Where versus What: College Value-Added and Returns to Field of Study in Further Education[1]

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Abstract

We use administrative records on educational and labor market trajectories to estimate the value-added of English further education colleges in terms of educational and labor market outcomes and earnings returns to different fields of study taught at these colleges. We find that dispersion in college value-added in terms of labor market outcomes is moderate compared to differences in earnings returns across fields of study. We further show that value-added in labor market outcomes is correlated with value-added in academic outcomes. We conclude that in English further education, *what* one studies tends to matter more than *where* one does so.

Keywords: Value-added, returns to education, returns to college, field of study, further education, vocational education and training

JEL Classification: H75, I21, J24, J45

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1 Introduction

Technological progress is changing the nature of many occupations. Tasks that traditionally have been executed by workers are increasingly performed by robots. Moreover, the declining costs of automation have accelerated the decrease in the demand for low-skill and routine jobs.[2] Adapting to this new environment will require that many workers acquire new skills in post-secondary education programs (Stromquist, 2019). While universities can provide the skills the labor market demands, they are not a feasible option for a large fraction of the population. Many individuals do not have the academic prerequisites, time, or resources to pursue a university degree. Therefore, enrolling in vocational education and training (VET) programs constitutes a natural response to the current dynamics of the labor market for many young people and adults.

In this study, we assess the relevance of two important decisions that prospective students have to make when pursuing vocational studies: We analyze whether *where* one studies is more (or less) relevant for labor market outcomes than *what* one studies. To this end, we estimate how differences in the quality of further education (FE) colleges in England and returns to field of study taught at these colleges contribute to explaining labor market outcomes for young and adult learners. Further, we ask what mechanisms drive heterogeneity in college value-added.

We start by analyzing FE colleges' effects on student human capital accumulation and labor market outcomes by estimating institution's *value-added* (VA) in terms of academic performance, earnings, and employment status.[3] Next, to explore the mechanisms that might be driving heterogeneity in college quality, we correlate college inspection ratings, indicators of resources available to students, and learning formats (e.g., distance learning, in the classroom, etc.) with measures of FE college VA. Finally, we estimate returns to fields of study taught at FE colleges and compare them with our VA estimates.

In our empirical strategy, we follow two approaches shaped by the nature of the outcome variables under study. First, to estimate VA in educational outcomes, where no repeated measures over time of the dependent variable exist, we use a cross-sectional strategy where an unusually detailed set of control variables helps to account for many potential confounders. The identifying assumption for this type of empirical specifications is that, conditional on observable characteristics, students are randomly assigned to FE colleges. We discuss the plausibility of this assumption and provide robustness checks supporting it. Second, we implement lagged dependent variable and individual level fixed effects models to provide estimates of FE college VA in labor market outcomes and earnings returns to field of study. The fixed effects analysis corresponds to estimating a treatment-on-the-treated effect, where we compare average gains in the outcome variable after vocational education attendance across different colleges or after specializing in a given sector. This approach allows us to deal with any time-invariant unobserved characteristics that might be related to potential outcomes. We also discuss and address concerns related to potential time-varying selection.

To the best of our knowledge, this study is the first to provide rigorous measures of FE college VA in terms of labor market outcomes for a large set of vocational institutions. The closest studies to ours are Clotfelter et al. (2013), Carrell and Kurlaender (2020), and Kurlaender, Carrell, and Jackson (2016), who estimate VA for community colleges in North Carolina and California. However, their estimates are focused on college outcomes rather than labor market outcomes. Much research in the economics of education has focused on estimating *returns* to vocational degrees or on the returns to attending different *types* of institutions (e.g., public vs. for-profit, 4-year vs. 2-year colleges). For example, Jepsen, Troske, and Coomes (2014) use labor market information prior to and after enrolling in US community colleges in Kentucky to study the returns to different degrees. Cellini and Turner (2019) use a difference-in-difference strategy to analyze the returns to attending for-profit colleges in the US. Similarly,

Andrews, Li, and Lovenheim (2016) analyze the labor market returns to attending community colleges relative to high-quality four-year institutions in Texas.[4] However, none of these studies assesses the degree of heterogeneity in VA across different community colleges. Moreover, our analysis involves estimating VA measures across *all* FE colleges in England, providing a complete picture of this sector. Furthermore, while many papers have studied the mechanisms that make some vocational institutions successful in the US (Jacoby 2006; Bailey et al. 2006; Calcagno et al. 2008; Stange 2012; Carrell and Kurlaender 2020), most of these analyses relate success only to academic outcomes, while we extend this analysis to labor market outcomes.

Finally, we bring new insights into understanding the relevance of fields of study for labor market outcomes.[5] Our focus on the returns to the number of learning hours *enrolled* in qualifications associated with specific fields of study, rather than achieved hours or completed degrees, provides two main advantages. First, it helps to alleviate endogeneity concerns related to differential selection into completion and achievement of qualifications. Second, the fact that individuals enroll in multiple qualifications from different specializations (i.e., not necessarily their main specialization) implies that our identification of the returns to fields of study is also obtained from students specializing in other fields.[6] If instead, we were focusing on estimating returns to completing degrees in different fields of study, these would only be identified from individuals who completed their studies in the specific field as their major. Furthermore, this is the first study to provide rigorous estimates on the returns to a large number of detailed fields of study in vocational education, as opposed to higher education, in England.

We find substantial heterogeneity in FE colleges' contributions to their students' educational attainment. Compared to the mean in the population, a one standard deviation (SD) increase in college VA increases the number (share) of achieved learning hours by 8.1% (6.5%). We also find that a one SD increase in college quality increases the likelihood of obtaining a good upper secondary qualification - a pre-requisite for attending university in

England - by 4.4 percentage points, or 10.5% compared to the sample mean, and increases the likelihood of later attending university by nearly 4 percentage points, or 10% compared to the sample mean. These findings indicate that certain FE colleges are more effective than others at enhancing academic outcomes.

Our findings also indicate a relatively modest dispersion in FE college value-added in terms of earnings, especially for individuals who attend FE college later in life. We show that a one SD increase in FE college VA leads to an increase in daily earnings of around 3% for individuals first attending FE college between ages 18 and 20 (*young learners*) and by 1.6% for individuals attending FE college later in life, between ages 25 and 54 (*adult learners*). Differences in the dispersion of VA between young and adult learners are likely driven by the fact that young learners enroll in and complete substantially more learning hours than adults, making the intensity of the treatment very different between the two groups. To put these numbers into context, Broecke (2012) shows that a one SD increase in university selectivity in the UK leads to a rise in earnings of approximately 7%. Relating our findings to returns to associate degrees in the US, Jacobson, LaLonde, and Sullivan (2005*b*) find that an additional year of community college increases earnings by 9% for men and 13% for women, which is substantially larger than the gain that could be obtained from attending an FE college with a one SD higher VA. In summary, while the overall returns to vocational education can be large, the dispersion in FE college value-added in terms of earnings is much smaller. Regarding the effects of FE colleges on improving employment probabilities, we find that a one SD increase in FE college VA increases the likelihood of being employed more than 90 days in a given year by only about 1.7 and 1 percentage points for young and adult learners, respectively. This represents only a slight increase of 2.3% and 1.2%, respectively, compared to the mean employment rate in the sample.

The potential mechanisms that could be driving the variability in FE college VA in labor market outcomes include both student achievement at college and college inputs. Our findings suggest a significant correlation between FE college VA in academic outcomes and FE college VA in earnings. Learning modes also seem to play a role in explaining variation in VA, with colleges offering a larger share of their courses in the classroom having higher VA in earnings for young learners. However, we find no correlation between measures of college spending and FE college VA in either earnings or employment.[7] For adult learners, we do not find meaningful correlations between VA in labor market outcomes and characteristics of colleges, which is likely due to the little variation in VA in labor market outcomes across colleges for this subgroup of the population.

How does the moderate heterogeneity in value-added across colleges in terms of earnings compare to the importance of field of study when it comes to labor market outcomes? We find comparatively large variation in the returns to different fields of study, especially for young learners. For instance, the typical young male learner who chooses engineering and manufacturing technology as his main field of study experiences an increase in average post-FE college daily earnings of 7.7% five years after finishing college. In contrast, the typical young male student choosing preparation for life and work experiences negative earnings returns of on average approximately 2% five years post-FE, compared to pre-enrollment earnings.[8] These findings are consistent with the literature on returns to field of study in vocational education. According to a review by Belfield and Bailey (2017a), the returns to an associate degree in a STEM field tend to be larger than for other fields.

Disparities in returns to sector are also large among young female learners. Average earnings returns five years post-FE college graduation range from a substantial 16.4% for arts, media and publishing to a mere 0.8% for preparation for life and work. Finally, we also find

that many specializations present negative returns immediately after finishing VET education that turn positive five years later, indicating that it takes time for positive returns to emerge.

In summary, our results show that there is important variation in returns to field of study, and this variation plays a larger role in labor market outcomes when compared to variation in FE college quality measured by VA. If we order fields of study based on their returns for the typical young male (female) learner, then changing from a field that is in the 10th percentile to one in the 90th percentile would lead to an increase in returns that is approximately 84% (43%) larger than if we were performing the same exercise based on FE college value-added.

We believe that our findings have relevant practical implications for many students and policymakers. First, they allow prospective FE college students better to understand the variation in quality across different institutions and compare the returns to different fields of study.[9] This is particularly important in light of the evidence suggesting that students tend to be misinformed about the labor market returns of VET qualifications. Baker et al. (2018), for instance, find that only 13% of students in a sample of community college students in California correctly rank four broad categories of majors in terms of salary. Second, our findings on mechanisms can inform policymakers about plausible paths to enhance the efficiency of a sector that is facing significant challenges, such as a perceived decline in quality and student performance, growing demands on their mission, and financial pressures related to increased competition for students and shrinking further education budgets.[10]

The remainder of this paper is organized as follows: Section 2 gives an overview of the institutional setting. Section 3 describes the data. Section 4 presents the empirical strategies used. In Section 5, we present FE college VA estimates, as well as robustness checks and the analysis of potential mechanisms explaining differences in VA across institutions. In Section 6, we present results on the returns to field of study. Section 7 concludes.

2 Institutional Background

Students in England complete compulsory education at the age of 16 (at the end of Key Stage 4 -KS4-, in year 11) when they take a set of standardized exams (i.e., the Graduate Certificate of Secondary Education -GCSEs-). All students must take English, math, and science exams at age 16 and are free to choose additional subjects. After compulsory education, students in the sample period we studied were free to choose to stay on in education and follow a further education program. A large fraction of students chooses vocational courses or a combination of vocational and academic courses (Hupkau et al., 2017), which are the subject of this study. Such programs are below a bachelor's degree level and typically take two years or less to complete. They are comparable to associate's degrees or vocational certificates offered at US community or for-profit colleges. In England, they are mainly offered at FE colleges. FE colleges are critical because they enroll many more students than universities.[11] They also differ substantially from them. FE colleges are typically not oversubscribed or selective, meaning they tend to admit all students that apply to them.[12] They do not tend to offer financial aid, but their courses are typically free to young people up to the age of 19, and many of their courses for adults are also publicly funded.

Table 1 summarizes the qualifications typically obtained by young and adult learners at FE colleges. A set of features characterizes qualifications: The level of the qualification, which is an indicator of depth and difficulty; the intensity and duration of a qualification, typically measured by the number of guided learning hours (i.e., the time when students are under the supervision of a teacher, tutor or lecturer) required to complete the qualification; and the field of study. The main vocational and technical qualifications offered at FE colleges are awards, certificates, and diplomas. Awards are short courses comprising up to 130 guided learning hours, corresponding to about half a semester of study time. Certificates are larger

qualifications, comprising between 130 and 370 guided learning hours and taking about one year of full-time study. Diplomas involve at least 370 guided learning hours and usually take up to two years to complete. Another common type of qualification is the National Vocational Qualification, which students take while working. Most of the aforementioned qualifications can be taken at levels two through eight, meaning that they are available both for 16-year-old school leavers with no further prior education, as well as at tertiary education levels (levels four and above), where individuals need to fulfill some prerequisites.[13] FE colleges also offer academic qualifications, including GCSEs, A-levels (university entry qualifications), and Foundation Degrees, which are higher education degrees lasting two years and are taken by only a small minority of students in our analysis. Note that most qualifications taken at FE colleges do not have a performance indicator akin to a grade associated with them, or if they do, they are often not comparable across different qualifications. Performance is, therefore, typically measured by whether a qualification is achieved.

According to the UK's Department for Education (DfE), students' FE college choices are very localized: Most learners (70%) travel less than 10 km from their home to the site of their further education provider, with 50% traveling less than 6 km (DfE, 2016). This is similar to US community college choices, where students usually attend the one closest to their home (Stange, 2012). Accordingly, selection is mainly driven by the sorting of parents (in the case of young learners) and adult learners into different geographic areas and neighborhoods (Gibbons and Telhaj, 2007).

While FE colleges are private corporations, the majority of their income comes from government grants, representing, on average, just under 80% of revenues in 2015/16, with only about 14% of revenues coming from tuition fees. Because the state funds most of the learning at FE colleges, the courses they provide are regulated by the Office of Qualifications and Examinations Regulation (Ofqual) to ensure certain standards for publicly funded learning.[14]

Qualifications are designed by awarding bodies, which are private, for-profit organizations that provide the curricula and assessment framework for different vocational qualifications.[15]

3 Data

For our empirical analysis, we combine several administrative datasets from England. We focus on the universe of more than 2 million learners for four cohorts of school leavers. The data contain comparable measures of prior achievement from age seven up until the end of compulsory education at age 16, and demographic characteristics (age, ethnicity, language spoken at home, socio-economic status, neighborhood characteristics, including measures of income and employment deprivation). It also covers every individual who has ever enrolled in publicly funded adult learning and records detailed information on the learning undertaken. Finally, we link educational data to administrative records of labor market outcomes before and after attending FE college.

Because we do not have the same measures of prior attainment and socio-economic background for all learners, we construct two different datasets for this study. The first dataset covers learners aged 16-20 (*young learners*) when first enrolling in FE colleges. The second dataset covers learners aged 25-59 (*adult learners*). Further details about the data sources, the dataset construction for both groups, as well as the sample restrictions can be found in Online Appendix A.1.

Tables 2 and 3 show summary statistics for young learners aged 16 to 20 and adults aged 25 to 59, respectively. One of the main differences between young and adult learners is in the duration and intensity of learning. Young learners enroll on average in about 1,049 total guided learning hours, and the average length of study time is about two years (732 days), compared to only 185 guided learning hours for adults and study duration of less than 10 months (290

days). In addition, whereas adult learners enroll in about two qualifications on average, young learners take about five courses.

The types of courses studied also differ across the young and adult sample. While more than 60% of young learners enroll in at least one course at level 3, only 31% of adult learners do so. Adults are most likely to be observed in learning at level 2 (62%), and a small share (7%) is doing advanced courses (level 4 and above), while almost none of the young learners is enrolled in such higher-level courses. The median distance traveled to the FE college attended for young learners in our sample is about 6 km and around 10 km for adults.

We also present summary statistics for young and adult learners by gender. Online Appendix Tables A1 and A2 correspond to young learners. Young males and females spend about two years on average in FE college learning, and the total number of guided learning hours enrolled is not substantially different across genders.[16] Labor market attachment is also similar across males and females prior to FE college attendance. Among the 18-20 age group, the percent of male and female students that had any employment experience before FE college entry are 75% and 76%, respectively. However, young males show larger annual earnings than females, with males earning on average £600 more per year than females in the year of FE college entry.

Online Appendix Tables A3 and A4 present similar summary statistics by gender for adult learners. The average duration of further education learning is 319 days for adult females, while for adult males, it is only 257 days. However, females enroll in a similar number of guided learning hours to their male counterparts (195 versus 173). We also find similar labor market participation rates between males and females, with the employment share before FE college entry being 73% and 74%, respectively. Males show substantially higher annual earnings than females in the year they enroll in FE college (£12,681 vs. £8,974). This is probably due to

females both working fewer hours and in sectors characterized by lower pay, among other potential reasons.[17]

4 Methodology

The main challenge associated with the identification of FE college value-added and returns to field of study is the problem of selection. FE colleges tend to admit all of their applicants, and students generally enroll in the institution closest to their home. Therefore, selection into FE colleges is mainly driven by the sorting of individuals into different geographic areas/neighborhoods. A naive approach that just compares the earnings of students enrolled across different institutions is likely to be misleading because it can confound students' prior academic preparation and other background characteristics with FE college inputs. Similarly, selection of students with more motivation or talent into specific fields of study might bias estimates of returns.

To illustrate how pervasive this problem is among young learners, Figures 1 and 2 plot, respectively, average prior attainment and a measure of socio-economic status against raw average labor market and educational outcomes by FE college. The prior attainment measure on the horizontal axis of Figure 1 is the average standardized KS4 score by college, while the horizontal axis in Figure 2 is the share of students eligible to receive free school meals by college. As is evident from these figures, there is large heterogeneity across FE colleges in the average characteristics of their student intake, and large and significant correlations between student intake characteristics and ex-post educational and labor market outcomes, measured by the number and share of guided learning hours completed, whether or not a level 3 qualification was obtained, earnings and employment rates.

To characterize selection into fields of study, Panel (a) of Figure 3 shows the share of students eligible to receive free school meals (FSM), and Panel (b) shows the prior academic performance as given by the average standardized KS4 score by field of study chosen at FE college, for young male and female learners.[18] Both panels display notable differences in the sorting of students across fields based on these characteristics.

These empirical regularities show that disentangling the contribution of student characteristics from the effect of institutions and specializations should constitute the main goal of our empirical strategy.

4.1 Value-Added Models

First, we propose a value-added model (VAM) with a very extensive set of control variables and lagged dependent variables, following the spirit of the teacher effectiveness literature. Second, we describe fixed effects strategies exploiting within-individual variation over time to estimate treatment-on-the-treated effects of the FE college attended and the field of study chosen on employment and earnings outcomes. Using both methods allows us to assess whether our results on VA heterogeneity change under different model specifications.

4.1.1 Cross-Sectional Models with Lagged Dependent Variables

The economics literature on teacher effectiveness (Kane and Staiger (2008), Chetty, Friedman and Rockoff (2014), and Koedel, Mihaly, and Rockoff (2015), among many others) is mainly characterized by the estimation of value-added models with lagged dependent variables in a cross-sectional setting. The key identification assumption of these models translated to our context is that after conditioning on lags of the dependent variable (i.e., sufficient statistics) and a large set of controls, individuals are no longer sorted into FE colleges based on unobservable determinants of the dependent variable.[19] The exceptionally rich set of controls

that we have available in our data for young learners gives us confidence that we can account for a large array of potential confounders. We describe these controls below.

Equation (1) characterizes our empirical specification. The post-FE college outcome, Y, of individual i, who attended FE college c and is measured at time T (e.g., 2017 for labor market outcomes or at the end of FE college attendance for outcomes related to academic achievement), is determined as follows:

$$(1) \qquad Y_{icT} = f_1(Y_{ict-z}) + f_2(\mathbf{X_1}_{ict-z}) + f_3(\mathbf{X_2}_{ict}) + f_4(\rho_{it}) + \pi_c + \varepsilon_{icT}$$

$f_1(Y_{ict-z})$ is a control function for the lagged outcome (in equations that have labor market outcomes as the dependent variable), with t indicating time while at FE college. For example, earnings specifications include earnings measured prior to FE entry, an indicator for when earnings prior to FE entry were measured, an interaction between these two variables, and also dummies indicating working status in the years before and at the time of FE college entry.[20] $\mathbf{X_1}_{ict-z}$ is a vector of characteristics measured prior to enrolling in the FE college and includes: gender, a series of dummies for ethnicity, a dummy for whether English is spoken at home, a dummy for whether the student had special education needs during compulsory education, a dummy for whether the student was eligible to receive free school meals at the end of compulsory education, the neighborhood IDACI score (i.e., a measure of socio-economic deprivation), the standardized KS4 score, the Ofsted rating of the KS4 school (analogous to school report cards in the US), and student KS2 and KS3 math and English scores.[21] $\mathbf{X_2}_{ict}$ is a vector of variables measured at the time of FE college attendance and includes: age when first entered FE college, whether the student attends full-time or part-time, a series of dummies for the main field of study, dummy variables indicating the region where the college is located (to account for different local labor market characteristics) and an additional vector of local

deprivation indicators based on the FE college's location and students' area of residence. $f_4(\rho_{it})$ is a flexible vector that includes controls for the academic year compulsory schooling was completed, dummies indicating the last year observed in education, indicators for the number of years since starting FE, and a series of dummies indicating the graduation year from FE college. These controls are included to account for potential earnings drops before FE college enrollment (the "Ashenfelter dip").[22] π_c is the value-added of the FE college attended and ε_{icT} denotes an idiosyncratic shock.

Given that the main object of analysis in these lagged dependent variable models is π_c (i.e., institution value-added), many covariates that could operate as mediating variables ("bad controls") are excluded from our specifications. These include, for instance, the share of guided learning hours achieved per student, which is a proxy for completion and constitutes an outcome of the FE college.

In terms of estimation, we implement a two-step approach following Guarino et al. (2015). In the first step, we perform an OLS regression where the institution effect (i.e. π_c) becomes part of the error term. The equation we estimate thus becomes:

$$Y_{icT} = f_1(Y_{ict-z}) + f_2(\mathbf{X1}_{ict-z}) + f_3(\mathbf{X2}_{ict}) + f_4(\rho_{it}) + \epsilon_{icT} \quad (2)$$

with

$$\epsilon_{icT} = \pi_c + \varepsilon_{icT}$$

In the second step, we estimate the population standard deviation of FE college VA, and best linear unbiased predictors (i.e., shrinkage estimates) of the institution's VA, following equations 15 to 21 in Guarino et al. (2015). Models are estimated on the whole sample, by age group on first entering FE college, and separately for males and females.

Despite the rich set of controls included in this cross-sectional setting, unobserved characteristics could still be driving the selection of students into different FE colleges. For labor market outcomes, we can further address this concern by exploiting within individual variation in outcomes before and after attending FE college. The next section describes this approach.

4.1.2 Fixed Effects Model

To further address the concern of possible selection on time-invariant unobservables, we exploit within-individual variation in labor market outcomes by estimating individual fixed effects models. Compared to the cross-sectional approach presented in Section 4.1.1, the fixed effects approach has the advantage of potentially further reducing omitted variable bias due to unobserved heterogeneity in ability or other time-invariant factors related to individual success in the labor market.[23]

We estimate the following specification for the two samples of young and adult learners, and also separately by gender:

$$Y_{ict} = f_1(\mathbf{X}_{it}) + f_2(\rho_{it}) + \zeta_i + D_{it}\pi_{ct} + \eta_{ict} \quad (3)$$

where $f_1(\mathbf{X}_{it})$ includes labor market experience up until FE college entry, main field of study, a series of dummies for the region where the FE college is located interacted with the academic year, academic year fixed effects and a second order polynomial in age.[24]

$f_2(\rho_{it})$ is a flexible vector of control variables that accounts for years since starting and leaving the FE college, and whether the individual is enrolled in some form of education in year *t*. The ζ_i's represent individual fixed effects. π_{ct} denotes the effect of the FE college attended on outcome Y_{ict} in period *t*. Following Jepsen, Troske, and Coomes (2014), π_{ct} is pre-multiplied by

the indicator variable D_{it}, which is equal to one once an individual has finished FE education and zero before.

The key identification assumption for fixed effects models is the absence of time-variant unobservable characteristics driving selection into FE colleges. While fixed effect strategies cannot handle selection on time-varying unobservables, note that $f_2(\rho_{it})$ is included to address some potential concerns in this regard. For example, if a wage dip motivates individuals to enroll in FE education, this could lead to an upward bias in our estimates.[25] To overcome these concerns, we take several steps. First, the indicator on whether the individual is enrolled in some form of education accounts for the opportunity cost of students while enrolled in education. Second, the variable capturing the number of years since the individual left the FE college controls for any general post-FE changes in earnings. The third set of controls are dummies for the number of years since entering FE education, which also includes the years before enrolling. This accounts for the "Ashenfelter dip".

In terms of estimation, we also implement a two-step approach. We focus on institution VA corresponding to the year 2017, the last year for which we have earnings and employment data. This implies using all the years when performing the first step regression, but using only the residuals corresponding to the year 2017 to obtain the population distributions of FE colleges' VA and their shrinkage estimates.

4.2 Returns to Field of Study

We propose the following empirical model to estimate the returns to learning hours in different fields of study:[26]

$$(4) \quad Y_{ict} = D_{it}\mathbf{Z_{it}}\boldsymbol{\Upsilon_1} + D_{it}\mathbf{Z_{it}}\tau_t\boldsymbol{\Upsilon_2} + D_{it}\pi_c + \zeta_i + D_{it}\phi_i + D_{it}\phi_i\tau_t + D_{it}\omega_i + g(\mathbf{X}_{it}) + f(\rho_{it}) + \eta_{ict}$$

Y_{ict} is the outcome of interest (i.e., log daily earnings) of individual *i*, who attended FE college *c*, measured at time *t*. D_{it} is an indicator variable that denotes whether the individual has finished FE education at time *t*. Z_{it} is a vector representing the number of guided learning hours enrolled in each field of study.[27] The advantage of using enrolled hours rather than achieved hours is that it helps to overcome endogeneity concerns associated with differential selection in terms of who completes them. τ_t indicates the number of years since leaving FE education. Υ_1 and Υ_2 represent the parameters of interest: the returns to guided learning hours by field of study, and the interaction term of years since completing FE college education and guided learning hours by field of study, respectively. This interaction accounts for the fact that returns to certain fields may take time to materialize. π_c denotes further education college fixed effects, which intend to capture the effects of college quality (π_c is no longer treated as a random effect as in the previous VA specifications). ζ_i denotes individual fixed effects. ϕ_i is a vector determining achieved guided learning hours in qualification types (e.g. BTEC, NVQ, etc.) and levels (i.e. levels 2-4), which intends to account for selection, difficulty, and signaling effects potentially attached to the different qualifications. $\phi_i\tau_t$ captures differential returns to types of qualifications since finishing FE education. This allows us to control for differential returns to experience that may not be absorbed by individual fixed effects. ω_i denotes the number of guided learning hours achieved by awarding body for each of the different qualifications that the student has enrolled in. $g(\mathbf{X}_{it})$ includes a second order polynomial for labor market experience and age, and region fixed effects interacted with academic year fixed effects to account for trends in local labor markets. Finally, $f(\rho_{it})$ is a flexible vector that accounts for years since starting FE college, whether the individual is enrolled in some form of education in year *t*, a linear trend for years since finishing education, and academic year fixed effects.

We are unaware of other studies that intend to estimate returns to field of study based on hours enrolled in each of the different fields of study, while simultaneously controlling for type

and awarding body of qualifications achieved, FE college attended, and individual fixed effects. Our approach is similar in spirit to that of Kane and Rouse (1995), who estimate returns to community college credits while conditioning on degree completion. However, they only consider overall achieved credits rather than enrolled credits by field of study. Moreover, returns to field of study in our setting are identified from individuals who specialize and those who do not specialize in a given field of study, because individuals tend to complete qualifications not only in their main specialization. Therefore, concerns regarding differential returns to experience for individuals that select into a given main specialization are less of a problem in our setting.

5 FE College Value-Added

This section presents value-added estimates for academic and labor market outcomes. We also include robustness checks and discuss plausible mechanisms behind our main findings. As described in Section 3, young and adult learners differ substantially in the number of guided learning hours they enroll in while in FE. This suggests that the returns to FE college education for these groups are likely to differ. We, therefore, present results separately by age group. We also show results by gender due to potential differences in the labor market trajectories of males and females.

5.1 Academic Outcomes and Progression to Higher Education

First, we assess to what extent some institutions are more successful than others at enhancing students' academic outcomes. These outcomes are only observed once. Therefore, we cannot implement a fixed effects strategy or control for lags of the dependent variable. However, these empirical models include an extensive set of covariates: We control for several measures of

prior academic performance, such as performance in English and math exams at age 16, 14 and 11, and many important background characteristics.[28]

Table 4 reports the population standard deviation (SD) of FE college value-added obtained from cross-sectional specifications for young learners that are 18-20 years old when first entering FE college (Column 1), and separately for males (Column 2) and females (Column 3).[29] To determine whether differences in VA across demographic groups are statistically significant, we report bootstrapped standard errors of the VA standard deviations in the second row of each panel.

The first panel of Table 4 focuses on total guided learning hours achieved. A one SD increase in institution value-added is associated with a 33-hour increase in achieved learning hours, and this effect is very similar for males and females. The effect is sizable, representing an 8% increase compared to the sample mean of 412 achieved guided learning hours.

The second panel considers the share of guided learning hours achieved, conditional on enrollment. Our findings show that a one SD increase in institution value-added is associated with a 4.5 percentage point increase in the share of guided learning hours achieved. This is equivalent to an increment of about 6.5% for the average student. Again, results are similar in magnitude for males and females.

The third panel focuses on achieving at least one level 3 qualification. Many learners enter FE college with qualifications at or below level 2. Achieving a level 3 qualification can therefore be considered an important milestone because it is a requirement for higher education. While these qualifications are taught in FE colleges, they are not awarded by them but by specialized awarding bodies, providing an objective and comparable measure of educational achievement. We find that a one SD increase in FE college value-added increases the probability of obtaining a level 3 qualification by approximately 4.4 percentage points, which

is equivalent to an increase of 10.5% when compared to the sample mean. Value-added of colleges in this outcome is higher for males than for females.

Finally, we study progression to higher education (HE) in the last panel of Table 4. A one SD increase in FE college value-added raises the probability of progressing to a higher education program by nearly 4 percentage points (equivalent to a 10% increase in terms of the sample mean). This effect is sizable and suggests that some FE colleges are, in fact, better than others at preparing students to enroll in higher education.

Overall, our findings indicate the presence of important variation in FE college value-added in academic outcomes, suggesting that some institutions are more successful than others at enhancing the human capital of their students. Next, we explore whether such heterogeneity is present when considering labor market outcomes.

5.2 Labor Market Outcomes

We now turn to the estimation of college value-added in labor market outcomes: log daily earnings, log annual earnings, daily earnings in levels (including zeros for those not employed), and whether the individual was employed for more than 90 days, all measured in 2017 (the last year for which we have labor market data). While annual log earnings condense the effect of FE college value-added on employment intensity and earnings, daily earnings in levels allow us to incorporate into the analysis those individuals who are not working after finishing FE education, combining extensive and intensive margin effects.

Results are reported in Table 5. The first three columns correspond to lagged dependent variable specifications using cross-sectional data for young learners (Equation 2), while the last six columns correspond to individual fixed effects specifications (Equation 3) for young (Columns 4 to 6) and adult learners (Columns 7 to 9). The top panel shows that a one SD

increase in college value-added increases daily earnings by around 3% to 3.6% for young learners, depending on the specification, and by 1.6% for adult learners.[30]

We also explore whether heterogeneity in FE college VA in log daily earnings varies by field of study. To this end, we estimate specifications allowing institution VA to interact with field of study, grouping subjects into two broader groups of STEM and non-STEM fields. We find that the standard deviation of institution VA conditional on STEM fields is 2.8%, while in non-STEM fields, it is 3.6%.[31]

Analysis by gender, summarized in Figure 4, shows that college VA tends to matter more for females than males among young learners. A one SD increase in college value-added increases daily earnings by 4.1% for females and 3.1% for males. These estimates are statistically significantly different from each other. For adult learners we do not observe the same gender disparities in value-added.

The second panel of Table 5 shows that results are similar to our previous specification for young and adult learners when considering log annual earnings. The third panel of Table 5 shows results corresponding to daily earnings in levels, which include individuals not in employment. Again, these estimates provide a similar picture as for log daily earnings or log annual earnings. For example, a one SD increase in FE college value-added increases daily earnings for young learners by approximately £1.7, which corresponds to a 3.8% increase in mean daily earnings, where the estimates are slightly higher for young females than for males (5% versus 3.7%). For older learners, a one SD increase in value-added increases daily earnings by around £1, equivalent to a 1.9% increase in their mean daily earnings.

Finally, we find little dispersion in terms of FE college's contribution to employment outcomes. The fourth panel of Table 5 shows that a one SD increase in FE college value-added is associated with an increase in the probability of being employed at least 90 days in 2017 of

1.7 percentage points for the young and 1 percentage point for the adult sample. This corresponds to a 2.3% increase with respect to the mean for the young and a 1.2% increase for adults.[32]

Our results do not imply that colleges do not add value or that there are no returns to attending college. Instead, they imply that overall, the variation in these returns is relatively modest. However, as shown in Figure A1, which plots college-level VA estimates in log daily earnings on the vertical axis, ordered by institutions' percentile rank in VA, the differences between extremes, high vs. low VA institutions, are less modest.

In summary, two main findings emerge from the value-added analysis. First, heterogeneity in labor market returns of attending different FE colleges can be characterized as more moderate when compared to the variability in academic outcomes. This suggests that other factors, such as field of study, might be important to explain heterogeneity in labor market outcomes among vocational education students. Second, the effects of college quality on adult learners are about half the size of those on young learners. These differences are likely driven by the lower intensity of treatment (i.e., the lower number of courses and guided learning hours completed) among adult learners.

5.3 Robustness Checks

The analysis for young learners presented so far includes students who attend higher education after FE college. Value-added estimates may, therefore, partially be picking up the effect of earning a university degree. To determine the extent to which this matters for our results and to get a sense of the importance of FE college value-added among those students whose final educational goal is to achieve a vocational degree, we present VA estimates for those who never attend university after leaving FE college (nearly 70% of the sample of young learners) in Online Appendix Table A7. Individual fixed effects estimates using panel data indicate that

increasing FE college value-added by one standard deviation increases daily log earnings by 2.6% for this sub-sample, which is similar in magnitude to estimates for the full sample reported in Table 5 (3%).

Individuals who first enter college at the ages of 16 or 17 are less likely to have prior labor market experience, which is why we have left them out of our main analysis above. However, this may compromise the external validity of our findings. To address this concern, Online Appendix Table A8 reports the variation in FE college value-added estimates for the 16-20 (Columns 1 to 3) and 16-17 (Columns 4 to 6) age groups. Reassuringly, the results are very similar to our main estimates in Table 5.

To better understand the richness of our control variables in the cross-sectional setting, Online Appendix Table A9 shows how adding different controls sequentially affects the variation in VA estimates across colleges. The first column shows that a one SD increase in FE college VA leads to an almost 8% increase in earnings when no controls are included. Controlling for gender (Column 2) reduces this estimate to 7.2%, whereas adding the learner's age and year of FE study in Column 3 reduces it to 5.2%. Further including controls for learners' socioeconomic status, local neighborhood deprivation, and prior school attainment at ages 11, 14, and 16 reduces the estimate to 4% (Column 6). Finally, adding lagged earnings (Column 7), main sector dummies (Column 8), and whether the student studies full-time vs. part-time (Column 9) further reduces the estimate to 3.6%. Overall, we believe that our rich set of control variables is quite powerful in addressing selection.

Despite our rich set of controls, cross-sectional models with lagged dependent variables cannot completely rule out selection on unobservables. If the large set of controls is not extensive enough to account for sorting into FE colleges, we will be confounding students' characteristics with the quality of the institution. To indirectly assess the likely importance of

selection on unobservables in the cross-section specifications, we follow Chetty et al. (2014) and the teacher value-added literature and analyze to what extent VA estimates correlate with *a priori* important observable student characteristics (i.e., prior performance - KS2 and KS3 scores - and free school meal eligibility) when the latter are left out intentionally from the empirical specifications. A strong correlation could indicate that selection on unobservables could still be an important driver of our findings. Figures 5 and 6 show, respectively, correlations of value-added measures in earnings and employment estimated in this way with measures of average prior academic preparation (i.e., average student performance in KS2 and KS3 at the college level) and socio-economic status (i.e., the share of the FE college's intake that had been eligible to receive free school meals in the year they completed compulsory education). Reassuringly, our value-added estimates show no correlation with either KS2 and KS3 performance nor with the share of enrolled free school meal eligible students.[33] In contrast, recall that in Figures 1 and 2, we saw that average raw daily earnings of graduates at FE colleges were significantly positively correlated with average school performance and negatively correlated with the share of the student intake that was eligible to receive free school meals. The absence of correlation between our FE value-added measures and *a priori* important variables that characterize the background of the learner suggests that selection on unobservables is not driving our cross-sectional results.

5.4 Mechanisms

To provide a better understanding of what might be driving FE college VA, we regress these measures on a set of potential mediating variables: college inspection ratings, value-added measures on academic outcomes (representing proxies for human capital accumulation), indicators for resources available to students, and the share of students enrolled in different types of learning formats in each institution (e.g., percent of subjects set in the classroom).[34]

Table 6 shows results corresponding to three college-level regressions where the dependent variables are VA in log daily earnings, employment, and enrollment in higher education. We focus the analysis on young learners, given that variation in FE college VA for adult learners is relatively small. Column 1 indicates that VA in log daily earnings is positively and statistically significantly correlated with VA in achievement of level 3 qualifications and VA in the share of achieved guided learning hours. We also find that different learning formats significantly correlate with VA in earnings. For example, institutions with a larger share of students taking in-person classes (note that the excluded alternative is distance learning) tend to exhibit higher VA in earnings. Finally, college inspection ratings (i.e., average grade received in Ofsted reports), and measures of available resources, do not seem to correlate with VA in earnings. Column 2 focuses on explaining VA in employment, and the only significant correlate is the percent of aims set in the classroom. The relatively low explanatory power of the mediating variables is somewhat unsurprising, given that we do not find much variation in VA in employment. Finally, Column 3 studies plausible mechanisms behind FE college variation in increasing the probability of attending higher education. Results show that value-added measures in achievement of level 3 qualifications and share of achieved guided learning hours are positively and significantly correlated with VA in progression to higher education. This is expected, given that achieving a level 3 qualification is a prerequisite for higher education. Finally, we also find that the share of total staff cost spent on teachers is positively, though only marginally significantly, correlated with VA in progression to higher education, but not with VA in labor market outcomes.

Overall, our findings indicate that VA in academic outcomes (which are directly linked to human capital formation) are significantly correlated with VA in earnings. This suggests that the human capital accumulation channel is important to explain why some colleges are better than others at improving the labor market outcomes of their students. We also find that learning

formats may play a role in explaining quality. However, like Stange (2012), we do not find strong evidence indicating that college expenditure levels are associated with FE college quality.

6 Returns to Field of Study

In this section, we first present the results on returns to field of study, and then provide a discussion of the results and several robustness checks.

6.1 Results

The full set of results is reported in Tables 7 to 10. Column 1 displays the level effect of enrolled guided learning hours in each field of study, while Column 2 reports their interaction with years since finishing FE college.[35] Column 3 reports mean GLH in a given sector when that field is the main field of study. Columns 4 and 5 provide an approximation of the marginal effect of specializing in each field one and five years after finishing FE education. We report the share of individuals specializing in each field in Column 6. Finally, for each of the subsamples, we summarize the marginal effects of specializing in each field one and five years after finishing FE education in Figure 7, focusing on the fields representing at least 5% of enrollment of the respective sample.

Young male learners: The top left panel of Figure 7 shows that the two fields of study that present the largest returns five years after graduation are engineering and manufacturing technology, and business administration and law. The average young male learner specializing in these fields experiences an increase of 7.7% and 5.8% in daily earnings, respectively. Many specializations present negative returns immediately after graduation that turn positive five years after graduation. Some fields, such as preparation for life and work, exhibit negative

returns even five years after graduation. The differences in returns among the top three majors in terms of enrollment are substantial: The average student in engineering and manufacturing technology will experience a return between 2.2 to 4.8 times larger than the average student in the two other specializations (Table 7 also reports these results).[36]

Adult male learners: The top right panel of Figure 7 shows that engineering and manufacturing technology, education and training, and business administration and law are among the fields that lead to the largest returns five years after FE college attendance for male adult learners. The average adult specializing in these fields shows an increase in daily earnings five years after graduation of 1.5%, 1.1%, and 0.9%, respectively. As noted earlier, the overall lower returns compared to young learners are potentially driven by the fact that adult learners enroll in a substantially lower number of guided learning hours overall. Finally, most sectors lead to returns close to zero five years after completion. Some sectors, such as history, philosophy, and theology, even exhibit negative returns, but these are mostly insignificant, as they represent very small enrollment shares (Table 8 also reports these results).

Young female learners: This demographic group experienced statistically significant positive returns five years after graduation across almost all fields, as seen in the bottom left panel of Figure 7 and Table 9. For example, the average female specializing in arts, media, and publishing experiences an increase in daily earnings of 16.4% five years after graduation, while those specializing in business administration or health experience returns of 10.3% and 3.6%, respectively. If we compare returns between young males and females, it is not clear what drives these differences. A possible explanation could be gender disparities in matching between FE college specialization and occupation. An alternative explanation could be gender differences in work intensity in the years before and after enrolling in FE college. Finally, it is worth highlighting that the enrollment of young females across fields is very different

compared to their young male counterparts. For example, while 1.2% of females do engineering and manufacturing as their main field of study, 20.4% of young males do so. To conclude, similar to young male learners, the differences in returns among the top three majors for females in terms of enrollment are significant: The average young female student in business administration and law will experience a return that is between 1.9 to 2.9 times larger than the average student in the two other specializations.[37]

Adult female learners: These learners mainly specialize in health, public services, and care (34.3%), business administration and law (14.8%), and education and training (12.7%). All these fields show returns between approximately 2% and 3% five years after graduation for the average learner (see bottom right panel of Figure 7 and Table 10). Those specializing in retail and commercial enterprise experience a negative return five years after completion of -2.5%. Overall, returns for adult females are larger in magnitude than for adult males, mirroring the findings for young learners. Note that while in our main specifications we tend to find higher returns to specializations for females than for males, this does not imply that females overall have higher earnings post FE-college attendance. As can be seen from the summary statistics in Online Appendix Tables A1 to A4, women have consistently lower average earnings five years after FE college attendance.

Four main conclusions emerge from these results. First, there are important heterogeneities in the returns to fields of study. Second, adults experience smaller overall returns to field of study. Third, engineering and manufacturing technology, and business administration and law are not only showing large enrollment levels among young and adult male learners, but they are also among the fields that lead to the largest positive returns. Finally, business administration and law and health, public services, and care are the fields that show both high levels of enrollment and consistently positive returns for females across age groups.

6.2 Discussion and Robustness Checks

In our main analysis, we estimate the returns to field of study while simultaneously controlling for achieved qualifications by type, level, and awarding body. This allows us to estimate returns to GLH in different fields net of completion effects, which is important because many students do not finish their studies. To get an understanding of potential sheepskin effects (i.e., the value of qualification achievement above and beyond the value of enrolling and studying a given amount of GLH by sector), Online Appendix Tables A10 to A13 show returns estimates when controlling for *enrolled* rather than *achieved* qualifications by type, level and awarding body. Estimates are generally similar across the two specifications, suggesting that sheepskin effects are not very important in this setting. However, we find some larger differences for young females, for instance, in health, public services and care, and retail and commercial enterprise. These findings are consistent with Kane and Rouse (1995), who find only small returns to degree completion over and above the value of the credits completed, except for the case of females, which is mainly driven by nursing.

Our estimates of returns to field of study are, in general, smaller than those found elsewhere in the literature for community colleges in the US (see, for instance, Belfield and Bailey (2017a) and Stevens, Kurlaender, and Grosz (2019)). Unlike most of these other studies, which include dummy variables to capture returns to field of study, the granularity of our data allows our identification strategy to estimate returns to field of study by exploiting information on the number of guided learning hours enrolled in each of the specific fields while holding constant enrolled guided learning hours in other fields. Moreover, our specifications control for qualification achievement. These two features are likely to make some of our estimates lower than in other studies.[38]

Finally, we explore the importance of learning in one's main sector versus other fields. We do this in specifications where we include a variable indicating GLH in the main field of study

and a variable measuring GLH in other fields. We find that returns to GLH in the main field of study are 20% and 35% larger than returns to GLH in other fields for young male and female learners, respectively. Results are available upon request.

7 Conclusions

In this study, we estimate FE college value-added in terms of several academic and labor market outcomes and returns to field of study in vocational education for young and adult learners in England. Our findings show that variability in FE college VA is larger for young than adult learners, which is likely driven by differences in the intensity of the treatment: Adults tend to enroll in fewer, shorter and less intense courses in terms of learning hours. We find moderate variability in college value-added in terms of earnings and employment probabilities. However, there is more heterogeneity across institutions when considering completion of learning hours, and progression to higher levels of learning.

We present indicative evidence that certain characteristics of the FE colleges correlate with institution VA in labor market outcomes. VA in earnings presents a statistically significant positive correlation with college VA in terms of the share of GLH achieved, VA in achieving a good (level 3) upper secondary qualification, and with in-person (as opposed to distance) learning. While these correlations cannot be interpreted as causal, they provide potential avenues for further research into the drivers of college value-added.

The moderate variation in institution VA on earnings contrasts with the larger heterogeneity in returns to field of study, suggesting that *what* one studies rather than *where* one does so is more relevant for labor market outcomes. For instance, if we order fields of study based on their returns for the typical young male (female) learner, then changing from a specialization that is in the (bottom) 10th percentile to one in the (top) 90th percentile would lead to an

increase in returns that is approximately 84% (43%) larger than if we were performing the same exercise but based on FE college value-added. The larger heterogeneity in returns to field of study is not driven by "niche" fields with low enrollment levels. Differences in returns to field of study among the most popular specializations (in terms of enrollment) are also substantial. These findings also imply that rather than colleges not producing human capital that is valued in the labor market, many of them do not seem to be enrolling students in the programs with the highest returns.

Overall, our findings can help prospective FE learners make more informed decisions on how to confront important trade-offs in post-secondary education. These results are particularly relevant in light of the evidence suggesting that students tend to be misinformed about the labor market returns of VET qualifications. For example, Baker et al. (2018) find that only 13% of students in their sample of community colleges in California correctly rank four broad categories of majors in terms of salary. Since the typical student attending FE is relatively immobile, policymakers should focus particularly on ensuring appropriate career advice to students regarding the field of study they choose.

Our findings are also relevant since most students attending FE college tend to be from a disadvantaged socio-economic background and have low prior attainment. Therefore, providing information so that these students can achieve high labor market returns after completing vocational qualifications could be crucial for reducing inequality.

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Tables

Table 1: Overview of qualifications offered at FE colleges in England

(1) Qualification Types	(2) Available levels	(3) Length: Learning hours	(4) Some common examples of qualifications in General Further Education colleges
Panel A: Vocational/Technical qualification s (job focused)			
Award	2 to 8	up to 130 guided learning hours	Award in Food Safety in Catering Award in Preparing to Teach in the Lifelong Learning Sector
Certificates			
Certificate	2 to 8	between 130 guided learning hours and 370 guided learning hours	Certificate in Understanding the Safe Handling of Medicines Certificate in Teaching in the Lifelong Learning Sector
Higher National Certificate (HNC)	4		BTEC National Certificate in Sport and Exercise Sciences BTEC Higher National Certificate in Construction
Diplomas			
Diploma	2 to 8	over 370 hours of training	BTEC First Diploma for ICT practitioners Diploma in Accounting
Higher National Diploma (HND)	5		BTEC National Diploma in Art and Design BTEC Higher National Diploma in Business
Other			
National Vocational Qualification (NVQ)	2 to 7	varying sizes/credits, depending on level of study; qualifications are work-based achieved through competency assessment	NVQ in Hairdressing NVQ in Accounting
Foundation Degree	5	2 years full time study	Foundation Degree in Early Years
Panel B. Academic: subject-focused			
Functional skills	2	at least 45 guided learning hours	Functional Skills Qualification in English
GCSE	2	120 guided learning hours	GCSE in English
A/AS Level	3	360 guided learning hours	A Level in Mathematics
Access to Higher Education Diploma	3	1 year full time study	Access to Higher Education Courses

Notes. The table focuses on the most relevant qualifications that can be undertaken in General FE Colleges at level 2 and above. Entry level and Level 1 qualifications, as well as apprenticeships, are not shown. Most qualifications undertaken in FE colleges are at level 2 (lower secondary education), level 3 (upper secondary education and university entry qualifications), and Level 4 (non-tertiary post-secondary qualifications). Column 4 shows examples of common qualifications undertaken at those levels.

Table 2: Summary Statistics for Young Learners

	(1) 16-17	(2) 18-20	(3) Total
Students	838,939	130,009	968,948
FE Colleges	258	255	260
Learner Characteristics			
Share female	50.34	48.43	50.08
Share max. level enrolled: 2	29.57	33.97	30.16
Share max. level enrolled: 3	61.55	54.48	60.60
Share max. level enrolled: 4	0.35	0.95	0.43
Share observed in HE after FE	30.92	36.61	31.68
Average guided learning hours enrolled	1,115	622	1,049
Duration of learning (days)	767	506	732
Average nb. of courses enrolled	5.57	2.79	5.20
Median distance KS4 school to FE college (km)	6.43	9.72	6.82
Labor market characteristics			
Share employed before FEC entry*	44	76	49
Earnings in FEC entry year	3,779	7,611	4,824
Earnings before FEC entry	3,407	6,915	5,395
Earnings 5 years post FEC	13,264	14,566	13,441

Source: NPD, ILR, HESA, and LEO.

Notes: The table shows summary statistics for young learners aged 16 to 20 who enrolled in a further education college at level 2 and above and first enrolled in an FE college between 2005 and 2010. FEC denotes Further Education College. Earnings are annual and reported in real terms (in 2015 £). * ~~denotes~~Denotes e~~E~~mployed in at least one of the two years preceding college entry or in entry year.

Table 3: Summary Statistics for Adult Learners

	(1) 25-29	(2) 30-39	(3) 40-49	(4) 50-59	(5) Total
Learners	135,886	293,729	247,086	127,238	803,939
FE Colleges	255	255	255	255	255
Learner Characteristics					
Share female	51.80	52.86	54.68	51.90	53.09
Share max. level enrolled: 2	59.41	59.81	62.17	66.48	61.52
Share max. level enrolled: 3	32.16	32.37	30.43	27.60	30.98
Share max. level enrolled: 4	8.43	7.82	7.41	5.92	7.50
Average guided learning hours enrolled	248	211	159	106	185
Duration of learnings (days)	320	307	281	236	290
Average nb. of courses enrolled	2.28	2.17	1.98	1.78	2.07
Median distance to FE college (home)	8.79	9.24	10.64	12.16	10.04
Labor market characteristics					
Share employed before FEC entry*	70.79	71.60	74.91	78.28	73.54
Earnings in FEC entry year	8,436	9,724	11,789	13,338	10,713
Earnings before FEC entry	7,891	9,563	11,671	13,559	10,561
Earnings 5 years post FEC	19,850	20,348	21,087	20,265	20,501

Source: ILR and HMRC.

Notes: The table shows summary statistics for adult learners aged 25 to 59, enrolled in a further education college at level 2 and above, and first enrolling in an FE college between 2007 and 2010. FEC denotes Further Education College. Earnings are annual and reported in real terms (in 2015 £). * Denotes ~~E~~e~~e~~mployed in at least one of the two years preceding college entry or in entry year.

Table 4: Value-Added in Academic Outcomes

	(1) All	(2) Male	(3) Female
	Total GLH achieved		
SD Value-Added (A)	33.454	35.013	33.624
S.E.	(1.118)	(1.256)	(1.381)
Mean dep var (B)	412	417	407
(A)/(B)	0.081	0.084	0.083
Observations	94,559	48,728	45,654
Nb. of colleges	228	221	227
	Share of GLH achieved		
SD Value-Added (A)	0.045	0.049	0.044
S.E.	(0.001)	(0.002)	(0.002)
Mean dep var (B)	0.689	0.686	0.693
(A)/(B)	0.065	0.072	0.063
Observations	94,424	48,661	45,587
Nb. of colleges	228	221	227
	Achieved 1+ Level 3 Qualification		
SD Value-Added (A)	0.044	0.048	0.043
S.E.	(0.001)	(0.002)	(0.002)
Mean dep var (B)	0.417	0.378	0.458
(A)/(B)	0.105	0.127	0.095
Observations	94,559	48,728	45,654
Nb. of colleges	228	221	227
	*Progression to Higher Education**		
SD Value-Added (A)	0.038	0.044	0.038
S.E.	(0.001)	(0.002)	(0.002)
Mean dep var (B)	0.376	0.343	0.411
(A)/(B)	0.102	0.127	0.091
Observations	94,559	48,728	45,654
Nb. of colleges	228	221	227

Notes: The table shows summary statistics of value-added measures based on estimations of Equation (2) (without lagged dependent variables). The reported standard deviations of value-added measures are adjusted for sampling error. Bootstrapped standard errors on the standard deviations are reported in lines denoted "S.E.". * Denotes observed in a higher education institution at the bachelor's degree level and above. **Estimates based on cross-sectional data for young learners** include the following controls: A series of dummies for region where FE college is located, fixed effects for academic year compulsory schooling was completed, a series of dummies for the last year observed in education (FE or HE), dummy variables indicating the number of years since starting FE, age first entered FE college, whether student attends full-time or part-time, a series of dummies indicating the last year observed in FE college, a series of dummies for main sector, gender, a series of dummies for ethnicity (White, Mixed, Asian/Chinese, Black), a dummy for whether English spoken at home, a dummy capturing whether student had special education needs during compulsory schooling, dummy for whether student was eligible to receive free school meals in KS4 year, neighborhood IDACI score based on postcode prior to joining FE college, standardized KS4 score, OFSTED rating dummies of KS4 school, KS3 math result, KS3 English result, KS2 English result, KS2 math result, series of dummies indicating whether the student had worked before FE college (never worked before college, worked in year of entry, worked one year before entry, worked two years before entry), a series of deprivation indicators (crime, employment, health, income) based on FE college postcode and based on student's postcode coming from ILR.

Table 5: Value-Added in Labor Market Outcomes in 2017

	18-20-year-olds						25-29-year-olds		
	Cross-Section			Panel			Panel		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	Male	Female	All	Male	Female	All	Male	Female
	Log daily earnings in 2017								
SD Value-Added	0.036	0.026	0.044	0.030	0.031	0.041	0.016	0.018	0.019
S.E.	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	70,321	36,331	33,729	87,449	45,695	41,506	459,816	203,861	255,902
Nb. of colleges	227	218	224	248	242	243	252	250	252
	Log annual earnings in 2017								
SD Value-Added	0.035	0.024	0.041	0.040	0.048	0.051	0.020	0.025	0.024
S.E.	(0.003)	(0.005)	(0.005)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)
Observations	70,321	36,331	33,729	87,449	45,695	41,506	459,816	203,861	255,902
Nb. of colleges	227	218	224	248	242	243	252	250	252
	Daily-earnings in Levels in 2017 (incl. zeros for not employed)								
SD Value-Added (A)	1.748	2.106	1.972	1.705	1.855	1.967	0.923	1.202	0.899
S.E.	(0.230)	(0.383)	(0.333)	(0.163)	(0.220)	(0.200)	(0.044)	(0.077)	(0.039)
Mean dep var (B)	45.273	50.316	39.839	44.830	49.742	39.460	48.760	56.501	42.270
(A)/(B)	0.039	0.042	0.050	0.038	0.037	0.050	0.019	0.021	0.021
Observations	90,033	46,602	43,260	112,891	58,982	53,748	551,440	251,483	299,957
Nb. of colleges	228	221	227	250	246	246	252	252	252
	Employed > 90 days in 2017								
SD Value-Added (A)	0.008	0.013	0.000	0.017	0.023	0.012	0.010	0.009	0.011
S.E.	(0.002)	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.000)
Mean dep var (B)	0.749	0.744	0.754	0.742	0.739	0.745	0.852	0.833	0.869
(A)/(B)	0.010	0.018	0.000	0.023	0.031	0.017	0.012	0.011	0.013
Observations	94,552	48,724	45,651	118,846	61,795	56,882	668,967	306,742	362,225
Nb. of colleges	228	221	227	250	246	246	252	252	252

Notes: The table shows summary statistics of value-added measures based on estimations of Equation (2) for cross-sectional data and Equation (3) for panel data. The reported standard deviations of value-added measures are adjusted for sampling error. Bootstrapped standard errors (S.E.) for the standard deviations are reported in parentheses. **Estimates based on cross-sectional data for young learners** include the following controls: Earnings measured prior to FE entry, indicator for when earnings prior to entry were measured, interaction between pre-FEC earnings measure and timing of measurement (for earnings specifications), series of dummies for region where FE college is located, fixed effects for academic year compulsory schooling was completed, a series of dummies for the last year observed in education (FE or HE), dummy variables indicating the number of years since starting FE, age first entered FE college, whether student attends full-time or part-time, a series of dummies indicating the last year observed in FE college, a series of dummies for main sector, gender, a series of dummies for ethnicity (White, Mixed, Asian/Chinese, Black), a dummy for whether English spoken at home, a dummy capturing whether student had special education needs during compulsory schooling, dummy for whether student was eligible to receive free school meals in KS4 year, neighborhood IDACI score based on postcode prior to joining FE college, standardized KS4 score, OFSTED rating dummies of KS4 school, KS3 math result, KS3 English result, KS2 English result, KS2 math result, series of dummies indicating whether the student had worked before FE college (never worked before college, worked in year of entry, worked one year before entry, worked two years before entry), a series of deprivation indicators (crime, employment, health, income) based on FE college postcode and based on student's postcode coming from ILR. **Estimates based on panel data for young learners** include the following controls: Individual fixed effects, a series of dummies indicating the main sector (taking the value one from the year of completing FE college education and zero before), a series of dummies for region where FE college is located interacted with the academic year, years of work experience prior to entering FE college, age, age^2, a dummy indicating whether the individual is in any form of learning in a given academic year (FE or HE), dummy variables capturing the number of years prior to FE entry, and the number of years since finishing further education. **Estimates based on panel data for adult learners** include the following controls: Individual fixed effects, academic year fixed effects, series of dummies indicating the main sector (taking the value 1 from the year of completing FE college education), series of dummies for region where FE college is located interacted with the academic year, years of cumulative work experience up to FE entry, age, age^2, dummies indicating whether the learner is undertaking any learning in a given year (whether observed in the Individual Learner Records or Work Based Learning collection), dummy indicating whether the learner is doing an apprenticeship in that year, the number of years since finishing further education, a series of dummy variables indicating the number of years since starting FE.

Table 6: Value-Added for Young Learners and College Characteristics

	(1) VA ln earn	(2) VA emp	(3) VA HE
Average OFSTED rating[a]	0.002	-0.002	-0.001
	(0.003)	(0.001)	(0.003)
VA in achieved Lev 3	0.109**	0.009	0.104*
	(0.051)	(0.021)	(0.060)
VA in % of GLH achieved	0.167***	-0.005	0.200***
	(0.048)	(0.019)	(0.056)
Teacher salary cost/Total staff cost	0.039	-0.000	0.065*
	(0.034)	(0.014)	(0.039)
Total expenditure over FTE students	0.003	-0.000	-0.000
	(0.002)	(0.001)	(0.002)
% aims set in workplace	-0.227*	-0.011	-0.138
	(0.128)	(0.052)	(0.150)
% aims classroom/provider	0.098***	0.025*	0.007
	(0.033)	(0.013)	(0.039)
Observations	225	226	226
R^2	0.213	0.047	0.113

Notes: The table shows regressions of value-added measures in labor market outcomes and progression to higher education on college-level characteristics. VA in log daily earnings (Column 1) and employment (Column 2) derived using panel data and individual fixed effects strategy for the sample of ~~18-20 year-olds~~18–20-year-olds. VA in progression to higher education (Column 5) was derived using cross-sectional data for the sample of ~~18-20 year-olds~~18–20-year-olds. Standard errors in parentheses. *p<0.5 ** p<0.01 *** p<0.001. "*a"* denotes average between 2005 and 2010. GLH: Guided Learning Hours; FTE: Full-time equivalent; Lev 3: level 3.

Table 7: Earnings Returns to Field of Study - **Males** (young learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1-year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	0.001	0.001***	402	0.010	0.027***	8.1%
	(0.002)	(0.000)		(0.007)	(0.006)	
Science and Mathematics	−0.005	0.002***	447	−0.012	0 030*	2.2%
	(0.003)	(0.001)		(0.014)	(0.012)	
Agriculture, Horticulture and Animal Care	−0.007*	0.001*	633	−0.036*	-0.010	1.7%
	(0.003)	(0.000)		(0.018)	(0.016)	
Engineering and Manufacturing Technology	0.002	0.002***	622	0.025***	0 077***	20.4%
	(0.001)	(0.000)		(0.006)	(0.005)	
Construction, Planning and the Built Environment	−0.004***	0.002***	614	−0.014*	0 035***	18.3%
	(0.001)	(0.000)		(0.007)	(0.006)	
Information and Communication Technology	−0.007***	0.002***	706	−0.030**	0 037***	6.7%
	(0.002)	(0.000)		(0.010)	(0.009)	
Retail and Commercial Enterprise	−0.003	0.001***	477	−0.010	0.015	4.6%
	(0.002)	(0.000)		(0.010)	(0.009)	
Leisure, Travel and Tourism	−0.010***	0.003***	570	−0.039***	0.036***	8.8%
	(0.001)	(0.000)		(0.008)	(0.007)	
Arts, Media and Publishing	−0.009***	0.002***	926	−0.063***	0.016*	10.8%
	(0.001)	(0.000)		(0.009)	(0.008)	
History, Philosophy and Theology	−0.022**	0.004*	411	−0.077**	-0.018	0.5%
	(0.008)	(0.001)		(0.030)	(0.025)	
Social Sciences	−0.008	0.003*	356	−0.018	0.030	0.3%
	(0.011)	(0.002)		(0.037)	(0.033)	
Languages, Literature and Culture	−0.009	0.004*	118	−0.006	0.014	0.7%
	(0.013)	(0.002)		(0.014)	(0.012)	
Education and Training	0.022	0.006**	197	0.057*	0 108***	0.3%
	(0.015)	(0.002)		(0.027)	(0.023)	
Preparation for Life and Work	−0.014***	0.001	154	−0.020***	-0.017***	9.4%
	(0.003)	(0.000)		(0.004)	(0.004)	
Business Administration and Law	0.000	0.002***	551	0.010	0.058***	7.3%
	(0.002)	(0.000)		(0.009)	(0.008)	
Observations	286,935					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation 4). The Υ_2 are the interaction terms between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours achieved by awarding body and type/level of qualification, plus the interaction term between GLH achieved by type/level of qualification and years since finishing FE college, college fixed effects, and cumulative experience, in addition to the controls reported in Section 4.2. Sample: Male learners aged 18-20 who were enrolled in FE college between 2005 and 2010 and who study towards qualifications at level 2 or above.

Table 8: Earnings Returns to Field of Study - **Males** (adult learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1-year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	−0.009***	0.003***	73	−0.005***	0.004***	19.0%
	(0.001)	(0.000)		(0.001)	(0.000)	
Science and Mathematics	−0.035***	0.007***	215	−0.061***	-0.001	1.1%
	(0.002)	(0.000)		(0.004)	(0.003)	
Agriculture, Horticulture and Animal Care	−0.019***	0.003***	182	−0.029***	-0.006*	1.5%
	(0.002)	(0.000)		(0.003)	(0.002)	
Engineering and Manufacturing Technology	−0.004***	0.002***	207	−0.003**	0.015***	19.0%
	(0.001)	(0.000)		(0.001)	(0.001)	
Construction, Planning and the Built Environment	−0.008***	0.002***	284	−0.018***	0.007***	10.7%
	(0.001)	(0.000)		(0.002)	(0.001)	
Information and Communication Technology	−0.019***	0.005***	166	−0.025***	0.006***	7.9%
	(0.001)	(0.000)		(0.001)	(0.001)	
Retail and Commercial Enterprise	−0.005***	0.001***	88	−0.003**	0.002	6.9%
	(0.002)	(0.000)		(0.001)	(0.001)	
Leisure, Travel and Tourism	−0.031***	0.003***	134	−0.037***	-0.018***	3.7%
	(0.002)	(0.000)		(0.002)	(0.002)	
Arts, Media and Publishing	−0.021***	0.004***	342	−0.059***	-0.010***	2.3%
	(0.001)	(0.000)		(0.003)	(0.002)	
History, Philosophy and Theology	−0.076***	0.012***	389	−0.250***	-0.070***	0.5%
	(0.003)	(0.001)		(0.010)	(0.007)	
Social Sciences	−0.049***	0.008***	348	−0.142***	-0.033**	0.1%
	(0.005)	(0.001)		(0.016)	(0.011)	
Languages, Literature and Culture	−0.005	0.001	113	−0.004	0.000	1.6%
	(0.003)	(0.001)		(0.003)	(0.003)	
Education and Training	0.004**	0.001***	119	0.006***	0.011***	6.8%
	(0.001)	(0.000)		(0.001)	(0.001)	
Preparation for Life and Work	−0.026***	0.005***	109	−0.023***	-0.003*	4.7%
	(0.002)	(0.000)		(0.002)	(0.001)	
Business Administration and Law	0.003**	0.001***	131	0.005***	0.009***	14.2%
	(0.001)	(0.000)		(0.001)	(0.001)	
Observations	2,695,465					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation 4). The Υ_2 are the interaction terms between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours achieved by awarding body and type/level of qualification, plus the interaction term between GLH achieved by type/level of qualification and years since finishing FE college, college fixed effects, and cumulative experience, in addition to the controls reported in Section 4.2. Sample: Male learners aged 25-59 who were enrolled in FE college between 2006/07 and 2009/10 and who study towards qualifications at level 2 or above.

Table 9: Earnings Returns to Field of Study - **Females** (young learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1 year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	−0.002	0.002***	514	0.000	0.036***	25.3%
	(0.001)	(0.000)		(0.006)	(0.005)	
Science and Mathematics	−0.008*	0.005***	369	−0.009	0.071***	2.8%
	(0.004)	(0.001)		(0.013)	(0.012)	
Agriculture, Horticulture and Animal Care	−0.002	0.003***	796	0.014	0.122***	2.5%
	(0.002)	(0.000)		(0.017)	(0.015)	
Engineering and Manufacturing Technology	0.002	0.002***	555	0.024	0.073***	1.2%
	(0.004)	(0.001)		(0.020)	(0.017)	
Construction, Planning and the Built Environment	−0.006	0.003***	630	−0.018	0.052*	0.8%
	(0.005)	(0.001)		(0.029)	(0.025)	
Information and Communication Technology	−0.007	0.003***	351	−0.013	0.036***	3.0%
	(0.004)	(0.001)		(0.012)	(0.011)	
Retail and Commercial Enterprise	−0.004*	0.003***	590	−0.006	0.055***	25.0%
	(0.002)	(0.000)		(0.009)	(0.008)	
Leisure, Travel and Tourism	−0.002	0.003***	611	0.011	0.095***	5.6%
	(0.002)	(0.000)		(0.011)	(0.010)	
Arts, Media and Publishing	−0.004**	0.004***	877	0.007	0.164***	11.3%
	(0.001)	(0.000)		(0.010)	(0.009)	
History, Philosophy and Theology	−0.018**	0.007***	432	−0.048	0.071***	1.0%
	(0.007)	(0.001)		(0.026)	(0.021)	
Social Sciences	0.003	0.007***	336	0.034	0.123***	0.4%
	(0.010)	(0.002)		(0.032)	(0.028)	
Languages, Literature and Culture	−0.017	0.004**	133	−0.017	0.006	1.2%
	(0.009)	(0.001)		(0.011)	(0.009)	
Education and Training	0.031***	0.001	165	0.053***	0.062***	1.5%
	(0.009)	(0.001)		(0.013)	(0.011)	
Preparation for Life and Work	−0.022***	0.005***	175	−0.029***	0.008	5.9%
	(0.004)	(0.001)		(0.007)	(0.006)	
Business Administration and Law	0.004*	0.004***	430	0.036***	0.103***	12.5%
	(0.002)	(0.000)		(0.007)	(0.006)	
Observations	226,524					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation 4). The Υ_2 are the interaction terms between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours achieved by awarding body and type/level of qualification, plus the interaction term between GLH achieved by type/level of qualification and years since finishing FE college, college fixed effects, and cumulative experience, in addition to the controls reported in Section 4.2. Sample: Female learners aged 18-20 who were enrolled in FE college between 2005 and 2010 and who study towards qualifications at level 2 or above.

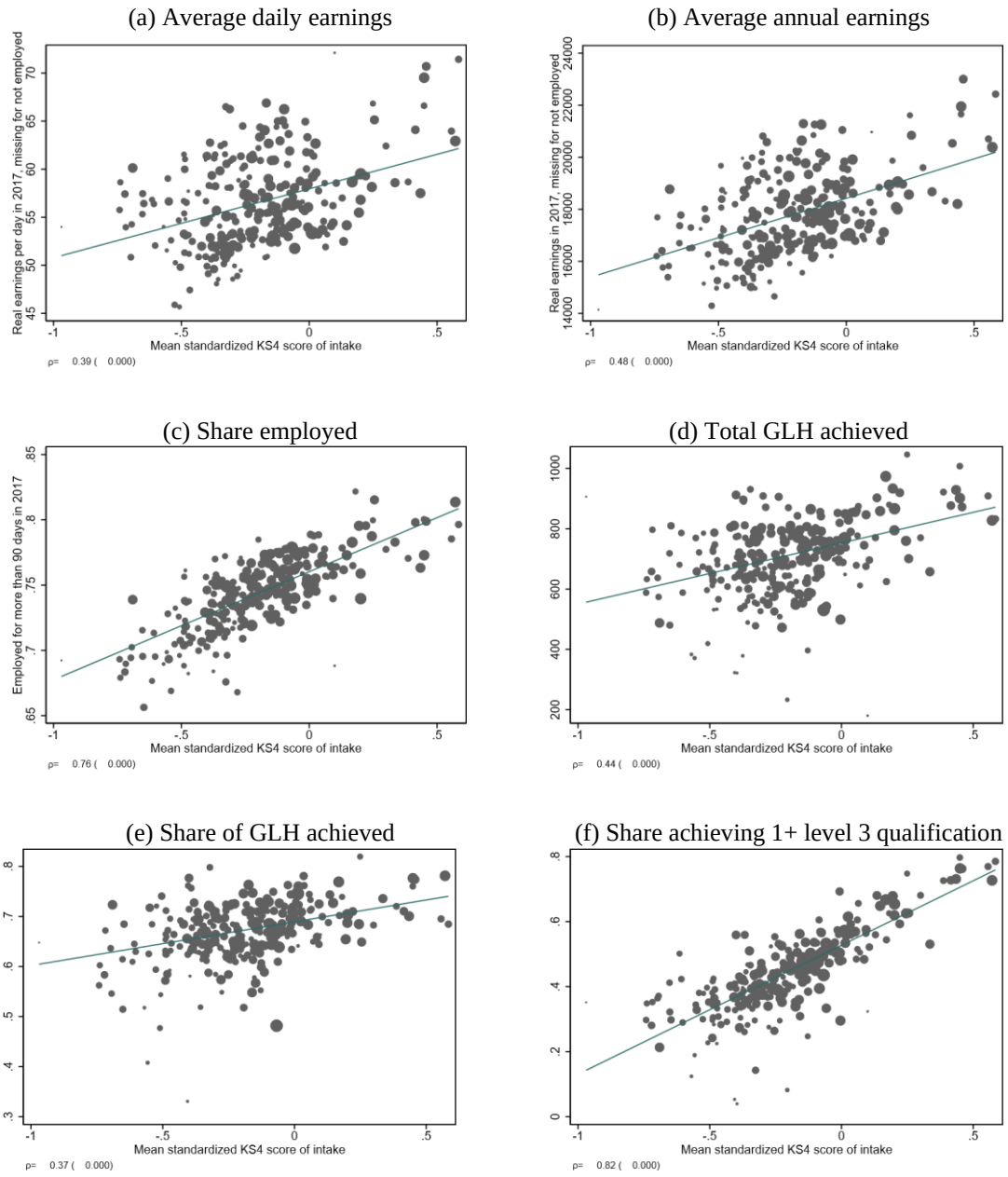
Table 10: Earnings Returns to Field of Study - **Females** (adult learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1 year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	−0.009***	0.005***	136	−0.006***	0.019***	34.3%
	(0.001)	(0.000)		(0.001)	(0.000)	
Science and Mathematics	−0.028***	0.009***	177	−0.034***	0.027***	2.2%
	(0.002)	(0.000)		(0.003)	(0.002)	
Agriculture, Horticulture and Animal Care	−0.012***	0.001**	343	−0.038***	-0.028***	1.1%
	(0.001)	(0.000)		(0.004)	(0.003)	
Engineering and Manufacturing Technology	−0.005*	0.001***	172	−0.007*	0.003	1.2%
	(0.002)	(0.000)		(0.003)	(0.002)	
Construction, Planning and the Built Environment	−0.004**	0.003***	398	−0.006	0.038***	0.5%
	(0.002)	(0.000)		(0.006)	(0.005)	
Information and Communication Technology	−0.023***	0.005***	134	−0.024***	0.002	7.2%
	(0.001)	(0.000)		(0.002)	(0.038)	
Retail and Commercial Enterprise	−0.021***	0.002***	218	−0.041***	-0.025***	11.3%
	(0.001)	(0.000)		(0.002)	(0.002)	
Leisure, Travel and Tourism	−0.017***	0.001***	176	−0.028***	-0.020***	1.7%
	(0.002)	(0.000)		(0.003)	(0.002)	
Arts, Media and Publishing	−0.017***	0.002***	291	−0.043***	-0.018***	2.7%
	(0.001)	(0.000)		(0.002)	(0.002)	
History, Philosophy and Theology	−0.052***	0.013***	431	−0.169***	0.056***	1.1%
	(0.002)	(0.000)		(0.006)	(0.005)	
Social Sciences	−0.026***	0.007***	429	−0.082***	0.039***	0.3%
	(0.002)	(0.000)		(0.009)	(0.007)	
Languages, Literature and Culture	−0.005**	0.001*	130	−0.006*	-0.001	2.5%
	(0.002)	(0.000)		(0.002)	(0.002)	
Education and Training	−0.009***	0.006***	140	−0.005***	0.026***	12.7%
	(0.001)	(0.000)		(0.001)	(0.001)	
Preparation for Life and Work	−0.021***	0.009***	139	−0.017***	0.030***	6.5%
	(0.001)	(0.000)		(0.002)	(0.001)	
Business Administration and Law	0.002*	0.001***	187	0.006***	0.017***	14.8%
	(0.001)	(0.000)		(0.001)	(0.001)	
Observations	3,194,471					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation 4). The Υ_2 are the interaction terms between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours achieved by awarding body and type/level of qualification, plus the interaction term between GLH achieved by type/level of qualification and years since finishing FE college, college fixed effects, and cumulative experience, in addition to the controls reported in Section 4.2. Sample: Female learners aged 25-59 who were enrolled in FE college between 2006/07 and 2009/10 and who study towards qualifications at level 2 or above.

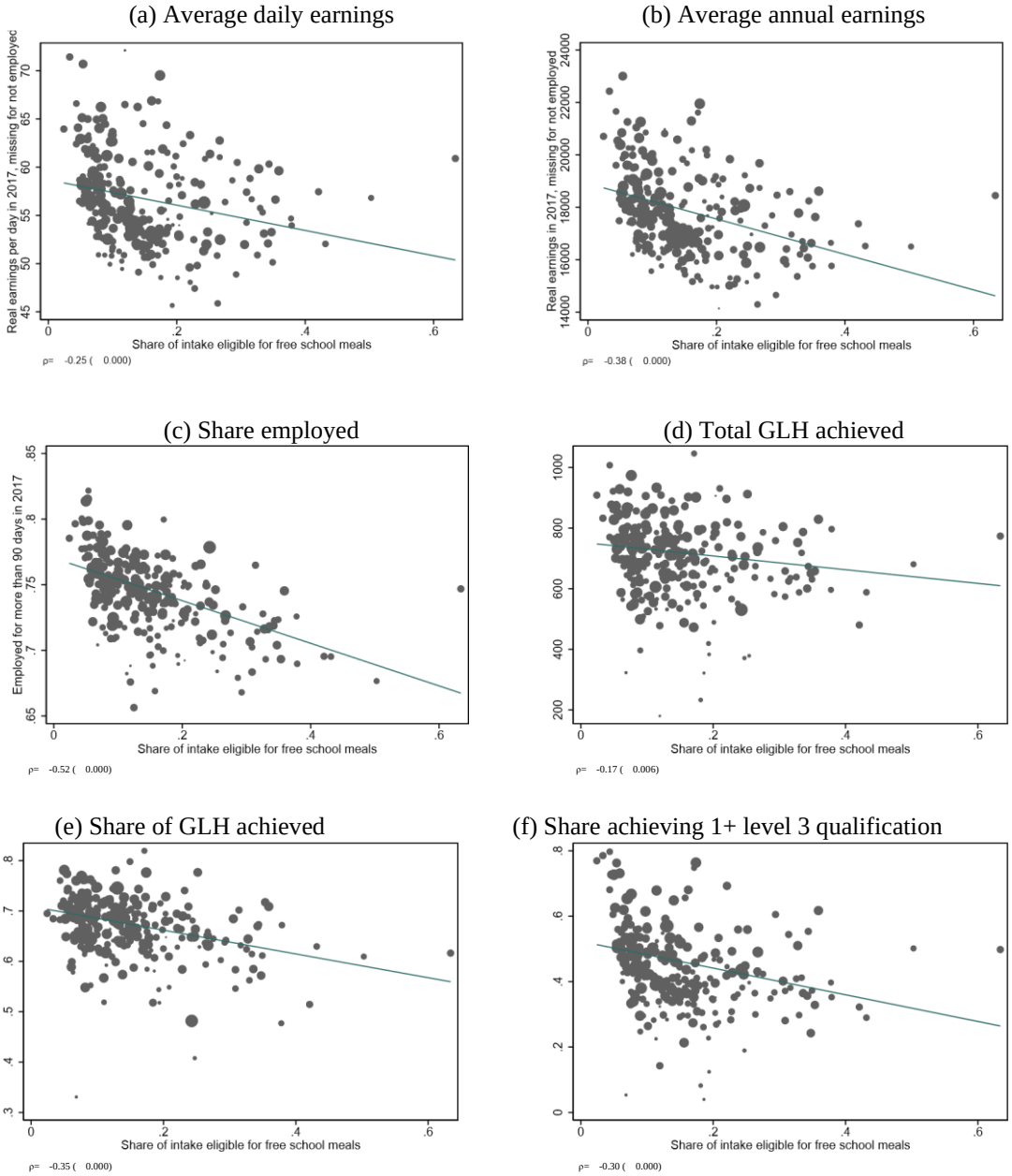
Figures

Figure 1: Prior attainment and raw average outcomes by college



Note: The graphs plot various labor market outcomes (sub-figures (a)-(c)) and variables of educational achievement (sub-figures (d)-(f)) for students having studied at a college against the average standardized KS4 score (test score at end-of-compulsory schooling) of the intake of that college for cohorts of students having finished compulsory education between 2004 and 2007. The correlation coefficient (ρ) between the two variables is reported at the bottom left of each graph (p-value in parentheses).

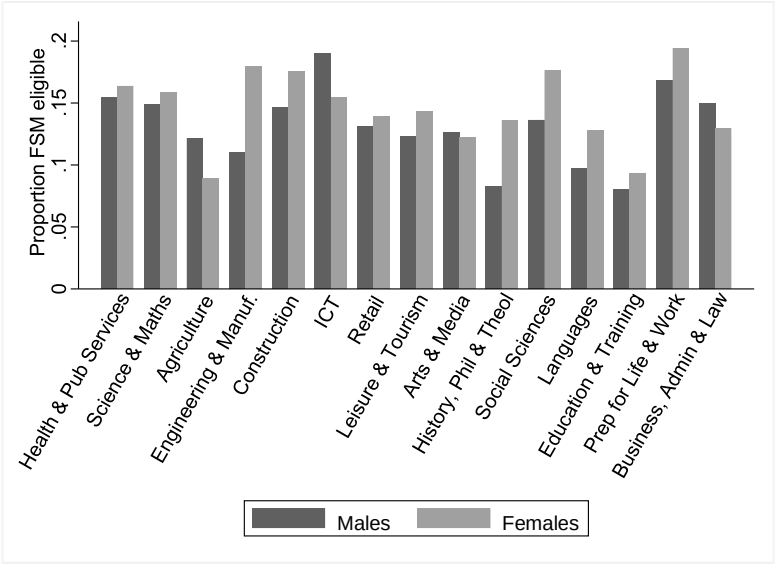
Figure 2: Socio-economic status and raw average outcomes by college



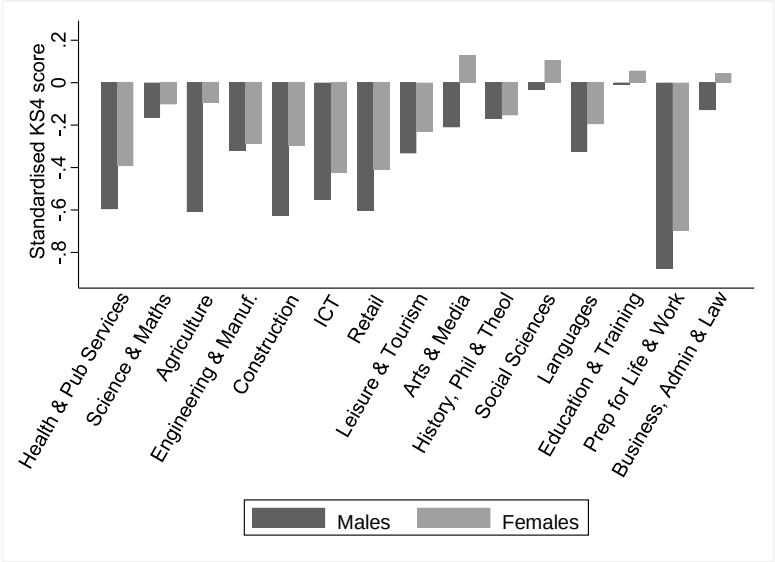
Note: The graphs plot various labor market outcomes (sub-figures (a)-(c)) and variables of educational achievement (sub-figures (d)-(f)) for students having studied at a college against the share of the intake that was eligible for free school meals during compulsory schooling for cohorts of students having finished compulsory education between 2004 and 2007. The correlation coefficient (ρ) between the two variables is reported at the bottom left of the graph (p-value in parentheses).

Figure 3: Field of study, socio-economics status and prior attainment

(a) Share eligible for FSM

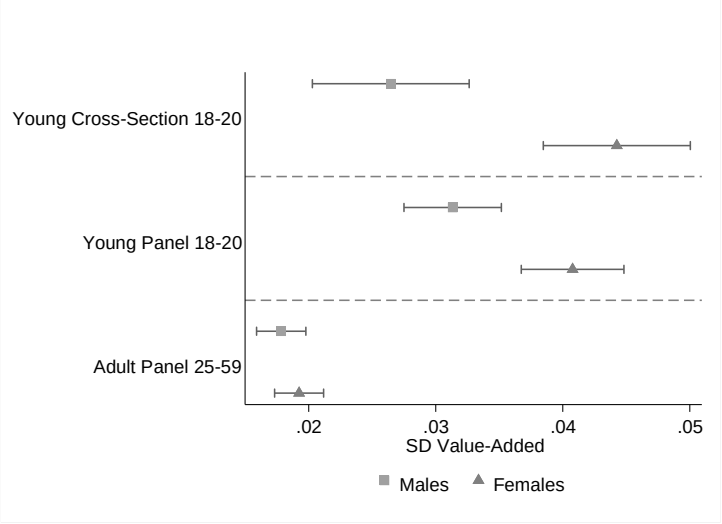


(b) Average standardized KS4 score



Note: The graphs plot (a) the share of students eligible for free school meals (FSM) in compulsory education by field of study chosen and (b) the average standardized KS4 score for students choosing a particular field as the main field of study. We exclude students who progress to higher education.

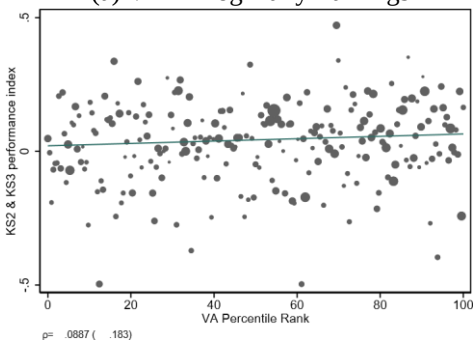
Figure 4: Value-Added in Log Daily earnings - by gender



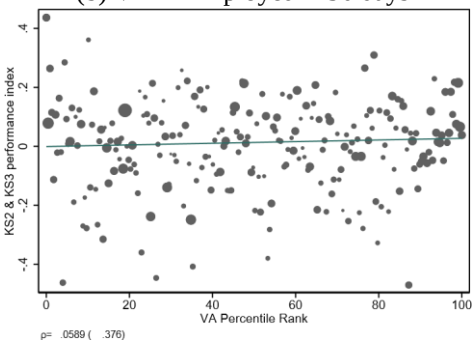
Note: The graph plots VA estimates corresponding to VA in log daily earnings for males and females separately for the Young Cross-Section, the Young Panel, and the Adult Panel. The whiskers represent the 95% confidence intervals derived using bootstrapped standard errors.

Figure 5: Value-Added in labor Market Outcomes and Test Scores at age 11 and 14

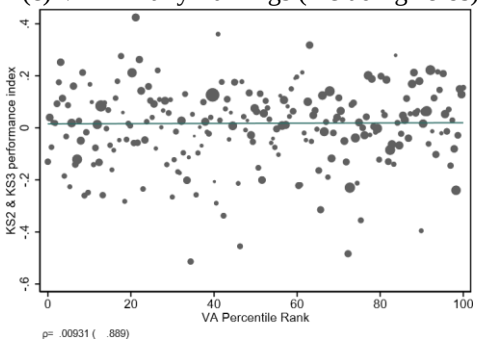
(a) VA in Log Daily Earnings



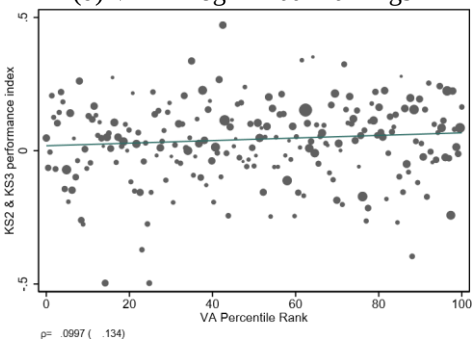
(b) VA in Employed > 90 days



(c) VA in Daily Earnings (including zeros)



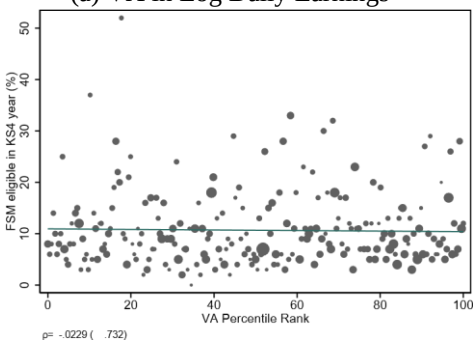
(d) VA in Log Annual Earnings



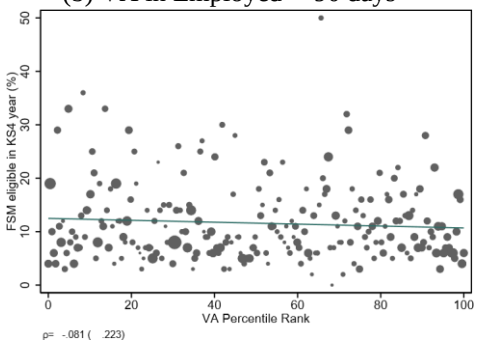
Note: The graph plots the average score on an index for KS2 and KS3 performance in math and English at a college against the college's ranking in terms of value-added in different dimensions, estimated using cross-sectional data for individuals aged 18-20 when first enrolling in the college with the same control variables as reported in Table 5, but excluding KS2 and KS3 performance. A higher rank indicates high value-added. Value-added by college is weighted by the number of observations for the college. The correlation coefficient (ρ) between the two variables is reported at the bottom left of each graph (p-value in parentheses).

Figure 6: Value-Added in labor Market Outcomes and Socio-Economic Status

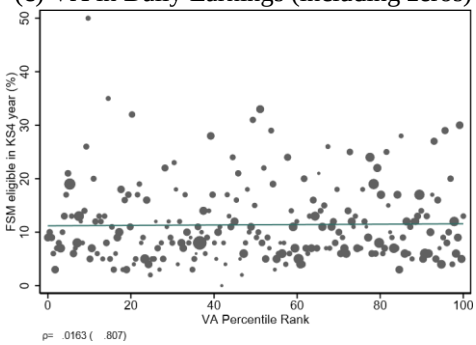
(a) VA in Log Daily Earnings



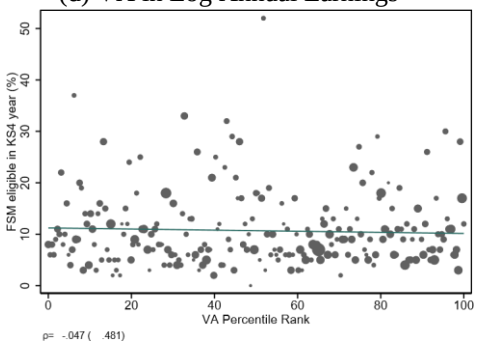
(b) VA in Employed > 90 days



(c) VA in Daily Earnings (including zeros)



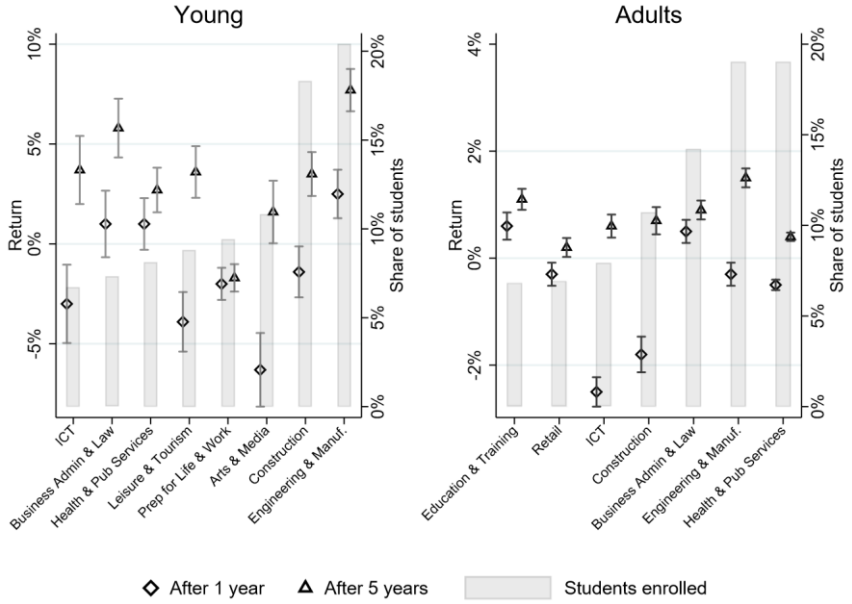
(d) VA in Log Annual Earnings



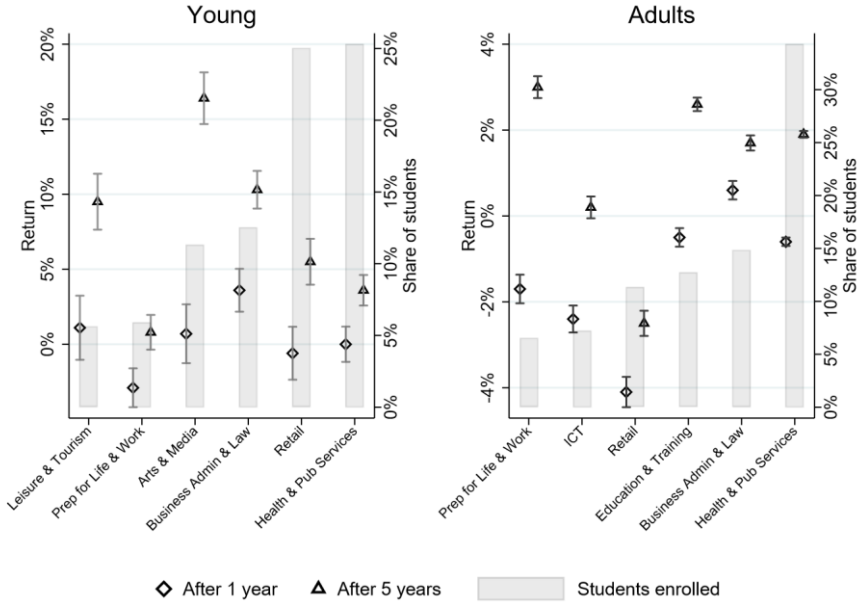
Note: The graph plots the share of students at a college having been eligible for free school meals at some point during compulsory schooling against the college's ranking in terms of value-added in different dimensions, estimated using cross-sectional data for individuals aged 18-20 when first enrolling in the college with the same control variables as reported in Table 5, but excluding free school meal eligibility. Value-added by college is weighted by number of observations for the college. The correlation coefficient (ρ) between the two variables is reported at the bottom left of each graph (p-value in parentheses).

Figure 7: Daily earnings returns to field of study

(a) Males



(b) Females



Note: The graph plots estimates for the marginal returns to field of study one and five years after FE college graduation for the average learner specializing in these fields. These are obtained by multiplying the average guided learning hours taken among those that specialize in a given field reported in Column 3 of Table 7 for young males (Table 8 for adult males, Table 9 for young females and Table 10 for adult females), multiplied by the returns per 100 hours one and five years after leaving FE education (Columns 1 and 2 of the respective tables). The whiskers represent the 95% confidence intervals. Only fields with at least 5% of enrollment are shown. The bars represent the enrollment shares in each field. Sample: Individuals aged 18-20 (25-54) when first enrolling in FE college for young (adult) learners.

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[2] For example, the world's largest electronics assembler based in Taiwan (Foxcoon Technology Group) reduced its workforce by 30 percent when it included robots in the production process (Saliola, Mohamed Islam and Winker 2020).

[3] As noted by Hoxby (2015), a deep understanding of value-added measures is important to evaluate the potential benefits and costs of any policy that affects individuals' decisions to attend VET.

[4] The literature on the returns to vocational degrees in the U.S. is extensive. For example, Jacobson, LaLonde and Sullivan (2005*a*,*b*); Bahr (2014); Cellini and Chaudhary (2014); Bahr et al. (2015); Dadgar and Trimble (2015); Liu, Belfield and Trimble (2015); Stevens, Kurlaender and Grosz (2019); Zeidenberg, Scott and Belfield (2015); Bettinger and Soliz (2016); Xu and Trimble (2016); Belfield and Bailey (2017*a*); Mountjoy (2021), among others. Belfield et al. (2018) and Hickman and Mountjoy (2019) provide an extensive analysis of returns in higher education in the UK and Texas.

[5] There is a large literature on returns to field of study. See, for instance, Arcidiacono (2004); Arcidiacono, Cooley and Hussey (2008); Hastings, Neilson and Zimmerman (2013); Bahr (2016); Kirkeboen, Leuven and Mogstad (2016); Belfield and Bailey (2017*a*); Altonji, Arcidiacono and Maurel (2016); Altonji and Zimmerman (2018); Belfield et al. (2018); Altonji and Zhong (2021).

[6] For example, a student specializing in engineering and manufacturing technology may also take courses in business administration. Bahr (2014) also relies on credits but the focus is on credits achieved.

[7] Similarly, Stange (2012) finds that instructional expenditure per student has no impact on community college students' educational attainment.

[8] Qualifications classified under the field *Preparation for Life and Work* are usually Functional Skills qualifications that teach post-16 and adult learners in England how to apply practical math and English skills to real-life and vocational contexts.

[9] Value-added estimates for colleges have attracted widespread attention in the US, following the publication of college score cards by the US Department for Education in 2012 (US Department for Education, 2015).

[10] FE colleges face a challenging mission, providing VET to learners with very different levels of experience, academic preparation and at very different stages of their professional lives. Further details about these institutions are given in Section 2.

[11] Over the time period we study, there were around 257 General FE colleges in England. Due to mergers and closures of colleges, this number varies from year to year.

[12] Experts at the Association of Colleges, an organization representing FE colleges in England, indicate that General FE colleges, the ones object of this study, do not typically experience over-subscription for their courses.

[13] FE colleges also offer qualifications at lower levels of learning. We do not consider this remedial type of learning in our analysis.

[14] The regulatory bodies responsible for further education funding determine which qualifications are eligible for funding, which can change from year to year. To get an idea of the variety of funded learning available for young learners, the list of approved qualifications for 14 to 19-year-olds comprised 12,580 qualifications in 2019 (ESFA, 2019).

[15] There are many awarding bodies in England, specializing in different kinds of qualifications. In VET, the dominant organizations are Pearson (offering technical qualifications like Business and Technology qualifications (BTECs)), EAL (offering engineering qualifications) and City & Guilds (offering National Vocational Qualifications in fields such as hairdressing, plumbing or construction).

[16] About 40% of the gender gap in guided learning hours enrollment is explained by field of study.

[17] While we observe number of days employed, we do not observe hours worked or the sector or occupation in which individuals are employed.

[18] The KS4 score has been standardized based on the sample of all individuals in a cohort of school leavers, including those going to higher education. Our analysis on returns to fields of study will, however, focus on students that did not enroll in a bachelor's degree after VET in order to ease interpretation of the findings. This explains the negative values on most bars in Panel (b) of Figure 3.

[19] For example, Chetty, Friedman and Rockoff (2014) argue that, in the context of the teacher value-added literature, a plausible approach to estimating the impact of teachers on wages is to control for lagged wages (i.e., prior to college enrollment). However, they

do not pursue this route because it is impossible to have information on pre-enrollment wages in their context.

[20] To assess the extent to which pre-FE college earnings reflect the productivity of young learners, in Online Appendix Table A5 we explore the correlation between earnings at age 18 and earnings nine years later among individuals who never attend further education after leaving compulsory education. We find relatively large and statistically significant correlations, even after controlling for a detailed measure of end of secondary school performance, gender, and whether the student was eligible to receive free school meals (see Columns 1-4). For comparison purposes, similar correlations for a subsample of adult learners that were not enrolled in any institution during the period of analysis (i.e., between the nine years that separate the earnings outcome and the right-hand-side earnings variable) are presented in Columns 5-8. As would be expected, pre-FE college earnings of adult learners are more predictive of future earnings than those of young learners. However, prior attainment and socio-economic background data for adults is less precise than for young learners, hence the magnitudes of the correlation coefficients are not completely comparable between young and adult learners. Nevertheless, the magnitudes of the correlations for young learners suggest that pre-FE college earnings are capturing important aspects of heterogeneity for this population.

[21] KS2 and KS3 scores correspond to standardized measures of student performance at ages 11 and 14.

[22] We discuss this in more detail in Section 4.1.2.

[23] Belfield and Bailey (2017b) provide a thorough discussion of the different empirical strategies that have been implemented in the literature to estimate labor market returns to associate degrees in the US. ~~In particular, they~~They discuss the relative advantages and disadvantages of using fixed effects strategies. The lagged dependent variable and the fixed effects empirical strategies complement each other because they rely on different sources of variation in the data. This makes it possible to determine how sensitive the heterogeneity in FE college VA is to different modeling assumptions.

[24] The dummies indicating the main field of study take the value one from the year the learner completes FE college education, and zero otherwise.

[25] Another concern is related to the number of post-FE college outcome observations, which should be uncorrelated with the FE institution attended. For example, if individuals in a certain field of study are more likely to drop out of the sample, we may overstate the impact of that field of study. However, given that the labor market information is coming from the HMRC records, we can follow individuals independently of their field of study or institution attended.

[26] This model is estimated separately by age group and gender.

[27] Students can enroll in multiple courses in different fields. Therefore, for each student we observe a vector of the total number of guided learning hours enrolled in each field of study. For example, returns to guided learning hours in business are identified from students that specialize in business and those that specialize in social sciences, but were taking some courses in business. Online Appendix Tables A14 and A15 show the share of guided learning hours completed in other fields for an example of a popular main sector for male and female young learners, respectively.

[28] The full set of controls is reported in the footnotes of Table 4.

[29] We focus on learners aged 18-20 because this is our main sample for the analysis of VA in labor market outcomes and because most students show a pre-FE college labor market experience. For completeness, we report analogous results for the 16-20 age sample and adult learners in Table A6 in the Online Appendix. The results for the 16-20 sample are very similar (see row four for every outcome, where the SD in VA is expressed as the percent of the mean of the dependent variable). The same exercise for the adult sample shows bigger VA estimates in this subsample. However, the lack of many background characteristics and prior attainment measures in the adult sample calls for extra caution when interpreting these estimates.

[30] Given that estimates are very similar across model specifications for young learners, moving forward, we describe the results based on our preferred specification of panel estimates for this group (Columns 4 to 6).

[31] While aggregation in two broad categories may mask other types of heterogeneities across sectors, sample size limitations related to having enough observations per sector and college prevent us from further disaggregating the results into finer fields of study. Note that these estimates are not reported in Table 5.

[32] The number of observations for daily earnings in the third panel is lower than the number of observations for employment because we drop outliers from our earnings observations, e.g., those positive but very low daily earnings (less than £10) or very high daily earnings (more than £1000). Individuals who were not employed in a given year are coded as having zero earnings.

[33] A similar test would be to estimate the correlation of FE college value-added when we include and exclude prior performance and free school meal eligibility (FSM). Our results show, for example, that the correlation of FE value-added in log daily earnings between these models is 0.998 when we include and exclude FSM from the preferred specification.

[34] College inspection ratings are performed on a regular basis and colleges receive a grade between one and four, where four means that the college requires improvement, and one means that the college is outstanding (Ofsted reports). We re-coded the measure so that a four means "outstanding", and one means "requires improvement".

[35] The coefficients on the interaction terms correspond to $\boldsymbol{\Upsilon_2}$ in Equation (4).

[36] Engineering and manufacturing technology, construction, planning and the built environment, and arts, media and publishing represent approximately 50% of the total enrollment of male young learners.

[37] Health, public services and care, retail and commercial enterprise, and business administration and law represent approximately 60% of the total young female enrollment.

[38] In fact, we run the analysis with main field dummies and the returns to field of study in those specifications tend to be larger. Results are available upon request.

Where versus What: College Value-Added and Returns to Field of Study in Further Education*

Esteban M. Aucejo† Claudia Hupkau‡ Jenifer Ruiz-Valenzuela§

Online Appendix

*The authors thank participants at the CEP (LSE) labor Market Workshop, the Royal Economic Society conference, the AEDE annual conference, FEDEA workshop, the Centre for Economic Performance Annual conference, the Southern Economic Association conference, and the UB (IEB), the UCL CEPEO, and CVER (LSE) seminar series for helpful suggestions and comments. The authors are grateful to the Department of Education and the SFA for providing the data and valuable background information. The latter bear no responsibility for the analysis or interpretation of these data.

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Online Appendix

A.1 Data Appendix

Data for Young Learners To estimate the value-added of FE colleges and study the returns to field of study at FE colleges for young learners, we create a dataset containing family background information, characteristics of the school attended during compulsory secondary education, information on the educational attainment during compulsory schooling, information on courses taken in FE colleges, information on subsequent enrollment in university and employment histories and earnings for four cohorts of school leavers completing compulsory schooling in the academic years from 2003/2004 to 2006/2007. Except for some publicly available datasets detailed below, most data are provided by the UK Department for Education and comes from the recently created Longitudinal Educational Outcomes (LEO) administrative database. This dataset combines several sources.

Data on students' background characteristics and prior attainment comes from the National Pupil Database (NPD) and include two sources: the pupil level census and the learning outcomes data. Information on ethnicity, gender, special educational needs, free school meal eligibility status while in compulsory schooling and eight different measures of neighborhood characteristics come from the pupil census.[1] Performance in math and English tests in Key Stages 2 to 4 come from the learning outcomes data. We add a quality measure of the KS4 secondary school attended to this data, which is publicly available from the UK Office for Standards in Education (Ofsted).

[1]The eight covariates of neighborhood characteristics correspond to Income Deprivation, Employment Deprivation, Health Deprivation and Disability, Education Skills and Training Deprivation, Barriers to Housing and Services, Living Environment Deprivation, Crime and Income Deprivation Affecting Children.

Administrative data on further education comes from the Individualized Learner Record (ILR) database, and comprises all individuals in our cohorts who attended publicly funded vocational education and training between 2004 and 2014. The ILR includes extensive information on the FE college curricula undertaken by each learner, including the guided learning hours per course taken, the level of the courses, the field of study of each course, the type of qualification, the awarding body of the different qualifications and whether the learner attended the FE college on a full- or part-time basis. We construct a variable indicating the main field of study of the learner by computing the guided learning hours in each field, and designating the field where they undertake the highest overall share of their learning as their main field of study.[2]

Higher education data are provided by the Higher Education Statistics Agency (HESA) and comprises all individuals in our Key Stage 4 cohorts observed at a higher education institution in the UK. The data contains information on when a student first enrolled in higher education, the type of degree they enrolled in, the outcome of the degree and the major chosen. We observe higher education outcomes up until individuals in our sample are aged between 25 and 29, i.e. up to nine years after leaving compulsory education for the youngest cohort, and up to 12 years after leaving compulsory education for the oldest cohort.

Finally, these datasets are linked to labor market outcomes. Earnings data comes

[2]We follow the classification of specializations given by Sector Subject Areas (Tier 1). Sector Subject Areas (also called sector subject categories) are a single framework of sectors and subjects used to categorize qualifications, developed for use across relevant education agencies and bodies in England, Wales and Northern Ireland. The 15 categories are: 1) Health, Public Services and Care, 2) Science and Mathematics, 3) Agriculture, Horticulture and Animal Care, 4) Engineering and Manufacturing Technology, 5) Construction, Planning and the Built Environment, 6) Information and Communication Technology, 7) Retail and Commercial Enterprise, 8) Leisure, Travel and Tourism, 9) Arts, Media and Publishing, 10) History, Philosophy, and Theology, 11) Social Sciences, 12) Languages, Literature and Culture, 13) Education and Training, 14) Preparation for Life and Work, 15) Business Administration and Law. We exclude qualifications in the field called *Preparation for Life and Work* in the computation of the main field of study, unless the learner only takes qualifications in that field, as these qualifications are normally taken alongside other qualifications in sectors that would constitute the main field of study.

from Her Majesty's Revenue and Customs (HMRC) records and data on employment and benefit records comes from the Department for Work and Pension (DWP). We observe employment spells (including start and end dates) and earnings for individuals of our cohorts of learners up to the tax year 2017, that is, for a minimum of 10 and a maximum of 13 years after leaving compulsory education, for the youngest and oldest cohorts, respectively. Given the panel nature of the earnings and employment dataset, we can observe many individuals both before, during and after attending FE colleges, providing us with a unique opportunity to assess returns to qualifications and FE college value-added using individual fixed effects models.

Our labor market outcomes of interest are log daily earnings, and daily earnings in levels (including zeros for non-employed individuals), log annual earnings and annual earnings in levels, and the probability of being employed for more than 90 days in a given year.[3] We also look at academic outcomes, i.e. academic achievement while at FE colleges, and progression to higher education. In particular, the outcome variables of interest are the total number and the share of guided learning hours a student achieved (both measures of learning completion), whether they achieved at least one level 3 qualification (which is a measure of academic progression, since most students enter FE colleges with qualifications at level 2 or below). We also define a measure of progression to university, by creating a dummy variable indicating whether an individual was ever observed as enrolling in a bachelor's degree in higher education.

Column 2 of Table A16 in Appendix A.2 shows the number of students in the cohorts of young learners we study, which range from about 570,000 in the academic year 2003/2004 to nearly 600,000 in 2006/2007. More than half of the students in each cohort choose

[3] As in **?**, our measure of daily earnings in levels includes observations with zero earnings and therefore captures both employment and earnings effects, whereas the log specification captures only earnings for those who work.

qualifications at level 2 or 3 at further education providers (Column 3), and the majority of them studies in General FE colleges (Column 4). The last column shows the number of FE colleges (which decreases slightly over the period due to mergers among FE institutions).

To see how the population of young learners in FE colleges differs from the general population of school-leavers, Table A17 in Appendix A.2 compares summary statistics for our sample of interest of young learners enrolled at level 2 and above in FE colleges with the overall population of school leavers. Learners in further education colleges tend to be more disadvantaged, measured as having received free school meals (FSM) at some point during their compulsory schooling (14.1% versus 12.4%). In terms of educational attainment, students undertaking learning in FE colleges at levels 2 and above have lower prior attainment, with only about 33% achieving 5 GCSEs with grades between A* and C, including English and math, a commonly used measure of attainment in England. This compares to 44.5% on average among the overall cohort of learners. In terms of outcomes, the bottom Panel of Table A17 in Appendix A.2 shows that students in FE are 0.7 percentage points less likely to be employed for at least 90 days. This is measured in 2015, when students are between 24 and 27 years old. They also have lower median annual earnings (£14,149 versus £15,740).

Data for Adult Learners The data on learning undertaken by adults in General FE colleges comes from a version of the ILR dataset that allows identifying individuals over time. This dataset is available from the academic years 2003 to 2012. As is the case for young learners, this dataset includes information about the learners and about the different qualifications (i.e. courses) taken while in further education institutions. We use information on the level of learning and the number of guided learning hours in each of the qualifications, the field of study, the type of qualification(s) undertaken, and

the awarding body certifying those qualifications. With this information, we construct a variable indicating the main field of study for each adult learner following the same methodology as for young learners.

We merge information on earnings and employment records coming from the HMRC datasets to ILR records. The information on employment spells is available from tax years 2003 to 2017, whereas information on gross annual earnings by tax year is available from 2004 to 2017. Compared to the young learners dataset, we do not have prior attainment and lack some background characteristics, such as free-school meal eligibility.

Sample Selection Our group of learners of interest are those students observed in the ILR as being enrolled in General FE (or Tertiary) colleges, in either a level 2 or a level 3 course, which is equivalent to lower and upper secondary education, respectively. We focus on these learners to have a relatively homogeneous group of students. As **?** show, vocational learning in England is extremely diverse and the different types of qualifications show very different progression patterns. We focus on young learners first enrolling in FE college between the academic years 2004/05 to 2009/10 and those who complete their FE college learning in the academic year 2015/16 or before, to ensure we have sufficient post-FE earnings and employment observations and a long enough time has passed to be able to observe them in higher education post-FE college. As seen in Table A16 in the Appendix, in Column 4, there are more than 1 million young learners with these characteristics.

For young learners, we drop individuals from our sample who are not in year group 11 at age 16 (i.e., they have repeated or skipped at least one school year, which is rare in England), and who do not have at least one full GCSE entry and for whom a measure of the KS4 performance, the end of compulsory schooling exam in England, is missing.

We also cannot consider students that are not observed in the student census (i.e. with missing demographic data) and those observed in further education data for whom we do not have information on whether they attend FE on a full or part-time basis. We also drop individuals for whom we cannot identify the main field of study in the FE college, because data on the field of study of their qualifications is missing. Finally, we drop all institutions with less than 30 learners. After these steps, we are left with 85% of the initial group of interest.

A key feature of the VET sector is that a large proportion of individuals show some labor market experience before enrolling in FE colleges. For example, Tables **??** and **??** show that between 44% and 76% (71% and 78%) of young (adult) learners have worked at least 3 months within the three years before enrolling in FE education.[4] This characteristic of the data will allow us to implement two different empirical strategies to estimate FE college value-added and the returns to different fields of study in vocational education.

Among the young learners, we focus our main analysis on those aged between 18 and 20 at the time they first enrolled in an FE college, to ensure that we have a relatively homogeneous sample with a large share of individuals with pre-FE college earnings and employment data. Our baseline sample comprises 130,009 individuals. We also perform robustness checks using the entire sample of young learners. Finally, for individuals that are observed in more than one college we only consider the institution in which they did most of the learning.[5]

Similar restrictions apply for adult learners. We additionally restrict the sample

[4]For young learners, this includes the two years prior to enrolling in an FE college for the first time, and the year of enrollment. For adult learners, this includes all three years prior to joining an FE college, and the year of enrollment.

[5]About 78% of young learners in the dataset only attend one college.

to those who first enrolled in an FE college between the academic years 2006/07 and 2009/2010. This is because we want to observe adult learners several periods before and after they first enroll in an FE college during the period of data availability. Moreover, given that we cannot link higher education data for adult learners, we restrict our sample of adults to those aged 25 to 59 when they first enroll in further education. This is because the majority of learners that start some type of learning in FE colleges after age 25 are very unlikely to be observed in higher education institutions afterwards.

We apply a series of other sample restrictions for the adult learner sample. Similar to young learners, for those individuals that are observed in more than one FE college, we only consider their main institution in terms of learning.[6] In line with the restrictions applied for young learners, we focus our attention on individuals whose maximum level of learning observed at the FE college is level 2 or above. Finally, we drop all institutions with less than 30 learners. In total, we have a baseline sample of 803,939 adult learners.

Since not all learners have earnings and employment information available, the final sample for both value-added regressions and for estimating the returns to specializations will depend on the outcome measure considered.

[6] About 81% of adult learners in the dataset only attend one college.

A.2 Additional Tables

Table A1: Summary Statistics for Young Learners - Males

	(1) 16-17	(2) 18-20	(3) Total
Students	416,637	67,041	483,678
FE Colleges	258	255	260
Learner Characteristics			
Share max. level enrolled: 2	32.84	35.22	33.17
Share max. level enrolled: 3	56.07	50.89	55.35
Share max. level enrolled: 4	0.31	0.79	0.38
Share observed in HE after FE	28.29	33.66	29.03
Average guided learning hours enrolled	1,101	642	1,037
Duration of learning (days)	783	536	749
Average nb. of courses enrolled	5.35	2.81	5.00
Median distance KS4 school to FE college (km)	6.58	10.43	7.04
Labour market characteristics			
Share employed before FEC entry*	42	75	47
Earnings in FEC entry year	4,029	8,028	5,112
Earnings before FEC entry	3,619	7,292	5,705
Earnings 5 years post FEC	14,211	15,858	14,442

Source: NPD, ILR, HESA and LEO.

Notes: The table shows summary statistics for young learners aged 16 to 20, enrolled in a further education college at level 2 and above and first enrolling in an FE college between 2005 and 2010. FEC=Further Education College. Earnings are annual and reported in real terms (in 2015 £). *=Employed in at least one of the two years preceding college entry or in entry year.

Table A2: Summary Statistics for Young Learners - Females

	(1) 16-17	(2) 18-20	(3) Total
Students	422,302	62,968	485,270
FE Colleges	258	255	260
Learner Characteristics			
Share max. level enrolled: 2	26.34	32.64	27.16
Share max. level enrolled: 3	66.95	58.30	65.83
Share max. level enrolled: 4	0.39	1.12	0.48
Share observed in HE after FE	33.51	39.75	34.32
Average guided learning hours enrolled	1,129	601	1,061
Duration of learning (days)	751	474	715
Average nb. of courses enrolled	5.80	2.76	5.40
Median distance KS4 school to FE college (km)	6.28	9.07	6.56
Labour market characteristics			
Share employed before FEC entry*	46	76	50
Earnings in FEC entry year	3,493	7,147	4,499
Earnings before FEC entry	3,162	6,475	5,035
Earnings 5 years post FEC	12,294	13,151	12,408

Source: NPD, ILR, HESA and LEO.

Notes: The table shows summary statistics for young learners aged 16 to 20, enrolled in a further education college at level 2 and above and first enrolling in an FE college between 2005 and 2010. FEC=Further Education College. Earnings are annual and reported in real terms (in 2015 £). *=Employed in at least one of the two years preceding college entry or in entry year.

Table A3: Summary Statistics for Adult Learners - Males

	(1) 25-29	(2) 30-39	(3) 40-49	(4) 50-59	(5) Total
Learners	65,501	138,450	111,983	61,207	377,141
FE Colleges	255	255	255	255	255
Learner Characteristics					
Share max. level enrolled: 2	64.41	63.36	62.53	62.91	63.22
Share max. level enrolled: 3	28.21	29.21	30.72	31.76	29.90
Share max. level enrolled: 4	7.38	7.43	6.75	5.33	6.88
Average guided learning hours enrolled	240	195	147	99	173
Duration of learnings (days)	295	272	244	205	257
Average nb. of courses enrolled	2.31	2.14	1.96	1.78	2.06
Median distance to FE college (home)	12.07	12.60	13.67	13.87	13.02
Labour market characteristics					
Share employed before FEC entry*	71.95	71.43	73.11	76.44	72.83
Earnings in FEC entry year	9,280	11,787	14,393	15,211	12,681
Earnings before FEC entry	8,737	11,634	14,483	15,703	12,637
Earnings 5 years post FEC	22,719	24,512	25,735	23,810	24,474

Source: ILR and HMRC.

Notes: The table shows summary statistics for male adult learners aged 25 to 59, enrolled in a further education college at level 2 and above and first enrolling in FE college learning between 2007 and 2010. FEC=Further Education College. Earnings are annual and reported in real terms (in 2015 £). *=Employed in at least one of the two years preceding college entry or in entry year.

Table A4: Summary Statistics for Adult Learners - Females

	(1) 25-29	(2) 30-39	(3) 40-49	(4) 50-59	(5) Total
Learners	70,385	155,279	135,103	66,031	426,798
FE Colleges	255	255	255	255	255
Learner Characteristics					
Share max. level enrolled: 2	54.75	56.64	61.87	69.79	60.02
Share max. level enrolled: 3	35.83	35.18	30.19	23.74	31.94
Share max. level enrolled: 4	9.41	8.18	7.95	6.46	8.04
Average guided learning hours enrolled	255	225	170	112	195
Duration of learnings (days)	343	339	312	264	319
Average nb. of courses enrolled	2.26	2.20	2.00	1.77	2.08
Median distance to FE college (home)	6.93	7.33	8.95	10.91	8.25
Labour market characteristics					
Share employed before FEC entry*	69.71	71.75	76.41	79.98	74.16
Earnings in FEC entry year	7,651	7,885	9,630	11,602	8,974
Earnings before FEC entry	7,104	7,716	9,340	11,572	8,726
Earnings 5 years post FEC	17,187	16,971	17,730	17,146	17,291

Source: ILR and HMRC.

Notes: The table shows summary statistics for female adult learners aged 25 to 59, enrolled in a further education college at level 2 and above and first enrolling in FE college learning between 2007 and 2010. FEC=Further Education College. Earnings are annual and reported in real terms (in 2015 £).*=Employed in at least one of the two years preceding college entry or in entry year.

Table A5: Earnings correlations of individuals never attending FE

	Young Learners				Adult learners			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log daily earn. t-9	0.236***	0.195***	0.192***	0.170***	0.482***	0.442***	0.447***	0.444***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.001)	(0.001)	(0.001)	(0.001)
Male		0.364***	0.364***	0.406***		0.147***	0.149***	0.151***
		(0.007)	(0.007)	(0.007)		(0.002)	(0.002)	(0.002)
FSM eligible			-0.116***	-0.070***				
			(0.010)	(0.010)				
KS4 score (std)				0.102***				
				(0.003)				
Age							0.064***	0.065***
							(0.001)	(0.001)
Age^2							-0.001***	-0.001***
							(0.000)	(0.000)
IDACI score							-0.093***	-0.084***
							(0.005)	(0.005)
Prior attainment:								
Level 1 or below								0.004
								(0.004)
Full level 2								0.028***
								(0.004)
Full level 3 or above								0.077***
								(0.003)
Unknown								0.020***
								(0.003)
Constant	3.018***	2.925***	2.951***	3.072***	2.032***	2.128***	1.146***	1.106***
	(0.025)	(0.023)	(0.024)	(0.023)	(0.005)	(0.005)	(0.018)	(0.018)
Observations	22248	22248	22248	22248	432344	432344	432344	432344

Source: LEO. The table shows coefficients from regressing log daily earnings at age 27 (young learners, Columns 1-4) or in the year 2017 (adult learners, Columns 5-8) on log daily earnings of the same individual 9 years before. Sample restricted to individuals who never attended FE college or other post-secondary education (young) or who were observed in FE college or other VET for the last time in 2007 or before (adults). FSM eligible is a dummy equal to one for learners who received free school meals in the last year of compulsory schooling. The IDACI score is a measure of geographic deprivation (a higher score indicates higher deprivation, based on the postcode of residence). Level 1 or below, Full level 2, Full level 3 or above or unknown are dummies indicating the prior attainment (before FE college) of adult learners. The omitted category is not holding any qualifications.

Table A6: Value-Added in Academic Outcomes

	16-20 year olds			25-59 year olds		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Male	Female	All	Male	Female
			Total GLH achieved			
SD Value-Added (A)	60.037	64.807	58.953	22.052	23.532	23.570
S.E.	(0.459)	(0.723)	(0.705)	(0.235)	(0.385)	(0.345)
Mean dep var (B)	726.618	706.500	746.966	120.115	107.896	130.257
(A)/(B)	0.083	0.092	0.079	0.184	0.218	0.181
Observations	696,171	349,770	346,373	627,193	284,471	342,722
Nb. of colleges	238	237	238	254	254	254
			Share of GLH achieved			
SD Value-Added (A)	0.046	0.052	0.043	0.053	0.061	0.053
S.E.	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean dep var (B)	0.687	0.680	0.694	0.721	0.715	0.726
(A)/(B)	0.067	0.077	0.062	0.074	0.085	0.074
Observations	695,828	349,571	346,229	617,786	280,217	337,569
Nb. of colleges	238	237	238	254	254	254
			Achieved 1+ Level 3 Qualification			
SD Value-Added (A)	0.039	0.043	0.039	0.057	0.076	0.055
S.E.	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean dep var (B)	0.484	0.434	0.534	0.301	0.301	0.301
(A)/(B)	0.081	0.099	0.074	0.191	0.254	0.182
Observations	696,171	349,770	346,373	627,193	284,471	342,722
Nb. of colleges	238	237	238	254	254	254
			Entered Higher Education^{A}			
SD Value-Added (A)	0.038	0.038	0.038			
S.E.	(0.000)	(0.001)	(0.001)			
Mean dep var (B)	0.329	0.300	0.359			
(A)/(B)	0.114	0.128	0.106			
Observations	696,171	349,770	346,373			
Nb. of colleges	238	237	238			

Notes: The table shows summary statistics of value-added measures based on estimations of Equation (**??**) (without lagged dependent variables). The reported standard deviations of value-added measures are adjusted for sampling error. A=Observed in a higher education institution at level of bachelor degree and above. **Estimates based on cross-sectional data for young learners** as defined in the notes to Table **??**. **Estimates based on cross-sectional data for adult learners** include the following controls: Series of dummies for region where FE college is located, academic year first entered FEC, age first entered FE college, whether student attends full-time or part-time, ever entered apprenticeship, a series of dummies for main sector, gender, a series of dummies for ethnicity (White, Mixed, Asian/Chinese, Black), a set of dummies indicating learning difficulties (unknown, some learning difficulty), a series of dummies indicating prior attainment (No qualifications, Level 1 or below, Full level 2, Full level 3 or above, unknown), dummies indicating whether employed in the three years before FEC entry (Worked in year of entry, worked 1 year before entry, worked 2 years before entry, worked 3 years before entry), and a series of deprivation indicators (crime, employment, health, income) based on FE college postcode and based on learner's postcode coming from ILR.

Table A7: Value-Added in labor market outcomes for individuals never attending HE

	Cross-Section			Panel		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Male	Female	All	Male	Female
	Log daily earnings in 2017					
SD Value-Added	0.040	0.035	0.049	0.026	0.031	0.028
S.E.	(0.003)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)
Observations	42,226	22,969	18,260	52,358	28,969	22,705
Nb. of colleges	224	202	200	246	230	227
	Log annual earnings in 2017					
SD Value-Added	0.039	0.038	0.050	0.038	0.051	0.039
S.E.	(0.005)	(0.006)	(0.008)	(0.003)	(0.004)	(0.004)
Observations	42,226	22,969	18,260	52,358	28,969	22,705
Nb. of colleges	224	202	200	246	230	227
	Daily earnings in Levels in 2017 (incl. zeros for not employed)					
SD Value-Added (A)	1.964	2.507	2.075	1.552	1.955	1.537
S.E.	(0.358)	(0.466)	(0.552)	(0.237)	(0.356)	(0.355)
Mean dep var (B)	41.716	48.285	33.786	40.901	47.356	32.969
(A)/(B)	0.047	0.052	0.061	0.038	0.041	0.047
Observations	56,316	30,644	25,170	70,632	38,693	31,400
Nb. of colleges	226	213	215	249	235	237
	Employed > 90 days in 2017					
SD Value-Added (A)	0.007	0.012	0.013	0.019	0.026	0.016
S.E.	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)
Mean dep var (B)	0.716	0.720	0.712	0.708	0.713	0.701
(A)/(B)	0.010	0.017	0.018	0.027	0.036	0.022
Observations	58,950	31,846	26,611	74,101	40,280	33,288
Nb. of colleges	227	214	216	250	236	238

Notes: The table shows summary statistics of value-added measures based on estimations of Equation (**??** for cross-sectional data and Equation (**??**) for panel data. The reported standard deviations of value-added measures are adjusted for sampling error. **Estimates based on cross-sectional and panel data for young learners** as defined in the notes to Table **??**. Sample: Individuals aged 18-20 when first enrolling in an FE college, excluding individuals who attend higher education at some point after FE college.

Table A8: Value-Added in Labor Market Outcomes in 2017 - by age group

	16-20 year olds Cross-Section			16-17 year olds Cross-Section		
	(1) All	(2) Male	(3) Female	(4) All	(5) Male	(6) Female
	Log daily earnings in 2017					
SD Value-Added	0.036	0.033	0.043	0.037	0.034	0.043
S.E.	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	521,057	265,142	255,874	450,629	228,566	222,025
Nb. of colleges	238	237	237	235	234	234
	Log annual earnings in 2017					
SD Value-Added	0.040	0.037	0.047	0.041	0.038	0.048
S.E.	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	521,057	265,142	255,874	450,629	228,566	222,025
Nb. of colleges	238	237	237	235	234	234
	Daily earnings in Levels in 2017 (incl. zeros for not employed)					
SD Value-Added	1.972	2.244	2.074	2.022	2.324	2.068
S.E.	(0.059)	(0.082)	(0.090)	(0.055)	(0.107)	(0.070)
Mean dep var (B)	44.916	50.324	39.388	44.861	50.330	39.319
(A)/(B)	0.044	0.045	0.053	0.045	0.046	0.053
Observations	664,768	336,031	328,711	574,618	289,213	285,349
Nb. of colleges	238	237	238	235	234	234
	Employed > 90 days in 2017					
SD Value-Added	0.010	0.015	0.011	0.011	0.016	0.012
S.E.	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean dep var (B)	0.754	0.755	0.753	0.755	0.757	0.752
(A)/(B)	0.014	0.020	0.014	0.015	0.021	0.016
Observations	696,098	349,731	346,339	601,425	300,785	300,611
Nb. of colleges	238	237	238	235	234	235

Notes: The table shows summary statistics of value-added measures based on estimations of Equation **??** for cross-sectional data and Equation (**??**) for panel data. The reported standard deviations of value-added measures are adjusted for sampling error. **Estimates based on cross-sectional and panel data for young learners** as defined in the notes to Table **??**.

Table A9: Value-Added in Log Daily Earnings in 2017

	18-20 year olds - Cross-Section								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SD Value-Added	0.077	0.072	0.052	0.049	0.040	0.040	0.039	0.037	0.036
S.E.	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	70,321	70,321	70,321	70,321	70,321	70,321	70,321	70,321	70,321
Nb. of colleges	227	227	227	227	227	227	227	227	227
Gender	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Timing	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SES	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Neighborhood	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Prior attainment	No	No	No	No	No	Yes	Yes	Yes	Yes
Lagged earnings	No	No	No	No	No	No	Yes	Yes	Yes
Main sector	No	No	No	No	No	No	No	Yes	Yes
Full-time / Part-time	No	No	No	No	No	No	No	No	Yes

Notes: The table shows summary statistics of value-added measures based on estimations of Equation (**??**) for cross-sectional data. The reported standard deviations of value-added measures are adjusted for sampling error. Specification (1) shows raw VA. Specification (2) controls for gender. Specification (3) additionally controls for fixed effects for academic year compulsory schooling was completed, a series of dummies for the last year observed in education (FE or HE), dummy variables indicating the number of years since starting FE and age first entered FE college. Specification (4) additionally controls for a series of dummies for ethnicity (White, Mixed, Asian/Chinese, Black), a dummy for whether English spoken at home, a dummy for whether student had special educational needs, dummy for whether student was eligible for free school meals in KS4 year. Specification (5) additionally controls for neighbourhood IDACI score based on postcode prior to joining FE college and a series of dummies for region where FE college is located. Specification (6) additionally controls for standardized KS4 score, OFSTED rating of KS4 school, KS3 maths result, KS3 English result, KS2 English result, KS2 maths result. Specification (7) additionally controls for series of dummies indicating whether the student had worked before FE college (never worked before college, worked in year of entry, worked 1 year before entry, worked 2 years before entry), earnings measured prior to FE entry, indicator for when earnings prior to entry were measured, and an interaction between pre-FEC earnings measure and timing of measurement. Specification (8) additionally controls for a series of dummies for main sector. Specification (9) additionally controls for a series of dummies indicating mode of attendance (Fulltime, Full-time part year, Part time, Unknown/Missing).

Table A10: Earnings Returns to Field of Study - **Males** (young learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1 year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	0.003	0.001	402	0.013	0.022***	8.1%
	(0.002)	(0.000)		(0.008)	(0.007)	
Science and Mathematics	−0.006	0.002***	447	−0.015	0.024	2.2%
	(0.004)	(0.001)		(0.015)	(0.013)	
Agriculture, Horticulture and Animal Care	−0.005	0.001	633	−0.031	−0.017	1.7%
	(0.003)	(0.001)		(0.019)	(0.017)	
Engineering and Manufacturing Technology	0.004***	0.001***	622	0.036***	0.069***	20.4%
	(0.001)	(0.000)		(0.007)	(0.006)	
Construction, Planning and the Built Environment	−0.002	0.001***	614	−0.005	0.024***	18.3%
	(0.001)	(0.000)		(0.007)	(0.006)	
Information and Communication Technology	−0.006***	0.002***	706	−0.031*	0.022*	6.7%
	(0.002)	(0.000)		(0.012)	(0.011)	
Retail and Commercial Enterprise	0.000	0.000	477	0.002	0.002	4.6%
	(0.003)	(0.000)		(0.011)	(0.010)	
Leisure, Travel and Tourism	−0.009***	0.003***	570	−0.035***	0.026**	8.8%
	(0.002)	(0.000)		(0.009)	(0.008)	
Arts, Media and Publishing	−0.009***	0.002***	926	−0.066***	0.000	10.8%
	(0.002)	(0.000)		(0.013)	(0.011)	
History, Philosophy and Theology	−0.025**	0.004**	411	−0.087**	−0.018	0.5%
	(0.008)	(0.001)		(0.030)	(0.025)	
Social Sciences	−0.012	0.004*	356	−0.030	0.027	0.3%
	(0.011)	(0.002)		(0.037)	(0.033)	
Languages, Literature and Culture	−0.008	0.005**	118	−0.003	0.023	0.7%
	(0.014)	(0.002)		(0.015)	(0.013)	
Education and Training	0.023	0.006**	197	0.057*	0.105***	0.3%
	(0.015)	(0.002)		(0.027)	(0.023)	
Preparation for Life and Work	−0.016***	0.000	154	−0.024***	−0.023***	9.4%
	(0.003)	(0.000)		(0.004)	(0.003)	
Business Administration and Law	0.000	0.002***	551	0.008	0.042***	7.3%
	(0.002)	(0.000)		(0.010)	(0.009)	
Observations	286,935					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation **??**). Υ_2 is the interaction term between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours enrolled by awarding body and type/level of qualification, plus the interaction term between GLH enrolled by type/level of qualification and years since finishing FE college, college fixed effects and cumulative experience, in addition to the controls reported in Section **??**. Sample: Male learners aged 18-20 who were enrolled in FE college between 2005 and 2010 and who study towards qualifications at level 2 or above.

Table A11: Earnings Returns to Field of Study - **Males** (adult learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1 year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	−0.010***	0.003***	73	−0.004***	0.010***	19.0%
	(0.001)	(0.000)		(0.000)	(0.000)	
Science and Mathematics	−0.036***	0.007***	215	−0.042***	0.034***	1.1%
	(0.002)	(0.000)		(0.003)	(0.003)	
Agriculture, Horticulture and Animal Care	−0.022***	0.004***	182	−0.022***	−0.012***	1.5%
	(0.002)	(0.000)		(0.002)	(0.002)	
Engineering and Manufacturing Technology	−0.006***	0.003***	207	−0.009*	0.008**	19.0%
	(0.001)	(0.000)		(0.004)	(0.003)	
Construction, Planning and the Built Environment	−0.010***	0.003***	284	−0.007	0.033***	10.7%
	(0.001)	(0.000)		(0.004)	(0.003)	
Information and Communication Technology	−0.021***	0.005***	166	−0.029***	0.006***	7.9%
	(0.001)	(0.000)		(0.002)	(0.002)	
Retail and Commercial Enterprise	−0.007***	0.002***	88	−0.018***	−0.009***	6.9%
	(0.002)	(0.000)		(0.001)	(0.001)	
Leisure, Travel and Tourism	−0.033***	0.004***	134	−0.023***	−0.013***	3.7%
	(0.002)	(0.000)		(0.002)	(0.002)	
Arts, Media and Publishing	−0.022***	0.004***	342	−0.053***	−0.018***	2.3%
	(0.001)	(0.000)		(0.003)	(0.002)	
History, Philosophy and Theology	−0.075***	0.011***	389	−0.153***	0.050***	0.5%
	(0.003)	(0.001)		(0.006)	(0.004)	
Social Sciences	−0.049***	0.008***	348	−0.066***	0.032***	0.1%
	(0.005)	(0.001)		(0.007)	(0.005)	
Languages, Literature and Culture	−0.005	0.001	113	−0.005**	0.000	1.6%
	(0.004)	(0.001)		(0.002)	(0.002)	
Education and Training	0.003*	0.001***	119	−0.005***	0.023***	6.8%
	(0.001)	(0.000)		(0.001)	(0.001)	
Preparation for Life and Work	−0.025***	0.005***	109	−0.013***	0.026***	4.7%
	(0.002)	(0.000)		(0.001)	(0.001)	
Business Administration and Law	0.002*	0.001***	131	0.003***	0.014***	14.2%
	(0.001)	(0.000)		(0.001)	(0.001)	
Observations	2,695,465					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation **??**). Υ_2 is the interaction term between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours enrolled by awarding body and type/level of qualification, plus the interaction term between GLH enrolled by type/level of qualification and years since finishing FE college, college fixed effects and cumulative experience, in addition to the controls reported in Section **??**. Sample: Male adult learners aged 25-59 who were enrolled in FE college between 2006/07 and 2009/2010 and who study towards qualifications at level 2 or above.

Table A12: Earnings Returns to Field of Study - **Females** (young learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1 year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	−0.003	0.002***	514	−0.004	0.044***	25.3%
	(0.002)	(0.000)		(0.009)	(0.008)	
Science and Mathematics	−0.011**	0.006***	369	−0.020	0.068***	2.8%
	(0.004)	(0.001)		(0.014)	(0.012)	
Agriculture, Horticulture and Animal Care	−0.002	0.004***	796	0.015	0.145***	2.5%
	(0.003)	(0.000)		(0.019)	(0.016)	
Engineering and Manufacturing Technology	0.005	0.003***	555	0.043*	0.099***	1.2%
	(0.004)	(0.001)		(0.021)	(0.018)	
Construction, Planning and the Built Environment	−0.005	0.003***	630	−0.014	0.065*	0.8%
	(0.005)	(0.001)		(0.030)	(0.025)	
Information and Communication Technology	−0.007	0.004***	351	−0.010	0.048***	3.0%
	(0.004)	(0.001)		(0.013)	(0.011)	
Retail and Commercial Enterprise	0.002	0.003***	590	0.033**	0.114***	25.0%
	(0.002)	(0.000)		(0.012)	(0.011)	
Leisure, Travel and Tourism	−0.002	0.004***	611	0.014	0.121***	5.6%
	(0.002)	(0.000)		(0.013)	(0.012)	
Arts, Media and Publishing	−0.006**	0.005***	877	−0.002	0.185***	11.3%
	(0.002)	(0.000)		(0.014)	(0.013)	
History, Philosophy and Theology	−0.019**	0.007***	432	−0.054*	0.064**	1.0%
	(0.007)	(0.001)		(0.026)	(0.021)	
Social Sciences	0.005	0.006***	336	0.040	0.127***	0.4%
	(0.010)	(0.002)		(0.032)	(0.029)	
Languages, Literature and Culture	−0.016	0.004**	133	−0.015	0.007	1.2%
	(0.009)	(0.001)		(0.011)	(0.010)	
Education and Training	0.029***	0.002	165	0.051***	0.062***	1.5%
	(0.009)	(0.001)		(0.013)	(0.011)	
Preparation for Life and Work	−0.022***	0.005***	175	−0.031***	0.004	5.9%
	(0.005)	(0.001)		(0.008)	(0.007)	
Business Administration and Law	0.004	0.005***	430	0.039***	0.119***	12.5%
	(0.002)	(0.000)		(0.009)	(0.008)	
Observations	226,524					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation **??**). Υ_2 is the interaction term between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours enrolled by awarding body and type/level of qualification, plus the interaction term between GLH enrolled by type/level of qualification and years since finishing FE college, college fixed effects and cumulative experience, in addition to the controls reported in Section **??**. Sample: Female learners aged 18-20 who were enrolled in FE college between 2005 and 2010 and who study towards qualifications at level 2 or above.

Table A13: Earnings Returns to Field of Study - **Females** (adult learners)

Field of Study	(1) Coefficients Υ_1	(2) Coefficients Υ_2	(3) Mean GLH if main field	(4) Estimated return 1 year post FE	(5) Estimated return 5 years post FE	(6) Share of individuals specializing in field
Health, Public Services and Care	−0.010***	0.005***	136	−0.007***	0.019***	34.3%
	(0.001)	(0.000)		(0.001)	(0.000)	
Science and Mathematics	−0.028***	0.009***	177	−0.035***	0.028***	2.2%
	(0.002)	(0.000)		(0.003)	(0.002)	
Agriculture, Horticulture and Animal Care	−0.014***	0.001***	343	−0.042***	−0.022***	1.1%
	(0.001)	(0.000)		(0.004)	(0.003)	
Engineering and Manufacturing Technology	−0.007**	0.002***	172	−0.008*	0.007**	1.2%
	(0.002)	(0.000)		(0.003)	(0.002)	
Construction, Planning and the Built Environment	−0.006***	0.004***	398	−0.010	0.046***	0.5%
	(0.002)	(0.000)		(0.006)	(0.005)	
Information and Communication Technology	−0.023***	0.005***	134	−0.023***	0.005***	7.2%
	(0.001)	(0.000)		(0.002)	(0.001)	
Retail and Commercial Enterprise	−0.023***	0.002***	218	−0.044***	−0.023***	11.3%
	(0.001)	(0.000)		(0.002)	(0.002)	
Leisure, Travel and Tourism	−0.019***	0.002***	176	−0.030***	−0.017***	1.7%
	(0.002)	(0.000)		(0.003)	(0.002)	
Arts, Media and Publishing	−0.018***	0.003***	291	−0.046***	−0.015***	2.7%
	(0.001)	(0.000)		(0.002)	(0.002)	
History, Philosophy and Theology	−0.052***	0.013***	431	−0.169***	0.056***	1.1%
	(0.002)	(0.000)		(0.006)	(0.005)	
Social Sciences	−0.026***	0.007***	429	−0.082***	0.039***	0.3%
	(0.002)	(0.000)		(0.009)	(0.007)	
Languages, Literature and Culture	−0.006**	0.001**	130	−0.006**	0.000	2.5%
	(0.002)	(0.000)		(0.002)	(0.002)	
Education and Training	−0.010***	0.006***	140	−0.006***	0.027***	12.7%
	(0.001)	(0.000)		(0.001)	(0.001)	
Preparation for Life and Work	−0.021***	0.009***	139	−0.017***	0.034***	6.5%
	(0.001)	(0.000)		(0.002)	(0.001)	
Business Administration and Law	0.000	0.002***	187	0.004***	0.020***	14.8%
	(0.001)	(0.000)		(0.001)	(0.001)	
Observations	3,194,471					

Notes: The Υ_1**'s** are coefficients from individual fixed effects regressions of log daily earnings on the total number of guided learning hours (in '00) enrolled in a particular field of study (Equation **??**). Υ_2 is the interaction term between guided learning hours enrolled (in '00) and years since finishing FE college education. The estimated returns reported in Columns 4 and 5 are the marginal effects, one and five years after leaving the college, respectively, of choosing the sector as the main sector. The regression controls for guided learning hours enrolled by awarding body and type/level of qualification, plus the interaction term between GLH enrolled by type/level of qualification and years since finishing FE college, college fixed effects and cumulative experience, in addition to the controls reported in Section **??**. Sample: Female adult learners aged 25-59 who were enrolled in FE college between 2006/07 and 2009/2010 and who study towards qualifications at level 2 or above.

Table A14: Distribution of guided learning hours by main field of study and age group - Males

Main Sector	Sector	Share of total GLH (%) age 18-20	Share of total GLH (%) age 16-20
Construction & Planning	Health, Public Services & Care	0.64	0.83
	Science & Mathematics	0.13	0.21
	Agriculture, Horticulture & Animal Care	0.15	0.14
	Engineering & Manufacturing Technology	2.02	1.86
	Construction & Planning	85.57	80.35
	Information & Communication Technology	0.36	0.50
	Retail and Commercial Enterprise	0.14	0.13
	Leisure, Travel and Tourism	0.31	0.41
	Arts, Media and Publishing	0.22	0.34
	History, Philosophy & Theology	0.03	0.02
	Social Sciences	0.04	0.05
	Languages, Literature & Culture	0.09	0.16
	Education & Training	0.05	0.03
	Preparation for Life & Work	6.98	11.06
	Business Administration & Law	0.35	0.23

Notes: The table shows the share of guided learning hours enrolled in the different sectors conditional on enrolling in construction and planning as the main sector.

Table A15: Distribution of guided learning hours by main field of study and age group - Females

Main Sector	Sector	Share of total GLH (%) age 18-20	Share of total GLH (%) age 16-20
Health, Public Services & Care	Health, Public Services & Care	85.77	78.94
	Science & Mathematics	0.53	1.08
	Agriculture, Horticulture & Animal Care	0.17	0.09
	Engineering & Manufacturing Technology	0.04	0.10
	Construction & Planning	0.11	0.06
	Information & Communication Technology	0.27	0.47
	Retail and Commercial Enterprise	1.64	1.20
	Leisure, Travel and Tourism	0.40	0.73
	Arts, Media and Publishing	0.44	0.62
	History, Philosophy & Theology	0.11	0.10
	Social Sciences	0.09	0.25
	Languages, Literature & Culture	0.39	0.90
	Education & Training	0.13	0.13
	Preparation for Life & Work	6.58	10.17
	Business Administration & Law	0.32	0.58

Notes: The table shows the share of guided learning hours enrolled in the different sectors conditional on enrolling in health and social care as the main sector.

Table A16: Number of Students and General/Tertiary FE Colleges

(1) Year completion compulsory schooling	(2) Number of students (cohort size)	(3) L2/L3+ in ILR	(4) of which: in FE College	(5) # of FE Colleges
2003/2004	572,513	304,816	244,427	260
2004/2005	575,789	307,331	246,555	258
2005/2006	585,973	318,877	256,774	255
2006/2007	597,763	336,575	272,123	250
Total	2,332,038	1,267,599	1,019,879	

Source: NPD and ILR.

Note: Column (1) shows the academic year in which the student completed compulsory schooling (at age 16). Column (2) shows the total number of students reported in the NPD pupil level census completing compulsory schooling in a given academic year. Column (3) shows the number of students enrolled in L2/L3+ in ILR, which includes students enrolled in any qualifications above Level 2 in General/Tertiary FE colleges or Sixth Form colleges, that were in year group 11 by the end of KS4, with data on KS4 performance and appearing in the pupil level census. Column (4) shows the subset of those in Column (3) that are enrolled in FE colleges. Column (5) shows the number of General/Tertiary FE colleges.

Table A17: Summary Statistics: All Students and our Population of Interest

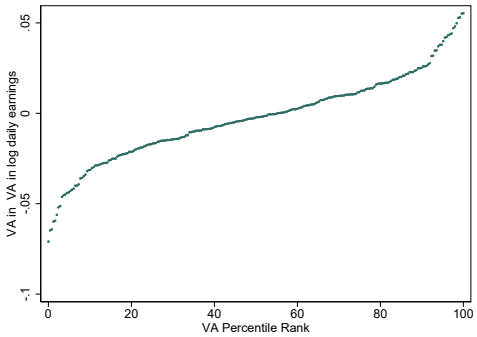
	(1) All school leavers	(2) L2/L3+ in FE colleges
Demographics and education		
Male	0.504	0.496
Eligible for Free School Meals (FSM)	0.124	0.141
White ethnicity	0.837	0.837
English Spoken at Home	0.907	0.911
Special Educational Needs (SEN)	0.160	0.174
5 or more GCSEs at A*-C incl. English & Maths	0.445	0.330
Ever enrolled in a Bachelor Degree	0.371	0.268
Labour market outcomes		
Employed for more than 90 days[$]	0.794	0.787
Median annual earnings[$] (£)	15,740	14,149
Number of students	2,332,038	1,019,879

Source: NPD, ILR, HESA and LEO.
Notes: Column (1) shows summary statistics for all four cohorts of school leavers (2003/04-2006/07). Column (2) shows summary statistics for students enrolled in L2/L3+ in FE, which includes students enrolled in any qualifications above Level 2 in General/Tertiary FE colleges, who were in year group 11 by the end of KS4, with data on KS4 performance and appearing in the pupil level census.
$ = Measured in 2015.

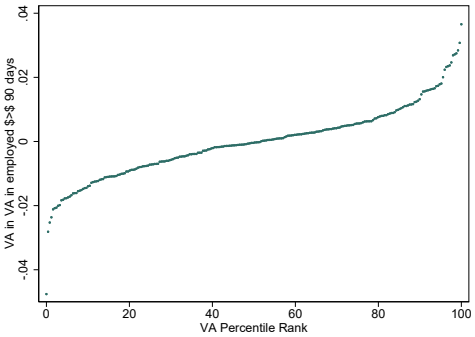
A.3 Additional Figures

Figure A1: Distribution of VA measures in different outcomes

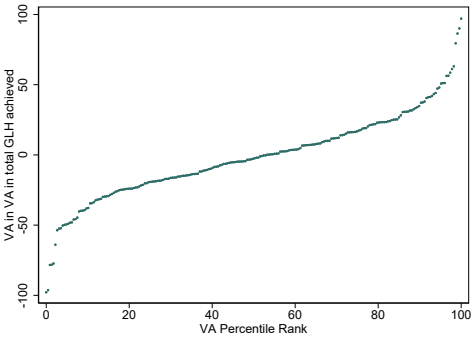
(a) VA in Log Daily Earnings



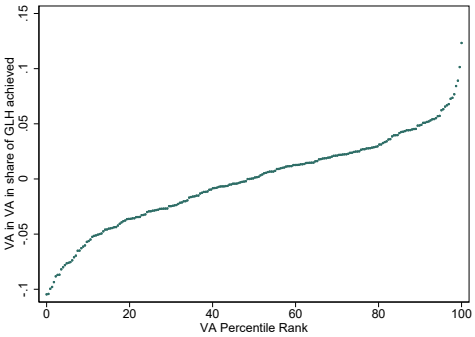
(b) VA in Employed > 90 days



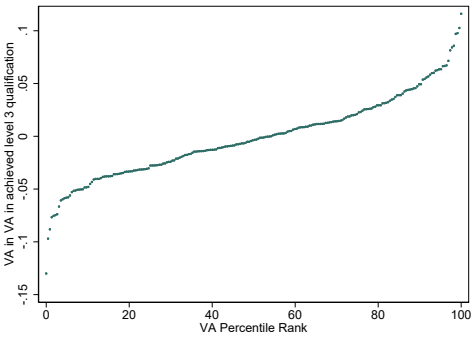
(c) VA in Total GLH achieved



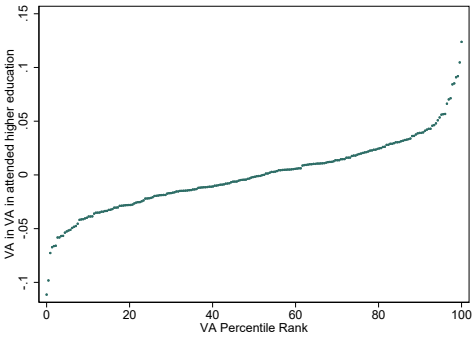
(d) VA in Share of GLH achieved



(e) VA in Achieved level 3 Qualification



(f) VA in Entered Higher Education



Note: The graphs show estimates of value-added in different outcomes against the college's percentile rank in terms of value-added in this outcome, estimated using panel data (sub-figures (a) and (b)) and cross-sectional data (sub-figures (c) to (f)) for individuals aged 18-20 when first enrolling in FE college.