CENTRE FOR VOCATIONAL EDUCATION RESEARCH

Effectiveness of CEOs in the Public Sector: Evidence from Further Education Institutions

Jenifer Ruiz-Valenzuela, Camille Terrier, Clémentine Van Effenterre

Briefing Note 005

December 2017

CENTRE for ECONOMIC PERFORMANCE

National Institute of Economic and Social Research

LE London Economics

The University Of Sheffield.

The Centre for Vocational Education Research (CVER) is an independent research centre funded by the UK Department for Education. CVER brings together four partners: the LSE Centre for Economic Performance; University of Sheffield; National Institute of Economic and Social Research and London Economics.

Any views expressed are those of the authors, and do not represent the views of DfE. For more details on the Centre, go to cver.lse.ac.uk

Authors:

Jenifer Ruiz-Valenzuela, Centre for Economic Performance (CEP) and Centre for Vocational Education Research (CVER), London School of Economics (LSE). Email: J.Ruiz-Valenzuela@lse.ac.uk

Camille Terrier, Massachusetts Institute of Technology, School Effectiveness and Inequality Initiative and CEP and CVER (LSE). Email: cterrier@mit.edu

Clémentine Van Effenterre, Harvard Kennedy School (WAPPP); CEP and CVER (LSE). Email: clementine_van_effenterre@hks.harvard.edu

Acknowledgements: We are grateful to Sandra McNally, Bev Robinson and Alison Wolf for comments on earlier versions of this briefing note, and to Charlynne Pullen for providing us with access to the SIR dataset. Nathalie Baker provided superb research assistance for this project.

Published by:
Centre for Vocational Educational Research
London School of Economics & Political Science
Houghton Street
London WC2A 2AE

Executive summary

The understudied role of further education. Most policy debates addressing educational issues focus on primary and secondary education. When higher education is considered, it is often through the narrow angle of university attendance and completion. Yet, most students do not follow an academic track, and most importantly, most of them do not go to university. In England, about 60 per cent of a typical cohort enrolls in post-compulsory institutions qualified as "further education colleges". Most of these students attend general/tertiary further education colleges, which provide some form of vocational or technical training. For various reasons, this sector has historically been under-considered by academics and policy makers alike. Yet, to have a fuller picture of the education system, studying vocational or technical colleges along with academic colleges is particularly important because the students the former colleges cater for have lower educational attainment, come from more disadvantaged backgrounds, and are most at risk of dropping out from the education system. Further education is therefore a key determinant of England's educational level, social mobility, unemployment, and other labour market indicators. This briefing note fills some of the knowledge gap by investigating the role of principals in further education colleges.

Political context. This study comes along with a growing interest from policy makers in vocational and technical education. Following the 2010 election of the British Coalition Government and the Wolf Review of 14-19 Vocational Qualifications (Wolf, 2011), the Government started to give more autonomy to further education colleges. One of the objectives was to free them from central government control by reinforcing the role of college governors in setting the strategic direction of the colleges and selecting the best principal (Department for Business Innovation and Skills, 2013). More recently, the post-16 skills plan of the Department for Education aims at re-structuring technical education. This new educational context highlights the need for strong leadership in the post-16 education sector, and for more research in this area.

Data and methodology. This briefing note uses a novel panel dataset of principals in FE institutions in England over the period 2003 to 2015, and combines it with data on education performance coming from the Individualised Learner Records (ILR), the National Pupil Database (NPD) and the Higher Education Statistics Agency (HESA). It also exploits the information contained in the Staff Individualised Records (SIR). To estimate the importance of principals, we exploit the fact that we observe principals and colleges over time. We therefore see a given principal in different institutions, and a given institution managed by different principals. This allows us to use an empirical strategy that takes into account the fact that principals might sort into different types of colleges depending on their characteristics. We focus only on the outcomes of publicly funded learners that can be linked to their past education performance. This means we necessarily focus on young learners (who did their GCSE exams between the years 2002 and 2014). We evaluate the impact of principals on outcomes for these learners but not for those who are older. The latter is an important part of the work of FE colleges, though not for Sixth Form Colleges that generally cater for those aged 16-18.

Outcomes used to measure principals' effectiveness. We proceed in two steps to investigate college principals' role. First, we look at whether principals do matter for students' educa-

tional performance. The three achievement outcomes we use are whether the student achieves a Level 2 qualification, whether the student achieves a Level 3 qualification, and whether the student enrols in any kind of Level 4 –or above– qualification. Then, we investigate potential mechanisms that could explain principals' performance, in particular recruitment and wage policies set by the principals. We construct outcomes that capture the share of teachers that are hired under a permanent contract, the share of female teachers, the share of teachers with a Qualified Teacher Status (QTS) and teacher's average salary.

Better principals do make a difference to their student's educational outcomes. Our results reveal that principals do matter for the educational performance of their students, and that principals differ in their ability to enable students to progress. After having estimated the performance of college principals, we rank them by increasing order. We find that switching from a principal who is at the bottom 25th percentile to a principal who is in the top 75th percentile increases students' probability to achieve level 2 by 15.9 percentage points, to achieve level 3 by 14.1 percentage points, and to enrol in a Level 4 or above qualification by 3.7 percentage points. This shows that leadership does make a clear difference to learner performance; and that it matters to attract and retain 'high quality' principals.

Principals' characteristics do not seem to explain differences in effectiveness. We then investigate whether principals' performance correlates with their age and gender, as well as their salary and teaching qualification. Overall, we find no significant correlations between these characteristics and students' educational outcomes, suggesting that principals' performance might be driven by characteristics that we do not observe in the data. It is particularly interesting to notice that principals' effectiveness seems unrelated to their salary.

Differences in recruitment and wage policies might explain principals' effectiveness. The second part of the analysis is devoted to differences between principals in their recruitment and wage policies. Again, we find strong differences between college principals in their recruitment and wage policies. Our results show that switching from a principal who is at the bottom 25th percentile to a principal who is at the top 25th percentile would increase the share of teachers under a permanent contract by 12.9 percentage points, the share of female teachers by 5.5 percentage points, and the share of certified teachers by 14.1 percentage points. Principals also significantly differ in terms of salary policies. Switching from a principal who is at the bottom 25th percentile to a principal who is at the top 25th percentile of the wage fixed-effects distribution would increase the average gross annual salary of teachers by £3,511.

Take-away. This policy brief shows that principals do matter for the educational performance of their students. Most importantly, principals notably differ in their ability to enable students to progress. This has wide-ranging implications. First, it matters to invest time and resources in finding ways to improve the quality of leadership amongst FE principals. Second, our results show how important it is to attract and retain high quality principals to FE colleges. While the findings elsewhere in the literature show that teachers impact student achievement, the quality of the principal is also a determining factor. And whereas the recruitment of a new high-performing teacher affects a few classes, the recruitment (or the training) of a high-performing principal directly impacts thousands of students in a college. This suggests that

effective ways of improving the quality of college principals might also be cost-effective.

1 Introduction

The past twenty years have witnessed a large increase in research about the role of Chief Executive Officers (CEOs) in the management of firms, as well as about what constitutes good management practices (Bertrand and Schoar, 2003; Lazear et al., 2015; Bloom et al., 2016). It is now widely recognized that CEOs have an important impact on the success of private companies. However, the economics literature on CEO effectiveness in the public sector is more limited.[1] Yet, this question merits examination for at least two reasons. First, a significant proportion of public sector resources is invested in public services, notably for managers' remuneration. It is also fundamental to understand what makes good public-sector managers to better inform decisions on leadership and management in key public services such as health, transport and education.

A growing literature has tried to assess the impact of principals in compulsory education in different countries (Branch et al., 2012; Coelli and Green, 2012; Dhuey and Smith, 2014; Grissom et al., 2015; Clark et al., 2009). Böhlmark et al. (2016) for instance find that individual principals have a substantive impact on school policies, working conditions and student outcomes.[2] Perhaps surprisingly, far less research has been devoted to studying the impact of principals in post-compulsory education.

This briefing note aims to fill that gap by considering principals ("CEOs") of post-compulsory education institutions in England – referred to as further education (FE) institutions. In particular, the analysis considers principals in two types of institutions: General FE and Tertiary colleges and Sixth Form Colleges. There are several reasons why management in post-compulsory education institutions might differ from management in primary or secondary schools. First, general FE and Tertiary colleges share several characteristics with public institutions such as universities and hospitals. They are very large and unlike secondary schools –that offer a single service– general FE and Tertiary colleges offer a great variety of courses and qualifications in a wide range of vocational and academic subjects at many levels.[3] They also cater for a heterogeneous population of students in terms of age (i.e. 45% of the students are older than 25 – as documented by Hupkau and Ventura (2017)). This complexity of provision and range of potential funding sources make the management of these type of colleges very challenging. Sixth Form Colleges are smaller institutions (the median is less than 2000 students per institution) and offer a more homogeneous selection of post-16 qualifications that are more likely to lead to progression to higher education.[4]

[1] See Bloom et al. (2015) for instance that analyse the causal impact of competition on managerial quality using data from public hospitals in the United Kingdom. Other papers have analysed the relationship between principals' pay and their performance (Besley and Machin, 2008).

[2] They also find that characterising successful management with observable characteristics is difficult, suggesting that the role of unobservable innate skills might be central.

[3] The median number of learners in academic year 2014 was 6749 students per institution according to Hupkau and Ventura (2017). In terms of qualification levels, General FE and Tertiary colleges offer qualifications from entry level to Level 7. A more in-depth explanation of English qualifications levels is given in Section 2 and in Hupkau et al. (2017).

[4] The age distribution is also different: 89% of students attending Sixth Form Colleges in 2014 were in the 16 to 18 age group, and 90% were doing so on a full-time basis (Hupkau and Ventura, 2017).

Principals of FE institutions in England are appointed by a governing body, and their roles and responsibilities are defined in each college's Articles of Government.[5]

Much like CEOs in the private sector, principals have a multi-dimensional role. They are in charge of the corporate strategy and policy of the college (including advising the governors on the educational character and mission of the College). They provide leadership and management for the college staff and students. They supervise teaching activities, determine the appropriateness of the college's core activities, and ensure retention, pass rates, high grades, value added and progression of students. Finally, acting as accounting officer, principals are also responsible for the financial health of the college (see Association of Colleges (2017), or Sala (2003) for more information on the role of principals). As Böhlmark et al. (2016) point out, principals provide management in complex and knowledge-intensive organisations; and principal's leadership is often viewed as a crucial component for educational success.

This briefing note uses a novel panel dataset of principals in FE institutions in England over the period 2003 to 2015, and combines it with data on education performance coming from the Individualised Learner Records (ILR), the National Pupil Database (NPD) and the Higher Education Statistics Agency (HESA). It also exploits for the first time the information contained in the Staff Individualised Records (SIR). When estimating the importance of principals ("principal fixed effects"), being able to follow principals and colleges over time allows us to use an empirical strategy that takes into account the fact that principals might sort into different types of colleges depending on their characteristics.[6]

Our results show that principals have a substantial impact both in terms of their student's achievement and in terms of staff recruitment and wage policies. Switching from a principal who is at the 25th percentile of the performance distribution to a principal who is in the 75th percentile increases students' probability to achieve level 2 by 15.9 percentage points, and to achieve level 3 by 14.1 percentage points. Interestingly, we find no significant correlations between observable principal characteristics – such as gender, age, whether principals have teacher qualifications and salary – and educational outcomes. This is similar to what the teacher value added literature finds. As Böhlmark et al. (2016) point out, it seems difficult to identify what makes good principals using observable characteristics only.

This analysis is highly relevant with regard to current UK government policy. Since the election of the Coalition Government in May 2010, there have been reforms in most aspects of 14-19 education policy. The Wolf Review of 14-19 Vocational Qualifications (Wolf, 2011) and the subsequent government response emphasised the value of apprenticeships, work-based learning and internships. As a response, the Government has "freed FE colleges from central government control, and reinforced the increasingly important role of college governors in setting the strategic direction of their institutions" and selecting the best principal (Department for Business Innovation and Skills, 2013). The more recent Report of the Independent Panel on

[5]Prior to 2011, the Instrument and Articles were the same for all colleges, but the Education Act 2011 gave colleges the power to vary their Instruments and Articles provided that certain key features were included. For more information, see `https://www.aoc.co.uk/funding-and-corporate-services/governance/induction-governors/the-local-framework`.

[6]We refer the reader to section 3 for a detailed account of our methodology as well as a description of how we deal with the different identification challenges.

Technical Education (Sainsbury, 2016) and the subsequent re-structuring of technical education envisaged in the post-16 skills plan (Department for Education and Department for Business Innovation and Skills, 2016) will also affect the post-16 education sector and its management. This new educational context highlights the need for strong leadership in the post-16 education sector, and for more research in this area.

The briefing note is structured as follows. Section 2 presents the data used in this project and provides some summary statistics. Section 3 discusses the estimation strategy as well as the main challenges to identification of causal effects. Section 4 quantifies the importance of principals of General FE colleges and Sixth Form colleges and Section 5 offers some concluding remarks.

2 Data

As Bertrand and Schoar (2003) point out, a straightforward way to determine whether there are systematic differences in the way principals behave is to ask whether there are important "principal fixed effects" in college outcomes and/or practices, controlling for all relevant observable college-level characteristics. Therefore, in order to identify principal fixed effects, we construct a college-level panel data set that allows tracking of individual principals over time. We start by using the EduBase dataset provided by the Department for Education. The EduBase is a register of educational establishments in England and Wales, maintained by the Department for Education. It provides information on establishments providing compulsory, higher and further education. This dataset includes the name and last name of the principal in each institution and for each academic year. However, this dataset is prone to a substantial amount of measurement error in terms of the exact timing of principal changes. To mitigate this weakness, for each institution, we have performed online searches to identify the principal in each academic year from 2003 to 2016. We reconstruct movements of principals using online searches and other sources, such as local and specialised newspapers (like FE Week or the Times Education Supplement). This information, together with official documents (like Ofsted reports), have allowed us to construct an accurate panel of principal-by-college-by-year dataset. When performing online searches, we collected additional information like the reason behind a change of principal. We use this information to perform robustness checks to our main identification strategy.

We construct outcomes related to the educational achievement of students by using information contained in the Key Stage 5 Records coming from the National Pupil Database (NPD), the Individual Learner Record (ILR) database and the Higher Education Statistics Agency (HESA) dataset. The three achievement outcomes we use are whether the student achieves a Level 2 qualification, whether the student achieves a Level 3 qualification, and whether the student enrols in any kind of Level 4 –or above- qualification. In the English education system, level 2 qualifications are expected when a student finishes Key Stage 4 by age 16 (lower secondary). Level 3 qualifications are the next level up and are equivalent to upper-secondary qualifications. Level 4 qualifications or above are usually taken after upper-secondary education (post-

18). The vast majority of the latter (Level 4 or above qualifications) are offered in universities (bachelor degrees are Level 6 qualifications, for instance), though some are offered in General and Tertiary FE colleges. A more in-depth description of the English post-16 education system is provided in Hupkau et al. (2017). We follow this hierarchy to define our first two college-level educational outcomes. Specifically, we look at the fraction of students that achieve a level 2, and the fraction that achieve a level 3 qualification, from the pool of students that respectively enrol in a level 2 or level 3 qualification. Our third educational outcome captures whether certain principals are more effective in enabling their students to progress to education at level 4 or above. In particular, this variable measures progression to higher-level qualifications within the same college or in other higher education institutions. For these educational outcomes, the analysis is confined to publicly funded learners who are young enough to have previous education records in the National Pupil Database (i.e. they appear in the NPD version of the ILR from 2003 to 2015 –and until 2013 for the Level4+ outcome) and who were enrolled in a general/tertiary further education college or sixth form college during the period under analysis. It is worth mentioning that a big fraction of students in general/tertiary FE colleges will be enrolled in qualifications that are not Level 2 or Level 3 (e.g. below Level 2 qualifications); whereas most students enrolled in sixth form colleges will be enrolled in Level 3 qualifications. Furthermore, the highest fraction of learners in FE colleges are over 19 years of age whereas those in sixth form colleges will mostly be aged 16-18.

Additionally, we use information from the student spring Census and NPD datasets (Key Stage 2 and 4) to construct variables about the student's prior attainment (total points in the national Key Stage 2 and Key Stage 4 examinations), ethnicity, language spoken at home, gender and whether the student has ever received free school meals (FSM).

To investigate some mechanisms that could explain the degree of principals' effectiveness (including staff recruitment and salaries), we use data from the Staff Individualized Record (SIR) dataset for academic years 2004/2005 to 2013/2014.[7] To the best of our knowledge, this data has never been used before for the purposes of academic research. However, this dataset comes with some limitations that are discussed in Appendix 1. Finally, we obtain data on the principal's salary from the College Accounts dataset for academic years 2001/2002 to 2014/2015.[8]

Given that the variation of interest is at the college level, we aggregate the data and work with observations that represent averages at the college-academic year level. This also has the advantage of keeping the estimation strategy consistent between outcomes at the student, teacher and college level.

[7]This dataset is provided by the Education and Training Foundation.

[8]The college accounts are compiled by the Skills Funding Agency and the Education Funding Agency. More information can be found here: `https://www.gov.uk/government/publications/sfa-financial-management-college-accounts`.

3 Descriptive statistics

Table 1 reports the number of institutions in our study. Over the period, there are 369 unique institutions divided between General FE and tertiary colleges (265) and Sixth Form Colleges (104).[9] This number masks a decreasing trend in the number of institutions during the period, which is the result of mergers of institutions that have been taking place in the Further Education sector in England. Using data from the Association of Colleges on the list of mergers that have occurred since 1993, we have built a dataset of college mergers to identify the final merged institution as well as the prior institutions involved in the merger.[10] The last row in Table 1 shows that there are roughly two principals per college during the period under study.

Table 2 describes principals' characteristics during the period.[11] The average principal age is 56, and very similar for both General FE and Tertiary Colleges and Sixth Form Colleges. Principals' salary (measured in pounds) is higher in General FE and Tertiary Colleges, while the proportion of principals that have qualified teacher status (QTS) is higher for Sixth Form Colleges.[12] It is more common that principals of FE colleges have had previous professional experiences outside the education sector. There are more male than female principals. Unfortunately, information on principal characteristics is often missing (i.e. not available for every year in the different datasets). This is especially the case for the variables in Table 2 that come from the College Accounts (Principal's salary) and the SIR (Proportion of principals with Qualified Teacher Status). As detailed in Appendix 1, since participation in the survey is not compulsory, there is a substantial amount of missing information. Therefore, results that use principal characteristics and more generally, SIR data, have to be interpreted with caution.

As can be seen in the last column of Table 3, the same caution applies to outcomes related to recruitment and wage policies. The number of non-missing observations reflects the available observations for each outcome, and the averages in the table are constructed over this number of observations (college-by-year). Table 3 shows that the achievement rate of those enrolled in level 2 qualifications is similar across institution types, but the achievement rate of those enrolled in level 3 qualifications is 20 percentage points higher in Sixth Form Colleges. This is likely to reflect the profile of incoming students rather than any differential effectiveness between these types of institutions. These two outcomes cover the period 2003 to 2015. For the third outcome, we do not look at outcomes after 2012, to ensure that the last cohorts of students in our sample have enough time to progress to higher levels of education.[13] This explains why the number of college-year observations in the last column of Table 3 is smaller for this outcome. The enrolment rates in Level 4 qualifications reflect what was anticipated above. Students in Sixth form Colleges are almost 30 percentage points more likely to progress

[9] These institutions are identified using the Unique Reference Number (URN) indicator in the EduBase dataset.

[10] When estimating the principal fixed effects on any of the outcome measures, it is important to net out the effect of principals from that of mergers. More details about how we deal with this are provided in Section 3.

[11] We show this information for the last year the principal is observed in the data.

[12] This is unsurprising given that QTS is a general teaching qualification designed for schools (which would resemble Sixth Form Colleges far more closely than FE colleges).

[13] Students starting a qualification in FE colleges after 2013 would not have had the chance to progress to level 4+ education, so we would not have an outcome for them.

to a level 4 qualification. Again, this is likely to be partly explained by the rather different profile of incoming students in the two types of institutions.

The next set of outcomes is related to staff recruitment and staff wage policies. In particular, we construct outcomes that capture the share of teachers that are hired under a permanent contract, the share of female teachers, the share of teachers with a Qualified Teacher Status (QTS) and teacher's average salary. Principals can arguably have a strong impact on these outcomes, depending on their different views on issues such as gender-balanced teaching staff, contractual arrangements, or the need for their teachers to have formal teaching qualifications (one can become an FE teacher without a teaching qualification in England). In terms of wage setting, colleges are able to negotiate their own salary scales with the national trade unions, and salaries vary according to experience (both within and outside of the teaching profession), qualifications, subject demand, institution and geographical location.

The statistics shown in the bottom panel of Table 3 reveal significant differences across institution types; in particular, when it comes to the contractual arrangements and share of teachers with a qualified teacher status. Sixth Form Colleges hire more teachers under permanent contracts and more teachers with a qualified teacher status. Full-time teachers in those institutions also earn more. As noted above, given the limitations of the SIR data outlined in Appendix 1 (non-compulsory participation in the survey, attrition and backfilling), analysis of recruitment and wage practices is more limited than analysis of student achievement. The results should therefore be interpreted with caution.[14]

4 Empirical strategy

The key challenge for any study aimed at identifying the causal effect of principals on student's success or management practices is to disentangle the contribution of principals from other institutional level factors that can potentially drive these outcomes. Being able to disentangle these two effects is particularly important if one thinks that there might be assortative matching between good principals and colleges with more favourable characteristics (better governance, higher achieving students, etc.). A strategy to separate these effects is to include college fixed-effects in the regressions used to relate outcomes to principal fixed effects. Such effects account for unobserved characteristics of the colleges that are constant over time and impact student's achievement and management practices (by unobserved, we mean the colleges' characteristics that we, as researchers, cannot observe, or for which we do not have data). By adding college fixed effects, the identification of the principal effects stems from within college variation in outcomes under different principals.[15]

Formally, we derive our empirical strategy from Bertrand and Schoar (2003) and Böhlmark

[14]The following variables are available for years 2003 to 2014: share of teachers that are permanent staff, share of female teachers, teacher's gross salary and teacher's salary variation. Share of teachers with QTS is available for years 2003 to 2011.

[15]When college fixed effects are accounted for, it becomes evident that the estimation of principals' performance (as measured by a vector of principals' fixed-effects) is not possible for principals who never leave a given college if that college has only one principal.

et al. (2016) and estimate the following regression:

$$Y_{st} = \alpha_s + \delta_t + \beta_1 X_{st} + \beta_2 X_{st-1} + \mu_p + \epsilon_{st} \quad (1)$$

Where Y_{st} is the outcome of college s in academic year t; α_s are college fixed effects accounting for all non-varying college characteristics and δ_t is a vector of year dummies. X_{st} is a vector of time varying college level characteristics accounting for selection of students of different ability and socioeconomic background into different institutions. This vector includes average performance in terms of capped total points at Key Stage 4 (age 16), average performance in Key Stage 2 (age 11), and indicators for the average fraction of students that are female, of white ethnicity, have ever received Free School Meals (FSM), speak English Language at home and have ever been classified as having special education needs (SEN). The vector of principal fixed effects is given by μ_p. We correct the standard errors for clustering at the college level.

Finally, even if the terms X_{st} and μ_p mitigate issues of student and principals' selection into colleges, principals' selection might still be correlated with trends in student achievement (or other characteristics). In other words, some colleges might change the college principal as a response to a decrease in outcomes. When the new principal takes over, mean reversion would drive the potential recovery, rather than actual improvement due to the new principal's actions. In order to deal with this challenge, we introduce a set of pre-arrival controls at the college level (for one and two years before the arrival of the new principal), including the share of students who ever received free school meals, the share of female students and the share of non-white students, as well as the lagged value of the outcome of interest. This is captured by the term X_{st-1} in equation 1.

We account for sampling error in the estimation of principal fixed effects by applying a shrinkage estimator to obtain the true variance of principal fixed effects (Kane and Staiger, 2002).[16] With limited number of observations at the college level, due to sampling variations, a few students can have a large impact on test scores, and on estimations of principals' fixed effects. The observed distribution of principal fixed effects recovered from the estimation of equation 1 would therefore overstate the true distribution of principal fixed effects.

There is one main limitation to this framework. Some principals do not change college during the period (and are therefore only observed in one college). For such principals, a fixed effect can be estimated if s/he is observed in a college that has at least one other principal that changes college in the sample. For non-movers principals, even if we estimate a fixed effect, it is impossible to disentangle the effect of time-specific college unobserved characteristics and their principal fixed effect. In order to overcome this problem, the best solution would be to restrict our sample to work with principals that switch colleges during the period of observation (also called switchers). Unfortunately, our sample would become very small if we were to use only switchers. As an alternative, we show results for the whole sample first, and then for a

[16] At the school level, Kane and Staiger (2002) found that in the smallest schools, more than half (56 percent) of the variance in mean gain scores is due to sampling variation and other non-persistent factors. Several recent applications have therefore used empirical Bayes estimates to estimate teacher value added (Jacob and Lefgren, 2005; Kane et al., 2008; Chetty et al., 2014).

sample of principals that are either switchers or are principals that are observed in colleges that employ at least another switcher principal during the sample period.

For the educational outcomes, we perform two additional robustness checks. First, we use information on the reason why a principal left a college. We might worry that a principal's change is driven by reasons that we do not observe, such as an internal scandal or issues between the principal and teachers or other staff members. If this was the case, then college level unobservable characteristics – such as the attractiveness of the college for instance - might differ before and after the change of principal. This would make it more difficult to disentangle the principal effect from college-level, time-specific unobserved characteristics. To address this concern, we collected data on the reason why principals in the sample left a given college. Table 4 shows that the most frequent reason for principal switch is retirement. Between 27% and 32% of principals leave their college because of retirement.[17] Among all reasons for principal change, it is less likely that retirement is correlated with college and student characteristics than departures due to resignations or scandals. Retirement is mainly associated with principal's age. As a robustness check, we therefore use the sample of principals that retire and principals that follow a retirement (that is, those who are hired after a principal retires). We call this sample the retirement sample.[18]

Finally, when estimating the principal fixed effects on any of the outcome measures, it is important to net out the effect of principals from that of institutional mergers. Given the amount of restructuring in the Further Education sector in England during the sample period (described in Section 2.1), we use the sample of colleges that have never been part of a merger process as a second robustness check. Unfortunately, the small sample size prevents us from doing the two latter robustness checks for outcomes related to management practices (that is, using the retirement and non-mergers samples). Finally, for outcomes constructed using the SIR data, we include an additional dummy variable in the regressions indicating whether the variable has been backfilled.

5 Results

5.1 Educational Outcomes

Table 5 presents the adjusted R-squared of regressions with and without principal fixed effects. The aim is to see whether (and by how much) adding principal fixed effects to the regressions increases the share of the variation of outcome variables explained by predictor variables. The table is divided in four panels. Panel A shows the results when all available observations are used; whereas panel B uses the sample of colleges where there is at least one switcher. The number of principals fixed effects identified decreases considerably in Panel B, but results are very similar. For the preferred specification (Panel B), adding principal fixed effects increases

[17] For almost 9% of the principals, we were unable to find the reason of change, and 32% of the principals in our sample are still observed in their position in the last year of observation.

[18] Some principals at the end of their careers might be less motivated than younger principals. The inclusion of pre-arrival controls mitigate this concern.

the adjusted R-squared by 1 and 2 percentage points, respectively, for the Achieved Level 2 and Level 3 outcomes, and very little for the outcome capturing progression to Level 4+ education. The results are very similar when restricting the sample to institutions that never merged (Panel D). However, changes in adjusted R-squared are considerably higher when we use the retirement sample. Overall, Table 5 shows that principals do matter for the educational performance of students. Something relevant here is the fact that the inclusion of college fixed effects in the regressions could be wiping away some of the potential impact of principals, especially if we think that there's assortative matching between good principals and colleges. In this case, it could be argued that the results in this briefing note provide a lower bound for principal effects.

Table 6 contains information about the distribution of principal fixed effects and about its overall significance. We use the same 4-panel structure as in Table 5. The F-statistics from tests of joint significance of the different sets of principal fixed effects are large and allow us to reject in all cases the null hypothesis that all principal fixed effects are zero. Qualitatively, the results in all four panels are similar. Looking at the distribution of principals' fixed effects gives us some indication on the difference that better principals can make to their student's educational outcomes, once college fixed effects and other variables capturing selection and student composition have been accounted for. To interpret principals' fixed effects, it might help to have a benchmark in mind: in the full sample, 56% of the students enrolled in a level 2 qualification achieve that qualification, and 58% of the students enrolled in a level 3 qualification achieve that qualification. For the preferred specification in Table 6 (Panel B), and for the level 2 achievement outcome in panel B, the twenty-fifth percentile of the principals' fixed-effects distribution equals -0.077, while the seventy-fifth percentile equals 0.082. This means that switching from a principal who is at the bottom 25th percentile to a principal who is at the top 25th percentile increases students' probability to achieve level 2 by 15.9 percentage points, and to achieve level 3 by 14.1 percentage points. College principals make less of a difference for student enrolment in a Level 4 or above qualification.

We can also directly interpret the percentile values. A principal in the bottom quartile of principals' effectiveness decreases the chances of their students achieving Level 3 qualifications by 6.1 percentage points in the preferred specification (panel B); whereas a principal in the top quartile increases that probability by 8 percentage points. Not surprisingly, and as seen in Table 5 for the R-squared results, the ability to impact progression to education at Level 4 and above is smaller compared to the ability to impact achievement results in the college itself.

The previous results have provided suggestive evidence of systematic differences in achievement among principals. However, the presence of principal fixed effects does not tell us much about which specific principal characteristics might influence their effectiveness. We therefore analyse the possible role of principals' age and gender, as well as whether the principal has a qualified teacher status and his/her salary. Table 7 shows the results of a regression of each educational outcome variable on these observable principal characteristics, college fixed effects, academic year dummies, and student controls at the college level.[19] Results in Table 7 show no

[19]There are two points worth emphasizing about the specification we use here. First, our specification includes college fixed effects. Our identification is therefore not driven by average differences across colleges in the type of

significant correlations between observable principal characteristics and educational outcomes (with the exception of the QTS variable for one of the outcomes and at the 10% level). It is particularly interesting to notice that principals' effectiveness seems unrelated to their salary.

These results are robust to different specifications: (1) introducing principal characteristics in the regression one at a time (and therefore making use of all the potential observations available for that particular characteristic); (2) excluding student level controls; (3) restricting the sample to those institutions that have never participated in a merger; (4) dividing the sample into General/Tertiary FE colleges and Sixth Form Colleges; (5) using salaries instead of log salaries. The lack of evidence of significant correlations between principal characteristics and student outcomes is similar to results in Böhlmark et al. (2016). Interestingly, these results also parallel those found in the teacher value added literature (Chetty et al., 2014; Kane et al., 2008). It seems to be difficult to identify what makes good principals using observable characteristics only.

Finally, as mentioned in the introduction and Section 2, there are two types of institutions in our sample that differ in several respects. We therefore analyse whether principals' effectiveness differs in 6th form colleges, compared to General FE and Tertiary colleges. To do so, we start by separately plotting the distributions of fixed effects in Figures 1, 2 and 3, for each of the educational outcomes. Two relevant observations emerge. First, the blue lines capturing the distribution of principal fixed effects in Sixth Form Colleges show that principals are more homogenous in those institutions. This is reasonable since principals in these institutions are more similar (a higher proportion of them comes from a teaching career) and both the qualifications taught and the public they cater for are also less heterogeneous than in General Further Education Colleges. Second, the distribution of principal fixed effects in Sixth Form Colleges for the Achieved Level 3 outcome is clearly right shifted compared to the distribution of principal fixed effects in General and Tertiary Colleges. It is not surprising to observe that Sixth Form Colleges principals do better in terms of achievement at Level 3 since these colleges largely specialise in Level 3 qualifications and the profile of incoming students have higher attainment levels.

5.2 Mechanisms through which principals might affect student achievement

Tables 8 and 9 show, for the recruitment and wage policy related outcomes, the equivalent of Tables 5 and 6 for educational outcomes. The structure is very similar, except that panels C and D are not shown because the number of principal fixed effects that we would be able to estimate would be rather small. In fact, the number of principal fixed effects that we are able to estimate in Panel B for colleges with switcher principals is about a sixth of the number in

principals they hire. Instead, our identification comes from within-college variation in the principals' characteristics. Second, this specification, in contrast to the one we use to estimate principals' fixed effects, no longer relies on our ability to track the same principal into different colleges over time. While principal turnover still drives our test, the only requirement to identify whether principals' characteristics are correlated with their effectiveness is changes in principal characteristics within firms over time. This is in line with Bertrand and Schoar (2003).

Panel B in Tables 5 and 6. For this reason, even if the results are qualitatively similar for both samples, we focus our comments on the results in Panels A of Tables 8 and 9.

The results in Table 8 suggest that principals have a significant impact on recruitment and wage policies. For all outcomes, the set of principals' fixed effects increases the predictive power of the models, as measured by change in adjusted R-squared. This is particularly true for the share of female teachers (5-percentage point increase).

As with the educational outcomes, we then look at the distribution of the principals' fixed-effects. This provides some evidence on the difference that principals make in terms of the share of female, certified, permanent teachers, and in terms of salaries, once we account for college fixed effects and other variables capturing selection and student composition. The F-statistics from tests of joint significance of the different sets of principal fixed effects displayed in Table 9 are large and always allow us to reject the null hypothesis that all principal fixed effects are zero.

The results reveal that a principal in the bottom quartile of principals' fixed effects reduces the share of teachers under a permanent contract by 6.2 percentage points (for a mean value of 62.7%), the share of female teachers by 2.7 percentage points (for a mean value of 54.9%), and the share of certified teachers by 8.4 percentage points (for a mean value of 51.9%). On the other hand, a principal in the upper quartile of principals' fixed effects increases the share of teachers under a permanent contract by 6.7 percentage points, the share of female teachers by 2.8 percentage points, and the share of certified teachers by 5.7 percentage points. Another way to interpret these results is to look at the impact of switching from a principal who is at the 25th percentile to a principal who is at the 75th percentile. Our results reveal that such a switch would increase the share of teachers under a permanent contract by 12.9 percentage points, the share of female teachers by 5.5 percentage points, and the share of certified teachers by 14.1 percentage points. Principals also significantly differ in terms of salary policies. Switching from a principal who is at the 25th percentile to a principal who is at the 75th percentile of the wage fixed-effects distribution would increase the average annual gross salary of the teachers by £3,511 (for a mean value of £31,511 average salary for full-time teachers in the sample).

6 Concluding remarks

This briefing note investigates the role of principals in further education colleges. We use a panel dataset of principals in FE institutions in England over the period 2003 to 2015 to look at whether principals do matter for students' educational performance. Then, we investigate potential mechanisms that could explain principals' performance, in particular recruitment and wage policies set by the principals.

Our results reveal that principals do matter for the educational performance of their students, and that principals substantially differ in their ability to enable students to progress. We find that switching from a principal who is at the bottom 25th percentile to a principal who is in the top 25th percentile increases students' probability to achieve level 2 by 15.9 percentage points, to achieve level 3 by 14.1 percentage points, and to enrol in a Level 4 or above

qualification (equivalent to higher education) by 3.7 percentage points. Such differences in effectiveness are not explained by principals' gender, age or salary. We find, however, strong differences between college principals in their recruitment and wage policies.

These results have wide-ranging policy implications. First, policy makers and colleges should find out ways of detecting low-performing principals and of improving the quality of leadership amongst college principals. Second, our results show how important it is to attract and retain high quality principals to further education colleges. Principals have a surprisingly low profile in the debates about education. The focus instead usually falls on curriculum, college/institution types (traditional versus academies) and teachers (how to measure their effectiveness, attract and keep good ones). We hear far more talk about holding teachers accountable than about principals. But, as we show, principals can make a real difference, and more attention could be devoted to them. For example, in the U.S, the federal education law passed in 2015 to replace the No Child Left Behind Act, puts a new emphasis on the development of principals. Some cities and states also increasingly recognize the key role that principals play. In Chicago, students, parents and teachers fill out an annual survey evaluating their principal. Principals are important because they offer one of the most effective means to improve college performance. Although teachers have been shown to impact on student achievement, the recruitment of a new high-performing teacher affects a few classes, whereas the recruitment (or the training) of a high-performing principal directly impacts on thousands of students in a college. Finding ways to improve principal quality could be cost-effective in that it potentially affects so many students.

References

Association of Colleges (2017). Induction of Governor, The local framework. *https://www.aoc.co.uk/funding-and-corporate-services/governance/induction-governors/the-local-framework*.

Bertrand, M. and A. Schoar (2003). Managing with Style: The Effect of Managers on Firm Policies. *The Quarterly Journal of Economics 118*(4), 1169–1208.

Besley, T. and S. Machin (2008, February). Are Public Sector CEOs Different? Leadership Wages and Performance in Schools. *Working paper*.

Bloom, N., E. Brynjolfsson, L. Foster, M. Patnaik, I. Saporta-Eksten, J. Van Reenen, and R. S. Jarmin (2016, March). What Drives Differences in Management? NBER Working Paper 23300,.

Bloom, N., C. Propper, S. Seiler, and J. Van Reenen (2015). The Impact of Competition on Management Quality: Evidence from Public Hospitals. *The Review of Economic Studies 82*(2), 457–489.

Böhlmark, A., E. Grönqvist, and J. Vlachos (2016). The Headmaster Ritual: The Importance of Management for School Outcomes. *Scandinavian Journal of Economics 118*(4), 912–940.

Branch, G., E. Hanushek, and S. Rivkin (2012, February). Estimating the Effect of Leaders on Public Sector Productivity: The Case of School Principals. NBER Working Paper 17803,.

Chetty, R., J. N. Friedman, and J. E. Rockoff (2014). Measuring the impacts of teachers I: Evaluating bias in teacher value-added estimates. *American Economic Review 104*(9), 2593–2632.

Clark, D., P. Martorell, and J. Rockoff (2009, December). School Principals and School Performance. National Center for Analysis of Longitudinal Data in Education Research (CALDER) Working Paper 38,.

Coelli, M. and D. A. Green (2012). Leadership effects: School principals and student outcomes. *Economics of Education Review 31*(1), 92–109.

Department for Business Innovation and Skills (2013). A Review of Further Education and Sixth Form College Governance. Technical report.

Department for Education and Department for Business Innovation and Skills (2016). Post-16 Skills Plan. Technical report.

Dhuey, E. and J. Smith (2014). How important are school principals in the production of student achievement? *Canadian Journal of Economics 47*(2), 634–663.

Grissom, J. A., D. Kalogrides, and S. Loeb (2015). Using Student Test Scores to Measure Principal Performance. *Educational Evaluation and Policy Analysis 37*(1), 3–28.

Hupkau, C., S. McNally, J. Ruiz-Valenzuela, and G. Ventura (2017). Post-compulsory education in England: choices and implications. *National Institute Economic Review 240*(1), 51.

Hupkau, C. and G. Ventura (2017, February). Further Education in England: Learners and Institutions. Centre for Vocational Education Research (CVER) Briefing Note 001,.

Jacob, B. and L. Lefgren (2005, July). Principals as Agents: Subjective Performance Measurement in Education. NBER Working Paper 11463,.

Kane, T. J., J. E. Rockoff, and D. O. Staiger (2008). What does certification tell us about teacher effectiveness? Evidence from New York City. *Economics of Education Review 27*(6), 615–631.

Kane, T. J. and D. O. Staiger (2002). The Promise and Pitfalls of Using Imprecise School Accountability Measures. *Journal of Economic Perspectives 16*(4), 91–114.

Lazear, E. P., Shaw Kathryn L., and C. T. Stanton (2015). The Value of Bosses. *Journal of Labor Economics 33*(4), 823–861.

Sainsbury, D. (2016). Report of the Independent Panel on Technical Education. Technical Report April.

Sala, F. (2003). Leadership in Education: Effective U.K. College Principals. *Nonprofit Management and Leadership 14*(2), 171–189.

Wolf, A. (2011). Review of Vocational Education – The Wolf Report. Technical Report March.

Tables and Figures

Table 1: Institutions

Academic year	General FE	Sixth Form	Total
2003	258	101	359
2004	258	101	359
2005	256	102	358
2006	255	100	355
2007	253	97	350
2008	249	95	344
2009	245	94	339
2010	236	93	329
2011	231	94	325
2012	228	94	322
2013	224	94	318
2014	223	93	316
2015	221	93	314
2016	220	93	313
Total college-year observations	3357	1344	4701
Unique institutions	265	104	369
Unique principals	588	219	792

† Note: This table reports the number of colleges by year, decomposed into General Further Education and Tertiary Colleges (General FE), and Sixth Form Colleges. Over the whole period, we observe 265 unique institutions, and 588 unique principals.

Table 2: Descriptive Statistics on Principals

	General FE	Sixth Form	Total	No Principals
Unique principals	588	219	792	
Proportion Female	0.398	0.306	0.374	792
	(0.490)	(0.462)	(0.484)	
Age	56	57	57	643
	(6)	(5)	(6)	
Average Salary (annual, in pounds)	151710	118247	143593	437
	(36488)	(24153)	(36802)	
Proportion with Qualified Teacher Status	0.519	0.890	0.596	478
	(0.500)	(0.314)	(0.491)	

† Note: General FE includes General FE colleges and Tertiary Colleges. The table shows means and standard deviations (in parentheses). The data corresponds to the last year the principal is observed in our sample. Average salaries are deflated using the consumer price index (with 2015=100). Sources: Proportion female and age (own construction departing from Edubase Dataset); Average Salary (College Accounts: https://www.gov.uk/government/publications/sfa-financial-management-college-accounts); Proportion with Qualified Teacher Status (QTS) comes from the Staff Individualised Records Dataset. It is calculated as equal to 1 if the principal is ever observed in the QTS category.

Table 3: Descriptive Statistics: Outcome Variables

	General FE	6th Form	Total	Non-missing
A. Educational Outcomes				
Achieved Level 2 qualification	0.569	0.552	0.564	4263
	(0.162)	(0.239)	(0.188)	
Achieved Level 3 qualification	0.524	0.728	0.583	4263
	(0.139)	(0.181)	(0.178)	
Ever enrolled in Level4+ qualification	0.269	0.647	0.379	3331
	(0.098)	(0.146)	(0.206)	
B. Recruitment and salary policies				
Share of teachers that are permanent staff	0.581	0.791	0.627	2372
	(0.273)	(0.162)	(0.267)	
Share of female teachers	0.540	0.580	0.549	2375
	(0.112)	(0.064)	(0.105)	
Share of teachers with QTS	0.441	0.776	0.519	2071
	(0.241)	(0.174)	(0.267)	
Teachers' salary (annual, in pounds)	30003	36570	31511	2203
	(6643)	(6744)	(7215)	

† Note: This table reports descriptive statistics on educational outcomes (in the upper part of the table) and on recruitment and salary policies (in the lower part of the table). The first column presents statistics for General FE which includes General FE colleges and Tertiary Colleges. The second column presents statistics for 6th form colleges. The last column reports the number of non-missing observations (at the college-by-year level). QTS stands for Qualified Teacher Status. Teacher's salary and teacher's salary variation is for full-time teachers.

Table 4: Reasons Behind a Principal Change

Reasons	General FE (%)	Sixth Form (%)	Total (%)
Changed jobs/position	3.79	4.25	3.91
Changed colleges	6.21	5.66	6.06
Health related problem	0.52	0.47	0.51
Interim principal	8.79	5.19	7.83
Merger	2.07	1.42	1.89
Resigned	6.21	2.83	5.30
Retirement	27.59	32.08	28.79
Scandal	4.66	3.77	4.42
Principal in last year observed	31.03	36.32	32.45
Unknown reason	9.14	8.02	8.84

† This table reports statistics on the reasons behind a principal departure. Source: Own data collection. Numbers are percentages. Principal in last year observed means that the principal is still in the post in the last year in the sample.

Table 5:
Education Outcomes: How Much Do Principal Fixed Effects Add to the Explained Variation?

	Adjusted R-squared		
College-level outcomes	No Principal FE	Principal FE	Number principals
A. Within college estimates			
Achieved Level 2 Qualification	0.6991	0.7034	500
Achieved Level 3 Qualification	0.7409	0.7559	499
Ever enrolled in Level4+ Qualification	0.9872	0.9883	348
B. Within college estimates in the sample of colleges with switchers			
Achieving Level 2 qualification	0.7124	0.7227	314
Achieving Level 3 qualification	0.6567	0.6795	313
Ever enrolled in Level4+ qualification	0.9818	0.9836	194
C. Robustness check: Sample of principals that retire or are appointed after a retirement			
Achieving Level 2 qualification	0.6862	0.7171	115
Achieving Level 3 qualification	0.5210	0.6601	111
Ever enrolled in Level4+ qualification	0.9095	0.9690	116
D. Robustness check: Sample of institutions that never merged			
Achieving Level 2 qualification	0.7255	0.7371	162
Achieving Level 3 qualification	0.6380	0.6584	161
Ever enrolled in Level4+ qualification	0.9625	0.9645	90

† Note: This table presents the adjusted R-squared of regressions estimating the probability of achieving a certain college-level outcome with and without principal fixed effects. In the first column, controls include total average KS2 score, total average KS4 score, ethnicity, gender, whether the pupil ever received free school meals, institution and year fixed effects. Pre-arrival controls are also included: proportion of girls, free-school meals, non-white students and pupils who entered level 3 in the college one and two years prior to principal's arrival. In the second column, principals' fixed effects are added. Standard errors are clustered at the college level. Panel A shows the results when all available observations are used, whereas panel B uses the sample of colleges where there is at least one switcher.

Table 6: Education Outcomes: Distribution of Principal Fixed Effects

	s.d	p25	p75	F-stat	P-value	Number of ppal FE
A. Within college estimates						
Achieved Level 2 Qualification	0.128	-0.063	0.063	198.734	0.000	500
Achieved Level 3 Qualification	0.106	-0.065	0.068	83526.484	0.000	499
Ever enrolled in Level4+ Qualification	0.030	-0.022	0.017	1932.295	0.000	348
B. Within college estimates in the sample of colleges with switchers:						
Achieved Level 2 Qualification	0.143	-0.077	0.082	115.249	0.000	314
Achieved Level 3 Qualification	0.110	-0.061	0.080	639.498	0.000	313
Ever enrolled in Level4+ Qualification	0.028	-0.020	0.017	195.539	0.000	194
C. Robustness check: Sample of principals that retire or are appointed after a retirement:						
Achieving Level 2 Qualification	0.068	-0.038	0.049	4.802	0.000	115
Achieving Level 3 Qualification	0.129	-0.066	0.099	25.894	0.000	111
Ever enrolled in Level4+ Qualification	0.032	-0.025	0.020	16.347	0.000	116
D. Robustness check: Sample of institutions that never merged:						
Achieving Level 2 Qualification	0.146	-0.441	0.493	18.816	0.000	162
Achieving Level 3 Qualification	0.102	-0.343	0.248	19.615	0.000	161
Ever enrolled in Level4+ Qualification	0.019	-0.038	0.055	12.745	0.000	90

† Note: This table contains statistics on the distribution of principal fixed effects and their overall significance. In each regression, the dependent variable is the probability of a certain college-level outcome, and controls include total average KS2 score, total average KS4 score, ethnicity, gender, whether the pupil ever received free school meals, institution and year fixed effects. Standard errors are clustered at the college level. Statistics presented in this table apply the shrinkage estimator. The F-stat and associated P-value are obtained from a model assuming general heteroscedasticity, with robust standard errors. Panel A shows the results when all available observations are used, whereas panel B uses the sample of colleges where there is at least one switcher.

Table 7: Education Outcomes: Impact of Principal Characteristics

	Achieving Level 2	Achieving Level 3	Ever Enrolled Level 4+
Age	-0.003	-0.012	0.003
	(0.008)	(0.010)	(0.002)
Age squared	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Qualified Teacher Status	-0.022*	-0.016	-0.001
	(0.012)	(0.012)	(0.003)
Woman	-0.004	-0.009	-0.002
	(0.011)	(0.013)	(0.003)
Log Salary	-0.009	0.011	-0.003
	(0.019)	(0.025)	(0.005)
Observations	3257	3258	2727

† Note: This table reports coefficients from within-college regressions where the column variable is regressed on the row variables. Observations are at the college-year level. Regressions include student controls (KS4 and KS2 prior attainment scores, and ethnicity, gender, ever FSM, ever SEN, and language dummies), college fixed effects and academic year dummies. The regression for the third outcome (Level 4+) only includes observations until academic year 2011/2012. Standard errors clustered at the college level in parentheses (results are very similar if standard errors are clustered at the principal level instead); *($p<0.1$), **($p<0.05$), ***($p<0.01$).

Figure 1: Distribution of Principal Fixed Effects by Institution Type

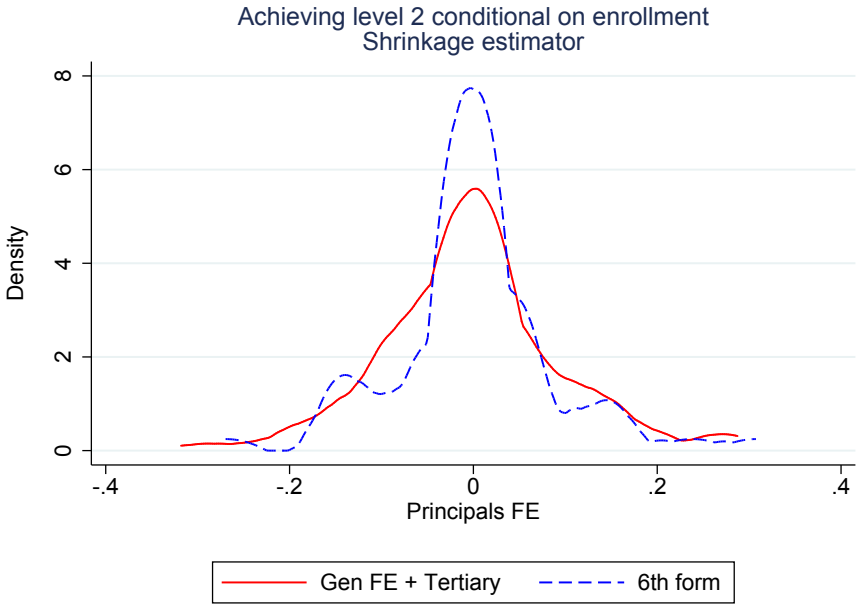

Figure 2: Distribution of Principal Fixed Effects by Institution Type

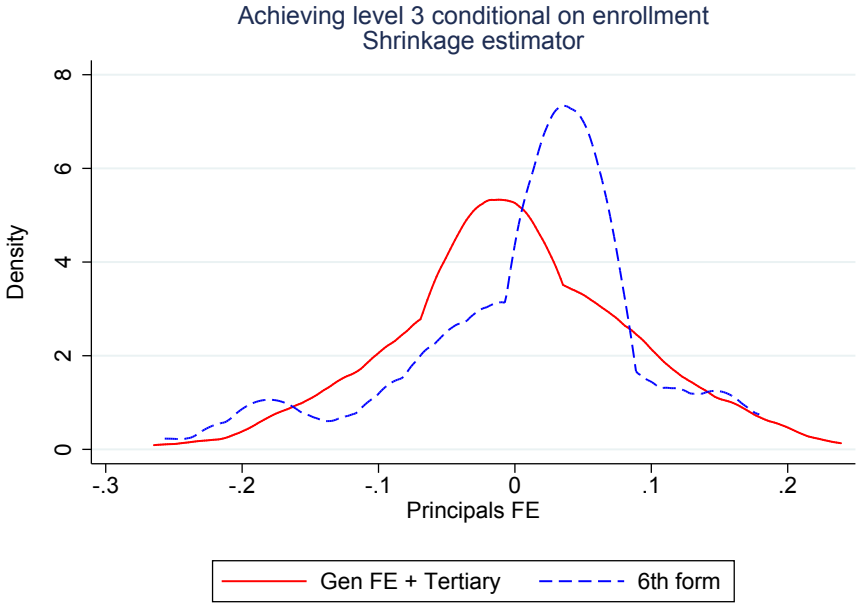

Figure 3: Distribution of Principal Fixed Effects by Institution Type

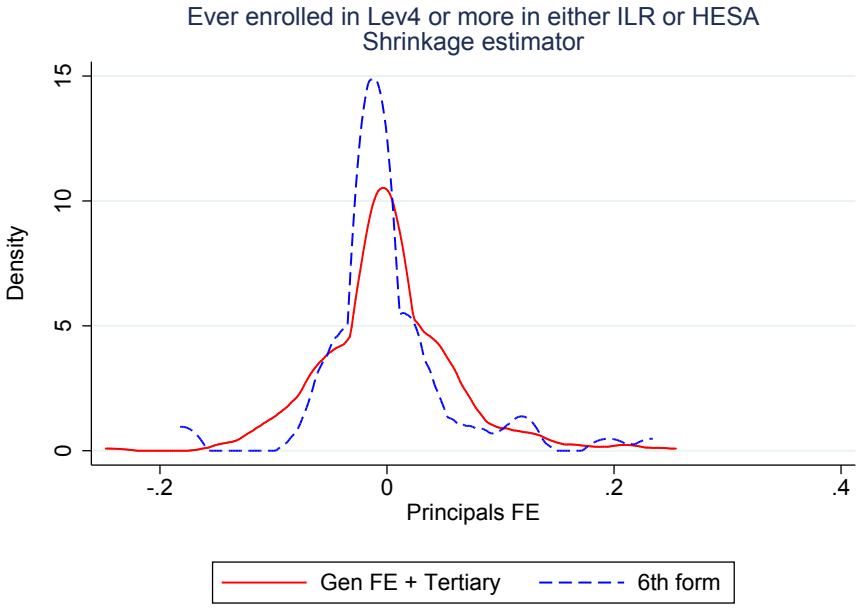

Table 8: Recruitment and Wage Policies
How Much Do Principal Fixed Effects Add to the Explained Variation?

	Adjusted R-squared		
College-level outcomes	No Principal FE	Principal FE	Number principals
A. Within college estimates			
Share of teachers permanent staff	0.7626	0.7718	158
Share of female teachers	0.6539	0.7064	159
Share of teachers with QTS	0.7992	0.8159	141
Teachers' average salary	0.6319	0.6330	146
B. Within college estimates in the sample of colleges with switchers			
Share of teachers permanent staff	0.7827	0.7912	52
Share of female teachers	0.3511	0.5033	43
Share of teachers with QTS	0.6543	0.7775	33
Teachers' average salary	0.6414	0.6635	49

† Note: This table presents the adjusted R-squared of regressions of college-level recruitment and wage variables with and without principal fixed effects. In the first column, controls include total average KS2 score, total average KS4 score, ethnicity, gender, whether the pupil ever received free school meals, a dummy variable controlling for whether the data has been backfilled in the SIR dataset, institution and year fixed effects. We also include principals pre-arrival control variables such as proportion of girls, free-school meals, non-white students and pupils who entered level 3 in the college one and two years prior to principal's arrival. In the second column, principals' fixed effects are added. Panel A shows the results when all available observations are used, whereas panel B uses the sample of colleges where there is at least one switcher. Standard errors are clustered at the college level. QTS stands for Qualified Teacher Status. Teachers' average salary is for full-time teachers.

Table 9: Recruitment and Wage Policies: Distribution of Principal Fixed Effects

	s.d	p25	p75	F-stat	P-value	Number of ppal FE
A. Within college estimates						
Share of teachers permanent staff	0.124	-0.062	0.067	30.459	0.000	158
Share of female teachers	0.065	-0.027	0.028	75.786	0.000	159
Share of teachers with QTS	0.149	-0.084	0.057	148.292	0.000	141
Teachers' average salary	3829.667	-1838.644	1672.887	18.076	0.000	146
B. Within college estimates in the sample of colleges with switchers:						
Share of teachers permanent staff	0.082	-0.052	0.061	5.017	0.000	52
Share of female teachers	0.079	-0.044	0.025	23.463	0.000	43
Share of teachers with QTS	0.157	-0.084	0.081	15.972	0.000	33
Teachers' average salary	2809.437	-1186.327	1407.108	8.150	0.000	49

† Note: This table contains statistics on the distribution of principal fixed effects and their overall significance. In each regression, the dependent variable is a college-level recruitment or wage variable, and controls include total average KS2 score, total average KS4 score, ethnicity, gender, whether the pupil ever received free school meals, institution and year fixed effects. Standard errors are clustered at the college level. Statistics presented in this table apply the shrinkage estimator. The F-stat and associated P-value are obtained from a model assuming general heteroscedasticity, with robust standard errors. QTS stands for Qualified Teacher Status. Teachers' average salary is for full-time teachers. Panel A shows the results when all available observations are used, whereas panel B uses the sample of colleges where there is at least one switcher.

Appendix 1. Treatment of duplicates and attrition in the SIR dataset

Participation in the SIR data collection is voluntary for colleges. Therefore, some colleges have not returned the information every year. To avoid having discontinuities in the data, the SIR data is reported by using a "backfill methodology" to fill the missing variables. This method consists of using the information available in a given year to fill the missing information in previous years. Intuitively, this artificial solution to attrition can be problematic for two reasons. First, replacing missing information by its value from the previous year can create significant noise in the available information. Second, for all backfilled years, the college level data omits the new recruitment of staff members. This means that, for backfilled years, not only the characteristics of the staff members might be incorrect, but also the number of staff members in a college (which omits turnover and new staff recruitments). Fortunately, the backfilled variables are all identified. Table A1 reports the percentage of information that has been backfilled for each year available in the sample. Attrition rises significantly from 2010/2011 to 2013/14. In the analysis, we keep backfilled information but control for a dummy indicating whether the information has been backfilled for a given college and academic year.

Table 10: Percentage of observations affected by backfilling

Academic Year	Percent not backfilled	Percent backfilled
2004/05	90.29	9.71
2005/06	91.86	8.14
2006/07	75.06	24.94
2007/08	91.12	8.88
2008/09	79.87	20.13
2009/10	75.38	24.62
2010/11	59.38	40.62
2011/12	46.22	53.78
2012/13	38.94	61.06
2013/14	41.52	58.48
Total	71.59	28.41

† Note: Percentage of observations affected by backfilling in the Staff Individualised Records (SIR) dataset.

CVER PUBLICATIONS

Research Papers

Building apprentices' skills in the workplace: Car Service in Germany, the UK and Spain, *CVER Research Paper 011*, December 2017
Philipp Grollmann, Hilary Steedman, Anika Jansen and Robert Gray

Apprenticeships for Young People in England: Is there a Payoff? *CVER Research Paper 010*, November 2017
Chiara Cavaglia, Sandra McNally and Guglielmo Ventura

The Payoff to Vocational Qualifications: Reconciling Estimates from Survey and Administrative Data, *CVER Research Paper 009*, November 2017
Gavan Conlon, Sophie Hedges, Steven McIntosh, Damon Morris and Pietro Patrignani

Peer Effects and Social Influence in Post-16 Educational Choice, *CVER Research Paper 008*, November 2017
Sophie Hedges and Stefan Speckesser,

The earnings differentials associated with vocational education and training using the Longitudinal Education Outcomes data, *CVER Research Paper 008,* October 2017
Gavan Conlon, Sophie Hedges and Pietro Patrignani

The longer the better? The impact of the 2012 apprenticeship reform in England on achievement and other outcomes, *CVER Research Paper 006,* September 2017
Vahé Nafilyan and Stefan Speckesser

Post 16 remedial policies: a literature review, *CVER Research Paper 005*, April 2017
Clémentine Van Effenterre

Young people in low level vocational education: characteristics, trajectories and labour market outcomes
CVER Research Paper 004, March 2017
Sophie Hedges, Vahé Nafilyan, Stefan Speckesser and Augustin de Coulon

Vocational vs. General Education and Employment over the Life-Cycle: New Evidence from PIAAC
CVER Research Paper 003, November 2016
Franziska Hampf and Ludger Woessmann

Labour Market Returns to Vocational Qualifications in the Labour Force Survey, *CVER Research Paper 002,* October 2016
Steven McIntosh and Damon Morris

Post-Compulsory Education in England: Choices and Implications, *CVER Research Paper 001,* July 2016
Claudia Hupkau, Sandra McNally, Jenifer Ruiz-Valenzuela and Guglielmo Ventura

Briefing Notes

Effectiveness of CEOs in the Public Sector: Evidence from Further Education Institutions, *CVER Briefing Note 005,* December 2017
Jenifer Ruiz-Valenzuela, Camille Terrier, Clémentine Van Effenterre

An analysis of the duration and achievement of apprenticeships in England, *CVER Briefing Note 004,* September 2017
Matthew Bursnall, Vahé Nafilyan, Stefan Speckesser

The incidence of publicly funded training in England, *CVER Briefing Note 003*, March 2017
Gavan Conlon, Sophie Hedges, Daniel Herr and Pietro Patrignani

The Decision to Undertake an Apprenticeship: A Case Study, *CVER Briefing Note 002,* March 2017
Steven McIntosh

Further Education in England: Learners and Institutions, *CVER Briefing Note 001,* February 2017
Claudia Hupkau and Guglielmo Ventura

http://cver.lse.ac.uk