongst men, we see even bigger differences. Men aged 22-29 working in education and teaching earned about £29,000, on average, in 2017-18. This is over £2,500 below the median for all men in professional occupations and about £3,000 below the highest paid occupations.

If we look beyond the average, we see that the 25th percentile amongst men and women in education and teaching occupations is only about £1,000 below the 25th percentile for all professional occupations. However, the 75th percentile for men in education and teaching is about £6,000 below that for all professional occupations. Amongst women, the 75th percentile for women in education and teaching is over £3,000 below that for the highest paid professional occupations.

In summary, teaching and education professionals were amongst the lowest paid of the professional occupations in 2017-18. Furthermore, high-flying graduates considering teaching and education occupations will have to weigh up alternative options paying substantial amounts more during their early career stage. The differences are particularly pronounced for men.

Differences by subject background

In Table 3.2 we show median earnings by subject studied five years after graduation for men and women, as well as equivalent figures for teachers.[16] This focuses on major secondary school subjects, with Appendix Figures B.3 and B.4 showing the wider differences by subject and how earnings vary by the number of years since graduation. All figures relate to the 2016-17 tax year (the most recent available data).

Table 3.2 – Median graduate earnings five years since graduation for major secondary school subjects and teachers

	Median Female Earnings	Difference with Female Teachers	Median Male Earnings	Difference with Male Teachers
Teacher	**£31,000**		**£32,000**	
Maths	£32,700	+£1,700	£35,200	+£3,200
Physics	£31,400	+£400	£33,600	+£1,600
Chemistry	£28,700	-£2,300	£29,400	-£2,600
Geography	£27,200	-£3,800	£28,100	-£3,900
MFL	£27,000	-£4,000	£29,600	-£2,400
History	£25,300	-£5,700	£26,500	-£5,500
Biology	£25,000	-£6,000	£26,500	-£5,500
English	£24,200	-£6,800	£23,800	-£8,200
Art & Design	£20,200	-£10,800	£21,000	-£11,000

Sources and Notes: Department for Education, Graduate Outcomes (LEO): 2016–17 (https://www.gov.uk/government/statistics/graduate-outcomes-leo-outcomes-in-2016-to-2017). School Workforce Census, November 2016

For women, this shows that teachers generally have higher or comparable earnings to graduates with degrees in most major secondary school subjects. Higher earnings for teachers are likely to represent both the level of salaries and the fact that many graduates will not have settled into particular occupations five years after graduation, whilst teachers, by definition, have settled into a professional occupation.

For men, teachers clearly earn less than male physics and maths graduates. This illustrates that it might be particularly difficult to attract male physics and maths graduates. This is likely to make it

more difficult to attract physics and math graduates in general, given that male maths graduates outnumber female maths graduates by about 2:1, and by about 4:1 amongst physics graduates.

Appendix Figure B.3 and B.4 illustrates the wider differences by subject studied. This shows that there is tremendous variation in graduate earnings by subject studied. Generally, individuals with degrees in maths, physics, medicine and economics tend to have the highest earnings, whilst those with degrees in creative arts, social science, psychology or English have the lowest levels of earnings. These differences grow by the number of years since graduation.

For five years after graduation, we also illustrate the range of earnings for graduates who studied individual subjects (shown by the error bars). This shows that the variation within subject is at least as great the variation across subject. Around a quarter English male and female graduates earn over £30,000 five years after graduation and over one quarter of geography graduates earn over £35,000. The figures become even starker for maths and physics. Over a quarter of female physics graduates earn over £39,000 and a quarter of female maths graduates earn over £43,000. For men, a quarter of physics graduates earn over £42,000 and a quarter of maths graduates earn over £50,000.

This analysis shows that graduate earnings vary markedly by the subject studied and teachers from some subject backgrounds can earn substantially more outside of the teaching profession.

4. Future options and challenges

As we saw in the previous section, teachers are currently paid less than men and women in other professional occupations. Options for high-flyers (i.e. those able to command the highest salaries) outside of teaching are even better, with 25 per cent of men in professional occupations in their 20s earning over £40,000. Teachers are relatively well-paid compared with most other graduates, particularly when they are in their early 30s. They are, however, paid less than graduates with degrees in maths and science subjects, particularly amongst men.

The government has committed to increasing mandatory starting salaries for teachers to £30,000 by September 2022. This represents an increase of just under £6,000 or 23 per cent as compared with current starting salaries of just over £24,000 outside London. Starting salaries are currently higher in London to reflect a higher cost of living, around £30,000 in inner London and £28,000 in outer London. In its evidence to the School Teachers' Review Body STRB, the government has committed to deliver large rises in starting salaries for teachers in London too, though slightly smaller than for teachers in the rest of England. Depending on how graduate salaries in other occupations evolve over the next three years, this rise in starting salaries is likely to leave teachers relatively highly paid compared with other major professional occupations, on average.

In its recent evidence submission to the STRB[17], the government set out a range of options for how higher starting salaries could be delivered between now and 2022, including potential costs and benefits, and indicated its preferred option.

The government is also committed to salary supplements or retention bonuses in shortage subjects for early career teachers. Such salary supplements are well-aligned with the empirical evidence, which finds that such payments can significantly ameliorate recruitment and retention problems. The government has proposed payments of £2,000 per year in years 2, 3 and 4 of teachers' careers for those starting training in 2020, with extra payments of £1,000 if they teach in a set of 'challenging' local authorities.

In what follows we set out the options and challenges in implementing these reforms to teacher pay and remuneration, starting with higher starting salaries before moving on to discuss retention payments. We discuss ways of implementing these changes, as well as their potential costs and benefits.

Implementing higher starting salaries

In its remit to the STRB, the **government has sought advice and recommendations on how to implement this rise in starting salaries**.[18] As part of this remit, the government committed to introducing a rise in starting salaries in addition to the London weighting, so that teachers in London will also see a rise. It also committed to delivering a pay rise to all teachers, though this would likely be less than the promised rise for new teachers. As a result, the salary schedule for teachers in 2022 is likely to be flatter than it is at present, with a much higher rate at the start of the scale and then rising more slowly with experience than at present. As we discuss below, this is well-aligned with empirical evidence showing the potential benefits for recruitment and retention of a flatter salary schedule.

The major choice for policymakers is how much of a pay rise to deliver for existing teachers. This has a major bearing on both the likely costs and benefits of such a policy.

Before detailing potential costs, a more practical question is **how to deliver a different salary schedule given that schools now have substantial autonomy over teacher pay levels**. Currently, the government sets the minimum and maximum levels for the main teacher pay range (£24,373 to £35,971 outside London) and upper pay range (£37,654 to £40,490 outside London).[19] Schools then have freedom to determine individual teacher pay levels within this range, with teachers moved on to the upper pay range if they pass the necessary assessment.

Figure 4.1 illustrates the broad range of options for policymakers that exist between increasing only starting salaries and increasing salaries across the board. The solid green line shows current average total pay levels of teachers in England outside London according to years of experience (projected from November 2016 based on annual pay awards). These figures include any additional payments and leadership roles, which become increasingly prevalent for teachers with more experience. They are therefore not a precise demonstration of the range of possible options, but do serve to illustrate the type and nature of options available to policymakers.

During their first few years of teaching, pay levels currently rise at a relatively fast rate, rising from an average of £24,000 for new teachers to about £40,000 after about 6-7 years of experience. It then flattens to reach about £44,000 after about 13 years of experience.

The light green area then shows the broad range of possible salary schedules for 2022, given the government's commitment to introduce higher starting salaries. The cheapest option would be to just increase all pay levels below £30,000 up to this new minimum and leave other salaries unchanged. This would result in a flat pay schedule for teachers' first 3-4 years of experience. At the other extreme, the government could increase all pay levels by 23 per cent, which would shift the pay schedule up by an equal percentage for all teachers.

In between these extremes, there are a vast range of possibilities. By way of an example, we show a possible pay schedule where starting salaries are increased to £30,000 or 23 per cent, most experienced teachers are offered a pay rise of 11.5 per cent (half the 23 per cent proposed for new teachers) and pay levels for teachers in the first years of their career are increased somewhere in

between these values. This delivers a flatter pay schedule, as well as well as a pay rise above expected inflation for existing teachers.

Figure 4.1 – Average teacher pay levels by years of experience outside London area, current and potential options for 2022
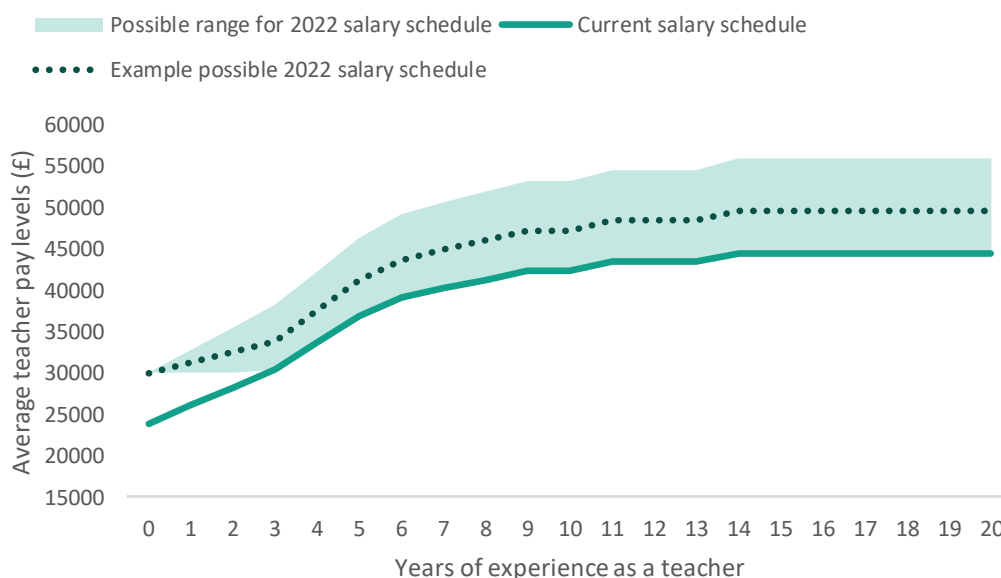
Source and notes: Author's calculations using School Workforce Census. Teacher pay includes base salary, all additional payments and leadership pay levels. The current (2019) salary schedule is projected based on levels in November 2016 uprated by the increases in salary schedules implemented in September 2017, 2018 and 2019.

In its recent evidence to the STRB, **the government has set out a range of possible options for implementing higher starting salaries** in September 2020 and through to September 2022. Its **preferred method for implementing this is through specifying advisory pay points**. This would match the pay system that was in place until 2013, but now serves as a guide rather than a mandatory pay scale. Such a method has its advantages in terms of implementing the government's preferred salary schedule, as many schools still use these pay points in some way. However, it is important to recognise potential limitations, as schools do have the freedom to deviate from this structure, particularly academies. They may also be more likely to deviate if funding increases are below expected teacher pay increases.
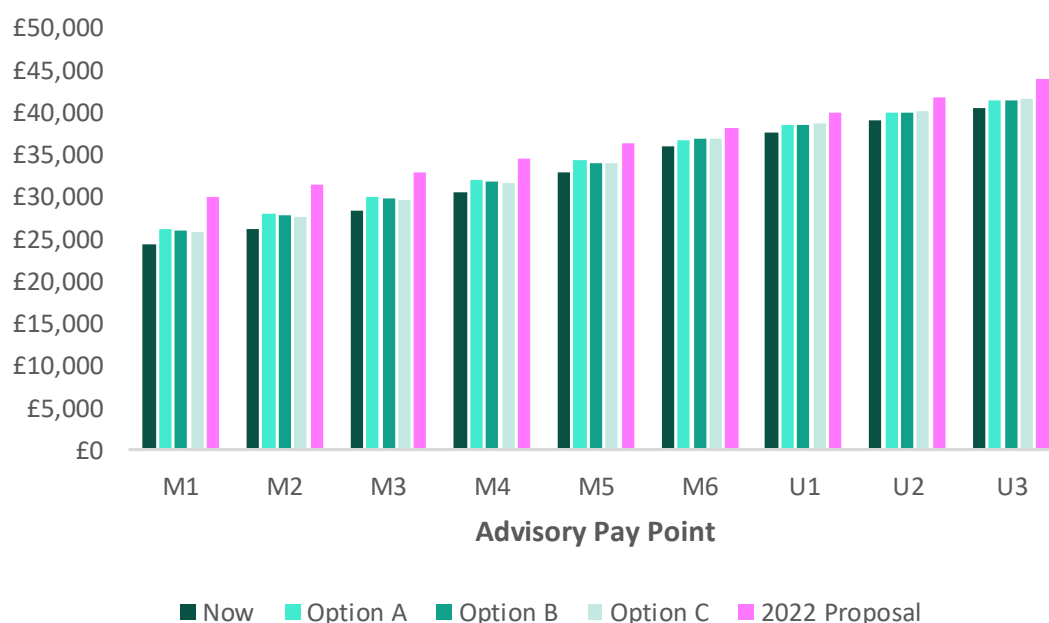
Limitations aside, Figure 4.2 illustrates the current levels of the advisory pay points (outside of the London area), as well as three options set out by the government for September 2020. The government's preferred approach is "Option B", which would deliver a 6.7 per cent rise in starting salaries and a 2.5 per cent rise towards the top of the scale (as well as for unqualified teachers and leadership pay points). "Option A" delivers a slightly smaller rise at the top of the salary scale (2.25 per cent) and a larger rise at the bottom of the scale (7.5 per cent), whilst "Option C" delivers a smaller rise at the bottom (6.3 per cent) and a bigger rise at the top (2.75 per cent). All these options would deliver an increase in average teacher pay per head of around 3 per cent for teachers, which aligns closely with what the government deems affordable (see section below).

Looking further to 2022, the government also illustrates an example salary schedule for the delivery of £30,000 starting salaries. This example would deliver a 23 per cent rise at the bottom and a 6-9 per cent rise at the top (varying slightly by pay point). The 23 per cent rise would represent a

substantial pay rise for new teachers. A 7 per cent cash rise for other teachers would represent a real-terms rise of around 1 per cent over three years and would be slightly below current Office for Budget Responsibility (OBR) forecasts for average earnings growth of just over 9 per cent between 2019 and 2022.[20] Combining all rises, the government's example schedule for 2022 would represent a 9.3 per cent rise in average teacher pay per head over three years, only slightly above expected growth in average earnings.

The different options for 2020 would imply slightly different paths to the 2022 proposal. Option B would be closest to a steady year-on-year increase in starting salaries in line with reaching the target set out in the 2022 proposal (about 7 per cent per year). In contrast, the rise would be more front-loaded for 2020 under Option A and more back-loaded under Option C.

Figure 4.2 – Options for Advisory Pay Points (outside London area)

Source and notes: https://www.gov.uk/government/publications/evidence-to-the-strb-2020-pay-award-for-school-staff

The government has also proposed pay increases for teachers in the London area, where salaries are higher due to London weighting. Under each option described above for 2020, the proposed pay increases at the top of the salary schedule would be identical in each London pay area (including inner, outer and fringe London). The proposed increases for early career teachers are lower in London (e.g. 5 per cent in inner London under "Option B" in contrast to 6.7 per cent outside of London). The logic for lower increases in London is that starting salaries are already higher in relative terms for less experienced teachers in London. However, this approach risks failing to address recruitment and retention difficulties in the capital. As we showed earlier, whilst schools in London seem better able to recruit and retain graduates with degrees in relevant subjects, schools in London are more likely to see vacancies or temporarily filled posts.

In Figure 4.3, we show how the proposed salary schedules would change between 2019 and 2022 for inner London, outer London and the rest of England. In each case, the solid line shows the salary points for 2019 and the dashed line shows the example salary schedule for 2022. The changes naturally lead to larger increases in salaries lower down the scale than further up the scale. This is wholly intentional. The increases in starting salaries are slightly smaller for inner and outer London

(around 17 per cent) than for the rest of England, again reflecting the fact that starting salaries are already higher in relative terms for teacher in London. Fringe London is not shown, but lies somewhere in between with a 21 per cent rise in starting salaries.

In all cases, the resultant salary schedules are flatter in 2022 than in 2019. Salaries also rise at a more constant rate in the 2022 schedule than the current schedule, which includes larger jumps up to the upper pay scale, particularly in inner London.

Figure 4.3 Current salary scales for 2019 and example salary scale for 2022 across pay areas
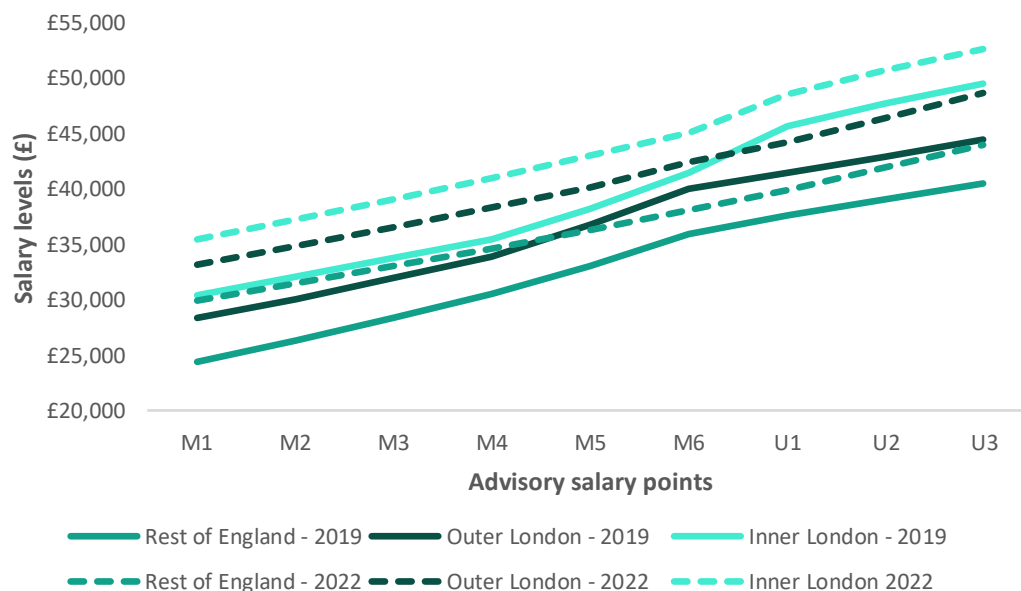
Source and notes: Fringe London not shown. https://www.gov.uk/government/publications/evidence-to-the-strb-2020-pay-award-for-school-staff

Short-run cost of implementing higher starting salaries

In its evidence to the pay review body, the government states that its preferred "Option B" would cost schools about £455m in 2020-21 (7/12 of the cost for a full financial year) and deems this affordable for schools. Here, we assess the cost of alternative options and their overall affordability given the school funding settlement.

The total schools budget (excluding pensions funding) for 2019-20 is £43.5bn.[21] Adding sixth form funding and a full year of the teacher pay and employer pensions contributions grants leads to a total baseline level of funding of £47bn.[22] According to the Department for Education, about 52 per cent of total school spending relates to teacher pay.[23] This implies a baseline teacher pay bill of £23.5bn. Using this baseline, **we calculate that the proposed increases in teacher pay would increase school costs by about £425m in 2020-21**. This is based on an approximate method for calculating the costs of rises in different pay points, which is fully detailed in Appendix C. Our costing is slightly below the £455m calculated in the government's evidence to the STRB. The government's costing is likely to be more accurate given their access to greater amounts of detailed data. However, our method is likely to be accurate in estimating the change in costs associated with different options and we are able to precisely replicate the average increase in teacher pay per head of 3 per cent under the various options proposed by the government

This small difference aside, Figure 4.4 shows how the cost of teacher pay settlement in 2020-21 varies with the size of the pay award offered to more experienced teachers, for a given profile of awards to less experienced teachers. This includes "Option B", which sees a rise of 6.7 per cent in starting salaries and a 2.5 per cent for more experienced teachers. We estimate this would cost schools about £425m in 2020-21. If we keep the pay rise for less experienced teachers constant (in line with Option B), but increase the rise for more experienced and other teachers to 3 per cent, then the cost would rise by about £50m. The graph then illustrates all possibilities between 2 and 4 per cent pay rises for more experienced and other teachers (see Appendix C for full detail on the methods used).

Figure 4.4 also illustrates "Option C", which involves a smaller rise in starting salaries. This would naturally lead to a lower cost than "Option B" if you assumed a 2.5 per cent increase in salaries for more experienced teachers. The actual cost of "Option C" (involving a 2.75 per cent rise in salaries for more experienced teachers) would be very slightly higher at £430m, though still quite similar to "Option B". Beyond these scenarios, there is a wide range of other options, which come with varying costs.

Figure 4.4 – Cost of various options for teacher pay settlement in September 2020, keeping pay for less experienced teachers constant
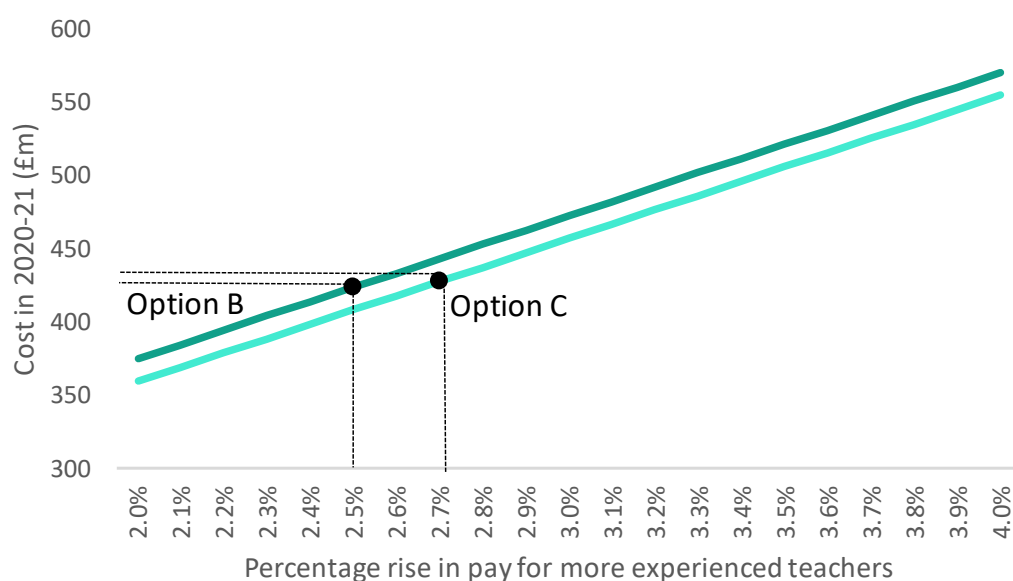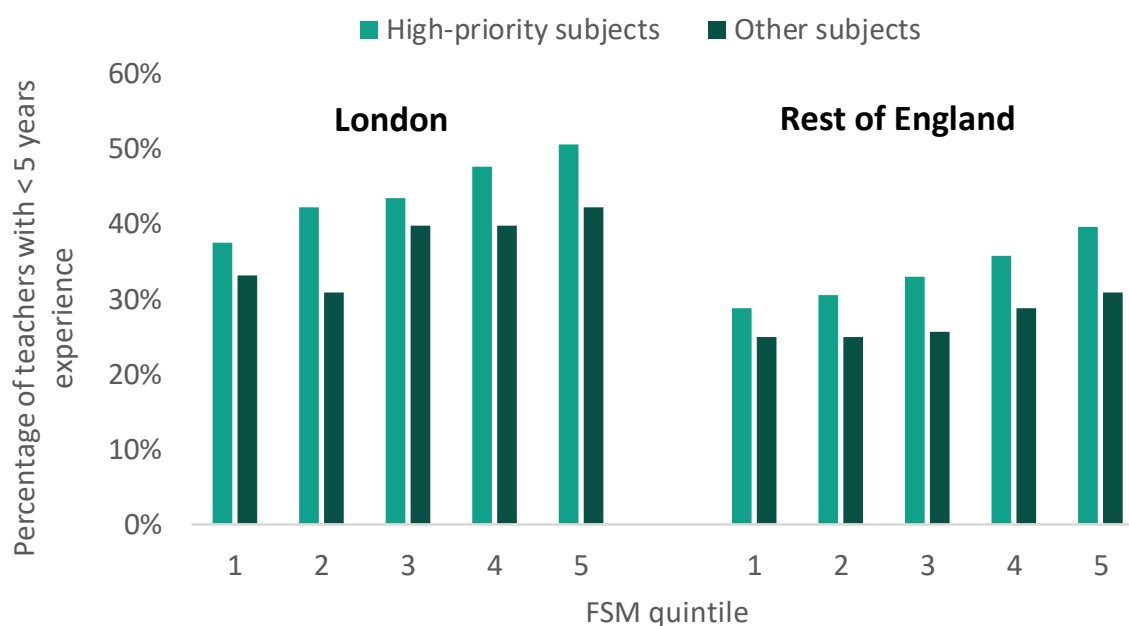

Notes and sources: Author's calculations using Department for Education's Evidence to the STRB (https://www.gov.uk/government/publications/evidence-to-the-strb-2020-pay-award-for-school-staff), School Workforce Census Statistics: November 2018 (https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018).

The key question is what is likely to be affordable for schools. **The cost of the three options proposed by the government seems to align closely with the school funding settlement for 2020-21**. According to the funding settlement, all schools will attract an increase in funding per pupil of at least 1.8 per cent in cash-terms in 2020-21[24], which represents a real-terms freeze in funding per pupil given expected inflation of 1.8 per cent. Many schools will receive more if they are gaining from the national funding formula or new minimum funding levels. Indeed, average school funding per pupil will rise by just over 4 per cent in cash-terms in 2020-21 in the national funding formula.

However, many schools will receive the minimum rise of inflation only. According to EPI analysis[25], about 50 per cent of disadvantaged secondary schools outside London are due to receive the minimum increase of 1.8 per cent, as are 37 per cent of disadvantaged primary schools outside London. About 90 per cent of schools in inner London will receive an inflation only increase.

All the pay options proposed by the government would increase teacher pay per head by 1.8 per cent in 2020-21, on average. This is well aligned with the minimum increase in funding per pupil. Any school experiencing the average increase in teacher pay per head would thus be able to keep other resources constant in real-terms or deliver a small increase if they are due to receive a bigger rise in funding per pupil. However, **the cost of the pay settlement is likely to vary from school to school depending on the share of teachers at the bottom end of the pay scale**. To illustrate the type of schools that might face higher costs, Figure 4.5 shows that the share of teachers with less than five years' experience is generally higher in more disadvantaged schools. Outside of London, early career teachers account for about 40 per cent of teachers in high-priority subjects and 30 per cent in other subjects. This compares with lower figures of about 29 and 25 per cent for the least disadvantaged schools, respectively. In London, an even larger share of teachers are in their early career phase, accounting for about 50 per cent of teachers in high-priority subjects and 42 in per cent in other subjects in the most disadvantaged schools.

Figure 4.5 – Proportion of teachers with less than five years' experience by proportion of pupils eligible for Free School Meals, by quintile (5 = highest proportion, 1 = lowest)

Source and notes: Author's calculations using School Workforce Census.

These figures imply that the cost of the teacher pay settlement is likely to be higher than average for more disadvantaged schools. Schools in London will also likely face higher costs, though this will be dampened somewhat by the fact that increases in starting salaries will be lower in London. However, as we have seen, disadvantaged schools and schools in London are also more likely to experience the lowest funding increases in 2020-21, as they are highly unlikely to be benefit from new minimum funding levels. As such, the proposed pay settlements might cost disadvantaged schools more than the average of 1.8 per cent per head. If such schools are also experiencing 1.8 per

cent increases in funding per pupil, then the proposed teacher pay settlement might not be affordable for these schools without real-terms falls in spending on other staff or inputs.

With this in mind, **"Option C" might be better aligned to the school funding settlement in 2020**. This would involve some backloading of the rise in starting salaries (a 6.3 per cent rise in starting salaries on the way to a 23 per cent rise) and a larger rise in salaries for more experienced and other teachers (2.75 per cent) in 2020. The backloading of starting salaries would fit with the school funding settlement in 2020, which provides lower increases to more disadvantaged schools that tend to employ more inexperienced teachers. The rest of the rise in starting salaries could then be delivered between 2020 and 2022 with a pattern of school funding increases designed to ensure its affordable for all schools. The STRB could also chose to increase salaries for more experienced teachers by slightly more (say 3 per cent in 2020) without much effect on the overall affordability. The total cost would rise by about £25m and would be more focused on less disadvantaged schools, who tend to employ more experienced teachers. Such schools are more likely to receive a bigger funding rise in 2020.

Long-run cost of higher starting salaries

Figure 4.6 sets out our estimates of the long-run cost of higher starting salaries of £30,000 in September 2022. This begins by showing the cost of the government's illustrative example pay structure for the main pay range. It then varies the average pay rise for more experienced and other teachers (see Appendix C for methods used). In the government's example structure, pay for more experienced teachers would rise by 7.3 per cent, on average, between September 2019 and September 2022. This is just above expected inflation of 6 per cent between 2019-20 and 2022-23 and would cost schools about an extra £1.9bn in 2022-23. **In this example pay structure, teacher pay per head would rise by just over 3 per cent per year, very close to expected growth in average earnings**.

If the rise for more experienced teachers was increased to expected growth in average earnings of 3 per cent per year (or 9.3 per cent in total), this would generate a cost of £2.2bn for schools and represent growth in teacher pay per head of just under 10 per cent in total.

Figure 4.6 – Cost of various options for long-run teacher pay settlement up to September 2022
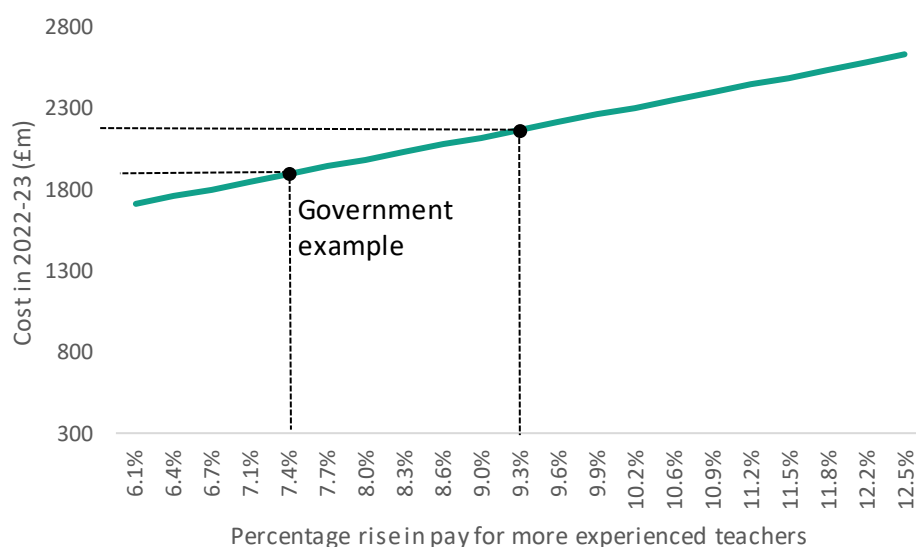
Notes and sources: Author's calculations using Department for Education's Evidence to the STRB (https://www.gov.uk/government/publications/evidence-to-the-strb-2020-pay-award-for-school-staff), School Workforce Census Statistics: November 2018 (https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018). Pay settlement for teachers on the main pay range are held constant at the government's example schedule throughout.

By way of context, the total schools budget is due to rise by £7.1 billion between 2019-20 and 2022-23. [26] About £700m has already been earmarked for the high-needs budget. Excluding this, school funding per pupil is due to rise by 12 per cent in cash-terms between 2019-20 and 2022-23. **A rise in teacher pay per head of about 10 per cent would thus seem affordable within the current funding settlement**. Indeed, deducting the estimated cost of such a settlement and other commitments up to 2022-23 leaves about £3.2 billion of the extra £7.1 billion for 2022-23.[27] This £3.2 billion would be partly needed to meet inflation in the cost of other inputs (e.g. pay settlements for other staff, energy, learning resources), but a 10 per cent rise in teacher pay per head would still allow other spending per pupil to rise in real-terms.

As with the 2020 settlement, the main challenge is how extra funding would be delivered to schools and the extent to which it matches expected growth in costs. As we have seen already, there is likely to be some mismatch in 2020, with disadvantaged and London schools expected to see the fastest growth in costs and the lowest increases in funding.

The only practical option to avoid this mismatch for 2020 would be to use the Teacher Pay Grant to give some extra funding to the schools likely to experience the biggest increases in costs, such as schools with a greater share of newly qualified teachers or more disadvantaged schools.

Looking forwards, the government has committed to provide all funding through the national funding formula. One natural option would be to introduce a funding factor to the national funding formula relating to the number of newly qualified teachers at each school, given the expected greater increase in costs for newly qualified and less experienced teachers. However, using such a funding factor on a long-term basis presents disadvantages too. Schools would not be facing the true cost of employing teachers of different levels of experience and may even be incentivised to employ extra newly qualified teachers just to gain funding.

Another option would be to increase formula factors correlated with the extra costs. For example, more disadvantaged schools tend to contain a greater share of such newly qualified teachers. The government could therefore increase deprivation factors more quickly over the next few years in order to offset the higher growth in costs for such schools. More generally, **the government should review the relative levels of different factors in the national funding formula to ensure that schools are not disadvantaged purely as a result of the change in the salary schedule**. This may involve changes to other factors too, such as the extra funding provided for schools in London.

In follow-up analysis, we will directly examine the potential variation across schools in the cost of higher starting salaries for teachers. If there is high variation, then it would be desirable for the funding system to recognise this in the way funding increases are provided over the next few years.

Potential benefits of higher starting salaries

There are several potential mechanisms by which higher teacher starting salaries could generate educational benefits. These can broadly be categorised into recruitment and retention effects.

Starting with recruitment effects, **higher teacher salaries could encourage more individuals to become a teacher**. A flatter pay scale with higher starting salaries could yield further benefits if individuals place a higher value on pay early in their career. Unfortunately, there is little evidence about the potential size of the effects here. The government therefore does not quantify the potential size of such benefits. However, the proposed long run pay settlement represents an average increase in teacher pay per head of about 3 per cent per year, which is close to the OBR's forecast for average earnings. This would leave overall teacher pay largely unchanged relative to expected average earnings. The overall recruitment benefits are thus likely to be small and would be driven largely by the extent to which teachers value being paid more early in their career.

Whilst there is little evidence on the effects of higher salaries on the number of teachers**, there is strong evidence to suggest that higher teacher salaries relative to local earnings can generate improvements in educational outcomes.** This is both in terms of children's educational outcomes and the average educational attainment of individuals who become teachers. This has been seen in the UK, US, Australia and other countries.[28] Delivering higher growth in teacher pay per head than the expected 3 per cent growth in average earnings could yield educational benefits, particularly as teacher pay has fallen behind growth in average earnings for most of the last decade.

Moving on to retention, there is clear **empirical evidence showing that higher starting salaries and a flatter salary schedule are likely to lead to significant improvements in teacher retention**, given that teachers have a high propensity to leave the profession during their first few years in the profession. [29] Indeed, we saw earlier that many of the retention problems in England appear early on in teachers' careers, with only 60 per cent of teachers still in post five years after their training. The government has used such evidence to estimate that its proposed new salary structure would increase the number of teachers by about 1,000 per year by 2022, about 0.2 per percent of the overall teacher workforce. This is based on a range of quite conservative assumptions and there are good reasons to believe that the real effect will be larger than this[30].

Salary supplements

We saw in section 1 of this report that **recruitment and retention problems are currently worse in shortage subjects, such as maths, science and languages**. Problems are also most severe for schools in disadvantaged areas outside London. Only one in six physics teachers in such areas possesses a relevant degree and such schools see the highest numbers of days lost to sickness and

absence each year. Whilst problems seem less acute in disadvantaged schools in London, such schools see high levels of churn and fluidity, with nearly half reporting a vacancy or temporary filled position.

The **changes to teacher pay will likely ease current problems to some degree**, but there are likely to remain problems in some subjects, such as maths and science, where graduates can obtain relatively high salaries outside of teaching. Across-the-board pay rises are also unlikely to change the relative incentive for teachers to apply to disadvantaged schools. Policymakers should thus consider how to specifically address recruitment and retention difficulties in more deprived schools.

In its recruitment and retention strategy**, the government proposed introducing salary supplements or retention bonuses in shortage subjects for early career teachers**. In October 2019, the government confirmed that teachers starting their training in 2020-21 in shortage subjects (maths, sciences and languages) would be eligible for payments of £2,000 in their 2nd, 3rd and 4th years of teaching (or £6,000 in total).[31] This would increase to £3,000 per year for those teaching in a list of 'challenging' local authorities.

The **cost of this new scheme is likely to be small** given it only applies to teachers starting their training in September 2020 and only applies to unsalaried routes. Based on 4,300 teachers training in shortage subjects in unsalaried routes in 2018-19 and 80% of teachers remaining in post two years after starting, we estimate that the main payments of £2,000 will cost about £7m when they are first made in 2022-23. This will increase to just over £19m by 2024-25 when a full cohort of teachers are receiving payments. The extra payments of £1,000 would add to this cost, but not by a substantial amount given they are 50% of the value and only targeted at just over one in four local authorities.

Importantly, this scheme is unlikely to have many effects in the next few years as existing teachers will not be eligible.[32] Those who are eligible would not start teaching until 2021 at the earliest and would not receive their first payment until 2022.

Given the extent of the current problems and the expected rise in the secondary school population, we model the cost of extending this scheme to all existing early career teachers (regardless of their training route into teaching) to ensure the system is better able to keep current teachers in shortage subjects as well.

Based on about 22,500 early career teachers (five years or fewer years of experience) in shortage subjects (as recorded in November 2016), payments of £2,000 for all existing teachers in shortage subjects would cost about £45m in a full year. This compares with our £19m estimate of the cost of the current scheme and is likely to be an over-estimate of the true cost, as we include Biology teachers, since it is difficult to separate out individual science teachers accurately within the School Workforce Census. Biology is not typically considered a shortage subject.

In section 1, we also showed that recruitment and retention difficulties are more pronounced in more disadvantaged schools, with greater levels of sickness/absence and a lower share of teachers with degrees in relevant subjects. Higher overall salaries may help alleviate some of these problems, but they are unlikely to affect the greater relative difficulties in attracting and keeping high-quality teachers in disadvantaged schools. **There is a need to consider how to specifically address recruitment and retention difficulties in more disadvantaged schools.**

With little evidence that disadvantaged schools have used the pupil premium and new freedoms on teacher pay to offer higher teacher pay levels to attract teachers to schools in disadvantaged areas,

it may be necessary for the government to consider a central scheme. This would be backed up by empirical evidence which suggests financial incentives can help attract teachers to high-poverty schools. [33]

The government's new salary supplement scheme already includes payments of £1,000 for those teaching in 'challenging areas.' However, as with the main payments, these are unlikely to have any effects on existing teachers. Furthermore, not all schools in disadvantaged areas are disadvantaged, and not all disadvantaged schools are in disadvantaged areas. Using area-level measures on their own are therefore relatively blunt and can be poorly targeted. It may therefore be desirable to instead make payments contingent on disadvantage measured at the school-level, such as the share of pupils eligible for free school meals or those who are persistently poor.

In any case, we estimate the cost of doubling additional payments to £2,000 for all early career teachers in shortage subjects in the 20 per cent most disadvantaged schools. This would increase the total payment from £3,000 to £4,000 and would cost about £10m. This would make a total cost of £55m combined with the £45m for making all early career teachers in shortage subjects eligible for the main payments of £2,000. This compares with just over £20m for a full cohort in the government's current scheme. As stated before, our estimate of £55m is likely to be an over-estimate of the true cost.

This is a **small cost relative to the remaining school budget** after implementing potential rises in teacher pay, increases to high-needs funding and commitments on maintaining per pupil funding (e.g. £3.2bn remaining in our example option for a nearly 10 per cent rise in teacher pay her head).

The extra cost of £35m also represents about one fifth of current spending on teacher bursaries (£170m at last count in 2016-17). As highlighted by the National Audit Office, there is actually little evidence to suggest that such high spending on teacher bursaries is effective or good value-for-money.[34] In contrast, there is strong evidence showing that retention payments can be highly effective in retaining teacher in shortage subjects and attracting them to high-poverty schools. **Re-allocating more of the bursary budget towards salary supplements and retention payments could therefore be an advisable budgetary shift.**

5. Conclusion

The teacher labour market in England faces some significant challenges in the next few years. First, **overall teacher numbers will need to rise to meet the needs of the growing pupil population**. This will be particularly challenging in secondary schools, where pupil numbers are expected to grow fastest and where there have been most problems recruiting enough teachers in recent years. Second, **problems have been even more acute in shortage subjects, such as maths, sciences and languages, and in more disadvantaged parts of the country**. At the same time as maintaining teacher numbers, overall teacher quality and effectiveness will also need to be maintained or increased to meet ambitious goals for improvements in educational attainment and productivity.

The government has two main sets of policies for improving overall teacher numbers and quality. First, it published a major teacher recruitment and retention strategy last year, which includes a new early career framework and entitlements to professional development. Second, it has committed to higher starting salaries of £30,000 by September 2022. **This will represent a substantial increase in**

pay for new teachers and will make the teacher pay schedule much flatter. **This is in line with recommendations from empirical evidence to have higher starting salaries and a flatter overall schedule, and will almost certainly improve retention**. However, the government has assumed an overall increase in teacher pay per head of about 3 per cent per year through to 2022, which matches expected growth in average earnings. As a result, **there may be few gains in terms of recruitment**. Such gains would probably only be realised if average teacher pay per head grew faster than average earnings. If it did, empirical evidence suggests that educational outcomes could be improved.

The main barrier to higher growth in teacher pay per head is affordability for schools within the proposed school funding settlement. The government has proposed a number of options for teacher pay in 2020 on the way to higher starting salaries. These options are well aligned with the school funding settlement, with 1.8 per cent growth in teacher pay per head matching the minimum per pupil increase in funding for schools in 2020. However, many disadvantaged schools rely more heavily on newly qualified teachers. They might therefore see faster than average growth of costs in 2020 and are highly unlikely to benefit from new minimum funding levels. **Disadvantaged schools might thus find it difficult to afford the proposed options for teacher pay in 2020**, without making real-terms cuts to other areas of spending.

Given this, the government has outlined an "Option C," with more of the rise in starting salaries back-loaded to after 2020 and a larger initial rise in salaries for more experienced staff. This might be better aligned with the school funding settlement. The rise for more experienced teachers could also be increased to 3 per cent at a small cost of about £25m for schools in 2020. This would be more likely to be borne by schools experiencing above average increases in funding or benefitting from new minimum funding levels.

The government has also set out an example teacher pay structure for £30,000 starting salaries in 2022. **These imply growth in average teacher pay per head of about 9 per cent between 2019 and 2022. This is below the average cash-terms increase in funding per pupil of 12 per cent**. Indeed, even if policymakers opted for faster growth in teacher pay per head of 10 per cent over three years, there would still be about £3.2bn left of the £7.1bn increase in the schools budget through to 2022. This would cover increased costs of other resources and allow for extra resources.

In delivering higher starting salaries and a flatter pay schedule through to 2022, the government will need to ensure greater overlap between the pattern of funding increases and likely growth in costs across schools. For 2020, this might involve using the existing Teacher Pay Grant to provide extra funds to schools experiencing the greatest increases in costs, either by directly targeting schools employing large numbers of newly qualified teachers or associated indicators, such as levels of disadvantage. Looking to future years, **the government should review the relative levels of different factors in the national funding formula to ensure that schools are not disadvantaged purely as a result of the change in the salary schedule**. This may involve changes to deprivation factors as well as others, such as the extra funding provided for schools in London.

Finally, whilst these changes in starting salaries are likely to alleviate some of the overall problems in the teacher labour market, **there are likely to remain problems in attracting and retaining teachers in shortage subjects (like maths and sciences) and in disadvantaged schools**. The government has introduced new salary supplements for shortage subjects (£2,000 per year if still teaching 2, 3 and 4 years after training) and challenging areas of the country (an extra £1,000). However, these are only

for new teachers. It would be relatively inexpensive to extend these to existing teachers to help keep them in the profession and double the extra payments for challenging areas or schools to attract teachers to such schools, costing around £55m in total or £35m more than the existing scheme. This compares with a total budget for teacher training bursaries of more than £170m. There is strong evidence to suggest that such salary supplements and retention bonuses represent a highly effective means to retain teachers in shortage subjects and to attract them to more challenging or disadvantaged schools.

Appendix A – Methods and assumptions

We link together three different files from the School Workforce Census between November 2011 and November 2016. First, the contracts file allows us to identify which individuals were employed as classroom teachers each year. Second, the curriculum file provides information on how many hours teachers spend teaching different subjects each week, on average, to different year groups. Unfortunately, curriculum data is missing for many teachers. Of the approximately 214,000 secondary school teachers we observe, curriculum data was missing in about 48,000 or 23 per cent of cases. We necessarily drop these individuals. Third, the qualifications data provides information on teachers' prior educational qualifications, including their level/type and subject. Data is missing or of poor quality in a further 36,000 cases. This leaves us with a main sample for analysis of qualifications of about 130,000 secondary school teachers, about 61 per cent of all secondary school teachers. These sample sizes are higher than those quoted in previous EPI analysis as we found a coding error that artificially reduced sample sizes. This coding error had almost no impact on the estimated results. Further details and comparisons available on request.

Analysis of qualifications

Our analysis of teacher qualifications is confined to November 2016, the most recent year of data available to us. Teachers are classified as having a degree in the subject they teach if they possess a degree-level qualification in a subject classified as relevant by the Department for Education.[35] For combined/general science, we assume that a teacher has a degree in the subject they teach if they have a relevant degree to teach biology, chemistry or physics, matching the assumption made in Department for Education statistics.

Our previous report highlighted that our estimates of the proportion of Key Stage 3 and Key Stage 4 hours taught by a subject specialist are slightly below Department for Education statistics. The exact source of this difference is uncertain, but it seems likely to result from the problems caused by missing curriculum and qualifications data.

Analysis of teacher pay

Teacher pay in the School Workforce Census is recorded for individual roles and contracts (many individuals have more than one). However, a number of anomalies and outliers in the data suggest a degree of inaccuracy. We therefore follow the procedure for cleaning teacher pay data set out in Sharp et al (2016). In particular, we adopt the following procedure for defining base pay:

- Create total base pay per full-time equivalent (FTE) across all roles
- **Remove outliers** - Set pay to missing if total base pay per FTE is greater than £115,000 for classroom teachers or £250,000 for leaders
- **Adjust cases that seem to have an extra zero** - Divide by 10 if total base pay per FTE is greater than £75,000 for classroom teachers or £125,000 for leaders, and implied value is within 18% of pay in adjacent years
- **Deal with implausibly low pay rates** - Set pay to missing if implied hourly pay rate is less than £7 per hour
- **Deal with implausibly low hours** - Set pay to missing where recorded FTE is less than 20 minutes per week

We then clean additional payments in the following ways:

- Create total payments per FTE across all roles for Teaching and Learning Responsibility (TLR) payments, Recruitment and Retention Allowances, SEN payments and other allowances
- Payments clearly above maximum value
    - TLR payments are set to missing if greater than £16,000
    - SEN payments are set to missing if greater than £5,000
    - Recruitment and Retention payments are set to missing if greater than £10,000
    - Other payments are set to missing if greater than £10,000

This allows to then create three key variables measuring teacher pay:

- Total base pay per FTE across all roles
- Total additional payments per FTE across all roles
- Total pay per FTE across all roles

Most of our analysis focuses on total pay, though we consider base pay and additional payments as part of analysis of the mechanisms driving differences in pay across schools and areas.

We also create a variable measuring raw total pay across all roles (i.e. not adjusted by FTE). This is for comparison with other data on graduate earnings that does not adjust for total hours worked.

We also select the sample for analysis of teacher pay by focusing on cases where pay is non-missing and non-zero and curriculum data is non-missing. We exclude schools with large amounts of missing pay data (schools where pay is missing for more than 50% of teachers) or large amounts of missing curriculum data (missing for more than 30% of teachers).

We analyse raw difference in pay by subject taught, with some individuals counted across multiple subjects if they teach more than one subject.

We also analyse pay by broad subject grouping in teacher recruitment priorities. High-priority includes maths, physics, chemistry, general science and languages, with all other subjects grouped together in a second category. Teachers are allocated to the group where they teach most hours.

Regression analysis

We use OLS regression analysis to better understand differences in teacher pay across schools and areas. This is performed separately for London and the rest of the country. In the regression analysis, we control for sex, ethnicity, age (squared), QTS status, time since achieving QTS (squared), whether individuals are on the leader pay scale and region (including a dummy variable for being in the inner London pay area).

Our focus is on the differences by quintile of disadvantage. This is defined by dividing schools into five equally sized quintile based on the proportion of pupils eligible for FSM. These quintiles are defined on a national level and not within London or the rest of England.

We analyse various sub-samples to understand the mechanisms driving pay differences, including: early career teachers (five years or less experience); classroom teachers, excluding leaders (i.e. excluding all head-teachers, deputy head-teachers and assistant head-teachers); teachers in core subjects (maths, English and science).

Appendix B – Additional figures and tables

Figure B.1 Socio-economic differences in total teaching hours by main subject taught, high priority subjects
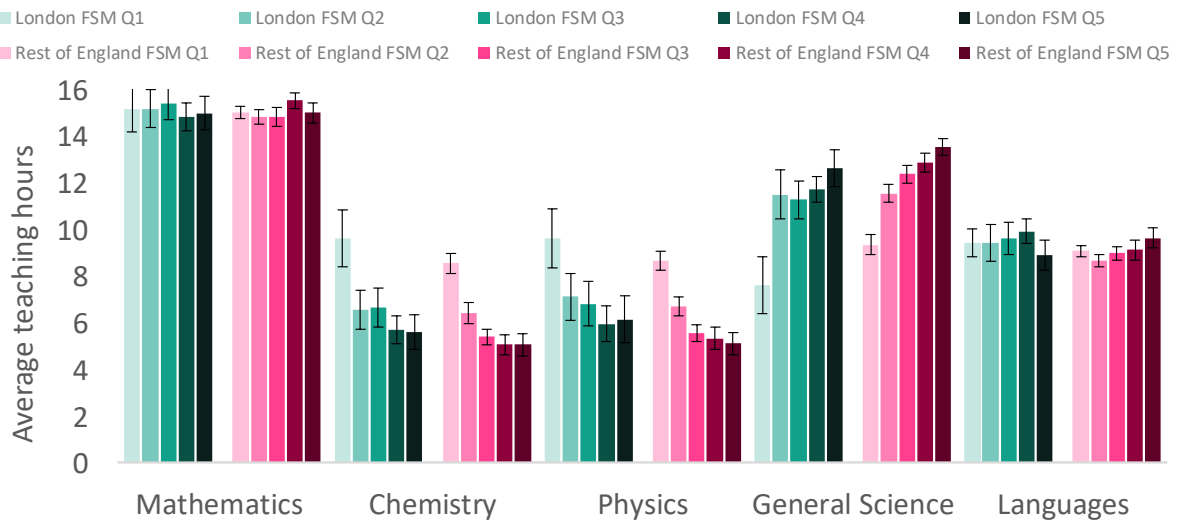

Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Errors bars show 95 per cent confidence intervals.

Figure B.2 Socio-economic differences in total teaching hours by main subject taught, other subjects
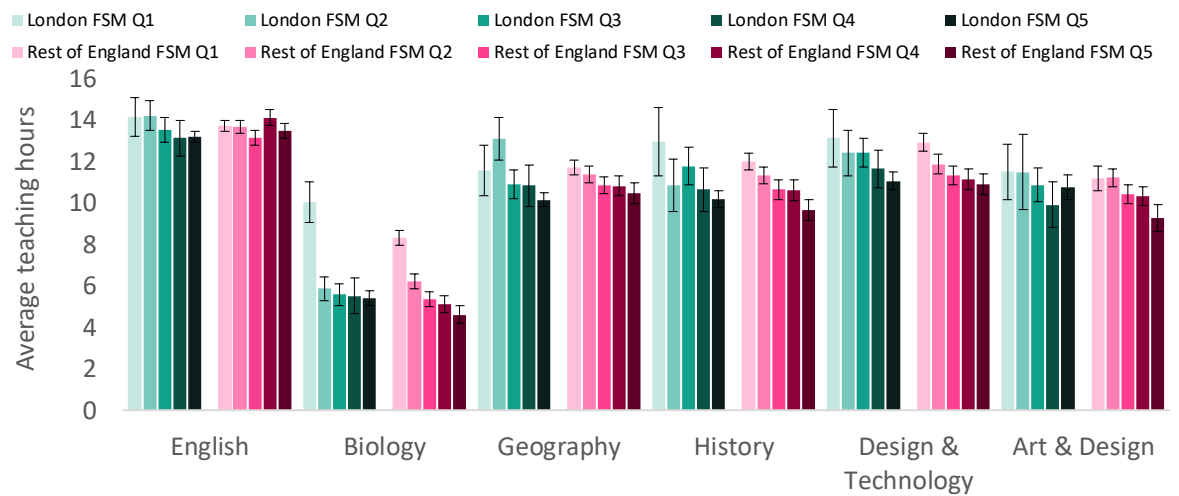

Sources and Notes: Author's calculations using School Workforce Census, November 2016 and Pupils, Schools and their Characteristics, January 2017. Errors bars show 95 per cent confidence intervals.

Figure B.3 – Average male graduate earnings by subject studied and years since graduation
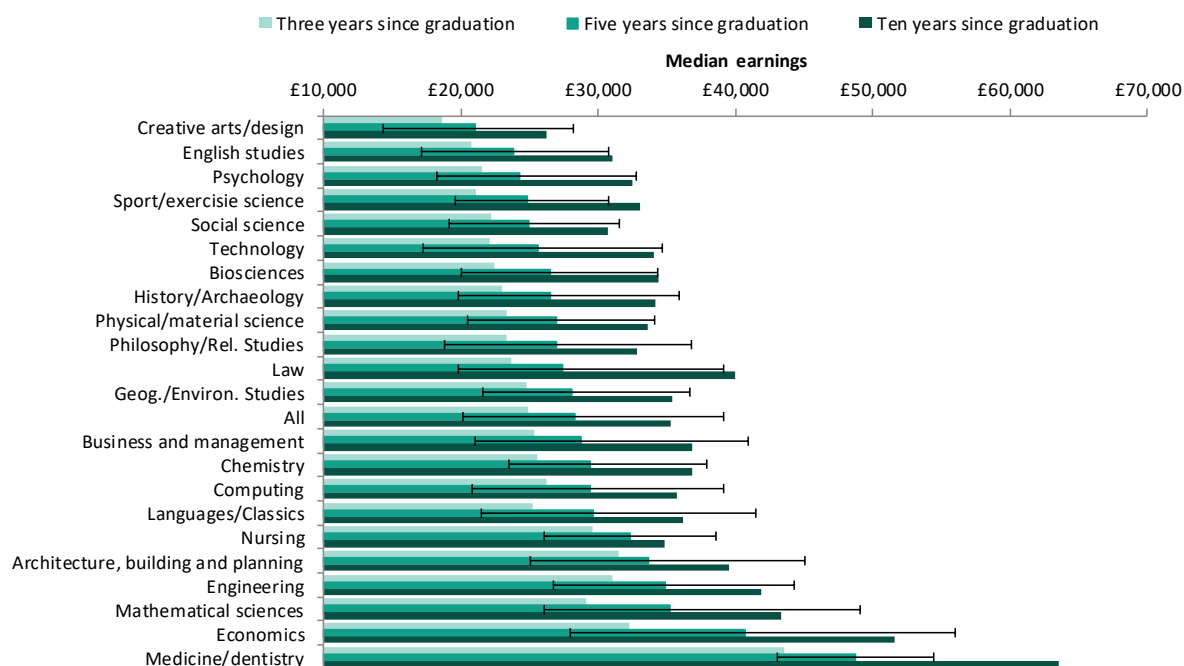
Sources and Notes: Department for Education, Graduate Outcomes (LEO): 2016–17 (https://www.gov.uk/government/statistics/graduate-outcomes-leo-outcomes-in-2016-to-2017). School Workforce Census, November 2016.

Figure B.4 – Average female graduate earnings by subject studied and years since graduation
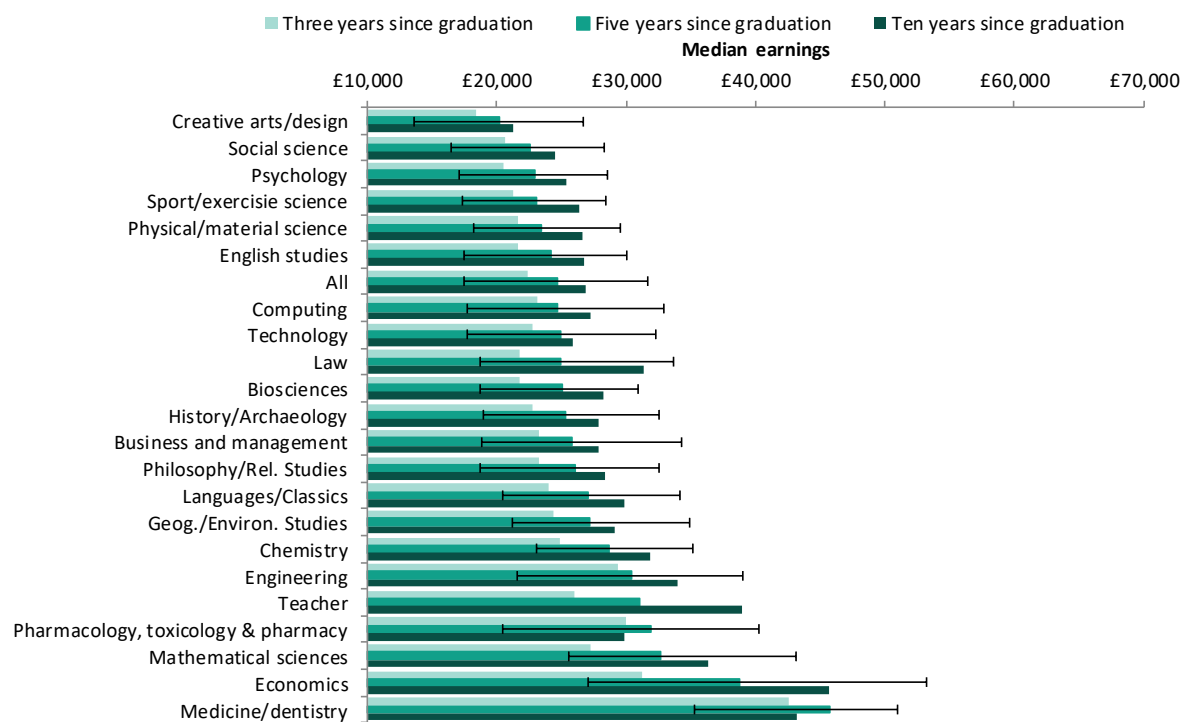
Sources and Notes: Department for Education, Graduate Outcomes (LEO): 2016–17 (https://www.gov.uk/government/statistics/graduate-outcomes-leo-outcomes-in-2016-to-2017). School Workforce Census, November 2016

Appendix C – Methodology for calculating cost of different options for teacher pay

In section 4, we estimate the cost to schools of various options for teacher pay, both for September 2020 and September 2022. To do so, we follow a similar method to that adopted by the Department for Education (DfE) in its written evidence to the School Teachers Review Body (STRB). As we do not have access to all the same data, we must perform a number of assumptions and approximations. This appendix describes our methods and assumptions.

Broadly speaking, the cost of different options for teacher pay are calculated as total paybill multiplied by the average increase in teacher pay per head. For September 2020, we further multiply this by 7/12 given that the pay award will only apply for 7 months out of 12 in the financial year. For September 2022, we multiply by 31/36 as the pay award will apply for 31 out of 36 months.

$$Cost = Paybill \; x \; \% \; increase \; in \; teacher \; pay \; per \; head \; x \; share \; of \; time$$

In what follows we describe how we calculate the total paybill and the increase in teacher pay per head, before setting out a comparison with DfE figures and how we calculate the cost of alternative options.

Calculating total paybill

The total schools budget for 2019-20 is £43.5bn[36]. Adding sixth form funding and a full year of the teacher pay and employer pensions contributions grants leads to a total baseline level of funding of £47bn. According to the school costs model[37], about 52 per cent of total school spending relates to teacher pay. This implies a baseline teacher pay bill of £24.4bn.

Calculating increase in teacher pay per head

We follow a very similar method to the Department for Education to calculate the increase in teacher pay per head. As per the below equation, the average increase in teacher pay per head is calculated as the sum of the contribution of each pay point to the increase in teacher pay per head. For each pay point (s) and each area (g), this is simply the rise in teacher pay for that pay point multiplied by the share of the teacher paybill taken up by that pay point.

$$\% \; rise \; in \; teacher \; pay \; per \; head_g = \sum_s \% \; pay \; point_{sg} \times paybill \; share_{sg}$$

Given that the proposed increases in teacher pay differ across London pay areas and the rest of England, we perform this calculation separately by area and then weight by the share of teachers in each pay area.

$$\% \; rise \; in \; teacher \; pay \; per \; head = \sum_g \% \; rise \; in \; teacher \; pay \; per \; head_g \times teacher \; share_g$$

This already leads to two differences with respect to evidence from DfE. First, given the lack published national statistics on paybill shares by pay region, we instead use the share of teachers in each area according to School Workforce Census statistics[38]. This gives 83 per cent of teachers in the rest of England, 6 per cent in inner London and just over 10 per cent in outer London. Second, we assume Fringe London follows the same pattern as the rest of England, given that School Workforce Census statistics do not list Fringe London separately.

For the rest of England, DfE's written evidence contains sufficient information to calculate this almost exactly. This leads to an increase in teacher pay per head of 3 per cent for the rest of England.

For inner and outer London, we must estimate the share of the paybill taken up by each pay point. Using the rest of England would be a poor assumption here as teachers in London tend to be less experienced, on average. To estimate these shares, we assume that the distribution of the paybill taken up by each point within the main pay range matches that for the rest of England. However, we rescale this so that the share of the paybill within each region taken up by the main pay range equals the share of classroom teachers in each London area on the main pay range multiplied by the share of the classroom teacher paybill taken up by the main pay range outside of London. This gives 36 per cent of the paybill accounted for by the main pay range in inner London and 33 per cent in outer London, as opposed to 31 per cent for the rest of England.

Comparison with DfE evidence

We compare our final figures against those quoted by the Department for Education (DfE). We calculate that "Option B" would lead to a 3.0 per cent increase in teacher pay per head. This is very similar to DfE's figure of 3.0 per cent. By pay region, we calculate that average teacher pay per head increases by 2.91 per cent in inner London, 2.97 per cent in outer London and 3.01 per cent in the rest of England.

We then calculate that the cost of "Option B" would be £425m in 2020-21, which is slightly below the £455m figure quoted by DfE.

DfE's figures are based on more finely grained and accurate data, and thus more likely to be close to true cost. However, given the approximations employed in our method, both these sets of figures are reassuringly close.

Cost of alternative pay options

Our calculation of the cost of alternative pay options follow the method set out above, with the exception that we vary the average pay award for the upper pay scale, leadership group and unqualified teachers. Pay rises for the main pay range are held constant throughout.

[1] Luke Sibieta, 'The teacher labour market in England: shortages, subject expertise and incentives' (London: Education Policy Institute, 30 August 2018), https://epi.org.uk/publications-and-research/the-teacher-labour-market-in-england/.

[2] Ronald G. Ehrenberg and Dominic J. Brewer, 'Do School and Teacher Characteristics Matter? Evidence from High School and Beyond', *Economics of Education Review* 13, no. 1 (1 March 1994): 1–17, https://doi.org/10.1016/0272-7757(94)90019-1; Thomas J. Kane, Jonah E. Rockoff, and Doug Staiger, 'What Does Certification Tell Us about Teacher Effectiveness? Evidence from New York City', *Economics of Education Review* 27, no. 6 (2008): 615–31; Andrew J. Wayne and Peter Youngs, 'Teacher Characteristics and Student Achievement Gains: A Review', *Review of Educational Research* 73, no. 1 (2003): 89–122.

[3] Sam Sims, 'What Happens When You Pay Shortage-Subject Teachers More Money? Simulating the Effect of Early- Career Salary Supplements on Teacher Supply in England', *Gatsby Foundation*, n.d., 34; Luke Sibieta, 'The teacher labour market in England: shortages, subject expertise and incentives' (London: Education Policy Institute, 30 August 2018), https://epi.org.uk/publications-and-research/the-teacher-labour-market-in-england/.

[4] Matthew Hendricks, "Towards an optimal teacher salary schedule: Designing base salary to attract and retain effective teachers," Economics of Education Review, Vol. 47(C), 143-167.

[5] Caroline Sharp et al., 'Evaluation of Teachers' Pay Reform-Final Report', Final (London: DfE, 2016).

[6] Simon Burgess, Ellen Greaves and Richard J. Murphy, 'Deregulating Teacher Labor Markets,' IZA Discussion Paper 12592, 2019.

[7] https://www.gov.uk/government/publications/teacher-recruitment-and-retention-strategy

[8] https://www.gov.uk/government/publications/evidence-to-the-strb-2020-pay-award-for-school-staff

[9] https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018

[10] High-priority subjects are defined as those receiving the highest levels of teacher training bursaries given shortages identified by the government (https://www.gov.uk/guidance/funding-initial-teacher-training-itt-academic-year-2019-to-2020). It includes maths, physics, chemistry, computing and languages.

[11] Ronald G. Ehrenberg and Dominic J. Brewer, 'Do School and Teacher Characteristics Matter? Evidence from High School and Beyond', *Economics of Education Review* 13, no. 1 (1 March 1994): 1–17, https://doi.org/10.1016/0272-7757(94)90019-1; Thomas J. Kane, Jonah E. Rockoff, and Doug Staiger, 'What Does Certification Tell Us about Teacher Effectiveness? Evidence from New York City', *Economics of Education Review* 27, no. 6 (2008): 615–31; Andrew J. Wayne and Peter Youngs, 'Teacher Characteristics and Student Achievement Gains: A Review', *Review of Educational Research* 73, no. 1 (2003): 89–122.

[12] Due to an errand single space bar in our syntax, community schools were incorrectly excluded from the previous analysis. This has now been corrected, but the results are largely unchanged as access to specialist teachers is similar across community and other state-funded schools, giving deprivation and location.

[13] Sam Sims, 'What Happens When You Pay Shortage-Subject Teachers More Money? Simulating the Effect of Early- Career Salary Supplements on Teacher Supply in England', *Gatsby Foundation*, n.d., 34; Luke Sibieta, 'The teacher labour market in England: shortages, subject expertise and incentives' (London: Education Policy Institute, 30 August 2018), https://epi.org.uk/publications-and-research/the-teacher-labour-market-in-england/.

[14] Caroline Sharp et al., 'Evaluation of Teachers' Pay Reform-Final Report', Final (London: DfE, 2016).

[15] Simon Burgess, Ellen Greaves and Richard J. Murphy, 'Deregulating Teacher Labor Markets,' IZA Discussion Paper 12592, 2019.

[16] For comparative purposes, we show average (median) earnings amongst teachers five years after gaining qualified teacher status (data relates to November 2016 to match the 2016-17 tax year). This is not an identical measure to five years after graduation, but is helpful for illustrating the journey of

a typical teacher in their early career phase. It should also be noted that earnings are not full-time equivalent in these figures as hours are not captured in the data for graduate earnings.

[17] https://www.gov.uk/government/publications/evidence-to-the-strb-2020-pay-award-for-school-staff

[18] https://www.gov.uk/government/publications/school-teachers-review-body-strb-remit-letter-for-2019

[19] https://www.gov.uk/government/publications/school-teachers-pay-and-conditions

[20] See Table 1.1, https://obr.uk/efo/economic-fiscal-outlook-march-2019/

[21] https://www.gov.uk/government/publications/spending-round-2019-document/spending-round-2019

[22] https://www.ifs.org.uk/publications/14369

[23] https://www.gov.uk/government/publications/schools-costs-technical-note

[24] https://www.gov.uk/government/publications/national-funding-formula-tables-for-schools-and-high-needs-2020-to-2021

[25] https://epi.org.uk/wp-content/uploads/2019/12/Priority-3-School-funding.pdf

[26] https://www.gov.uk/government/publications/spending-round-2019-document/spending-round-2019

[27] The cost of other commitments includes the £700m earmarked for the high-needs budget and £1.1 billion to keep spending per pupil at least frozen in cash-terms.

[28] Susanna Loeb and Marianne E. Page, 'Examining The Link Between Teacher Wages And Student Outcomes: The Importance Of Alternative Labor Market Opportunities And Non-Pecuniary Variation', *The Review of Economics and Statistics*, 2000; Andrew Leigh, 'Teacher pay and teacher aptitude', *Economics of Education Review*, 2012, 31(3); 82(3); Jack Britton and Carol Propper, 'Teacher pay and school productivity: Exploiting wage regulation', *Journal of Public Economics*, 2016, 133; Jose M. Cabrera and Dinand Webbink, 'Do higher salaries yield better teachers and better student outcomes?" *Journal of Human Resources,* 2019.

[29] Matthew Hendricks, "Towards an optimal teacher salary schedule: Designing base salary to attract and retain effective teachers," Economics of Education Review, Vol. 47(C), 143-167.

[30] For example, the modeling does not assume a higher response to salaries early in teachers' careers, as is found in the literature. Instead, all the benefits are delivered due to a higher attrition rate for early career teachers.

[31] https://www.gov.uk/guidance/mathematics-early-career-payments-guidance-for-teachers-and-schools

[32] Unless they were eligible for one of the pilot retention payments for maths teachers.

[33] Jennifer L. Steele, Richard J. Murnane, and John B. Willett, 'Do Financial Incentives Help Low-performing Schools Attract and Keep Academically Talented Teachers? Evidence from California', *NBER Working Paper No. 14780*, 2009, 40; Steven Glazerman et al., 'Transfer Incentives for High-Performing Teachers: Final Results from a Multisite Randomized Experiment', *Mathematica Policy Research*, n.d., 243.

[34] https://www.nao.org.uk/report/training-new-teachers/

[35] https://www.gov.uk/government/statistics/school-workforce-in-england-november-2016

[36] https://www.gov.uk/government/publications/spending-round-2019-document/spending-round-2019

[37] https://www.gov.uk/government/publications/schools-costs-technical-note

[38] https://www.gov.uk/government/statistics/school-workforce-in-england-november-2018