

Social inequalities in access to teachers

Social Market Foundation Commission on Inequality in Education: Briefing 2

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April 2016

SUMMARY

The quality of teaching is the most important school-based determinant of educational success. Previous research shows pupils make less progress when they have a teacher that does not have a formal teaching qualification; is newly qualified; less experienced; without a degree in the relevant subject; and when teacher turnover at their school is high.

Our new analysis finds that schools serving lower income communities are more likely to have teachers with all these characteristics. This suggests they face greater recruitment difficulties in hiring staff and offers one explanation as to why there continue to be substantial and persistent inequalities in educational outcomes between pupils from disadvantaged and more privileged backgrounds.

We find that:

- The proportion of teachers who are not qualified in primary schools with the highest concentration of Free School Meals pupils is 4%, while in the most affluent quintile this is 2%. The gradient is similar for secondary schools where the richest have 5% unqualified teachers and the poorest have 9%.
- Schools with affluent intakes have 12% of teachers with more than ten years of experience while the poorest have just 7%. Among secondary schools the figures are 12% and 8% respectively. The schools with more advantaged intakes also have a higher proportion of teachers with between five and ten years of experience.
- These inequalities in experience are compounded by inequalities in expertise. Pupils in schools serving areas of higher deprivation are much more likely to have teachers without an academic degree in a relevant subject. The 'expertise gap' is 10 percentage points for Key Stage 4 Maths, 14 percentage points for Chemistry and a remarkable 22 percentage points for Physics.
- The schools serving more disadvantaged communities also experience higher levels of teacher turnover than neighbouring, more advantaged schools. The gradient is steepest at secondary level where a teacher in the highest deprivation

quintile school is, other things being equal, 70% more likely to leave than one at a neighbouring school in the lower deprivation quintile. The odds of leaving the highest deprivation quintile school at primary level are 20% higher.

There are two policy options for reducing these inequalities: we must either persuade more experienced teachers to move to higher deprivation schools – the redistribution strategy; or we must support inexperienced teachers in these schools so that they are better able to succeed – the support strategy.

Re-distribution is not easy: inequalities in access to high quality teachers persist despite higher pay for equivalent experience in these schools. Though there may be a role for going further on pay, providing additional incentives for teachers to stay in disadvantaged schools. We also advocate greater emphasis on support to raise the retention rates of new teachers placed in more challenging teaching environments. While many new teachers start out with a strong sense of social mission, this can be undermined by the lack of support and mentoring.

1. THE STATE OF INEQUALITY IN EDUCATION

Inequalities in educational attainment are substantial. 40% of pupils who receive free school meals (FSM) achieve five good GCSEs (graded between A* and C), compared to 70% of their richer counterparts. Differences in educational attainment are present at age 5 (amounting to 7.2 months on the FFT Gap Index developed by Education Datalab) but crucially increase by the time students reach age 16 (to 10.2 months on the same index).² More generally, children in secondary schools with more disadvantaged intakes make less progress than their peers elsewhere and the schools are far more likely to be judged as failing or requiring improvement by Ofsted.³

Decades of educational reforms have been implemented to try and close the attainment gap. The Education Reform Act of 1988 hailed the start of market reforms to raise standards. Proponents hoped that the advent of school choice would give poorer pupils the chance to attend a better school. In the nineties, leagues tables and Ofsted were introduced to hold poorly performing schools to account. The noughties saw greater emphasis on good schools helping weaker schools through initiatives such as London Challenge and Specialist Leaders of Education. And since then the coalition and Conservative governments have increased resources into schools serving disadvantaged intakes through the Pupil Premium.

Despite this, previous research undertaken by the Social Market Foundation's (SMF) Commission on Inequality in Education shows that there has been little reduction in the attainment gap between rich and poor kids since 1970.⁴ The gap persists.

Why? Research consistently shows that the quality of teaching is by far the most important school-based determinant of a pupils' educational attainment.⁵ Indeed, moving a child from an average to top teacher means they will learn in six months what would otherwise have taken twelve.⁶ So while policies focusing on choice, accountability, collaboration and funding might contribute to closing the gap, they are missing the point of greatest leverage.

In this paper, we focus on this one critical point: do poor pupils have access to good quality teachers? Measuring the quality of teachers is tricky. In the US, detailed data linking teachers to pupils allows researchers to measure the pupil achievement in teachers' classrooms directly.⁷ In the UK the data isn't detailed enough to do this; so we take a different approach. Instead of measuring pupil progress we measure the characteristics of the teachers themselves and use this to make inferences about the distribution of high quality teachers.

We show that poor pupils are more likely than rich pupils to have teachers who are newly qualified or unqualified; inexperienced; do not have a relevant degree; or are more likely to leave their teaching jobs. All of these factors are associated with less effective teaching. The result is that poorer pupils they make less progress than their richer peers and the attainment gap persists.

Having shown that there are social inequalities in access to high quality teachers, we then discuss a number of reasons why this might be the case and make some policy suggestions for how to change it.

2. DO SCHOOLS SERVING DISADVANTAGED COMMUNITIES GET POORER QUALITY TEACHERS?

Measuring the quality of teachers is tricky. In the US, detailed data linking teachers to pupils allows researchers to measure differences in the learning gains of pupils taught by a teacher directly. This allows comparisons of the quality of teaching for rich and poor pupils. In the UK, however, limitations of the data make it impossible to link teachers to the pupils they teach. We therefore have to take a different approach. Instead of measuring the learning gains made by pupils in the classroom, we look at characteristics of the teachers themselves. We know from the extensive literature on teacher effectiveness that pupils tend to make less progress if their teachers have certain characteristics. For example, empirical evidence shows that:

- 1) Pupils make less progress when they have a newly qualified teacher.⁸ This is to be expected since new teachers are inexperienced and are still acquiring teaching skills.
- 2) Pupils make less progress when they have an unqualified teacher.⁹ This is also highly intuitive since unqualified teachers will not have received the same level of training as those who have acquired a formal qualification.
- 3) Pupils make more progress when they have a very experienced teacher.¹⁰ On average, teachers improve rapidly during their first two or three years in the classroom and then continue to improve, albeit at a slower rate, across the first ten years of their career.
- 4) Pupils make less progress when their teacher does not have a degree in the relevant subject.¹¹ Research suggests this is particularly important for technical subjects, such as maths, being taught at secondary level.
- 5) Pupils make less progress when teacher turnover at their school is high.¹² Research shows that high turnover in a school has a disruptive effect on pupil learning and reduces attainment as a result.

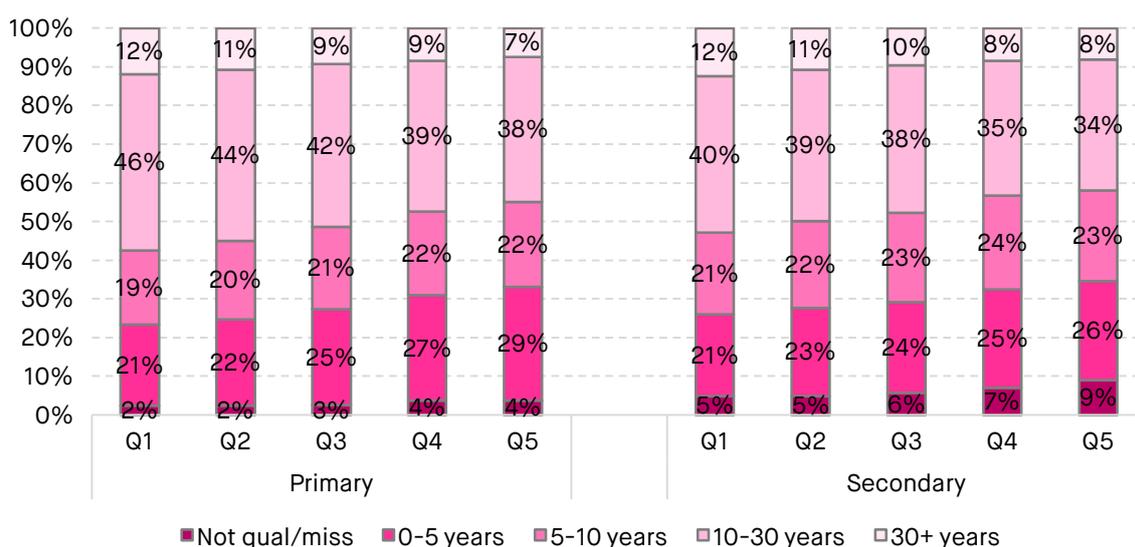
These five characteristics are particularly useful for our analysis because they can be observed in the School Workforce Census (SWC), the dataset which covers all staff working in English state schools (Annex A contains more information on our data). The rest of this section compares the characteristics of teachers working in different types of schools. We divide schools into five groups or quintiles. These distinguish schools which have the lowest proportion of pupils on Free School Meals (FSM), Quintile 1, all the way through to schools which have the highest proportion of these pupils, Quintile 5. From now on we refer to these as deprivation quintiles. We then compare the teachers working in each of these five deprivation quintiles on each of the five characteristics of effective teachers set out above.

Figure 1 compares the proportions of qualified teachers and levels of experience across the five deprivation quintiles for both primary and secondary schools. Schools on the left

have more affluent intakes and schools on the right have more disadvantaged intakes. The proportion of teachers who are not qualified in primary schools with the highest concentration of FSM pupils is 4%, while in the most affluent quintile this is 2%. The gradient is similar for secondary schools where the richest have 5% unqualified teachers and the poorest have 9%.

The most affluent quintile schools also have more highly qualified teachers. The lowest deprivation primary schools have 12% of teachers with more than ten years of experience while the poorest have just 7%. Among secondary schools the figures are 12% and 8% respectively. More affluent schools also have a higher proportion of teachers with between five and ten years of experience.

Figure 1: Teacher qualifications by Free School Meal (FSM) quintile of school, November 2014



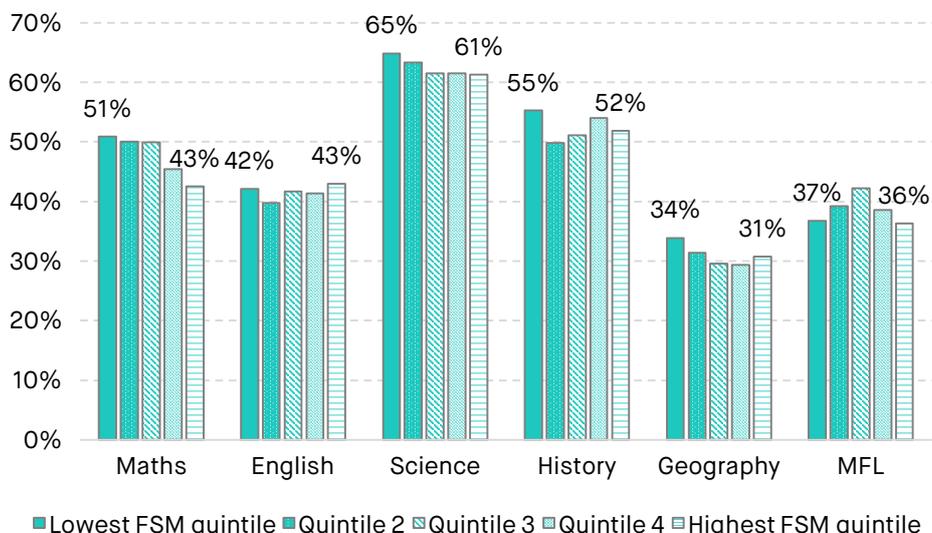
Source: School Workforce Census

These inequalities in experience are compounded by inequalities in expertise. Figure 2 shows whether KS3 teachers have an academic degree in the subject they are teaching across the five deprivation quintiles. Figure 3 shows the same for KS4 teachers. The results show a clear division between arts and science subjects. In both Key Stages, English, History, Geography and Modern Foreign Languages teachers are just as likely to have an appropriate degree across the deprivation quintiles. However, for Maths and science subjects a clear gradient emerges, with more deprived schools much more likely to have teachers with inappropriate qualifications. The ‘expertise gap’ is 14 percentage points for KS4 Chemistry and a remarkable 22 percentage points for Physics. That the largest expertise gaps occur in technical subjects like Maths and Physics is unfortunate because these are also the subjects for which research suggests that teachers having a relevant degree is most important.¹³

The subjects with the biggest expertise gaps are closely correlated with the subjects for which teacher shortages are the most severe (Physics, followed by Maths and then other sciences).¹⁴ This is what we might expect, since schools struggling to recruit in a specific area are more likely to have to settle for teachers with less appropriate qualifications.¹⁵

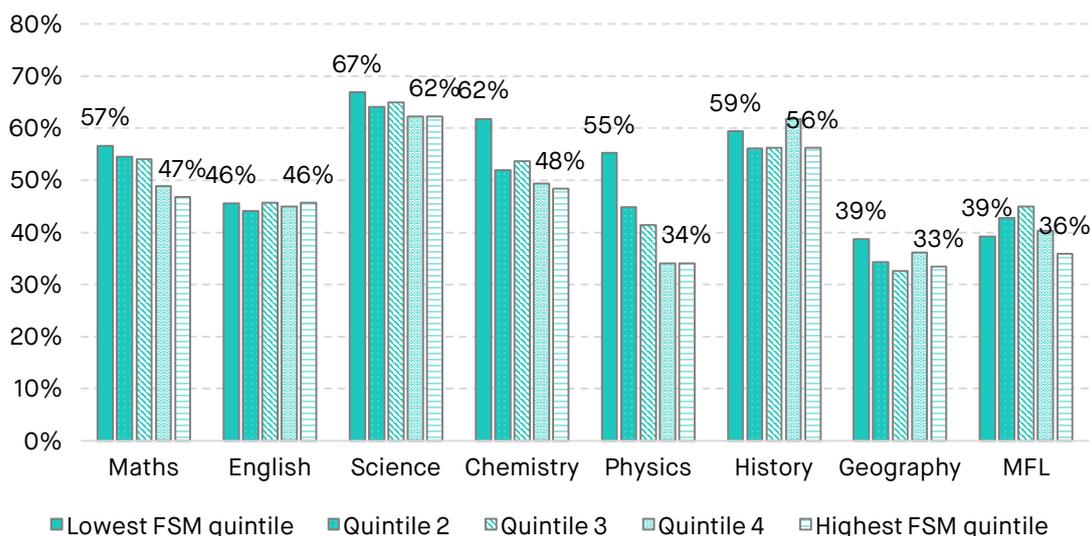
This suggests that teacher shortages are disproportionately harming the poorest students.

Figure 2: Proportion of Key Stage 3 teachers with a degree in the subject they are teaching, by school FSM quintile



Source: School Workforce Census

Figure 3: Proportion of Key Stage 4 teachers with a degree in the subject they are teaching, by school FSM quintile



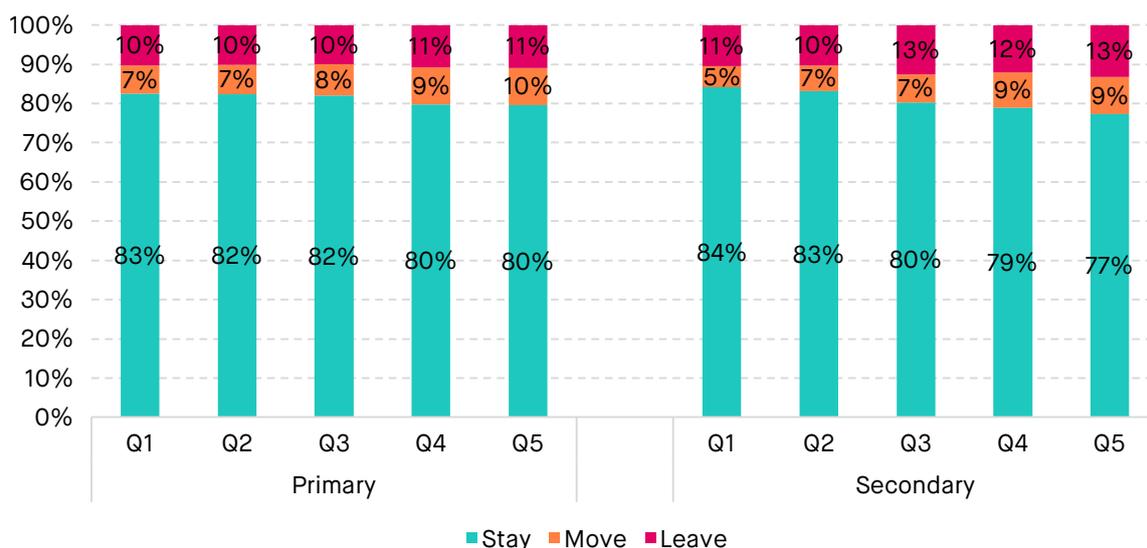
Note: We assume that one-third of KS4 science teaching time is devoted to each of physics and chemistry, regardless of school deprivation quintile

The last of the five characteristics we identified at the outset is turnover. Research shows that persistent high turnover in a school tends to be damaging for pupil attainment, although it can be an important factor in school turnaround situations.¹⁶ There are several different reasons for this.¹⁷ First, it may damage pupil learning by reducing continuity or coordination between teachers, especially if supply teachers are used in the interim period. Second, the teachers that leave may take with them hard-won knowledge about

specific pupils and their learning needs. Third, school leaders have to spend time and money recruiting new teachers in their place. Fourth, if replacement teachers are of a lower quality than those leaving the school, then average teacher quality will be reduced.

Figure 4 compares turnover across the deprivation quintiles for both primary and secondary schools. Once again, a clear gradient emerges with poorer schools seeing higher levels of turnover. The gradient is steeper at secondary level where the most deprived quintile of schools have almost a quarter (23%) of their teachers leave each year while the equivalent figure for the least deprived quintile is 16%. This is consistent with other research from the UK showing that a 10% increase in the proportion of FSM pupils at a school increases turnover by 1%.¹⁸

Figure 4: Proportion of teachers leaving the profession and moving schools, by school FSM quintile

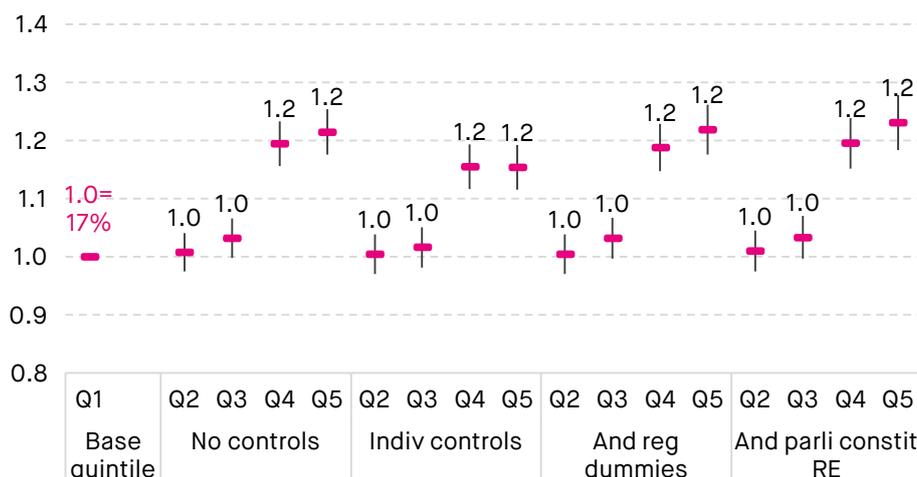


Note: Data quality is such that overall attrition from the sector may be overstated, but this should not affect schools differentially by FSM percentage.

The overall differences in teacher turnover by school deprivation do not uncover why these differences exist. Is it because schools serving disadvantaged communities are situated in labour markets (such as London) where turnover tends to be high? Or is it simply that they recruit younger teachers that have a greater propensity to move schools or leave the profession? These distinctions are important because they each point to very different policy implications.

We are able to disentangle these competing reasons by modelling the odds of leaving a school, accounting for all these reasons in turn. Figure 5 shows that the odds of a teacher leaving a primary school are 20% higher for the highest deprivation quintile, compared to the lowest deprivation quintile. This difference in the odds of leaving is persistent, even when we control for the demographic characteristics of teachers at the school, for differences in regional turnover rates and when we directly compare primary schools located in the same parliamentary constituency.

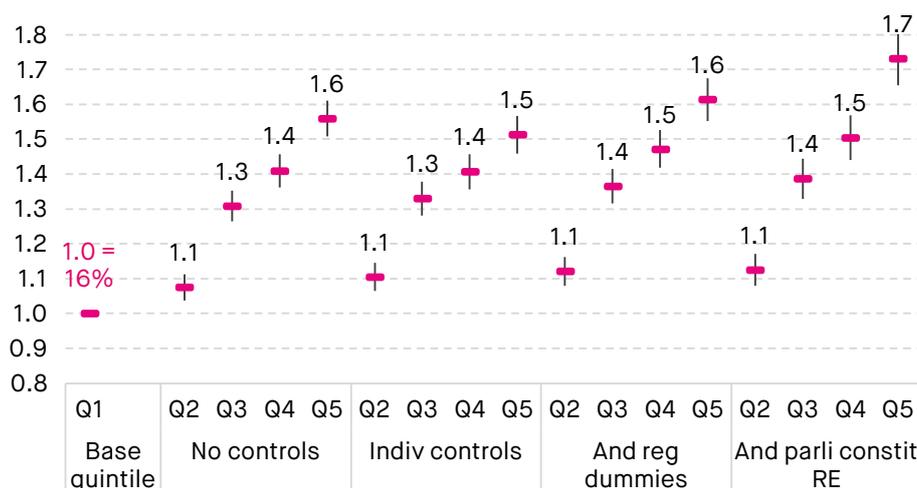
Figure 5: Odds ratio estimates of chances of a teacher leaving a primary school by FSM quintile, summer 2013



Source: School Workforce Census

These differences are far more marked among secondary schools, as shown in Figure 6. A teacher in the highest deprivation quintile school is 70% more likely to leave, once we take account of the individual teachers’ demographic characteristics and make direct comparisons between schools located in the same parliamentary constituencies. These inequalities in the propensity to leave a school are similar for both inexperienced and more experienced teachers.

Figure 6: Odds ratio estimates of chances of leaving a secondary school by FSM quintile, summer 2013



Source: School Workforce Census

In summary, across all five of our characteristics, we find stark inequalities in access to the highest quality teachers resulting in poorer pupils being taught by poorer quality teachers. Furthermore, we think that the presence of these characteristics in the workforce at more disadvantaged schools suggests they have greater difficulty hiring

staff in general and so may not hire the staff they optimally want. This provides an explanation as to why educational inequality in England persists.

3. WHY DO SCHOOLS SERVING DISADVANTAGED COMMUNITIES GET POORER QUALITY TEACHERS?

The clear patterns that emerge from the data may seem somewhat surprising. How have we managed to get into a position where well-funded schools serving disadvantaged communities appear to have difficulties in recruiting and retaining experienced and suitably qualified teachers?

These patterns are consistent with a situation where the typical teacher finds teaching in a higher deprivation school less agreeable. Pupil behaviour may be more challenging, teachers find they need to deal with social difficulties the child is experiencing and there is less home support for learning. The emotional challenge of teaching in some of our more disadvantaged schools can be considerable. Furthermore, the threat of the accountability system in the form of negative Ofsted judgements and test results that fall below government 'floor' standards affect those in more disadvantaged schools far more.

Given this, it is understandable that more experienced and well qualified teachers prefer to take jobs in less challenging environments, that high deprivation schools have fewer applicants for jobs and that those who do work in more challenging schools might continue their job search whilst in post.

This means that we are trapped in a system where young, newly qualified teachers naturally take jobs in schools that are recruiting. As we, and others, have shown, schools with more deprived intakes have higher teacher turnover and are therefore more likely to be recruiting.¹⁹ This alone explains why poor pupils are more likely to have unqualified and inexperienced teachers who will be less effective.

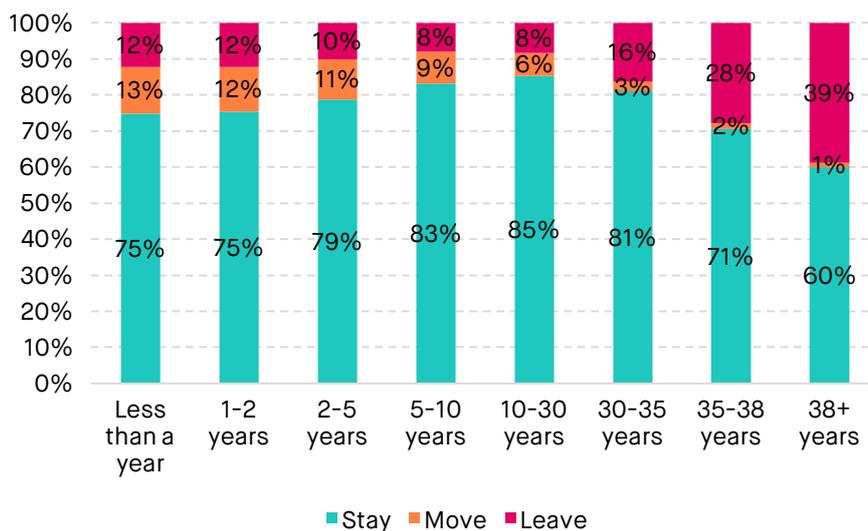
There is an additional factor. As it turns out, young, newly qualified teachers often start their careers with a strong sense of social mission and so may often seek out positions in a more challenging school environment. A recent survey investigating teachers' motivations for entering the profession found the most frequently cited reason was "making a difference to pupils' lives", with 60% of respondents cited this as a being "very important".²⁰ A further 45% cited the "opportunity to make a difference to society" as being very important. This sense of social mission that new teachers have is a real asset to the education system.

But why are they then more likely to leave these very same schools? Unfortunately, we also know that more deprived schools tend to be less supportive of new teachers, with less high-quality mentoring, less supportive colleagues and tougher teaching assignments.²¹ This lack of support makes it harder for young, inexperienced teachers to master the basics of teaching and a wealth of research shows that new teachers tend to leave their schools if they feel they are not developing new skills and improving their teaching practice.²² The same survey which asked teachers about their motivations for entering teaching also asked them about their motivations for staying in teaching. Although "changing pupils' lives" remained an important reason, the most frequently cited reason for staying is actually "being good at it", with 55% of respondents describing

this as very important.²³ So it appears that many new, inexperienced teachers are getting jobs in deprived schools but are not getting the support they need, are struggling to cope and then are leaving as a result. This helps explain why poor students are also exposed to higher teacher turnover.

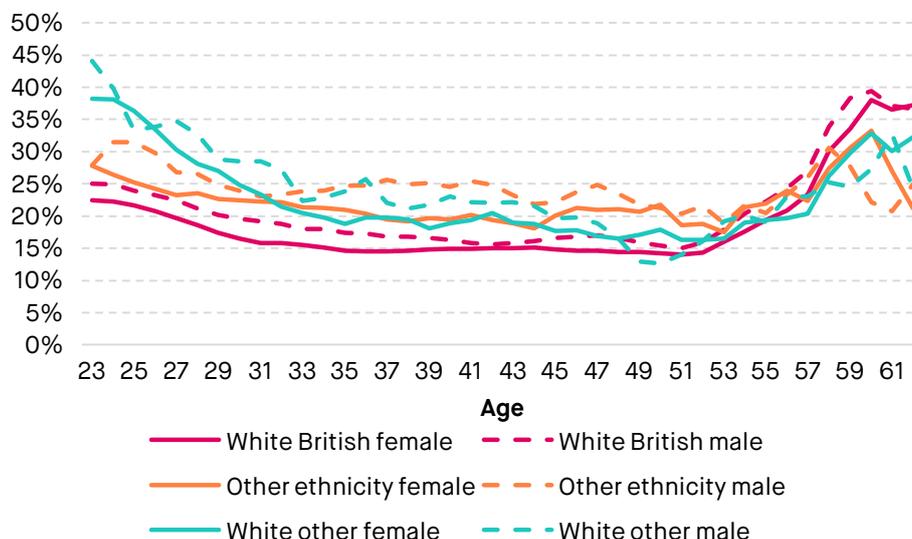
Figures 7 and 8 confirm this pattern in our own data: young and inexperienced teachers are indeed more likely to leave their school. Around a quarter of teachers with less than two years of experience leave their school each year. Among those with five to ten years of experience this drops to 17%. Similarly, teachers under thirty are more likely to leave their schools than those below fifty.

Figure 7: Percentage of teachers moving schools and leaving profession by time since qualified by school FSM quintile, summer 2014



Source: School Workforce Census

Figure 8: Proportions leaving a school by age, gender and ethnicity, summer 2013



Source: School Workforce Census

These patterns of behaviour are starker in the secondary sector than across primary schools. It is hard to ascertain why this might be. In general, teacher shortages are less pronounced in the primary sector and so fewer schools face these recruitment difficulties. It could be argued that behavioural difficulties associated with much younger children are less challenging for teachers to manage. And the support systems in place in the primary sector are quite different, quite simply due to the scale of the schools.

In summary, less effective teachers are more likely to find a vacancy at schools with disadvantaged intakes, more likely to successfully secure an appointment there, and then more likely to leave these schools within a few years. The chances are that they will then be replaced by yet more young and inexperienced teachers.²⁴ It is important to point out that this is only true on average; many schools with disadvantaged intakes have managed to halt and even reverse this cycle. But the fact remains: the way the system currently operates means that higher deprivation schools are much more likely to get poor quality teachers.

4. POLICY IMPLICATIONS

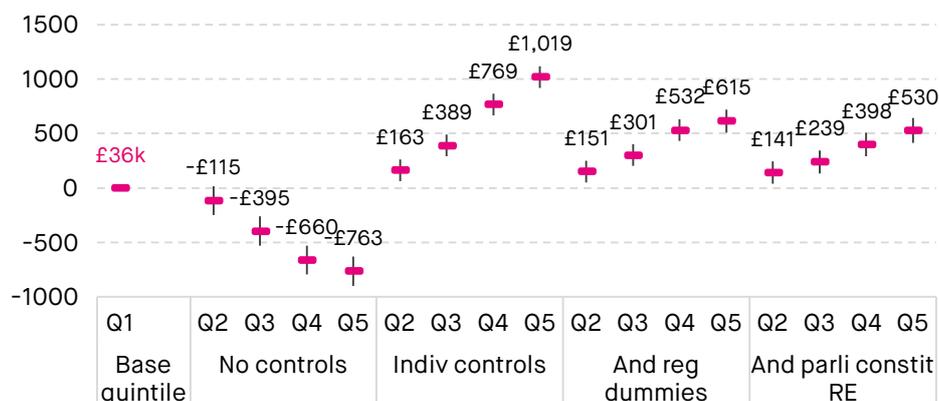
What can be done to improve access to good (more experienced, more appropriately qualified and more likely-to-stay teachers) teachers in the most disadvantaged schools? Broadly speaking there are two strategies available. The first is to try and divert inexperienced teachers away from disadvantaged schools and try to attract more experienced teachers in their place. We might call this the **redistribution strategy**. The alternative is to try and improve support for young, inexperienced teachers working in disadvantaged schools in order to improve their teaching and increase retention. We call this the **support strategy**.

First, the **redistribution strategy**. We could mandate that more experienced teachers work in disadvantaged schools for a period, perhaps as a condition of becoming a senior leader. Multi-academy trusts are particularly useful vehicles for facilitating fixed-term transfers with the right to return to original post. The National Teaching Service is based on a similar idea.²⁵ But this may only serve to make the teaching profession a less attractive prospect at a time when recruitment is already a problem. It would also disadvantage teachers that are highly geographically constrained through family commitments.

Instead, financial incentives are perhaps the prime candidate for attracting more experienced teachers to disadvantaged schools.²⁶ Figures 9 and 10 show how pay varies across the different deprivation quintiles. The average teacher at a more disadvantaged school is actually paid less, but this is because they are usually less experienced. So, the four data points on the right hand side of the graph control for teacher characteristics and local labour market characteristics. These show how much extra a given teacher would be paid - holding constant school location - to work in more deprived schools.

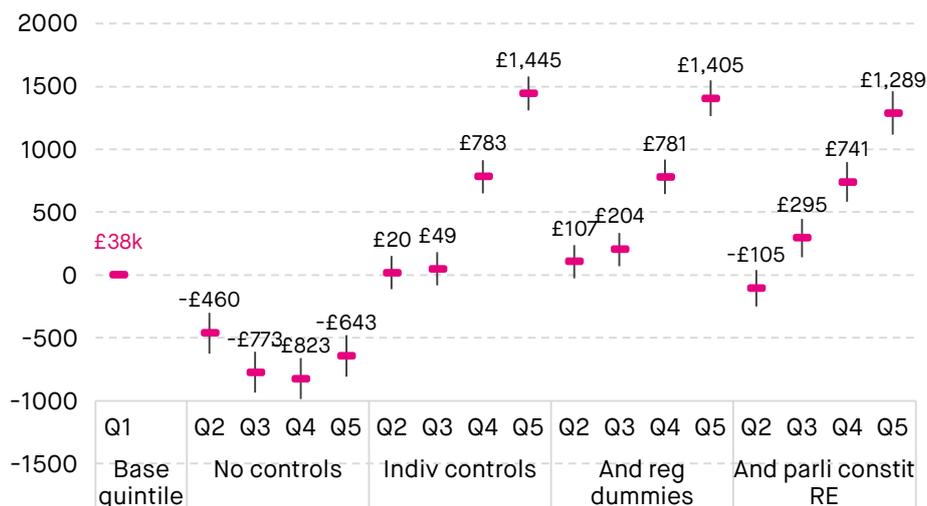
In primary schools the same teacher would get paid £530 per annum more to work in the most deprived quintile of schools than in the least deprived. In secondary schools the equivalent figure is £1,289 per annum. Figure 11 shows the average annual pay rise for those staying in their schools between 2010 and 2014. It shows pay rose faster in more deprived schools over this period, though this may simply be because they were less financially constrained.

Figure 9: Teacher pay by primary school FSM quintile, November 2013



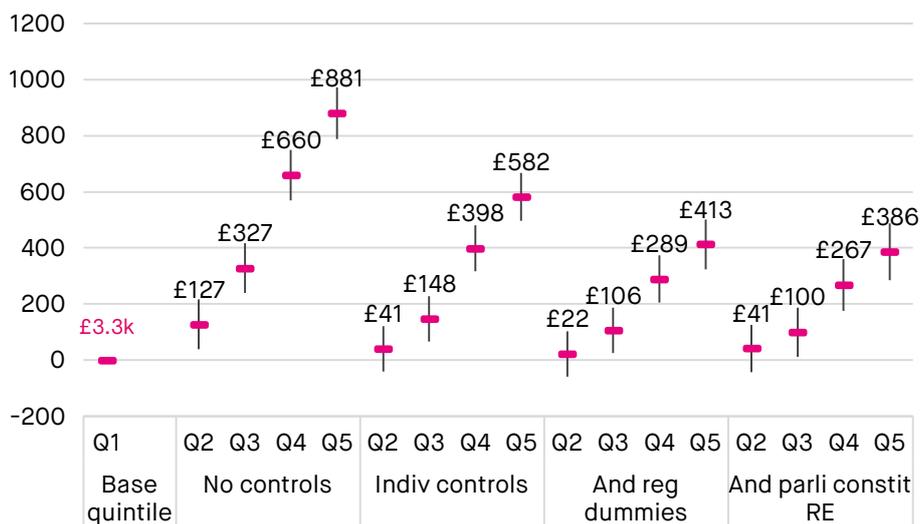
Source: School Workforce Census

Figure 10: Teacher pay by secondary school FSM quintile, November 2013



Source: School Workforce Census

Figure 11: Pay rises 2010-2014 for full-times remaining in school throughout



Source: School Workforce Census

These graphs show that differences in pay are already providing some incentives for teachers to work in schools with the poorest pupils. However, given the social inequalities in access to high quality teachers we showed earlier, these incentives are clearly not sufficient to compensate people for the perceived disadvantages of working in a more challenging environment. Even secondary school teachers, who face the strongest incentives, only get an extra £100 per month gross.

It is hard to know how large the pay incentives would need to be to attract experienced teachers back into high FSM schools. Detailed qualitative research following fifty teachers during their first two years in the profession shows that teachers value working conditions rather than pay when choosing whether to stay at or leave their current school. If the **redistribution strategy** is to work, the incentives therefore need to be significantly larger than they are at present.

This raises the question of whether we must also focus on helping the inexperienced teachers already working in disadvantaged schools: **the support strategy**. The main problem with the status quo is not that inexperienced teachers work in disadvantaged schools. Rather, it is that so many of them leave within the first two years and they are then replaced by yet more inexperienced teachers. This means that the average level of experience in disadvantaged schools is kept low (Figure 1). It follows from this that, if we can improve retention of young teachers in disadvantaged schools, there will be a rapid increase in the average level of experience of teachers in those schools. It only takes a few years for a young, inexperienced teacher to become an experienced teacher and mentor to others. The trouble is that many of them leave the profession or move on to a less disadvantaged school before this happens.

How could this be done? As discussed earlier, qualitative work investigating teachers' motivations for moving schools shows that they are attracted to supportive schools in which they can see themselves improving and becoming better teachers. This has since been validated by a number of sophisticated quantitative studies which have convincingly linked improved support to reduced turnover.²⁷ Taken together they suggest that the following factors are important:

- High quality mentoring by somebody with experience teaching similar age groups and subjects;
- A supportive network of colleagues that work together to plan lessons and share resources;
- Engaged school leadership that support teachers' professional development and help enforce a consistent school-wide discipline policy; and,
- Provision of the necessary instructional materials and resources for teachers to do their job.

As well as supporting schools to implement these changes, it may be necessary to provide some 'challenge' to ensure they take the necessary steps. This could be achieved by collecting data on training provision and turnover rates for early-career teachers in different schools and across multi-academy trusts. One option would be to provide this information to Regional Schools Commissioners, who could then compare similar schools in their area, and work with schools who are failing to support and retain early career teachers, for example by brokering support from schools that do a better job. A second option would be to make the early career retention and training information freely available to newly qualified teachers so that they can take it into account when making decisions about where to take jobs. Schools would then face a strong incentive to improve their retention rates in order to ensure they remain an attractive prospect for new teachers. It is worth pointing out that this system is similar to the way retention figures function in the market for new solicitors, where retention rates for different law firms are published by magazines and are an influential signal of how attractive different firms are to work for.²⁸ An equivalent measure for schools would have been constructed carefully to reflect the fact that turnover is not always bad, often rises during successful school "turnaround" efforts and is volatile where staff numbers are small, and so might be more meaningful at the level of the multi-academy trust.²⁹

The support strategy has two advantages over the redistribution strategy. First, it is better targeted, since even if experienced teachers can be lured to disadvantaged schools using cash incentives they may be assigned to top sets in which there are relatively few disadvantaged pupils.³⁰ By contrast, supporting inexperienced teachers to develop will help “level up” the quality of teaching in a school, making it more likely to have the desired effect in terms of narrowing the attainment gap. Second, instead of trying to divert the sense of social mission which newly qualified teachers have, it harnesses it for the good of disadvantaged pupils.

5. CONCLUSION

Disadvantaged schools are more likely to have unqualified, inexperienced, inappropriately trained and high turnover teaching staff. All these factors suggest the quality of teaching in these schools will be lower. We have demonstrated this to be the case during the time period in which the teacher labour market was fairly loose. Recruitment has become much harder since the 2013/14 school year. The patterns of teacher recruitment and turnover may have changed since then as a result. Given that disadvantaged schools were already doing worse than more advantaged schools in long-standing shortage subjects such as physics and maths, it seems most likely that more widespread shortages will disproportionately affect them.

Given that the quality of teaching is the critical determinant of pupil attainment, this is likely to be an important reason for the substantial and persistent attainment gap between rich and poor pupils in English schools. We need to bring an end to the cycle of high-recruitment and high-turnover which currently afflicts many disadvantaged schools, either by attracting experienced teachers to these schools or helping the schools do a better job at mentoring and supporting inexperienced teachers.

ANNEX A. DATA AND METHOD

This paper uses the School Workforce Census (SWC), an annual data collection of all staff in state schools in England each November. We are able to match together five sweeps from 2010 to 2014 using the teacher reference number (TRN) where possible, supplementing it with fuzzy matching of teacher personal identifiers such as name and date of birth. In this version of SWC, each teacher appears in only one row so where a teacher holds multiple jobs it records their main place of work.

In this study we use the following personal information on teachers:

- Gender
- Ethnicity (grouped in the final analysis into White British, White other, and other ethnicity)
- Age
- Qualified Teacher Status and date of qualifying

In each year we use the following information on the teacher's job:

- Pay (we use an adjusted pay that removes the profession agreed pay rises from 2010-2014 and records all pay on the 2014 scale; it also removes the London and fringe pay supplements; we also run algorithms to remove or recode implausible pay values)
- Proportion of a full-time contract worked (FTE)
- Start date at school and in contract

There are a number of limitations to SWC. We do not know the teacher's total length of service and so use their qualification date to proxy for their likely teaching experience. We also do not know their training route. Unfortunately, when teachers transfer to the independent sector (7% of English schools) or overseas then we cannot observe them so they are treated as leaving the profession. Finally, we cannot actually match teachers to the students they teach so cannot study within-school inequalities in access to teachers.

It is also worth noting that the quality of the SWC returns by schools is good, but not perfect. Where a school has made no return at all, the data is imputed using the Database of Teacher Records that is compiled from teacher pension returns. We have also written back individual records using the school start date field where they appear to be missing.

Finally, our analysis does not look at differences in teacher quality within schools. For example, where schools are using setting and streaming, it may be that the more experienced and better qualified teachers are being deployed to teach the top sets and those top sets may include proportionally fewer pupils from disadvantaged backgrounds.

Curriculum and qualification information

SWC asks secondary schools to submit curriculum and qualification information on teachers each year. In this report we use the data from 2011 return (cross-checking findings with 2010). It is important to note that the quality of returns here is not high. We reduce the sample of secondary schools from 3271 to 1733 by only selecting secondary schools where over 70% of the teachers have decent quality curriculum and qualification

information. In addition, in parts of the analysis we restrict attention to those teachers with these 1733 schools who have both curriculum and qualification information.

The qualification information contains a record for every qualification the teacher has, from undergraduate degree through to masters, PhD and teacher training qualifications. It has one or two subjects, recorded as Joint Academic Coding System (JACS) codes. In this study we are interested in the academic subjects studied so we drop records for post-graduate certificates in education. We use this data to record whether a teacher has an academic qualification of any sort in the following major subject areas:

- Maths
- English
- Science
- Chemistry
- Physics
- History
- Geography
- Modern foreign languages

The curriculum file records the number of hours taught by year group and subject area. We use this to compile hours taught in the same subject areas as above, separately for Key Stage 3 (ages 11-14) and Key Stage 4 (ages 14-16). There is inconsistency in how schools arrange and record teaching in science so we do not use the separate information on physics and chemistry teaching hours. Instead, we assume that Key Stage 4 science teaching at the school is split evenly into biology, chemistry and physics.

Other school information

We supplement this teacher-level dataset for information on the school's demographic profile and location. We match in the proportion of pupils in the school eligible for free school meals (FSM) and then convert this into quintiles, separately for the primary, secondary and special school sectors (this is important since the numbers taking free school meals declines as students get older).

We also match in information on the parliamentary constituency and region of the school. This allows us to analyse schools located within quite small geographical areas. There are 533 parliamentary constituencies in our analysis typically containing 32 primary schools and 6 or 7 secondary schools. Although these areas are small, the schools usually have quite different demographic profiles. 427 of these parliamentary constituencies have at least one school in each of the five FSM quintiles we created (91 have schools in four; 15 have schools in three).

Method for decomposing teacher turnover

In this study we explore teacher turnover between school by estimating how odds of a teacher leaving a school varies by school FSM quintile. We do this by running a series of logistic regressions with the binary outcome variable showing whether the teacher left the school in summer 2013 (i.e. present in SWC 2013, but not in that school in 2014). In the main analysis for this paper, we summarise the results by reporting the odds ratio of leaving a school in FSM quintiles 2, 3, 4 and 5, compared to the most affluent schools in quintile 1.

Table 1 summarises the estimation approach. In the first regression, only 4 dummy variables indicating the school FSM quintile are included in the regression. We report the odds ratios, which can be interpreted as a simple differences in the chances of a teacher leaving a school in a particular FSM quintile. In the second regression we add 23 dummy

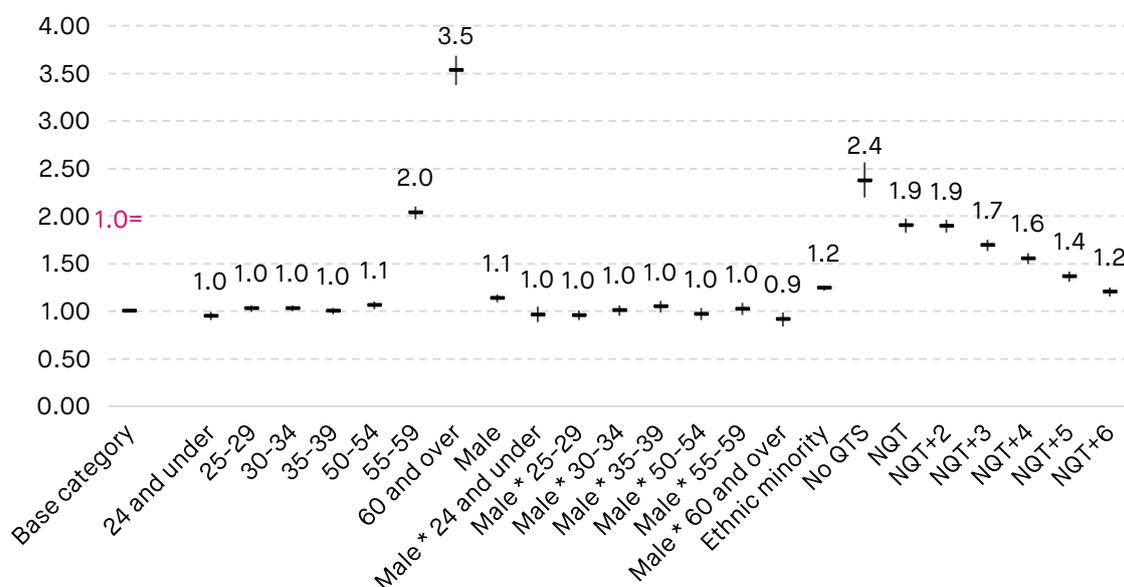
variables indicating the teacher’s background characteristics. This means that the coefficients on the FSM quintiles can be interpreted as a relative odds of a teacher with particular characteristics leaving the school. It allows us to distinguish between any differences in school retention rates that directly attributable to the demographic characteristics of their workforce.

Table 1: Summary of main logistic regressions

	School social context	Individual characteristics?	Geographical characteristics?	Number of observations on full sample
Regression 1	Yes, dummy variables for FSM quintile			494,168
Regression 2		Yes, 23 dummy variables		463,357
Regression 3		Yes, 23 dummy variables	Regional dummy variables	463,357
Regression 4		Yes, 23 dummy variables	Parliamentary random effects	463,351

Figure 12 shows how important it is to account for the characteristics of the teacher themselves. Teachers over 50 are far more likely to leave a school due to retirement and at the start of their career, those in their first year (known as NQTs) and each of the subsequent few years are more likely to leave. Ethnic minority teachers and unqualified teachers are more likely to leave a school and there are gender differences that vary depending on the age of the teacher. In all our analysis the default teacher is a qualified white British female in their forties with at least 7 years of experience.

Figure 12: Odds of leaving a school by teacher background characteristics



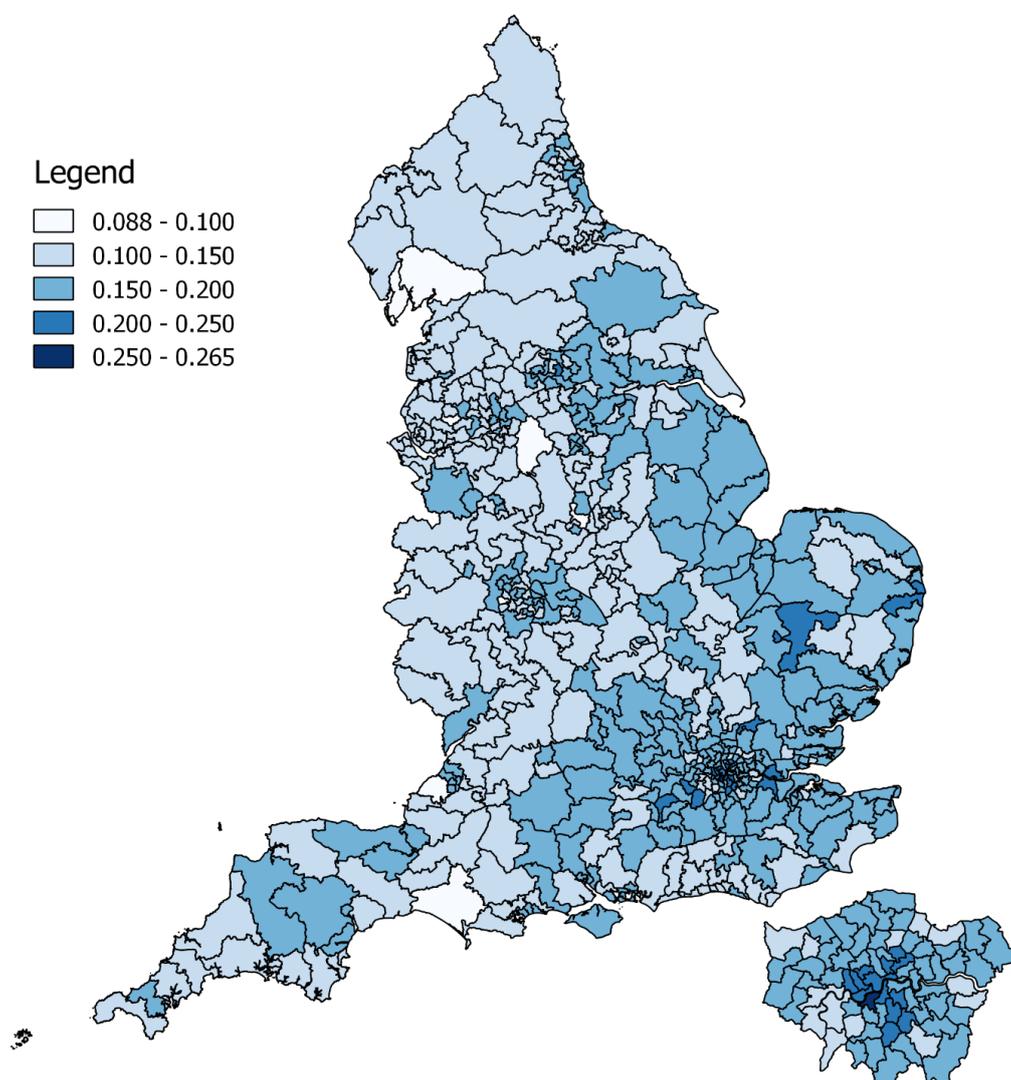
In regression 3 we model the odds of leaving a school, controlling for both the individual characteristics of the teacher and include dummy variables to control for region. Finally in regression 4 we account for overall retention rates in the parliamentary constituency (modelled as random effects for reasons of efficiency). Since parliamentary constituency

has around 6 secondary schools and 32 primary schools, we are looking at whether there are very local differences in school retention rates that are not explained by the demographic characteristics of the teacher themselves.

ANNEX B. TEACHER TURNOVER BY PARLIAMENTARY CONSTITUENCY

We measure teacher turnover as the average proportion of teachers leaving their school post in the years 2011 to 2014. Number of teachers are weighted in each instance for their working hours (full-time equivalent). Note that school identifiers are particularly unstable over this period due to high levels of academisation. We overcome this by matching in stable identifiers so that a change in school status is not identified as a school move. In addition, where more than 3 teachers appear to be making an identical move from one identifier to another, we assume that this is an administrative re-organisation and we discount the moves in question.

Although a census, the quality of the School Workforce Census annual collections is not perfect. We therefore believe that turnover is somewhat overstated here, on average. So, whilst patterns of turnover across the country are likely to be fairly stable, measured levels at individual schools may not accurately reflect actual teacher moves. Pooling data across 4 years of turnover helps stabilise the estimates.



ENDNOTES

¹ The authors would like to thank other members of the Social Market Foundation Commission on Inequality in Education for their comments on the paper. Also thanks to the participants of the roundtable hosted by Sheffield Hallam University in April for their contributions to the paper.

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³ Allen, R. (2015) *We cannot compare the effectiveness of schools with different types of intakes*. Education Datalab post, accessible at: <http://www.educationdatalab.org.uk/Blog/May-2015/We-cannot-compare-the-effectiveness-of-schools-wit.aspx>.

⁴ Social Market Foundation (2016) *Educational inequalities in England and Wales: Commission on Inequality in Education*. SMF report, accessible at: <http://www.smf.co.uk/wp-content/uploads/2016/01/Publication-Commission-on-Inequality-in-Education-Initial-Findings-Slide-Pack-120116.pdf>.

⁵ For a recent summary, see: Burgess, S. (2015) *Human Capital and Education: The State of the Art in the Economics of Education*. Available at: <http://www.coeure-book.ceu.edu/HumanCapital.pdf>; Hanushek, E. and Rivkin, S. (2012) The Distribution of Teacher Quality and Implications for Policy, *Annual Review of Economics*, 4 (1) (July): 131–157. doi:10.1146/annurev-economics-080511-111001.

⁶ Hanushek, E. (2003) Some Simple Analytics of School Quality, Conference paper, available at: http://cee.lse.ac.uk/conference_papers/28_11_2003/eric_hanushek.pdf; also William, D. (2012) *Building learning communities: Leader strategies for embedding a culture of formative assessment throughout schools*, conference presentation, accessible at: http://www.dylanwilliam.org/Dylan_Williams_website/Presentations_files/Teachology%20FA%20conference.pptx.

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¹¹ Wayne, A.J. and Youngs. P. (2003) Teacher Characteristics and Student Gains: a review, *Review of Educational Research* 73 (1): 89–122. doi:10.3102/00346543073001089.

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As a contrast, last year we published research showing no advantages to being taught GCSE science by a team with a physics specialist, but did not explore impact on physics GCSE or A level take-up. See: Education Datalab (2015) *Seven things you might not know about our schools*, accessible at: <http://www.educationdatalab.org.uk/getattachment/Blog/March-2015/Seven-things-you-might-not-know-about-our-schools/EduDataLab-7things.pdf.aspx>.

Teach First also report no association between first degree subject mis-match and QTS achievement or drop-out.

¹² Ronfeldt, M., Loeb, S. and Wyckoff, J. (2012) How Teacher Turnover Harms Student Achievement, *American Educational Research Journal*, 50 (1) (October 23): 4–36. doi:10.3102/0002831212463813.

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¹³ Wayne, A.J., and Youngs. P. (2003) Teacher Characteristics and Student Gains: a review. *Review of Educational Research* 73 (1): 89–122. doi:10.3102/00346543073001089.

¹⁴ See also National Audit Office (2016) Training New Teachers. Accessible at: <https://www.nao.org.uk/report/training-new-teachers/#>.

¹⁵ It is consistent with evidence from the OECD Teaching and Learning International Study that shows 25% of teachers in the lowest attaining schools taught 3 or more subjects, compared to 13% of teachers in the highest attainment schools. See Ilie, S., Jerrim, J. and Vignoles, A. (2016) *Teachers attitudes and characteristics in English schools: Evidence from TALIS*. Presentation to Sutton Trust Best in Class Summit.

¹⁶ Ronfeldt, M., Loeb, S. and Wyckoff, J. (2012) How Teacher Turnover Harms Student Achievement. *American Educational Research Journal* 50 (1) (October 23): 4–36. doi:10.3102/0002831212463813. Borg, J.R., Borg, M.O., & Stranahan, H.A. (2012) Closing the achievement gap between high-poverty schools and low-poverty schools. *Research in Business and Economics Journal*, 5, 1-24.

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²¹ Simon, N.S. and Johnson, S. M. (2013) *Teacher Turnover in High-Poverty Schools: What We Know and Can Do*. Working Paper: Project on the Next Generation of Teachers. Cambridge, MA: Harvard Graduate School of Education.

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²⁵ See <https://www.gov.uk/government/news/national-teaching-service-pilot-gets-underway>

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