Evidence for Excellence in Education

Report

Teacher Retention and Turnover Research

Interim Report

National Foundation for Educational Research (NFER)

Teacher Retention and Turnover Research: Interim Report

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About this report

Recruiting and retaining enough teachers to serve growing numbers of pupils is one of the key challenges currently facing England's education system. NFER has received grant funding from the Nuffield Foundation to undertake extensive new quantitative research to gain a more detailed understanding of the factors associated with teacher retention, turnover and returning to teaching in the state sector.

There are three broad strands of inquiry that this research project will explore. We start by using the Department for Education's longitudinal School Workforce Census to determine the key factors associated with a teacher leaving the profession or moving within the sector. In the second phase, we will use the Understanding Society survey to undertake new statistical analysis to understand the external and personal factors that are associated with teacher labour market behaviour. We will finish by examining the retention and turnover experience in two other major public sector professions – nursing and policing – and will explore what policy solutions have been successfully employed to see whether they could be relevant to the teaching profession. These strands are designed to provide a holistic and comprehensive view that helps our understanding of the nature of teacher retention and turnover, and inform where policy interventions and practice might usefully focus in future.

The first strand of this research project is well underway and we have already published two short research updates, as follows:

- **Teacher retention by subject:** This found that rates of early-career teachers in science, maths and languages leaving the profession are particularly high, and demonstrated the increase in both turnover and teacher leaving rates over the last few years (Worth and De Lazzari, 2017).
- **Teacher dynamics in Multi-Academy Trusts:** This showed that the amount of staff movement between schools in the same multi-academy trust (MAT) is relatively high and is particularly high in large MATs that are geographically clustered close together. It also highlighted the fact that teachers within MATs are more likely to move to more disadvantaged schools than teachers outside MATs (Worth, 2017).

In this interim report, which completes the first strand of the project, we summarise our remaining findings from analysing teacher retention and turnover data from the School Workforce Census. In this report, we explore:

- how the composition of the teacher workforce has changed between 2010 and 2015 according to different characteristics such as age, sex, experience, part-time status, and the subjects they teach
- how rates of leaving the profession and moving school differ according to these characteristics
- how teacher, school and wider geographical factors influence a teacher's likelihood of leaving the profession or moving school, and interact with one another.

We will be publishing more research reports on our findings from the second and third strands of this project later this year and in 2018.

Executive summary

In recent years, against the backdrop of increasing pupil numbers and teacher shortages in key subjects, teacher supply has climbed up the education policy agenda in England. There has been significant interest in teacher recruitment and retention among policy makers, and from school leaders who struggle to fill vacancies. This issue is further exacerbated as pupil numbers are forecast to rise in the secondary sector by 19 per cent between 2017 and 2026, which will increase recruitment and retention pressures. A thorough understanding of the factors associated with teacher supply in the state sector is crucial to assist policy makers and system leaders formulate effective responses to this complex issue.

The rate that older teachers have been leaving the profession increased between 2010 and 2015

The proportion of teachers in the workforce in their 50s has decreased markedly between 2010 and 2015. This is partly due to the cohort in this age band at the start of the period being larger than the one that followed it, and partly due to a higher rate of older teachers leaving the profession before normal retirement age over the period. If this trend continues, it will increase the scale of the challenge as new, inexperienced teachers will need to be recruited to replace them. This trend comes at a time when demand for secondary school teachers is already growing.

Recommendation 1: The Government should investigate why the rate of leaving among older teachers has been increasing and explore whether they could be incentivised to stay in the profession longer, particularly in subjects with specialist teacher shortages.

The increase in turnover has been greater than the increase in leaving rates, creating even more pressures for schools

The proportion of working-age teachers leaving the profession each year has risen steadily between 2010 and 2015, from nine to 11 per cent for primary teachers and 11 to 13 per cent for secondary teachers. Over the same period, the proportion of teachers moving school has risen more rapidly, from five to eight per cent for primary teachers and four to eight per cent for secondary teachers. This increase in teachers moving around the system, which is likely to have had a more pronounced impact on individual schools or specific types of school, could have caused a divergence between system-level and school-level perspectives on the current teacher supply situation. The leaving rate matters at a system-level as it affects the overall supply of teachers. However, more teachers leaving the profession and moving school means that school leaders have had more vacancies to fill each year, more staffing uncertainty to deal with and higher costs of recruiting replacements.

Recommendation 2: The Government should give greater attention to the impact of teachers moving around the profession and develop policies to support schools which are disproportionately affected.

The proportion of teachers leaving the profession or moving school has increased across all subjects between 2010 and 2015

Some subjects are more affected than others, with science and modern foreign language (MFL) teachers most likely to leave. Over this time period, the number of new teachers being recruited into these subjects has been running below the Government's own targets, which may be impacting on schools' ability to offer more teaching in these subjects, which are key elements of EBacc / Progress 8. Science and MFL teacher trainees attract generous bursaries of at least £25,000, which do not appear to be incentivising recruitment or retention to the levels required. Bursaries may be operating ineffectively because the payments are not tied to teachers staying in teaching. The Government's recent announcement to pilot student loan reimbursement for science and MFL teachers and introduce bursaries for maths teachers that include retention payments is a promising development.

Recommendation 3: Bursary payments, or other financial incentives such as student loan repayments, should be structured to explicitly incentivise retention in the teaching profession during the first few years after training.

Part-time teachers are far more prevalent in the primary sector than in the secondary sector

One in four teachers (25 per cent) in the primary sector is part-time compared to about one in six (17 per cent) in the secondary sector. Some of this gap is due to there being a greater proportion of female teachers in primary schools, but a large part of the gap persists even when accounting for differences in age, gender and the number/age of children. This suggests that primary schools are better able, or more willing, to accommodate part-time teachers. Secondary teachers who are employed part-time tend to have higher rates of leaving the profession than part-time primary teachers, suggesting that secondary teachers and/or secondary schools have more difficulty making part-time employment work. Greater flexibility over working patterns in the secondary sector may incentivise former teachers who left the profession to have families, to care for relatives, etc., to return to work part-time. Better part-time opportunities may encourage teachers who are at risk of leaving the profession in future because they cannot work part-time to stay. Both would alleviate the scale of the teacher supply challenge facing secondary schools.

Recommendation 4: The Government and stakeholders in the secondary sector need to look urgently at identifying ways that accommodate more and better part-time working in secondary schools.

Recommendation 5: Further research with secondary schools which successfully offer greater flexibility in working patterns should be undertaken and best practice shared.

Teachers in schools rated as being Inadequate by Ofsted are more likely to leave the profession or move school

A school's Ofsted rating is an important predictor of a teacher's probability of moving school and, to a lesser extent, leaving the profession. The rate of teachers leaving the profession and moving school are highest when the school has been rated as being Inadequate in successive inspections. Interestingly, teachers in schools which have been upgraded to Requires Improvement have a higher probability of moving school than after a downgrade to Requires Improvement, perhaps as the after-effect of previously being Inadequate, or as a result of the experience of delivering school improvement being viewed positively in the labour market.

There appears to be little evidence to date that MATs are better able to retain teachers by providing opportunities to move within their structure

Former Education Secretary Nicky Morgan suggested that a model of flexible staff development in MATs would 'give a clear path to career progression that will keep [teachers and leaders] engaged rather than looking for opportunities elsewhere' (Morgan, 2016). However, our analysis shows that MATs tend to have a slightly higher than average rate of teachers leaving the profession compared to other school types, even after accounting for the fact that a large number of schools in MATs are sponsored academies. This may be due to different staff management practices in MATs, but could also be due to the way that staff movements from a school to the MAT central team are recorded. In addition, after excluding internal moves within the same MAT, MATs have similar rates of teachers moving school when compared to other schools. There therefore appears to be little evidence to date to suggest that MATs are better able to retain their teachers.

Recommendation 6: To help improve retention, leaders of MATs should do more to promote the benefits of working in their organisation to their teachers; for example, by raising the profile of the MAT as the structure that teachers belong to, and through promoting career paths for teachers to develop and progress within the MAT.

The teacher supply challenge in London is particularly acute when compared to other geographic areas

London has considerably more teachers leaving the profession compared to other areas, including other large cities such as Birmingham and Manchester. Furthermore, while London schools attract a small net gain of teachers in their twenties from other geographic areas, they lose one per cent of teachers in their thirties and 0.6 per cent of teachers in their forties each year. This comes at a time when pupil numbers are rising faster in the capital than other areas. The cost of housing is likely to be a key factor influencing these trends.

Recommendation 7: Policy makers should look at how policy interventions, such as housing subsidies, could help to retain teachers in high-cost areas.

Recommendation 8: Further research exploring the geographical flows of trainees into the teacher workforce / during their careers would help to gain an understanding of the detailed dynamic picture within and across different areas and aid the development of policy solutions.

More analysis is needed to look at the impact of wider factors on retention and turnover

Our regression model using administrative data explains relatively little of the variation in the probability of teachers leaving the profession and moving school. The influence of wider factors such as job satisfaction, working conditions, the cost of living and commuting, and family circumstances are likely to be having important influences on teachers' decision-making. We will be examining this in the second strand of this research project.

1 Introduction

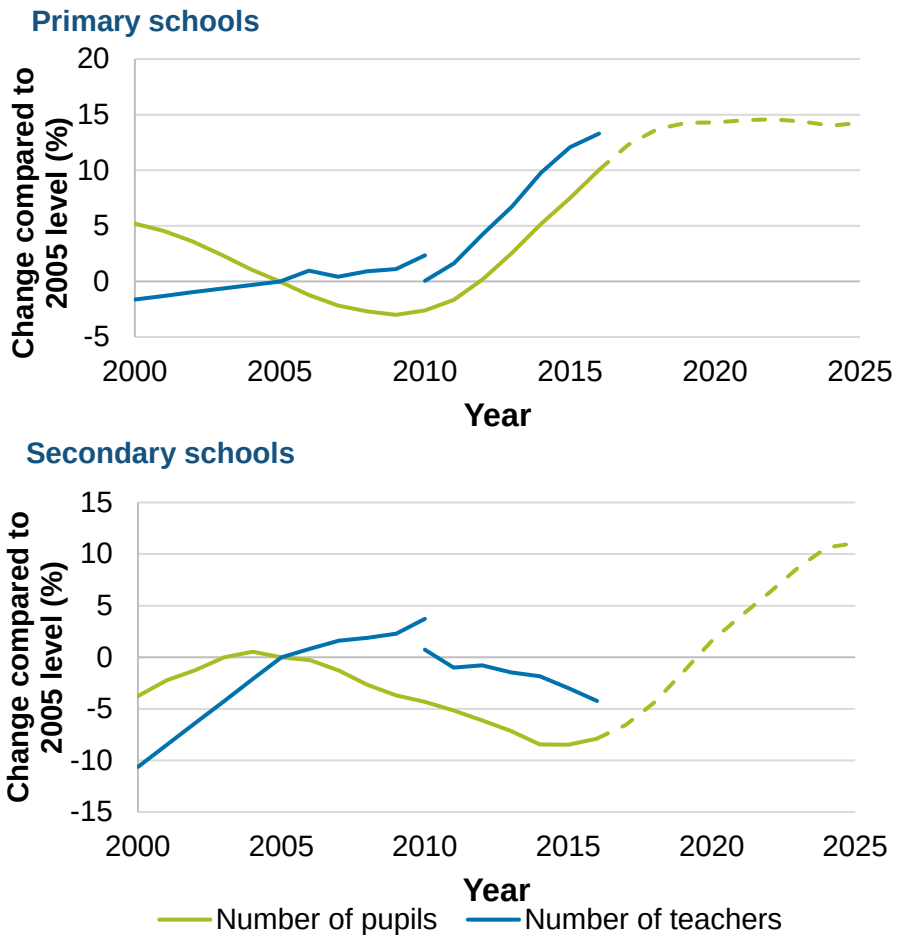
1.1 Policy background

Rising pupil numbers, shortfalls in the number of trainee teachers and concerns about the proportion of teachers who say they are considering leaving the profession means that teacher supply in the state sector is a major policy issue in England. Meeting the current and future demand for teachers across school phases and types, subjects and diverse geographical areas is a complex challenge. The wide array of data sources for understanding the nature of the challenge make it difficult to get a comprehensive picture of what is happening in the teacher labour market. Formulating effective policy responses to meet this complex challenge is demanding, but essential for educational standards.

Education policy changes and economic trends are also influencing teacher supply. The Government's emphasis on schools teaching English Baccalaureate (EBacc) subjects has put particular pressure on the supply of teachers in subjects such as science, maths and modern foreign languages. Research on the effects of economic conditions on teacher recruitment and retention suggests that the current low rate of unemployment has made teacher recruitment and retention more difficult (Hutchings, 2011). Teacher pay scales, which are rising more slowly than inflation and pay rates in other sectors, may have also made teaching a less attractive profession to enter, and perhaps to stay in.

The demand for teachers is expected to rise over the next few years as the number of pupils in primary and secondary schools increases. Figure 1 shows how the number of primary (top) and secondary (bottom) school teachers and the respective number of pupils have

Figure 1 Secondary schools will need an influx of teachers to meet demand



Note: The full-time equivalent (FTE) number of teachers was measured using a school-level return (Form 618g) between 2000 and 2010 and using the School Workforce Census from 2010 onwards.

Source: School Workforce in England (SFR25/2017); National Pupil Projections (SFR25/2016).

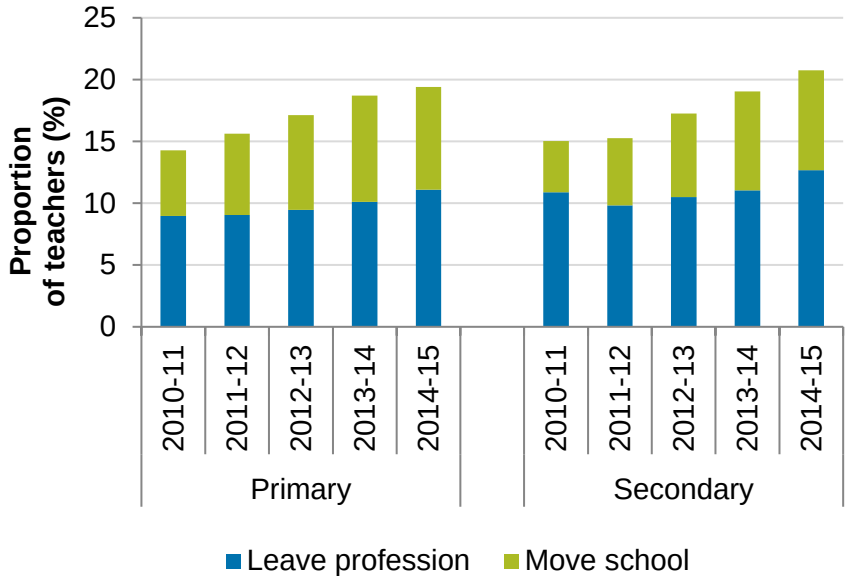
changed over time, including the projected acceleration in pupil numbers over the next decade (dashed line). Overall, primary teacher numbers have kept pace with pupil numbers as they have grown rapidly over the last five years. Primary pupil numbers are forecast to plateau over the next decade. However, secondary pupil numbers have started to grow and the increased growth forecast to take place over the next ten years means the system needs an influx of secondary teachers to meet this demand. Shortfalls in the number of new teacher trainees, particularly for secondary teachers, mean that retaining teachers who are already in the profession is all the more important for managing the current and future supply of teachers.

Policy makers have tended to pay less attention to retaining teachers currently employed in state schools than to recruiting new ones to address the teacher supply challenge. The House of Commons Education Committee recently called on the Government to "place greater emphasis on improving teacher retention" as a potentially more cost-effective way of managing the supply of teachers (GB, Parliament. HoC. Education Committee, 2017).

Figure 2 shows how retention of working-age teachers has changed between 2010-11 and 2014-15. The blue bars show the proportion of primary and secondary school teachers under age 60 leaving their teaching post in the state-funded sector over time[1]. The green bars show the proportion of teachers that move school over time.

The proportion of working-age teachers leaving the profession each year has increased since 2010-11 in both primary and secondary schools. This has important implications for system-level workforce planning because more teachers leaving the profession means that more teachers need to be recruited to replace them, if maintaining class sizes remains an important objective for policy makers.

Figure 2 Retaining working-age teachers is getting harder



The turnover rate (teachers leaving the school they are in, whether to move school or leave the profession – illustrated by the total of the blue and green bars) has increased more rapidly. This has been driven by the number of teachers moving between schools doubling between 2010-11 and 2014-15. Greater turnover means schools have had more vacancies to fill each year, which leads to school leaders having more staffing uncertainty to deal with and higher costs of recruiting replacements.

[1] We refer to teachers leaving their post in the state-funded sector as 'leaving the profession' in this report, although it may also include moving to teach in further or higher education, in independent schools, in other UK nations or abroad.

A rapid rise in the rate of teachers leaving their school in contrast to a modest rise in those leaving the profession may have caused a divergence between system-level and school-level perspectives on the current teacher supply situation. Both are important for understanding the teacher labour market, but have different implications for policy and how the government and school leaders respond: the leaving rate affects the overall supply of teachers, whereas the churn rate affects how teachers are distributed between different schools. The impact of this distribution could disproportionally affect certain types of schools.

1.2 Aims of this research

Focusing only on the overall number of teachers in the education system masks the more detailed teacher supply picture underneath. Understanding this detail is critical for gaining a better understanding of the nuances of England's teacher supply situation and identifying areas where policy changes could have an influence. The House of Commons Education Committee has called for more information to be available on teacher retention by subject, region and route into teaching. Recent research has found some important differences in the retention rates of teachers in different regions and for teachers who take different training routes (Allen *et al*., 2016). Our earlier research as part of this project has also identified differences in retention rates by subject taught, particularly among those early in their careers (Worth and De Lazzari, 2017).

This NFER research project – funded by the Nuffield Foundation – contributes new quantitative research to this gap in knowledge and seeks to inform policy makers and system leaders to help formulate effective responses to this complex issue. As noted earlier, there are three stands to this research. In this interim report, we focus on the first stage of the research, where we have gained insights into teacher retention and turnover from an in-depth analysis of the longitudinal School Workforce Census (SWC).

In the second stage of the research, we will use data from the Understanding Society survey and the Labour Force Survey to gain a wider labour market perspective on why teachers leave the profession, what happens after they leave and what can be concluded about teachers' motivations for leaving. We will also look at the experience in two other public sector professions – nursing and policing.

1.3 Methodology

We analyse data from six consecutive waves (2010-2015) of the Department for Education's SWC, which contains information on all teachers employed in state-funded schools in England. The SWC data we have used in this project covers:

- teachers' personal characteristics – e.g. age, gender, ethnicity, when they first entered the state-funded sector
- the nature of teachers' employment – e.g. school ID, permanent or temporary contract, part-time or full-time
- secondary teachers' timetables – e.g. weekly timetabled hours spent teaching different subjects and year groups.

We supplement the teacher-level information in the SWC with other information from a number of sources, including school information from Edubase and pupil demographic information from the School Census (which are published by the Department for Education), school inspection data published by Ofsted, and local-area pay data and unemployment data from the Office for National Statistics.

We investigate the relationship between teacher, school and wider geographical characteristics, and the probability of both leaving the profession and of moving school, using a logistic regression model. This statistical technique enables us to assess the importance of a variable in predicting the probability of an event, taking into account a set of other characteristics that are included in the model. More details about our method of analysis and a full list of the variables included in our regression models can be found in Appendix A.

We have estimated two different sets of models: the first predicts the probability that a teacher leaves the profession in the following year, while the second predicts the probability that a teacher moves to a different school in the following year, conditional on staying in the profession.

A teacher is considered as having left the teaching profession if they appear in one wave of the SWC but not in the following one. This usually happens because a teacher leaves the teaching profession, perhaps to retire, look after family, or pursue a different career. However, the SWC only collects information on teachers that are working in state-sector schools. Therefore, teachers also leave the SWC if, despite continuing to work as a teacher, they move to an independent school, a further education college, to teach in Wales or Scotland, or to teach abroad. They may also take up a non-teaching role in a school, which cannot be identified from the data we have analysed. Hence, we refer to 'leaving the profession' in this report, although it actually refers to teachers leaving teaching in the English state-funded sector. The proportion of teachers that leave the profession is the number of teachers who left the profession between one year and the next divided by the total number of teachers in the dataset in the initial year.

The definition of a teacher that moves school is simply a teacher that appears in two consecutive waves of the SWC, but is employed at two different schools[2]. Our measure of the proportion of teachers that move school is the number of teachers moving to a different school divided by the total number of teachers in the initial year, excluding those who leave the profession.

1.4 This report

The following sections set out the most important and policy-relevant findings from our analysis:

- section two explores the teacher perspective, showing how important age, experience, subject taught and part-time employment are for explaining retention and mobility, and how these characteristics have changed over time
- section three explores the school perspective, highlighting important differences in retention and mobility between schools with different Ofsted inspection ratings and different school structures
- section four explores the geographical perspective, comparing the dynamics of London's unique teacher labour market to that of other large English cities and other areas
- section five sets out some of the questions that remain unanswered from our analysis and how we will attempt to answer those questions through further research.

[2] We identify schools according to their Unique Reference Number and carefully identify schools that are unchanged except for changing URN, e.g. because of becoming an academy.

2 The teacher perspective

Among the teacher, school and geographical characteristics that we use to try and explain variation in the rate of teachers leaving the profession and moving school, the teacher characteristics are by far the most important. The set of teacher characteristics in our regression model explain around 95 per cent of the variation in the probability of leaving the profession that the whole model is able to explain[3]. In terms of moving school, the set of teacher characteristics explains a lower, but still substantial, proportion of the variation: just over 58 per cent at both primary and secondary level.

Three individual characteristics stand out from our analysis as being important for predicting teacher dynamics: a teacher's age and experience, the subject they teach and whether they work part-time. In the rest of this section, we show how each of these characteristics has changed since 2010 and the association they have with a teacher's probability of leaving the profession and moving school.

2.1 Age and experience

The age profile of teachers in both primary and secondary schools has changed in important ways between 2010 and 2015. In particular, the proportion of teachers older than 50 has decreased from 23 per cent to 18 per cent in primary schools and from 24 per cent to 19 per cent in secondary schools. At the same time, the proportion of primary teachers who are younger than 30 and secondary teachers in their 30s and early 40s have increased since 2010.

Figure 3 shows how the *number* of teachers of different ages has changed between 2010 and 2015. This sheds light on how much of these changes are down to 'cohort effects' (i.e. some cohorts of teachers are larger than others and move through the age distribution over time) or 'age effects' (i.e. different age groups are disproportionately more or less likely to join or leave the profession).

In both primary and secondary schools, the number of teachers older than 50 has decreased. The data shows that this was a particularly large cohort of teachers: those aged 51-59 in 2010 entered the profession during the boom in secondary pupil numbers that peaked in 1981 (House of Commons Library, 2012). This cohort was also born between 1951 and 1959, which corresponds to the last years of the post-war baby boom.

However, most of these individuals have not reached the normal retirement age: many are retiring early while some are likely to be leaving for other opportunities and for other reasons. The increase in the propensity to leave before normal retirement age for teachers older than 50 could be for a number of reasons which we cannot identify from the SWC data alone. It may be due to all the major reforms in education – to the National Curriculum, the accountability system, and to qualifications – that are likely to have increased workload and may have encouraged some teachers to leave.

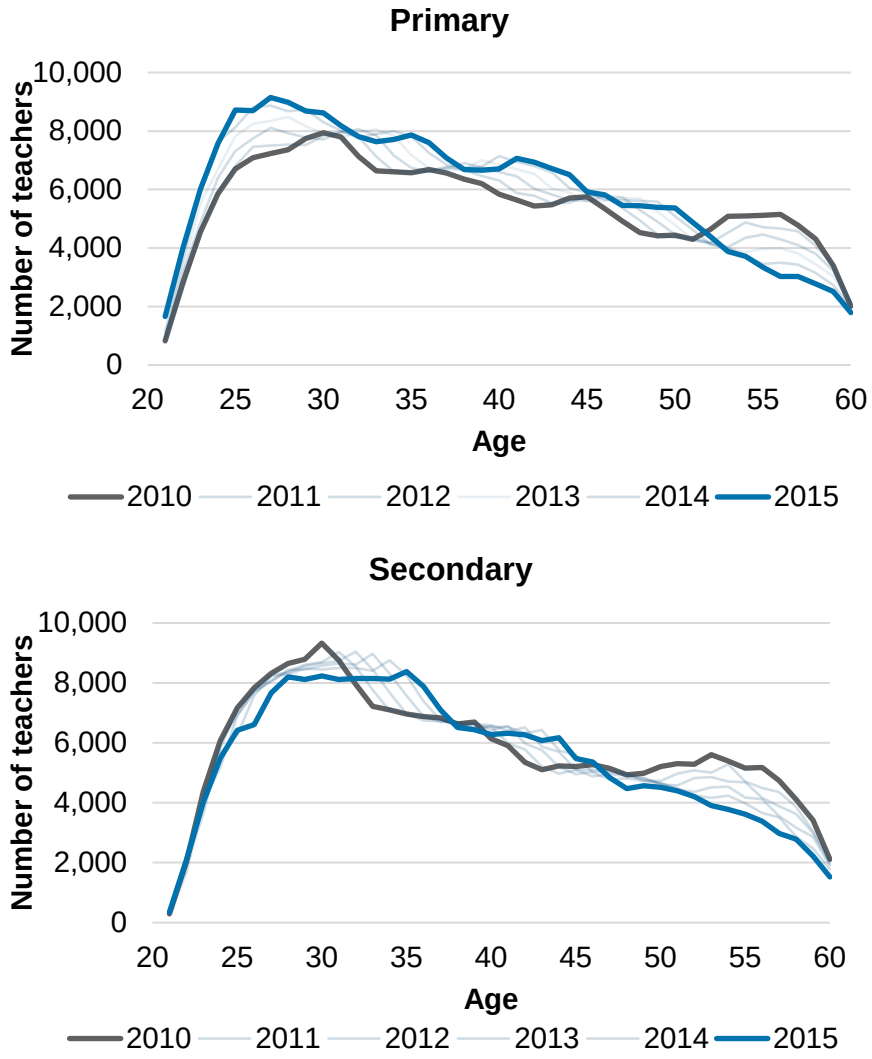
The decrease in the proportion of older teachers is a combination of both a 'cohort effect' and an 'age effect'. The cohort of teachers in

[3] However, a large proportion of the variation is unexplained by the whole model – see section five for discussion of this. The results are very similar for both primary and secondary school teachers.

their fifties in 2010 was larger than the cohort it was followed by, which explains part of the reason that the proportion of teachers in their 50s in the profession has fallen over time. However, there has also been a high rate of older teachers leaving, which has accelerated the decline in the proportion of the workforce that is over 50.

The increase in the number of young teachers in primary schools reflects the rise in the number of pupils enrolled in primary schools following a boost in birth rates starting from 2002, resulting in a ten per cent increase in the number of pupils in the primary sector between 2010 and 2015. This resulted in an increase in the number of new teachers recruited into primary schools, who tend to be in their early 20s. The increase in the number of secondary teachers in their thirties is due to the large cohort that were recruited and trained during the last period of growth in secondary pupil numbers, which peaked in 2004, moving up the age distribution. Secondary pupil numbers have been falling since then, but are set to increase again by 19 per cent between 2017 and 2026 (DfE, 2017b).

Figure 3 The number of teachers in their fifties has fallen since 2010

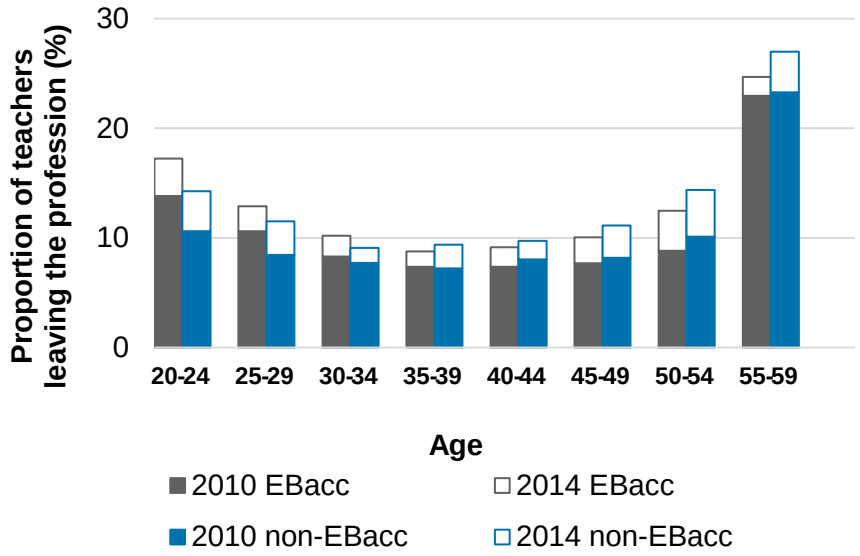


Breaking down Figure 3 by subject taught[4] (not reported here) shows that the decrease in the number of teachers older than 50, especially those age 55-59, is disproportionately driven by reductions in teachers of non-EBacc subjects. Our previous analysis found that between 2010 and 2015, school curriculum time for non-EBacc subjects saw a steady decrease (Worth and De Lazzari, 2017). This might indicate that older teachers teaching these subjects have been incentivised to retire early, or that they have become more frustrated or disaffected at their subject receiving less priority. More experienced teachers tend to be more expensive for schools to employ than younger teachers, so providing an incentive to these teachers to enter early retirement might be an attractive option for schools.

Figure 4 shows the proportion of secondary teachers leaving the profession in 2010 and 2014[5] by age group and by EBacc/non-EBacc subject[6]. The leaving rate is highest among teachers aged 55-59, and the greatest increase in the probability of leaving the profession is for teachers of non-EBacc subjects who are older than 50. This finding confirms that older teachers of non-EBacc subjects have been an important driver of the reduction in the proportion of teachers aged over 50.

The probability of leaving the teaching profession is highest for older and younger individuals, while the probability of moving school is highest for teachers in their 20s and decreases with age. Older teachers are the least likely to move school.

Figure 4 Younger and older secondary teachers have the highest rates of leaving the profession



Very similar relationships with rates of leaving the profession and moving school are seen when looking at age and experience[7]. This is because the two variables are closely related. However, age and

[4] We have identified six main subjects that are: English, Maths, Science, Humanities, MFL and non-EBacc subjects. To be classified as an English teacher a teacher needs to teach at least 10 hours a week of English and at least 50% of her total time needs to be spent teaching English. The non-EBacc group is a residual category that includes mostly teachers of non-EBacc subjects but also teachers that do not satisfy one of the above mentioned criteria.

[5] The leaving rate in a given year represents the proportion of teachers that leave the profession between that year and the following one.

[6] This graph is specific for secondary schools as we do not have information regarding the subject teachers teach in primary schools.

[7] The SWC does not contain data about the number of years of teaching experience a teacher has, so we use a proxy, which is the difference in years between the current year and the year when each teacher first taught

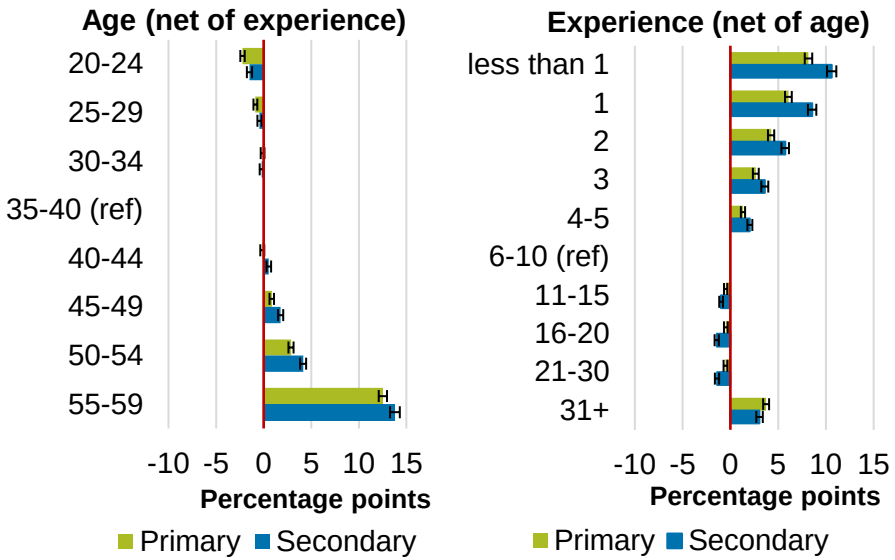
experience are not perfectly correlated, as teachers enter the profession at different ages.

2.1.1.1 Regression model findings

We estimate a logistic regression model to explore the relationship between the probability of a teacher leaving the profession and teacher, school and geographical factors. We also explore the relationship between these factors and the probability of a teacher moving school. The model enables us to assess the importance of a variable in predicting the probability of an event, taking into account the set of other characteristics that are also included in the model. See Appendix A for a detailed discussion of our methodology.

Our regression model is able to explain both the association between age and leaving the profession / moving school net of experience, and the association with experience net of age. Figure 5 shows the relationship between age and experience and the probability of a teacher leaving the profession, after accounting for other teacher, school and geographical factors. The effects are estimated separately for primary (green bars) and secondary teachers (blue bars). Each bar shows the average difference in the leaving rate between individuals of a certain age or experience level and the reference category (age: those age 35-39; experience: those with 6-10 years of experience), in terms of percentage points. For example, a secondary teacher with less than one year of experience is almost ten percentage points more likely to leave the profession than a similar individual with 6-10 years' experience. The black lines show the 95 per cent confidence interval: if the interval covers the zero line then that difference is likely to have arisen purely by chance.

Figure 5 Older and less experienced individuals have a higher probability of leaving the teaching profession



The probability of a teacher leaving the profession decreases as the number of years of experience increases, with the exception of the most experienced teachers. This is likely to be because career changes are more likely at the beginning of a career. On the other hand, younger teachers are less likely to leave the profession, after accounting for their low level of experience. This indicates that the higher chance of leaving the profession among younger teachers is the result of inexperience rather than being young. In contrast, for older individuals, age is more important for predicting the chance of

in the state sector. See Appendix A for more details about the limitations of this as a proxy for teaching experience.

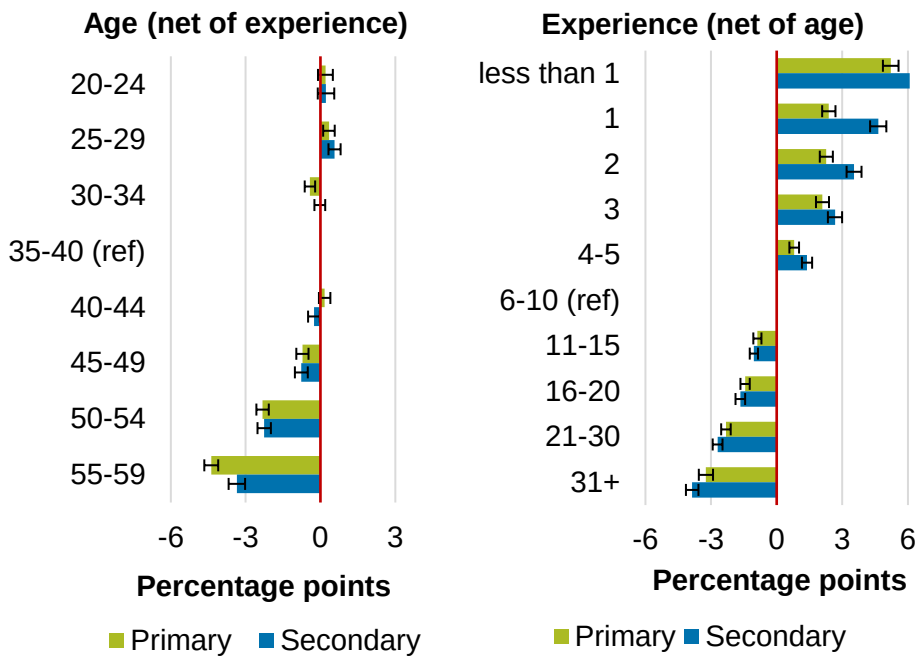
leaving the profession compared to the number of years of experience.

Overall, the regression models suggests that lack of experience drives the high leaving rate among young teachers, while age is the main driver at the opposite end of the spectrum. This may suggest that inexperienced teachers need greater support during the first few years of their career to increase retention in the profession. Initiatives to increase the engagement of more experienced teachers, including job flexibility, may also encourage them to continue teaching as they get older.

Figure 6 reports similar estimates from the regression models that predict the probability of moving school. The results indicate that, in line with our expectations, the older and the more experienced the teacher, the less likely they are to move school. Except for the oldest individuals, the effect of experience seems to be more important than age for explaining churn. The particularly high rate of inexperienced teachers moving school could be a consequence of wanting to gain more experience in different schools, improve their pay, gain a promotion or to find a school with a culture that suits them. The decline of moving school with age is consistent with greater ties (e.g. settled family, or partner's job) and other responsibilities (e.g. caring) making moving more difficult.

Experience also explains a higher proportion of the variation explained by the model than age. At primary level, experience represents nine per cent of explained variation compared to five per cent for age. At secondary level, experience represents 11 per cent of explained variation compared to two per cent for age.

Figure 6 The older and more experienced the teacher the lower the probability of moving school

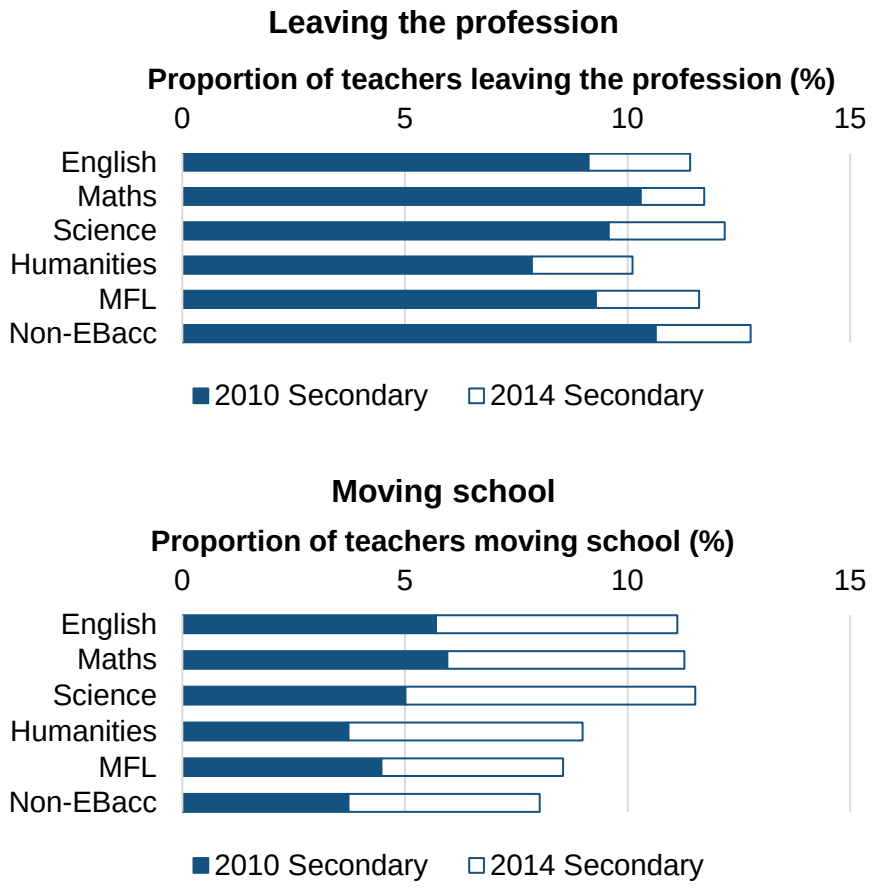


2.2 Subject taught[8]

In line with our previous findings that suggest a contraction in the number of hours of non-EBacc subject teaching in schools' timetables, between 2010 and 2015 the proportion of non-EBacc[9] teachers dropped from 47 per cent to 42 per cent (Worth and De Lazzari, 2017). Figure 7 shows the percentage of teachers leaving the profession (left) and moving school (right) in 2010 and 2014 separately by subject taught.

The proportion of teachers leaving the profession and moving school has increased for all groups, but by different amounts across the groups. Non-EBacc teachers have the highest probability of leaving the profession but the lowest probability of moving school. The limited mobility of non-EBacc teachers is consistent with fewer available opportunities due to the reduction of schools' curriculum time dedicated to non-EBacc subjects. The high mobility of English, science and maths teachers could be a consequence of the fact that they have bigger departments within schools and hence there are more opportunities for teachers to move to a different school, coupled with increased demand for teachers of these subjects across schools.

Figure 7 Non-EBacc teachers have the highest probability of leaving the profession but the lowest probability of moving school

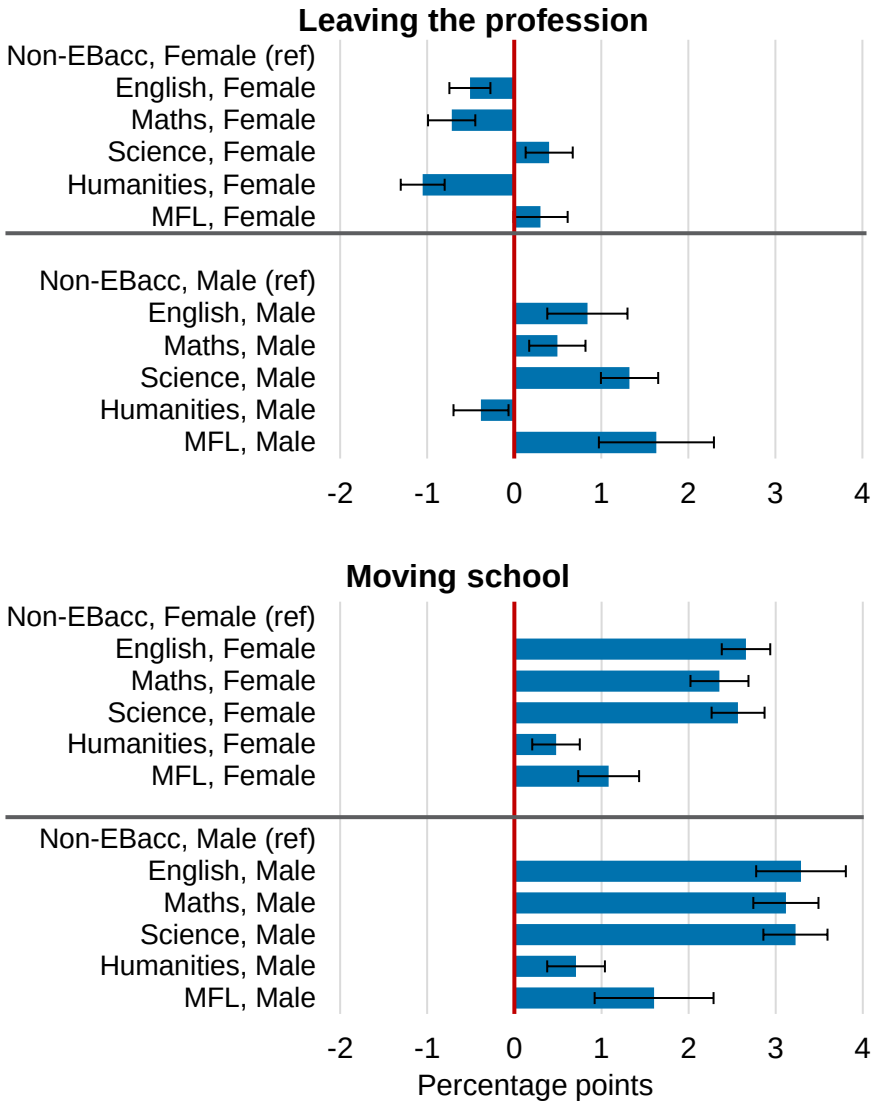


[8] The results presented in this section are specific for secondary schools as no information on the subject taught by primary teachers is available.
[9] The non-EBacc group is a residual category that includes mostly teachers of non-EBacc subjects, but also teachers that do not satisfy the criteria of teaching a particular subject for 10 hours or more and for at least half their teaching time.

Figure 8 shows how the probability of leaving the profession (top) and moving school (bottom) differs across subjects, after accounting for other individual, school and geographical characteristics. The coefficients are estimated separately for men and women and are reported using non-EBacc teachers, male and female respectively, as a reference category. Positive (negative) coefficients are interpreted as a higher (lower) probability of leaving the profession for a certain teacher compared to a non-EBacc teacher of the same gender.

For both men and women, humanities teachers are the least likely to leave the profession, while MFL and science teachers are the most likely to leave. Higher leaving rates among MFL and science teachers implies more trainees or returning teachers are required each year to maintain supply. The number of teacher trainees for both science and MFL have been below the Government's target for four years (DfE, 2016b). Lower recruitment and retention rates in sciences and languages have constrained schools' ability to offer more teaching in these subjects in response to the incentive to do so provided by the way EBacc is embedded in Progress 8, the main accountability measure for secondary schools (Worth and De Lazzari, 2017).

Figure 8 Humanities teachers are the least likely to leave the profession, while MFL and science teachers are the most likely



Science and MFL teacher trainees attract generous bursaries of at least £25,000, yet these payments are not currently linked to retention in teaching. Bursary payments are likely to be more effective if they are restructured to explicitly incentivise retention in the teaching profession during the first few years after training. Policy makers should also explore other ways of linking financial incentives to staying in the profession after training to teach a particular subject, such as student loan repayments. The Government recently announced piloting student loan reimbursement for science and MFL teachers and introducing bursaries for maths teachers that include retention payments, which is a promising development (DfE and Greening, 2017c).

The regression model results confirm that teachers of non-EBacc subjects are the least likely to move school, while English, maths and science teachers are the most likely to move school. In general, the direction of the coefficients estimated for men and women are very similar.

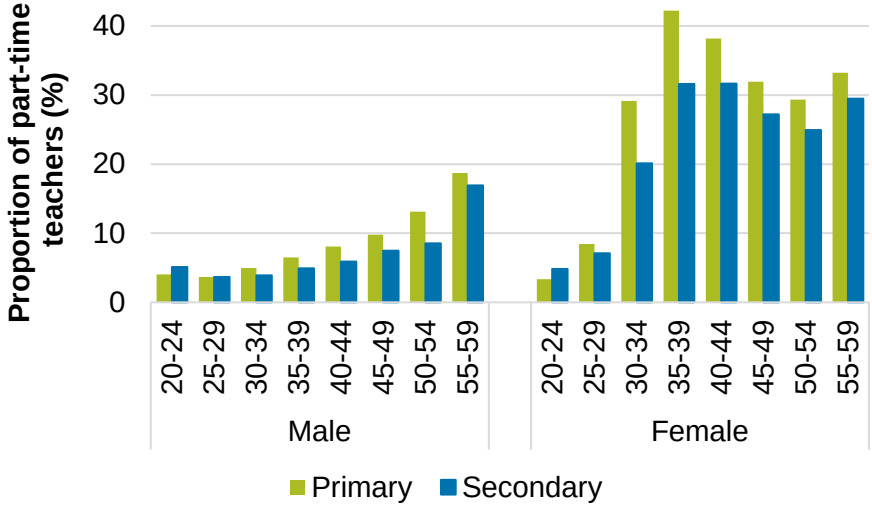
Despite being a significant predictor for the probability of leaving the profession and moving school, subject taught explains a relatively small amount of the overall variation in the models. The amount of variation explained by subject in the model predicting the probability of leaving the profession is smaller than the variation it explains in terms of the probability of moving school (0.3 per cent vs 5.6 per cent). Therefore, the most important influences on teacher retention in the profession appear to be general factors that apply across teachers of different subjects.

2.3 Part-time employment

The proportion of teachers working part-time remained relatively stable between 2010 and 2015, increasing slightly by about one percent point to 17 per cent in secondary schools. Primary schools have a considerably higher proportion of part-time teachers compared to secondary schools (25 per cent vs 17 per cent in 2015).

Figure 9 shows the difference in the proportion of part-time teachers in different age groups separately for men and women. Part-time employment peaks among women in their late 30s and early 40s, which corresponds to the period in which women are most likely to decrease their employment workload to take on childcare responsibilities. There is no evidence of an equivalent increase in part-time rates for men. For both genders, the proportion of part-time teachers increases with age as individuals approach retirement and seek to reduce their working hours as part of transitioning into retirement. Individuals may also need to spend more time caring for older relatives at an older age.

Figure 9 Part-time employment peaks between 35 and 45 for women



The overall gap in part-time employment between primary and secondary schools is partly explained by the fact that a greater proportion of primary teachers are female, who are more likely to work part-time. However, Figure 9 shows that the gap between the primary and secondary phases persists even when we compare teachers of the same age and gender.

We investigate this gap further by comparing the primary-secondary gap among teachers of the same age, gender and with the same number and age of children, using the Labour Force Survey. We find that the primary-secondary gap is undiminished at around five percentage points, even after accounting for the association between teachers having children and their likelihood of being employed part-time. This suggests that primary schools seem to be better able to accommodate part-time employment than secondary schools.

Figure 10 shows the rate of leaving the profession for full-time and part-time teachers in primary and secondary schools. The leaving rate among part-time teachers in secondary schools (19 per cent in 2014) is considerably higher than among full-time secondary teachers (11 per cent) and is also higher than part-time teachers in primary schools (14 per cent). Part-time teachers in primary schools also have a rate of leaving the profession that is higher than their full-time counterparts (10 per cent).

Figure 10 Part-time teachers are more likely to leave the profession than full-time teachers

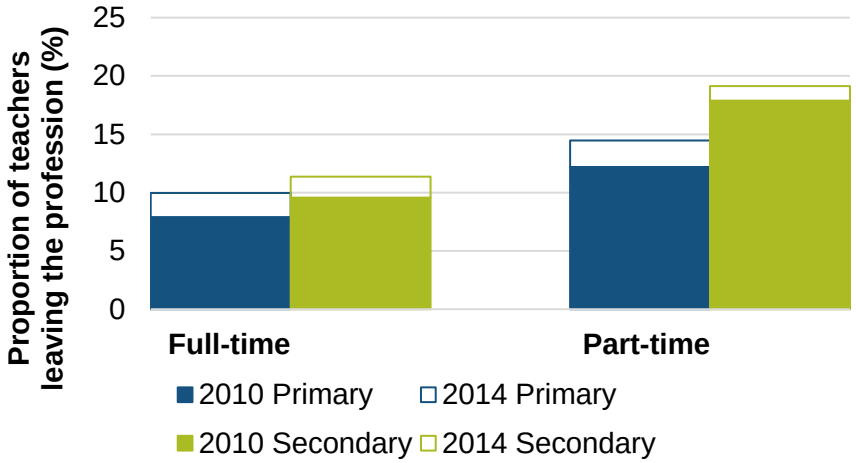
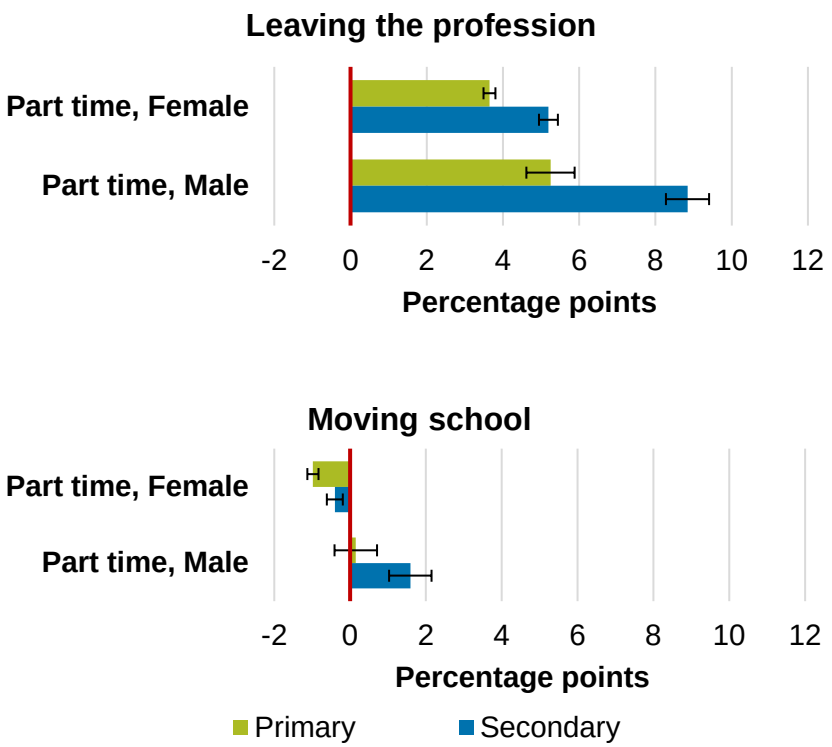


Figure 11 shows the difference in the probability of leaving the profession (top) and moving school (bottom) between part-time and full-time teachers from our regression model, after controlling for other individual, school and geographical characteristics. We have estimated the effect of part-time employment separately by gender because, as we have seen, there are big differences between male and female take-up of part-time employment. The reference category for each comparison is with full-time teachers of the same gender.

Figure 11 Part-time teachers are more likely to leave the profession than full-time teachers



This shows that part-time teachers are more likely to leave the profession than full-time teachers in both primary and secondary schools. The effect is particularly pronounced for men, which perhaps indicates that specific events or responsibilities may be pushing men into part-time employment and out of the teaching profession. Differences in the probability of moving school between part-time and full-time teachers are much smaller than the differences in the probability of leaving the profession after accounting for other characteristics, such as age.

The difference in the leaving rates between part-time and full-time teachers is greater in secondary schools. This may be indicative of primary schools seeming to be better able to accommodate part-time working in their timetabling than secondary schools. Part-time teachers in secondary schools may find it more difficult to sustain the demands of part-time working alongside their other responsibilities.

Secondary schools are facing a particular teacher supply challenge over the next decade because of the projected increase in pupil numbers. The secondary school teacher stock also has a large cohort of teachers approaching their mid-thirties, which is when part-time employment tends to peak, and an increasing proportion of female teachers. Policy makers and stakeholders in the secondary school sector therefore need to urgently identify ways to help secondary schools to overcome a dual challenge: accommodating more part-time teaching and improving the retention rates of teachers who are employed part-time. The former may incentivise former teachers who left the profession to have families to return to work part-time and the latter will ensure that any success at accommodating more part-time working is not short-lived. Identifying solutions is likely to help secondary schools to deal with existing and future teacher supply challenges.

The complexity of secondary school timetabling is often cited as a reason why part-time teaching is more difficult to accommodate in secondary schools than in primary. Further research identifying secondary schools that have successfully found solutions to accommodate part-time working, including overcoming the barriers presented by timetabling, and identifying best-practice, would provide a valuable resource for schools.

3 The school perspective

In this section, we examine the extent to which school-level factors affect a teacher's probability of leaving the profession or moving school.

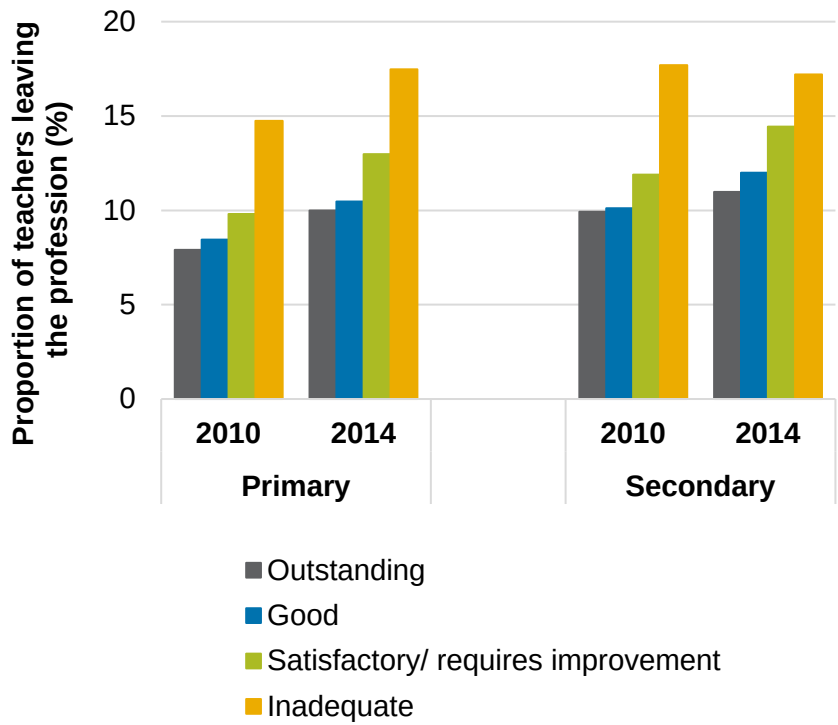
The most important school-level factors that are associated with leaving the profession and moving school are the school's Ofsted rating and school type. We investigate the relationship between a school's current Ofsted rating and the probability of leaving the profession and moving school. We also investigate the association between changes in Ofsted rating and the probability of leaving the profession and moving school, to assess whether there are differences between schools that have been upgraded, downgraded or have maintained their rating. We also explore school type as an explanation for differences in teacher retention and mobility, including the role played by multi-academy trusts.

Both Ofsted rating and school type are statistically significant predictors of the probability of leaving the profession and moving school, but in general school-level factors contribute a much smaller fraction of the overall variation explained by the model than teacher-level characteristics.

3.1 Ofsted ratings

Figure 12 shows the percentage of teachers leaving the profession in 2010 and 2014 by the school's Ofsted rating and by phase. This shows the lower the Ofsted rating, the higher the proportion of teachers leaving the profession. The rate of leaving the profession is highest in schools rated as being Inadequate by Ofsted. The leaving rate has increased between 2010 and 2014 for all Ofsted ratings, except for seondary schools rated as being Inadequate.

Figure 12 The lower the Ofsted rating, the higher the probability of leaving the profession



The Ofsted inspection framework was revised in 2012 and the Satisfactory rating was changed to Requires Improvement (RI). This shift in definition could explain why the retention rate for third-category schools became closer to that of Inadequate schools and less like that of Good schools between 2010 and 2014. The number of schools rated as being RI fell after 2012, while the number of schools rated as being Good rose. That suggests that the

composition of third-category schools has changed: the 'better' schools that were previously rated as being Satisfactory became Good, and the 'worse' schools that were previously rated as being Satisfactory became RI. This may explain why the leaving rate for schools rated as being Satisfactory / Requires Improvement has risen considerably for primary and secondary schools between 2010 and 2014.

Figure 13 The lower the Ofsted rating, the higher the probability of moving school

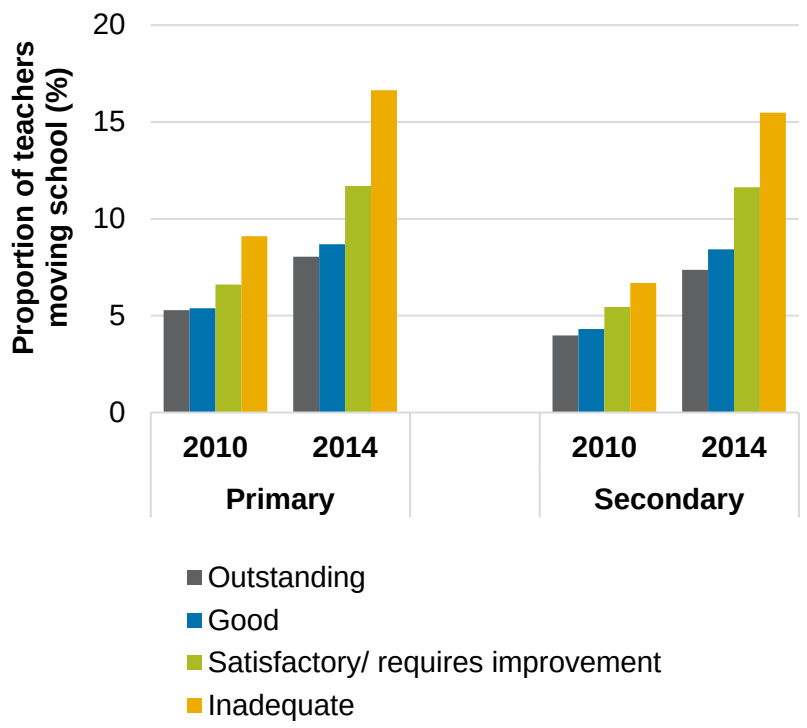
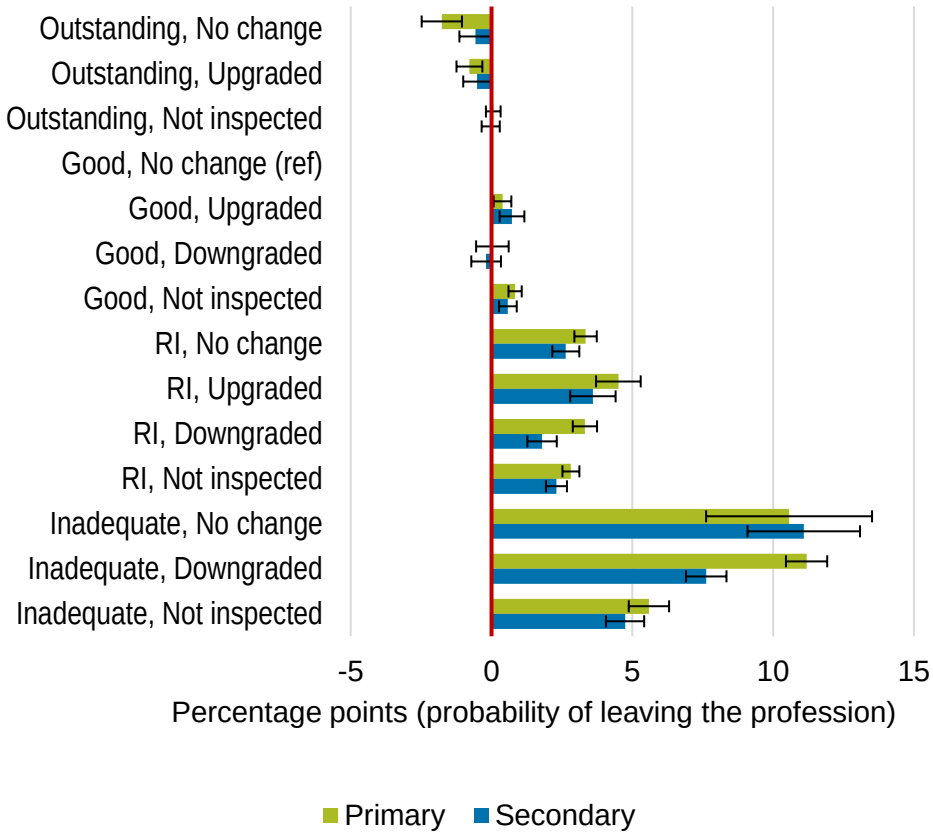


Figure 13 reports equivalent results for the probability of moving school. Again, lower Ofsted ratings are associated with higher proportions of teachers moving to different schools at both primary and secondary level, with a particularly high rate for schools rated Inadequate by Ofsted. Taken together, these patterns show that inadequate schools have much higher rates of staff turnover than other schools.

We have also examined what impact a change in Ofsted rating has on teacher turnover in the following year. Our analysis shows that schools that are downgraded have the highest proportion of teachers both leaving the profession and moving school.

In our regression models that predict the probability of leaving the profession and moving school, we include interactions between the current Ofsted rating and how that rating differs to the previous inspection rating. In addition to the three 'upgraded', 'downgraded' and 'no change' categories, we also include a group for all schools that have not been inspected in the previous year. Figure 14 shows the model estimates for the effect of each combination of Ofsted rating and how it has changed, on the probability of teachers leaving the profession.

Figure 14 Teachers in schools rated as being Inadequate by Ofsted are the most likely to leave the profession



Consistent with the descriptive statistics, the group with the next highest probability of leaving are teachers in schools rated as Requires Improvement (RI). Teachers working in RI schools that have been upgraded from Inadequate are slightly more likely to leave the profession than teachers working in the rest of RI schools. However, the confidence intervals are close to overlapping, which suggests most of these differences could be due to chance. There are no important differences in the leaving rate between Good and Outstanding schools.

Overall, changes in Ofsted rating with respect to the previous inspection rating seem to play a relatively marginal role when compared to the effect of the Ofsted rating itself. However, being rated as Inadequate (whether downgraded or re-graded) does seem to have a greater negative association with retention in the short-term compared to having previously been rated Inadequate and not recently inspected. This suggests that there is an immediate impact of being downgraded to Inadequate on the probability of a teacher leaving the profession. These results are consistent with research by Sims (2016), who finds that the immediate impact of being downgraded to Inadequate is a 3.4 percentage point increase in a school's teacher turnover, while there is no change for schools upgraded to Outstanding.

Figure 15 shows the relationship between Ofsted rating and the probability of moving school. The situation is similar to the relationship between Ofsted rating and the probability of teachers leaving the profession with the higher rates of moving school being in lower-rated schools. In the primary sector, schools that have been downgraded to, and re-graded as, Inadequate have the highest moving rates compared to Good schools. For the secondary sector, schools that have been re-graded as Inadequate (i.e. not changed following re-inspection) have the highest leaving rate compared to Good schools, and schools downgraded to Inadequate have the second-highest.

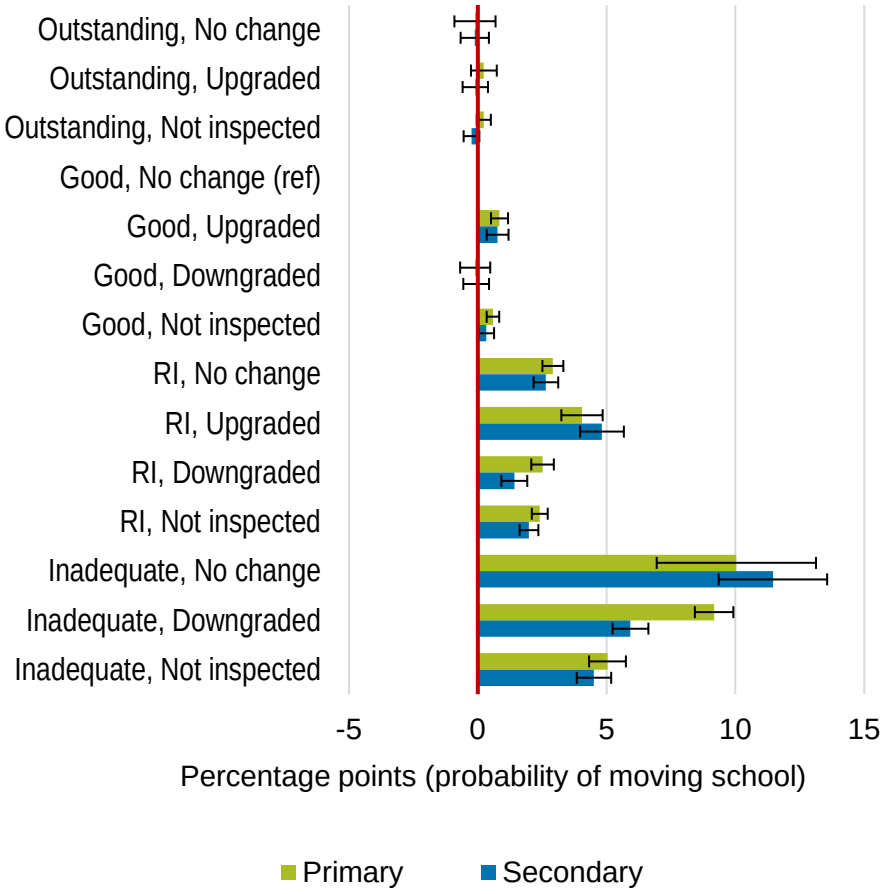
Among RI schools, the proportion of teachers moving school is higher for those that have been upgraded compared to those that have been downgraded, or seen no change. This might seem counterintuitive as

an upgrade should be seen as a positive outcome compared to a downgrade. However, this could be a lagged effect of having previously been rated Inadequate, which suggests the association between being rated Inadequate and staff turnover is complex, and one that extends beyond the immediate effect of being downgraded.

Our regression model is not able to determine whether the choice of moving is taken by the teacher or by the school. It is likely that the mobility associated with different Ofsted ratings is driven by different factors. For instance, the high mobility among teachers in inadequate schools could be teacher-driven or motivated by the school, or a combination of both. Dissatisfied teachers may wish to move to better-performing schools, while leaders of schools that are rated Inadequate will be under pressure to replace poorly performing teachers. In the case of Inadequate schools that have been upgraded to RI, the higher mobility might be a consequence of the fact that teachers with experience of delivering school improvement have an advantage in the market compared to teachers working in schools that were Good and have been downgraded to RI. We plan to look in greater detail at the relationship between Ofsted ratings and teacher dynamics later in this research project.

Ofsted ratings explain around three per cent of the variation explained by the model predicting the probability of leaving the profession, and considerably more of the explained variation in the probability of moving school (around 9 per cent for primary teachers and slightly less than seven per cent for secondary teachers). Ofsted rating is the most important school-level factor for explaining variation in moving school and also contributes to explaining differences in the probability of teachers leaving the profession.

Figure 15 Teachers in schools rated as being Inadequate by Ofsted are also the most likely to move school



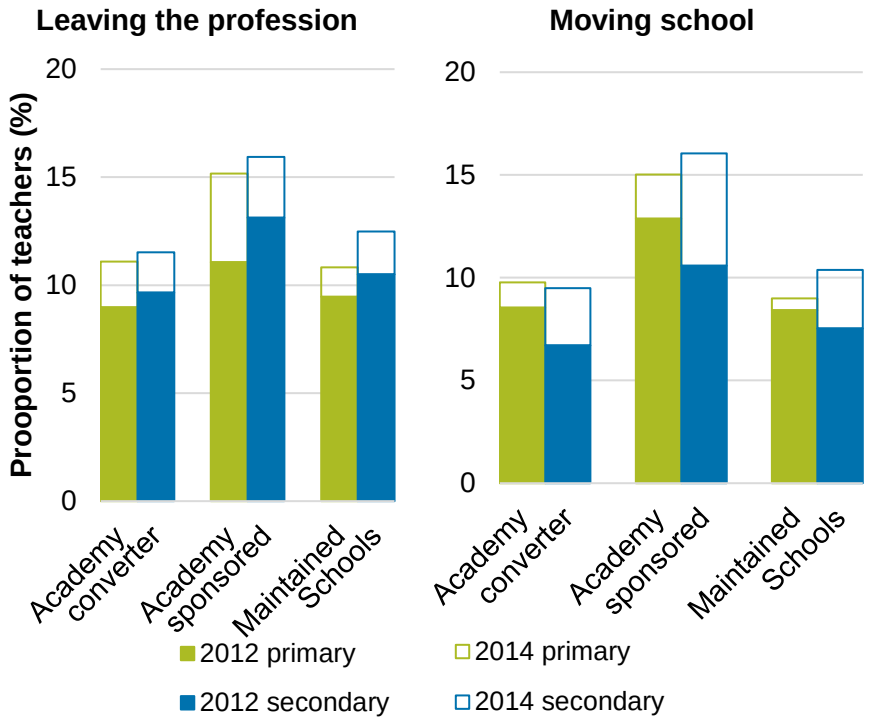
3.2 Academy status and multi-academy trusts

The number of teachers working in academies has increased between 2010 and 2015 alongside the growth in the number of academy schools. In 2015, two-thirds of secondary schools were academies while the proportion was still relatively low at about one in five at primary level. The most common type of academies in both phases are converter academies.

Figure 16 indicates that teachers working in sponsored academies are the most likely to leave the profession, while teachers working in maintained schools and converter academies have very similar rates of leaving the profession. The same applies to the proportion of teachers moving school. However, the differences are unlikely to be due primarily to how academy status affects schools' staffing policies, and more to do with the context of these schools as previously underperforming schools with other characteristics associated with higher staff turnover (such as lower Ofsted ratings, school performance and having a more disadvantaged pupil intake[10]).

Our regression models confirm that teachers in secondary sponsored academies have a higher probability of leaving the profession and moving school, after accounting for individual and other school characteristics. However, the difference between sponsored academies and other schools is smaller than the raw difference because these other factors explain a lot of the variation. Figure 17 shows that the difference in the probability of leaving the profession between secondary sponsored academies and converter academies from the regression model is between one and two percentage points.

Figure 16 Teachers working in sponsored academies have the highest probability of both leaving the profession and moving school



We further distinguish in our analysis between academies that exist as a single-academy trust (SAT) and those that belong to a multi-academy trust (MAT), and between MATs with different numbers of

[10] A school's disadvantaged intake is measured using the quintile of the proportion of pupils eligible for free school meals.

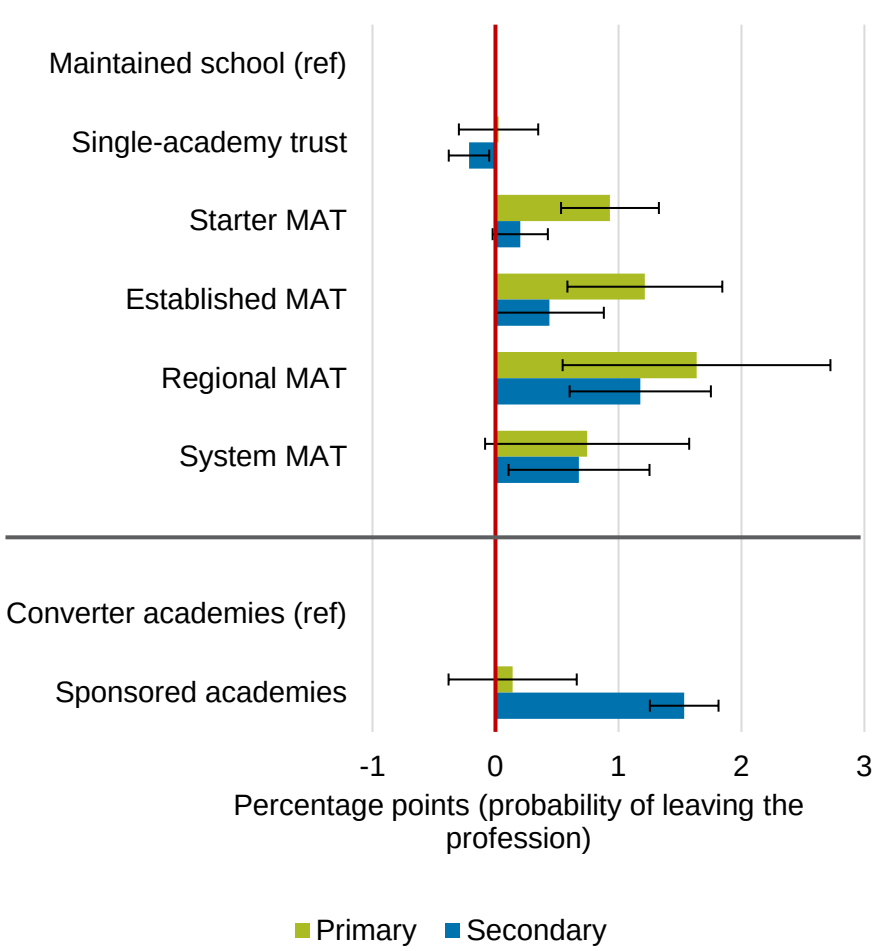
schools in them, using the National Schools Commissioner's four-tier system for classifying MATs according to their size[11].

Raw comparisons of leaving rates show that MATs tend to have a higher than average rate of teachers both leaving the profession and moving school when compared to SATs and LA maintained schools. However, MATs of all sizes, and particularly the largest MATs, are disproportionately comprised of sponsored academies.

Figure 17 shows the separate associations between MATs of different sizes and sponsored academy status and the probabilities of a teacher leaving the profession. The results suggest that MATs of all sizes have slightly higher rates of teachers leaving the profession compared to both SATs and LA maintained schools, after accounting for other factors such as the type of academy and Ofsted rating. However, some of these differences are uncertain due to wide confidence intervals. Primary schools in Starter, Established and Regional MATs have slightly higher leaving rates than SATs and maintained schools, which are statistically significant. Secondary schools in Regional and System MATs have slightly higher leaving rates that are statistically significant.

One possible explanation of slightly higher rates of teachers leaving the profession in MATs is that staff movements from a school-based role to a role in a central team are not captured by the SWC, as only school data is collected, and would therefore count as leaving the profession. However, with little information about the extent of staff flows from school- to central-based roles within MATs it is impossible to know how much of the difference this might explain.

Figure 17 Secondary schools in larger MATs have slightly higher rates of leaving the profession



[11] Starter trusts: MATs with between one and five academies (MATs with one school are treated separately from schools in single-academy trusts, because they have a distinct legal structure). Established trusts: MATs with between six and 15 academies. Regional trusts: MATs with between 16 and 30 academies. System trusts: MATs with over 30 academies.

The left-hand side of Figure 18 shows the relationships between maintained schools, SATs and MATs of different sizes and the probability of moving school. Again, this accounts for the different association between moving school and sponsored / converter academies. It suggests that MATs have a higher proportion of teachers moving school compared to SATs and non-academies.

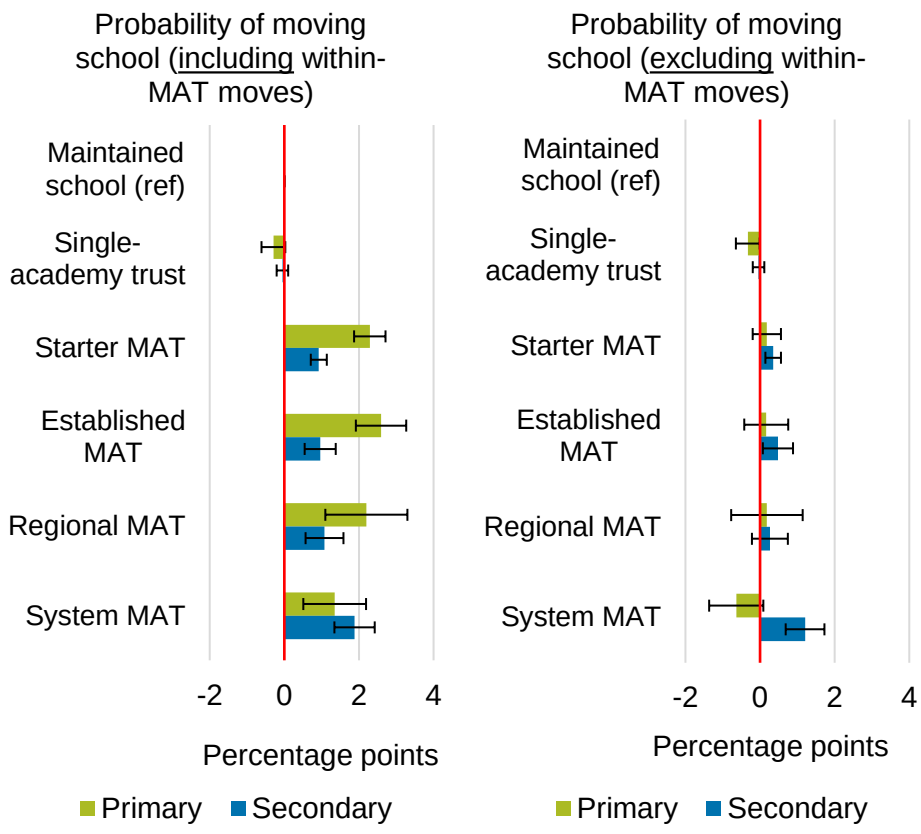
The right-hand side of Figure 18 shows the same relationships, but *excluding* teachers who move from one school in a MAT to another school in the same MAT. Our previous research found considerable movement between schools that are within the same MAT (see text box below). Figure 18 demonstrates that this within-MAT movement explains all of the difference in moving rates between most MATs and other schools, after accounting for other characteristics.

Teacher movement within multi-academy trusts

Our previous research (Worth, 2017) found that around one per cent of teaching staff who work in a school that is part of a MAT, move to another school within the same MAT each year. The largest MATs have more teachers and senior leaders moving to other schools within the same MAT, particularly in MATs with schools that are geographically clustered closely together. Senior leaders are also more likely to move within MATs than classroom teachers. This staff movement within MATs also tends to be towards higher-FSM schools, whereas in general teachers tend to move away from such schools (Allen *et al.*, 2012).

As the legal employers of all staff in their schools, MAT leaders have the opportunity to redeploy teachers and senior leaders to where they are most needed in their academy trust. The research shows that MAT leaders are making use of these opportunities by encouraging teachers to move within the MAT.

Figure 18 Schools in larger MATs have slightly higher moving rates but the difference disappears if we exclude within-MAT movements



These findings show very little evidence that schools in MATs have higher churn rates after excluding within-MAT movements. The only exception is secondary schools in system MATs, which do have a slightly higher rate of teachers moving to schools outside the MAT. These trusts may have different approaches to staff management

that may be leading to increased rates of teacher turnover. For example, they may have stronger models of performance management and school improvement and act quickly to remove teachers that they identify as underperforming.

The findings also suggest little evidence to date that giving teachers the opportunity to move within a MAT has increased the ability of MATs to retain staff within their trust. Former Education Secretary Nicky Morgan suggested that a model of flexible staff deployment would “give a clear path to career progression that will keep [teachers and leaders] engaged rather than looking for opportunities elsewhere” (Morgan, 2016). Taken together, Figures 17 and 18 suggest that MATs in fact have a slightly higher rate of teachers leaving the profession, and similar rates of teachers moving outside the MAT when compared to other schools, after accounting for differences in their characteristics. However, our analysis only covers staff movement over the period 2010-11 to 2014-15, a period during which MATs were growing and establishing. It will be important for research to continue monitoring whether the MAT model can deliver better teacher retention than other school structures over the longer-term.

Nonetheless, to help improve retention, MAT leaders should consider whether they can do more to promote to teachers the wider benefits of working in their trust. If teachers feel a greater connection to their schools rather than to their MAT, they might be less willing to consider managed career development moves within it. Raising the profile of the MAT among teachers and promoting career paths for teaching staff to develop and progress within the organisation might help to improve teacher retention in the MAT.

4 The geographical perspective

In September 2016, the Department for Education published a local analysis of the teacher workforce, summarising measures of teacher recruitment and retention by English region (DfE, 2016a). London stood out from the analysis as being different to the other regions, having higher than average rates of: teachers leaving the profession, proportions of unqualified teachers and proportion of schools with vacancies or temporary staff. However, the analysis was unable to establish whether this was unique to London, or whether these patterns were replicated in large cities across the country. This is because, in the Department for Education analysis, large English cities such as Manchester and Birmingham are contained within large regions, which contain cities, towns and rural areas.

Our analysis addresses this question directly by considering differences in retention rates by travel-to-work areas (TTWAs). We also explore the extent of flows between TTWAs to see how teacher movement affects different areas and how it changes the composition of teachers in those areas. TTWAs are geographical areas developed by the Office for National Statistics (ONS) using census data, which constitute areas where most people both live and work (ONS, 2016). They can therefore be seen as relatively self-contained labour market areas and useful for comparing London with large cities. We categorise TTWAs into five area types for our analysis, which are summarised in Table 1.

Table 1 Definition of travel-to-work area groups

TTWA group	Definition	Example TTWAs
London	London TTWA	London
Large urban areas	Working population: >300,000 (excl. London)	Manchester, Birmingham, Slough and Heathrow, Reading
Medium sized areas	Working population: 150,000-300,000	Coventry, Oxford, Southend, Crewe, Tunbridge Wells
Small, non-coastal areas	Working population: <150,000 and not coastal	Doncaster, Mansfield, Gloucester, Buxton, Hexham
Small, coastal areas	Working population: <150,000 and is coastal	Blackpool, Eastbourne, Chichester, Bridport, Whitby

Figure 19 shows the proportion of teachers leaving the profession in the five different categories and confirms that the leaving rate in London is considerably higher than the overall average over the period between 2010 and 2014 of around ten per cent. The data also shows that this is not the case in other large cities, which have teacher leaving rates slightly below the national average. This suggests there is something unique about London that makes the teacher supply challenge particularly acute. This may be due to there being more and better alternative opportunities and careers available to people with degrees living in the capital compared to larger cities, or may be linked to higher housing costs.

Figure 19 London has a particularly high rate of teachers leaving the profession

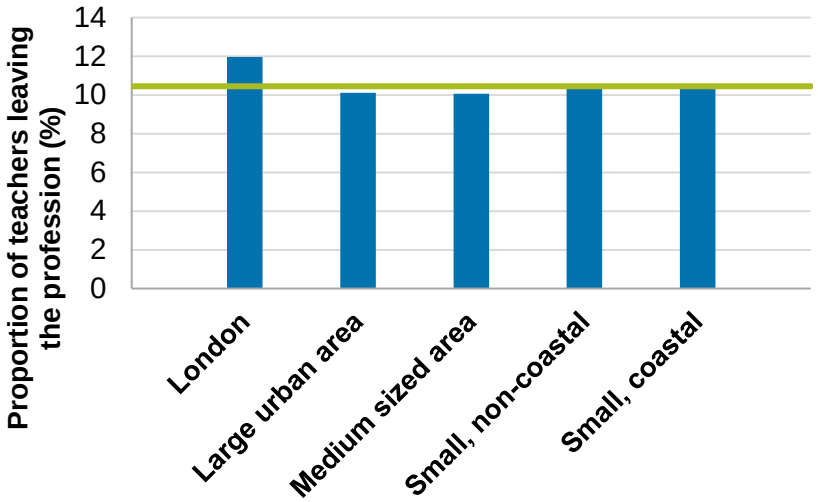
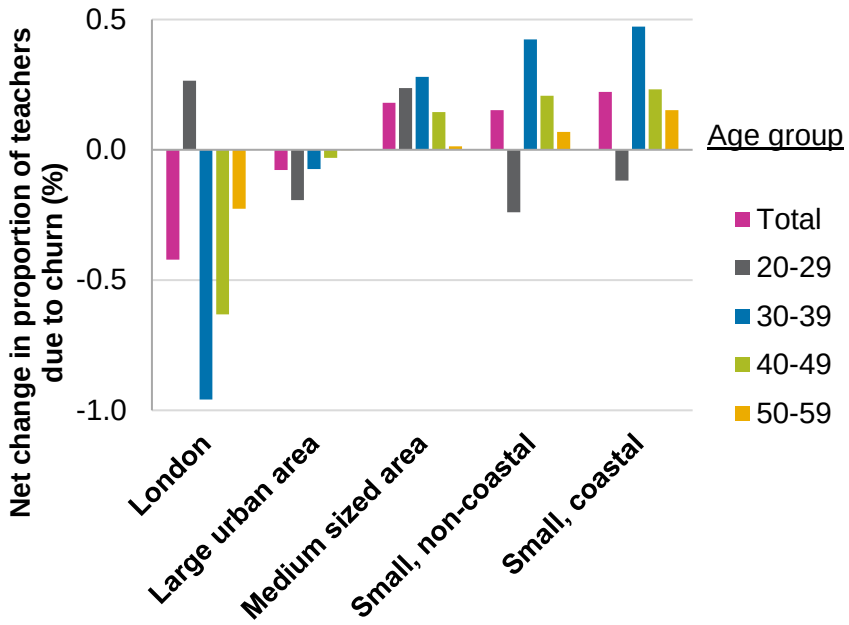


Figure 20 shows the net change in the proportion of teachers in an area due to teachers moving school. It measures the difference between the proportion of teachers who move school and enter the TTWA, and the proportion of teachers who move school and leave the area. The pink bars show the overall rates and the other bars show the net change for different age groups.

Overall, London loses 0.4 per cent of its workforce each year from teachers moving to other schools, after accounting for teachers moving to a school in London. Again, this is not the case in other large cities, where the net movement is more balanced. Small and medium-sized areas are the biggest destinations, each gaining around 0.2 per cent of teachers per year. These net changes are relatively modest, and do not capture other types of geographical movement, such as teachers leaving one area and returning after a break to a school in another area.

Figure 20 Teachers in their 30s and 40s tend to move out of London



The age breakdown shows considerable variation around the average. London schools lose one per cent of teachers in their 30s each year and 0.6 per cent of teachers in their 40s, while having a small net gain of teachers in their twenties.

These findings support the claim made by Lucy Heller, Chief Executive of London-based ARK Schools, in evidence to the Greater London Authority (London Assembly, 2016). She noted that:

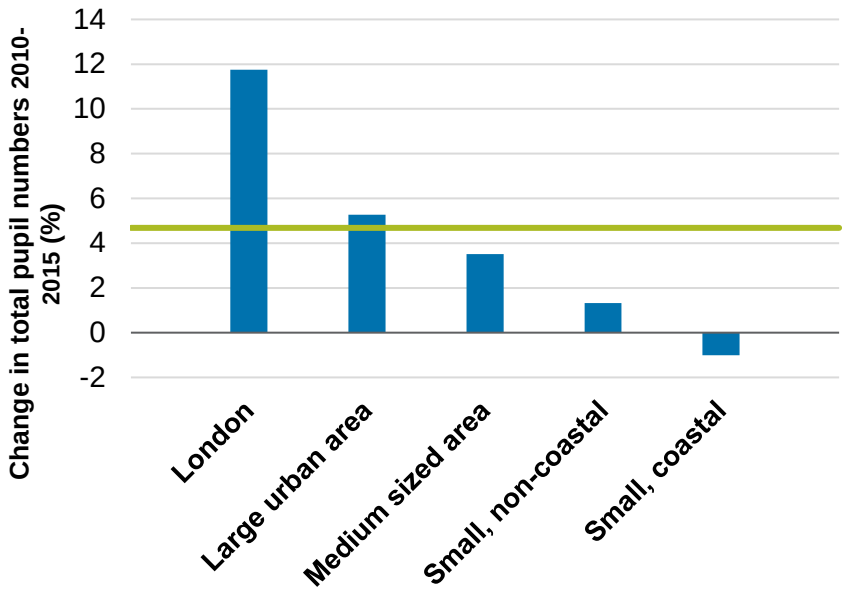
> *ARK are getting the young teachers who are prepared to come and live like sardines in flat shares and tiny spaces. We can keep those, and they come drawn by the magnet that is London. Our problem is retention.*

Heller explicitly linked this phenomenon to 'the larger problem about London housing', which is likely to be an important reason why the effect is London-specific, rather than more widespread across large cities.

This movement of teachers may represent more than just a reduction in the number of teachers in London. A disproportionate shift of mid-career teachers out of London schools may also put particular pressure on the senior leadership pipeline in London.

The high rates of London teachers leaving the profession and leaving for schools in other areas are despite London having seen the largest increase in teacher demand in recent years. Figure 21 shows that the greatest increase in pupil numbers between 2010 and 2015 has been in London, while small, isolated areas saw very little growth. Small coastal areas have actually experienced a small decrease in overall pupil numbers. Forecasts published by the Department for Education show that the secondary school population in London is expected to grow by 23 per cent between 2016 and 2023, compared to 18 per cent in the rest of England (Education Funding Agency and Education and Skills Foundation, 2017).

Figure 21 London has seen the fastest growth in pupil numbers



This analysis suggests a paradox: the proportion of teachers leaving has been highest in an area that has the greatest need for additional teachers. Geographical teacher dynamics open up additional supply gaps in London that need filling each year, but may also be helping to close supply gaps in more isolated areas. Analysis by the National Audit Office found that the number of trainees per 100,000 pupils was higher than average in London, suggesting at least one route by which London fills such gaps (NAO, 2016).

Further research exploring the geographical flows of trainees into the teacher workforce, and how teachers move during their careers, would help us to understand the detailed dynamic picture within different areas. It would also aid the development of policy solutions that are most relevant for particular areas, such as London. Analysis at more detailed geographical levels, such as individual TTWAs, may also reveal diversity within the TTWA groups that we have identified: the flow of teachers out of London and around the school system may have quite different effects in, for example, Eastbourne than in Blackpool.

Our analysis shows the teacher labour market is a dynamic system in which small, isolated areas, which may have fewer interactions with teacher training providers, tend to benefit from teacher flows out of London. Therefore, any local policy solutions would also need to consider the knock-on effects they might have on other areas. For example, any policy interventions aimed at improving teacher retention in London schools may have negative implications for the supply of teachers to smaller, more isolated, areas through labour market dynamics. Those supply gaps may then need to be filled in other ways.

5 Modelling considerations

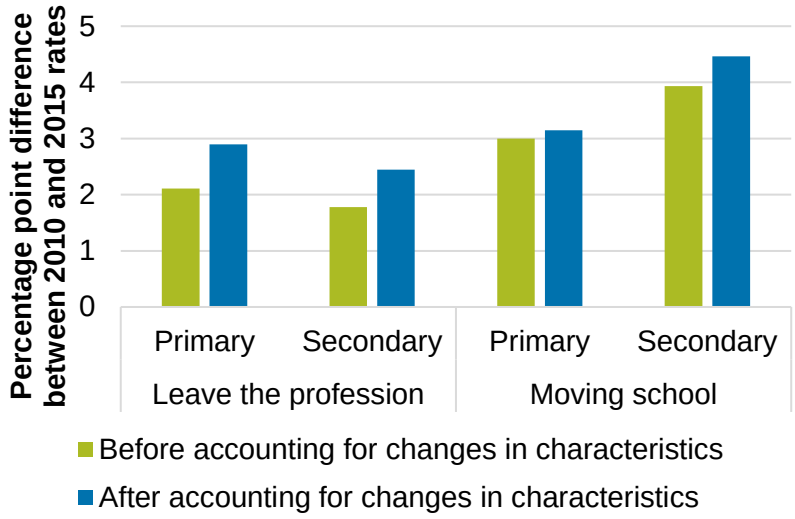
This section explores two questions that emerge from our analysis, which we hope to address with further analysis in this project.

5.1 Changes over time

Figure 2 in the Introduction section shows that the rate of teachers leaving the profession, and particularly the rate of teachers moving school, have increased over time. Some of this may be due to changes in the composition of teacher or school characteristics if the prevalence of a characteristic associated with higher leaving or moving rates increases over time. For example, teachers aged over 50 tend to have higher rates of leaving the profession and moving school: if the proportion of the workforce that is over 50 has changed, that could help to explain the change over time. Our regression model takes account of changes in the composition of teacher and school characteristics over time, and estimates the change in the rates of leaving the profession and moving school over time that are not explained by those changes.

Figure 22 shows the extent to which the rates of teachers leaving the profession and moving school have changed between 2010 and 2015. The green bars show the difference *without* taking account of any changes in characteristics: i.e. the overall rate of primary teachers leaving the profession has risen by two percentage points, from nine per cent to 11 per cent. The blue bars show the 2010-2015 difference estimated from our regression models, *after* taking account of changes in the distribution of teacher and school characteristics.

Figure 22 Changes in teacher and school characteristics do not explain why leaving and churn rates have risen over time



If the teacher and school factors that we included in our models help to explain why the leaving and churn rates have risen over time, then we would have expected the 'year effects' estimated by the regression model, i.e. after accounting for changes in characteristics, to be closer to zero. However, the findings from our regression model suggest that changes in the composition of teacher or school characteristics do not explain rising leaving and churn rates over time. In fact, the leaving and churn rates have risen by *more* than the changes in teacher and school characteristics would predict.

This analysis therefore suggests that there has been a substantial increase in the leaving and churn rate of teachers between 2010 and 2015 that is *not* explained by changes in the composition of the workforce and schools. Instead, other changes over time that are not

measured in our data are likely to be driving the increase in the rate of teachers leaving the profession and moving school.

Recent research has highlighted teacher workload, government policy, and lack of support from leadership as three main reasons for leaving the profession (Lynch *et al*., 2016; DfE, 2017d). Workload for teachers and senior leaders may have increased since 2010 due to the implementation of the revised 2014 National Curriculum, and other policy changes. Higher rates of teachers moving school could reflect schools competing more intensely for staff.

5.2 The wider perspective

One important finding from our regression models comes from the amount of variation that the regression model is *not* able to explain (see Appendix B for more details). Despite identifying some teacher, school and geographical factors that are important in determining the probability that a teacher leaves the profession or moves school, neither model is highly predictive. Our regression model of teachers leaving the profession is able to explain 12 per cent of the overall variance, whereas our model of teachers moving school is only able to explain 2-3 per cent of the overall variance.

This means that even with the wealth of data available in administrative datasets about a teacher and about the school they work in, we are not able to predict with a great degree of certainty whether that teacher will leave the profession or move to a different school in the following year. The amount of variation the regression model can predict increases when we instead model the probability of whether the teacher will leave the profession or move to a different school in the following five years. However, even these models do not generate a substantially higher degree of certainty, and are also of less relevance for determining policy solutions that will be effective in the short- to medium-term.

This finding indicates that the biggest drivers of teachers' decisions to leave the profession or move school are personal circumstances and choices that we cannot measure, at least using administrative data. They are likely to include job satisfaction (which previous NFER research has shown is an important explanatory factor), working conditions, relationships with colleagues, alternative career opportunities, and the cost of living and commuting (Lynch *et al., 2016)*. Family circumstances are also likely to have an important bearing, such as a teacher's partner's employment, family financial situation, important life events and responsibilities, such as caring for children or relatives.

Understanding this richer perspective on teachers' decisions to leave the profession or move school is important for developing effective policy solutions. We plan to explore the importance of these richer contextual factors through analysis of teachers in the Understanding Society survey. Understanding Society is the largest longitudinal household survey in the UK, containing information on participants' family situation and job satisfaction. The data will enable an analysis of how these factors influence teachers' decisions to leave the profession and how they change after having left teaching.

6 Conclusions and recommendations

6.1 Conclusions

Teacher-related factors

Age and experience

Individual characteristics are most important in our analysis for predicting whether a teacher will leave the profession or move school, of which age and experience particularly stand out. We find:

- Between 2010 and 2015, there has been a large reduction in the proportion of teachers who are aged between 51 and 59. Our research finds that this decrease is due to a combination of both a larger than average cohort and a higher rate of older teachers leaving over the period.
- The leaving rate in the number of teachers older than 50 is disproportionately driven by reductions in teachers of non-EBacc subjects in this age band. This may be because schools are incentivising older teachers of these subjects to retire early, or teachers may be frustrated at their subject receiving less priority.
- Age is more important for predicting the chance of leaving the profession for older teachers whereas the number of years of experience appears to drive the high leaving rate among younger teachers.
- The level of experience seems to be more important than age for explaining churn for all but the oldest teachers. Churn rates for inexperienced teachers are particularly high, which could be driven by a desire to seek better working conditions, or to gain more experience in a different school setting, whereas older teachers may have more family / other ties which make it more difficult to move.

Subject taught

The proportion of teachers leaving the profession and moving school has increased for all subject groups between 2010 and 2015, but by different amounts. After accounting for individual, school and geographical characteristics, we find that:

- MFL and science teachers are the most likely to leave the profession while humanities teachers are the least likely to leave. The number of teacher trainees for both MFL and science have been below the Government's target for four years, which may have constrained schools' ability to offer more teaching in these subjects.
- Teachers of non-EBacc subjects are the least likely to move school, while English, maths and science teachers are the most likely to move school. The limited mobility of non-EBacc teachers may be due to there being fewer available opportunities due to schools' reducing curriculum time dedicated to these subjects.

Part-time employment

There is a considerably higher proportion of part-time teachers in the primary sector compared to secondary schools. This gap persists when comparing teachers by age, gender and the number and age of children, which suggests that primary schools seem to be better able to accommodate part-time employment than secondary schools.

After controlling for other individual, school and geographical characteristics, we find:

- Part-time teachers are more likely to leave the profession compared to their full-time colleagues, both in the primary and secondary sector. This is particularly the case for males, which perhaps indicates that specific circumstances may be pushing them into part-time employment and out of the teaching profession.
- Differences in the probability of moving school between part-time and full-time teachers are much smaller than the differences in the probability of leaving the profession after accounting for other characteristics.

School-related factors

Ofsted ratings

Our analysis shows:

- The lower the Ofsted rating, the higher the proportion of teachers both leaving the profession and moving school, particularly for schools rated as being Inadequate by Ofsted. Taken together, this means that inadequate schools have much higher rates of staff turnover than other schools.
- Within the Inadequate category, schools with this rating in two consecutive periods are particularly associated with high rates of teachers moving school. Conversely, schools which are upgraded from Inadequate to RI are also associated with higher staff turnover than other RI schools.

Academy status

Our analysis shows:

- Teachers in sponsored academies have a much higher probability of leaving the profession and moving school, but after accounting for individual and other school characteristics, the gap narrows considerably.
- MATs have a slightly higher rate of teachers leaving the profession compared to single-academy trusts and maintained schools, after accounting for the fact that MATs are disproportionately comprised of sponsored academies. This may be due to different staff management practices in MATs, but could also be due to the way that staff movements from a school to the MAT central team are recorded. In addition, MATs also have higher than average rates of teachers moving school, although when we exclude staff movements within MATs, this difference mostly disappears. There appears to be little evidence to date that MATs are better able to retain their teachers by giving them opportunities to move within their organisation, as previously proposed by the Government.

Geographic factors

Our analysis suggests there is something unique about London that makes the teacher supply challenge particularly acute. London has considerably more teachers leaving the profession compared to other areas, including other large cities. It also suffers from far greater churn of teachers moving to schools outside of London, particularly experienced teachers in their thirties and forties. Small and medium-sized areas are the biggest destinations.

Wider factors

Our regression model using administrative data explains relatively little of the variation in the probability of teachers leaving the profession and moving school. The influence of wider factors such as job satisfaction, working conditions, the cost of living and commuting, and family circumstances are likely to be having an important influence on teachers' decision-making. The composition of the teacher workforce and the school landscape is also unable to explain why leaving and churn have increased between 2010 and 2015, suggesting that deeper trends are affecting labour market behaviour.

6.2 Recommendations

- The Government should investigate why the rate of leaving among older teachers has been increasing and explore whether they could be incentivised to stay in the profession longer, particularly in subjects with specialist teacher shortages.
- The Government should give greater attention to the impact of teachers moving around the profession and develop policies to support schools which are disproportionately affected.
- Bursary payments, or other financial incentives such as student loan repayments, should be structured to explicitly incentivise retention in the teaching profession during the first few years after training.
- The Government and stakeholders in the secondary sector need to look urgently at identifying ways that accommodate more and better part-time working in secondary schools.
- Further research with secondary schools which successfully offer greater flexibility in working patterns should be undertaken and best practice shared.
- To help improve retention, leaders of MATs should do more to promote the benefits of working in their organisation to their teachers; for example, by raising the profile of the MAT as the structure that teachers belong to, and through promoting career paths for teachers to develop and progress within the MAT.
- Policy makers should look at how policy interventions, such as housing subsidies, could help to retain teachers in high-cost areas.
- Further research exploring the geographical flows of trainees into the teacher workforce / during their careers would help to gain an understanding of the detailed dynamic picture within and across different areas and aid the development of policy solutions.

7 Next steps for this research

Teacher labour market behaviour

In the second stage of the project we will undertake new statistical analysis using data from the Understanding Society survey to understand the external and personal factors that are associated with teacher labour market behaviour. We will examine to what extent measures of personal and family circumstances, job satisfaction and life events can enhance our understanding of the factors associated with leaving the teaching profession. We will also examine teacher journeys in and out of the profession, using the rich set of employment variables to describe the destinations of leavers. Our analysis will also explore the short- and medium-term impact of leaving teaching on outcomes such as pay, working hours and job satisfaction.

Comparisons between teaching and other professions

In the third stage of the project, we will analyse Labour Force Survey and Understanding Society data, and conduct stakeholder interviews, to draw comparisons between teaching and other public sector professions, particularly nursing and policing. This analysis will provide a useful context for the findings from our analysis of teachers. In-depth qualitative interviews with influential stakeholders across the different sectors will explore what policy solutions have been employed in other professions and what the education sector could learn from their experiences.

Future dissemination

We will disseminate our findings from the second and third stages through further research updates in autumn 2017 and a final report will be published in early 2018.

Find out more about this project and sign up to receive reports when they are available at: www.nfer.ac.uk/research/teaching-workforce-dynamics/

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Appendix A Regression Methodology

This appendix describes in detail the regression models we have estimated to predict the probability of teachers leaving the profession and moving school and the variables included in the models. Both models have dichotomous ("yes/no") variables as a dependent variable, so all of our regression analysis has been estimated using logistic regression models.

Hereafter we report an exhaustive list of the variables included in the baseline model we have reported on and how each has been computed.

Year: In all regressions we have included a categorical variable that captures year-fixed effects. The reference year is 2010 and hence the coefficient associated with a given year measures the variation in the proportion of teachers leaving the profession/ moving school with respect to 2010.

Teacher characteristics

Gender: Dummy variable that takes value 1 if the teacher is a man and 0 otherwise. This variable appears in the model on its own as well as interacted with other variables. We will specify when a variable is interacted with gender in what follows.

Number of years of experience: This variable details the number of years since the first appearance of an individual as a teacher in the state sector. This is a proxy measure for the number of years spent in the teaching profession. Indeed, teachers that started their careers in the private sector will have a value that is lower than the actual figure because our variable counts the years starting from the first appearance in the state sector. On the other hand, in the case of returners (i.e. individuals that leave and then return to teach in the state sector) we are not able to account for the interruption. Hence, these individuals will have a number of years of experience that is higher than the actual figure. This may introduce some bias into our estimates, but we are confident that the approximation is not introducing large biases into our estimates. The potential bias is further mitigated by the fact that we group the number of years of experience into categories defined as follows: less than 1 year of experience, 1 year of experience, 2 years of experience, 3 years of experience, 4 to 5 years of experience, 6 to 10 years of experience (used as a reference group), 11 to 15 years of experience, 16 to 20 years of experience, 21 to 30 years of experience, more than 30 years of experience. Note that we are using a finer classification for teachers that recently entered the profession because we expect more differences in leaving and moving rates at the beginning of teaching careers. Despite being included in the regression, in the report we do not present the coefficients estimated for teachers with more than 30 years of experience due to the small sample size.

Age: The age of teachers is included in the regressions as a categorical variable that classifies teachers in the following age bands: Under 20, 20 to 24, 25 to 29, 30 to 34, 35 to 39 (reference category), 40 to 44, 45 to 49, 50 to 54, 55 to 59 and Over 60. Despite being included in the regressions, in the report we did not include the coefficients for teachers' age less than 20 due to the reduced sample size. In our analysis we include unqualified teachers, which is why we have some particularly young individuals in the sample. Finally, we exclude teachers' age over the normal retirement age of 60 from our retention analysis.

Qualified teacher status: This is a dummy variable that takes value 1 if the teacher is a qualified teacher and 0 otherwise.

Part-time: In all models we include a dummy variable that records whether a teacher is working full-time or part-time. To distinguish between part-time and full-time teachers we use the definition adopted by the SWC that identifies a teacher as full-time if she works more than 32.5 directed hours per week. In our regressions we include this variable as an interaction with gender to estimate separate part-time coefficients for men and women.

Ethnicity: This is a categorical variable that groups teachers according to their ethnic group as follows: White (reference category), Asian, Black and mixed/Other.

Role: This variable distinguishes between classroom teachers (reference category), headteachers, deputy/assistant headteachers and advisory teachers/lead practitioners.

Subject taught: We have classified teachers according to the subject they mainly teach into six subject groups: English, maths, science, humanities, MFL and non-EBacc (reference category). To classify individuals we have applied the following rule: to be classified as an English teacher, for instance, a teacher needs to teach at least 10 hours a week of English and at least 50 per cent of her total time needs to be spent teaching English. The non-EBacc group is a residual category. It includes mostly teachers of non-EBacc subjects, but also teachers that do not satisfy one of the above mentioned criteria are classified as belonging to this group. This variable is interacted with gender in order to have separate estimates for men and women.

School characteristics

Number of pupils: Headcount of pupils in the school in which the teacher is employed.

Proportion of FSM: This is a categorical variable that measures the prevalence of FSM in the school in which the teacher is employed. Starting from the proportion of pupils eligible for free school meals in each of the schools included in the School Workforce Census we have computed five percentiles each containing 20 per cent of the distribution. The first percentile includes schools that have the lowest proportion of FSM pupils, while the fifth includes schools that have the highest proportion of pupils that are eligible for free school meals. In the regression we use the first quintile as reference category.

Ofsted rating and change in Ofsted rating with respect to the previous year: In the baseline models we include a set of interactions between the Ofsted rating of the school the teacher is working at and its change with respect to the previous year. Ofsted ratings are those main inspection ratings used by Ofsted (Inadequate, Satisfactory/Requires Improvement, Good and Outstanding). With regard to changes in Ofsted rating with respect to the previous period we have proceeded as follows. First, we have identified schools that were not inspected in the previous year. Given that we are interested in the immediate effect of a change in Ofsted rating in the year after it occurs, we have included all the above mentioned schools in a group labelled ‘Not inspected’. For the remaining schools that were inspected by Ofsted in the previous period we have distinguished between schools that were upgraded, schools that were downgraded and schools that had their previous rating confirmed. Interacting the current Ofsted rating with the four categories just mentioned we ended up with the following 14 groups of schools:

- Outstanding schools that were upgraded with respect to the previous year
- Outstanding schools that maintained the same rating as the previous year
- Outstanding schools that were not inspected in the previous year
- Good schools that were upgraded with respect to the previous year
- Good schools that were downgraded with respect to the previous year
- Good schools that were not inspected in the previous year
- Good schools that maintained the same rating as the previous year (reference group)
- RI schools that were upgraded with respect to the previous year
- RI schools that were downgraded with respect to the previous year
- RI schools that were not inspected in the previous year
- RI schools that maintained the same rating as the previous year
- Inadequate schools that were downgraded with respect to the previous year
- Inadequate schools that were not inspected in the previous year
- Inadequate schools that maintained the same rating as the previous year

Despite having four categories both in terms of Ofsted rating and change in Ofsted rating, we end up with only 14 interactions (rather than 16). This is due to the fact that it is not possible for a school classified Outstanding to have been downgraded and similarly it is impossible for an inadequate school to have been upgraded.

School type: This is a categorical variable that specifies the type of school the teacher is teaching in. In the baseline model schools are classified into four groups: converter academies, sponsored academies, newly established academies and schools that are not academies (residual category and reference group).

Local authority characteristics

Average pay in the local authority: This variable measures the logarithm of the hourly earnings of individuals in the 70th percentile of earnings, taking the values from local authorities within a radius of 30 km from the school where the teacher is working. In the model this variable is interacted with gender as men and women might be differently affected by outside wages.

Unemployment rate in the local authority: This variable measures the unemployment rate, taking the values from local authorities within a radius of 30 km from the school where the teacher works. For the same reason mentioned for pay in the surrounding labour market, the unemployment rate is estimated separately for men and women.

Working area: This variable distinguishes teachers that are working in different pay areas, to control for the effect of being on a higher pay scale alongside local pay rates. The classification is: teachers working in inner London, teachers working in outer London, teachers working in London fringe and a residual category that gathers together teachers working in the rest of England.

Additional variables

We have estimated some further models that, on top of the covariates listed above, also include the following variables:

Type of contract: This variable distinguishes whether a teacher is employed on a permanent contract (reference category), a temporary contract or another type of contract (residual category). We chose not to include this specific variable in the baseline models because being on a temporary contract is an obvious driver of mobility, which might interact with, and change the interpretation of, the effect of other variables. Despite having a high level of prediction in terms of R^2, the inclusion of this variable doesn't affect most of the coefficients we have estimated in the baseline regressions, expect for experience (as temporary contracts tend to be used to employ NQTs and early-career teachers).

Multi-academy trusts and size of MAT: To investigate the relationship between being in a MAT and teachers' mobility, we have estimated a regression that includes a categorical variable that distinguishes academies belonging to a MAT from academies that are SATs. To further explore this we have estimated regressions that further distinguish academies according to the size of MATs, specifically using David Carter's four-tier categorisation. The variables we use are: schools that are not academies, SATs, Starter MATs (1-5 schools), Established MATs (6-15 schools), Regional MATs (16-30 schools) and System MATs (more than 30 schools). We have decided not to include these variables in the baseline models as their introduction reduces the sample size. On top of that, there are very few schools in some of the categories listed above and hence the results are only indicative.

Appendix B Predictive importance of explanatory variables

In this section we present the methodology used to compute the importance of each coefficient in explaining the variability in the data, as well as the resulting variables' ranking by predictive importance. Starting from our baseline regressions that included all the controls listed in Appendix A, we removed one variable at a time. The proportion of variability explain by a coefficient is computed as the percentage decrease in the R^2 when we move from the full model to the model that does not include the variable we are investigating.

For each of the variables included in the baseline model and for each of the four regressions we have estimated, Tables 3 and 4 show the percentage reduction in the pseudo-R^2 when the relevant variable is removed from the model. The predictors are listed from the most predictive to the least predictive. Note that, as well as including the change in pseudo-R^2 that follows the exclusion of age and experience one at a time, in the tables we have also included the variation in pseudo-R^2 when these two variables are removed simultaneously. We do so because the two predictors are highly correlated. We can see that the drop in pseudo-R^2 that results from the simultaneous exclusion of age and experience is higher than the sum of the reductions that result from excluding age and experience in turn.

Table 3 Percentage decrease in pseudo-R^2 resulting from exclusion of each variable from the baseline regression predicting the probability of leaving the profession

	Primary
Age and experience	-84.4
Age	-47.1
Experience	-5.8
Ofsted	-3.8
Full time	-3.4
Post	-1.7
QTS	-0.7
Gender	-0.7
N of pupils	-0.3
Ethnicity	-0.2
Pay area	-0.2
FSM	-0.1
LA unemployment	-0.1
LA pay	0.0
School type	0.0

	Secondary
Age and experience	-79.7
Age	-43.1
Experience	-8.7
Full time	-5.4
Ofsted	-2.6
QTS	-1.4
Gender	-0.7
School type	-0.4
No subject	-0.3
Ethnicity	-0.2
N of pupils	-0.1
FSM	-0.1
Pay area	-0.1
LA pay	0.0
LA unemployment	0.0
Post	0.0

Table 4 Percentage decrease in pseudo-R^2 resulting from exclusion of each variable from the baseline regression predicting the probability of moving school

	Primary
Age and experience	-39.4
Experience	-9.1
Ofsted	-8.8
Gender	-5.0
Age	-5.0
QTS	-2.5
N of pupils	-2.2
FSM	-1.2
Post	-1.0
School type	-0.7
Full time	-0.7
LA pay	-0.7
LA unemployment	-0.3
Pay area	-0.2
Ethnicity	0.0

	Secondary
Age and experience	-44.7
Experience	-11.5
Ofsted	-6.5
Subject	-5.7
Age	-2.5
School type	-1.5
Gender	-1.2
FSM	-1.2
LA pay	-1.0
Pay area	-0.7
N of pupils	-0.5
Ethnicity	-0.3
QTS	-0.3
Full time	-0.2
Post	-0.2
LA unemployment	0.0

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- insights
- breadth
- connections
- outcomes

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