Caught in the Cycle: Timing of Enrollment and Labor Market Performance of University Graduates*

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Abstract

We explore the labor market outcomes of cohorts who select into university at different points in the business cycle. We find robust evidence that cohorts of graduates who select into university during worse economic times have better average labor market outcomes than those who select during better times. This difference is not explained by differences in the economic conditions at the time of college graduation, by changes in the composition of the cohorts in terms of field of study, or by changes in selection into occupations or industries. We rule out the possibility that these cohorts are more positively selected at the time of enrollment by using information on their high-school outcomes. In spite of the lack of positive selection at the time of entry, these cohorts graduate with higher college grade point averages, and earn higher wages conditional on their grades. We interpret this as evidence that cohorts selecting into college during bad times exert more effort during their studies, and discuss several channels through which this increase in effort might operate.

Keywords: Business Cycle, Higher Education, Cohort Effects

JEL Classification: I23, J24, J31, E32

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1 Introduction

A rich line of research on cohort effects has focused on the role that the macroeconomic conditions prevailing at key moments in people's life play for their current and future economic achievements. This literature has highlighted how cohort wages at entry into the labor market are important predictors of later wages (Beaudry and DiNardo, 1991; Baker et al., 1994; Gibbons and Waldman, 2006; Hagedorn and Manovskii, 2013); and how cohorts who happen to graduate in a recession earn less when entering the labor market (Kahn, 2010; Oreopoulos et al., 2012; Altonji et al., 2016b; Liu et al., 2016) and suffer from slower career progressions (Kwon et al., 2010) than those who happen to graduate in periods of economic expansion. Overall, this literature finds robust evidence on the persistent effect of macroeconomic history on future cohort-level outcomes.

A separate strand of the literature shows that business cycle conditions also impact educational decisions. Empirical evidence for the US (Betts and McFarland, 1995; Dellas and Sakellaris, 2003), the UK (Clark, 2011) and Denmark (Sievertsen, 2016) shows that cohorts who experience high levels of unemployment when finishing compulsory schooling tend to stay in education more frequently. Sievertsen (2016) finds that poor economic conditions increase the probability of enrollment into post-secondary education by affecting both the timing of enrollment as well as the probability to ever enroll. Blom et al. (2015) show that cohorts who enroll during bad times tend to choose a different mix of university majors.[1]

In this paper, we link these two strands of the literature by directly exploring the link between macroeconomic conditions experienced at the time of college enrollment and future labor market outcomes.[2] Standard economic intuition suggests that the expansion of university enrollment that occurs during business cycle downturns would be associated with the entry of lower ability marginal students. Empirical evidence indeed suggests that the long-term expansion in college enrollment has led to a decline in the average quality of college graduates; see for example Carneiro et al. (2011) and Carneiro and Lee (2011). In light of this evidence, we would expect that the average unobserved ability of cohorts that enter college during a recession would be lower, and that their average wages would be lower as well. Strikingly, we find that the opposite is true. In particular, our analysis reveals robust evidence that the average wages of cohorts of graduates who select into university during worse economic times are higher than among those who select during better times.

[1]See also Barr and Turner (2015), who show that the Great Recession led to a large increase in college enrollment in the US. Other relevant contributions in this area include Méndez and Sepúlveda (2012) and Johnson (2013).

[2]To the best of our knowledge, the only paper exploring the implications of macroeconomic conditions at the time of college enrollment for future outcomes is Alessandrini (2017), who focuses on the impacts on intergenerational mobility.

Our analysis relies on data from the UK Quarterly Labour Force Survey (LFS) from 1998 to 2016. We restrict our analysis to college graduates enrolling between 1960 to 2010.[3] To avoid issues related to changes in female selection into college and into the labor market, we focus our analysis on men. The LFS presents several advantages for our analysis. First, it provides precise information on the timing of graduation. We exploit this information in order to impute individuals' year of college enrollment. Second, it provides detailed information on individuals' college majors, as well as their academic performance at both the high school and the university levels. This information will allow us to provide a rich analysis of the changes in the composition of different cohorts, both in terms of outcomes that are determined before college enrollment, and outcomes that are determined during the college years.

Our empirical approach compares wage outcomes across cohorts of college graduates who enroll at different points in the business cycle. As is well known, identification of cohort effects on wages is challenging, due to the fact that it is not possible to simultaneously control for age, calendar year and cohort in a fully flexible way. Relying on the rich cross-sectional and time dimensions of our data, and the fact that enrollment cohort is not a perfect function of age and calendar year in our setting (because individuals may enroll into college at different ages), our identification approach allows for fully flexible time and age effects, while imposing the identifying assumption that cohort effects evolve smoothly over time in a linear or quadratic fashion, except for the component that is systematically related to the business cycle prevailing at the time of enrollment, which is proxied by the average unemployment rate in the three years leading up to the year of enrollment. To check the robustness of our results, we allow for various specifications of the underlying cohort effects.

Our key finding is that average wages are systematically higher for cohorts who enroll into university during periods of higher unemployment. Our estimates imply that, conditional on age effects, time effects, and long-term trends in cohort quality, a 3 percentage point increase in the unemployment rate at the time of enrollment (approximately one standard deviation in the sample), increases average cohort wages by around 2.5%. This result is not driven by differential selection into employment. Through a series of quantile regressions, we find that the positive effect on wages is experienced throughout the cohort's wage distribution, with particularly pronounced effects in the upper half of the distribution.

We explore a number of potential mechanisms through which this wage differential may arise. First, we consider the impact of the economic conditions at the time of graduation. Previous research has produced well-documented evidence of the negative

[3] Throughout the paper we follow the convention in the literature to refer to university as "college". The group that would normally be referred to as college graduates in the UK (those who completed A-levels) are referred to in this paper as high-school graduates. More details about the UK education system are provided in Section 2.1.

impact of economic conditions at the time of college graduation on wages (Kahn, 2010; Altonji et al., 2016b; Oreopoulos et al., 2012; Liu et al., 2016). Provided that the unemployment rate when entering college and the unemployment rate at the time of graduation are negatively correlated, the positive impact of the recession at the time of college entry on wages that we identify may simply reflect the positive consequences of graduation in an expansion. We find, however, that adding controls for the economic conditions at the time of graduation to our wage equations does not alter our results.

Second, as returns to college vary substantially across fields of study (Altonji et al., 2012; Lemieux, 2014), we explore the possibility that changes in field selection account for our findings. Recent evidence by Blom et al. (2015) suggests that the business cycle impacts students' major choices in the US (the so called "allocative margin"). They find that during recessions individuals tend to choose majors with higher wages and better employment prospects.[4] The impact of the economic conditions when entering college on the choice of major is therefore a natural candidate to explain the better labor market outcomes of cohorts who enter college in a recession. In our UK data, we find mixed evidence for reshuffling towards higher-paying majors. In particular, we find that the share of students in Engineering fields significantly increases, but the share of students graduating from other high-paying fields such as Business, Administration and Law decreases. In general, the changes in major shares are quite small compared to the findings for the US, which likely reflects the fact that in the UK system, students' fields of study choices are pre-determined to a larger extent by their pre-university studies.

Importantly, when controlling for the field of study composition in our wage regressions, we still find that cohorts who enroll during worse economic times perform significantly better ex-post, even conditional on their field of graduation. In fact, when running our wage estimations separately by field, we find increases in average cohort wages within a wide range of fields, including Engineering. This, surprisingly, suggests that these marginal students who shift towards Engineering when economic conditions worsen actually increase the average quality of the graduating cohorts from this field.

Next, we explore whether differential selection into occupations or industries can account for our documented wage differences. Controlling for this channel, as well as the varying returns within occupations or industries across time periods and across individuals with different fields of study, only marginally reduces our estimated effect. Hence, we conclude that the majority of the wage difference occurs within occupation-field-year or industry-field-year cells.

In order to rationalize our findings, we turn to information on academic achievements at high-school and at university level. Although contrary to economic intuition

[4]See also Goulas and Megalokonomou (2015) and Bradley (2012).

(and with the literature discussed above), it is possible that the expansion in university enrollment that occurs during recession could actually lead to better selection of students in terms of their unobservable skills. To explore whether this type of *ex-ante* selection is at work, we analyze the high-school achievements of college graduates who enrolled at different points in the business cycle. Our results show that the wage differentials cannot be rationalized by an improvement in ex-ante selection along these lines. In particular, we find that the high school outcomes of cohorts who enroll during bad times are similar, or if anything slightly worse, than the outcomes of cohorts who enroll during good times.

Our measures of academic achievement in university, however, suggest that these cohorts do end up being of better quality *ex-post*. In particular, we find that, in spite of the lack of advantage at the high-school level, the cohorts who enroll during periods of higher unemployment graduate with higher university grades and, remarkably, also earn higher wages conditional on their university grade point average.

We interpret our findings as suggesting that students who enroll in university during bad times exert more effort during their university studies. An increase in effort can rationalize why students with similar high-school outcomes would graduate with higher grades in college and experience improved labor market outcomes. We suggest three potential channels that might lead to an increase in effort among these cohorts. First, the increase in cohort size due to countercyclical enrollment would lead to increased competition which might encourage higher effort.[5] Second, the lack of (part-time) employment opportunities might allow students to dedicate an increased proportion of their time towards their academic studies. Finally, as suggested by the impressionable years hypothesis (Krosnick and Alwin, 1987), the experience of poor economic conditions during early adulthood might generate a change in attitudes among the students that enroll in bad times, leading them to adjust their effort levels in university. While assessing the relative importance of the three mechanisms is of high interest and policy relevance, it is beyond the scope of this paper and we leave the task to future research.

This paper provides a number of important contributions to the literature. First, we add to the literature on cohort effects by highlighting a previously disregarded channel: labor market conditions at enrollment have important long-term implications for cohort-level outcomes. We also contribute to the related, and still embryonic, literature on the allocative margin by estimating, for the first time, the effects of the business cycle on major selection in the UK. Our findings also highlight the importance of considering the possibility that student skills are not entirely pre-determined at the time of university entry, and can be adjusted through variable effort. This has a number of important implications. First, it calls into question the external validity of instruments for schooling based on labor market conditions at the time of choice.

[5] See Morin (2015).

Variables such as average earnings or unemployment rates, often at the local level, have been widely used as instruments for schooling (Cameron and Heckman, 1998; Cameron and Taber, 2004; Carneiro et al., 2011, 2013), given their potential impact on the opportunity cost of education. Our results suggest that unemployment at choice affects later wages by inducing increased effort during university among those who choose to enroll. These individuals would be the "compliers" in the instrumental variable (IV) setting. As is well known, IV strategies identify Local Average Treatment Effects (LATE) for the compliers. In this setting, the effect for the compliers would include the effort boost, which would not be present for other cohorts. Hence, it would seem problematic to generalize the estimates for the returns to schooling that are obtained from this IV strategy for the broader population. Second, by underscoring the importance of effort on later outcomes, we contribute to the debate on whether obtaining an educational degree increases individuals' human capital or merely serves as a signal of their underlying innate (predetermined) ability – a persistent debate in the literature on the returns to education. Our results provide supportive evidence for the interpretation of education as enhancing human capital. A signaling model would be able to rationalize our results only if employers would interpret the choice of enrolling into tertiary education in a bad economy as a signal of higher ability, which seems highly unlikely.

The rest of the paper is organized as follows. Section 2 provides some background information on the UK higher education system, describes our dataset, and discusses identification of cohort effects in our setting. Section 3 describes our empirical approach and presents the key results in terms of wage outcomes across cohorts and explores various potential mechanisms through which these cohort-level wage differences may arise. Section 4 investigates the merit of the two possible interpretations of our findings in terms of ex-ante ability vs. effort. Finally, Section 5 presents the conclusions.

2 Data and Empirical Strategy

2.1 Background: Higher Education System in the U.K.

In this paper we concentrate our analysis on individuals whose highest educational achievement is an undergraduate degree.[6] In the UK, students attend secondary school until the age of 16, at which point they take a General Certificate of Secondary Education (GCSE) examination. This marks the end of compulsory education.[7] The

[6] This is often referred to as a *first* degree in the British Higher Education system.

[7] In England, compulsory education or training has been extended to 18 for those born on or after 1 September 1997.

GCSE diploma is required to continue on to post-compulsory studies, which involve two additional years of education leading to a standardized school-leaving qualification called 'A-levels' (short for General Certificate of Education (GCE) Advanced level). Students can choose the subjects that they wish to take A-level exams in. Most universities require at least three A-levels for admission.

After A-levels, around age 18, students can choose to pursue further studies at university level. Undergraduate degrees in England and Wales normally involve three years of studies, with some exceptions for degrees such as Medicine. In Scotland, the standard length of an undergraduate degree is four years.

Throughout the paper, and following the convention in the literature, we use the term 'college graduates' to refer to individuals who are awarded a university-level Undergraduate (Bachelor's) degree.

2.2 Data

2.2.1 Individual-Level Data

Our analysis is based on the UK Quarterly Labour Force Survey (LFS). The LFS is a widely used survey covering around 60,000 households living in the UK. It is managed by the Office of National Statistics (ONS) and is specifically designed to capture the labor market circumstances of the UK population. It has been conducted quarterly since 1992. In order to be consistent with our population of interest, we concentrate our analysis on 75 quarterly waves from 1998 to 2016, for which our key variables of interest are available.[8]

The LFS presents several advantages for estimating our parameters of interest. In particular, it records detailed information on educational attainments and labor market outcomes, as well as several background variables for individuals from a wide range of cohorts.

Schooling variables – In addition to recording individuals' highest level of education, the LFS also collects information on the year of graduation, the major studied in college and, since the last wave of 2005, two measures of educational performance: the number of GCSE exams passed in high-school and the degree class achieved at the end of the university career. This unique feature of the data allows us to observe educational performance at different stages for a large sample of individuals from a wide range of cohorts. Moreover, being able to identify the exact moment at which individuals achieve their highest level of education is crucial for our purposes,

[8]This includes all quarters from 1998 to 2016, with the exception of the first quarter of 2004, for which no information on educational levels is available. The wage analysis also excludes the first quarter of 2001, for which no earnings data is available.

as it allows us to infer, with a fair degree of accuracy, the point in time when the individual enrolled into tertiary education, and hence the macroeconomic conditions that prevailed at the time of enrollment. This is in contrast to most datasets which only record individuals' highest achieved education level, but not when they obtained this degree. Researchers who use such datasets and are interested in the impact of macroeconomic conditions at the time of college entry (or graduation) must make the assumption that individuals chose their degree at the standard age of high-school graduation (see e.g. Betts and McFarland, 1995; Dellas and Sakellaris, 2003; Blom et al., 2015). Our dataset shows, however, that an important proportion of students enroll in university at later ages; hence this distinction is empirically important.

Construction of cohorts by enrollment year – We impute the year of enrollment as the year of graduation minus three for all major categories except for graduates in Medicine for which the normal course of study takes five years. In Scotland, the length of a standard undergraduate degree is four years, rather than three years. Unfortunately, the publicly available LFS data do not provide information on where individuals obtained their undergraduate degree. For the waves from 2001 onward we do, however, know whether individuals were born in Scotland. Analysis of restricted-use LFS data from April-June 2017 supplied by the Data Advice and Relations Team at the ONS show that nearly 85% of undergraduate degree holders who were born in Scotland also studied at a Scottish university. Hence, when information on the location of birth is available, we impute the year of enrollment as the year of graduation minus four for individuals born in Scotland. We also check the robustness of our results to excluding the Scottish born.

The assignment of enrollment years allows us to group individuals into cohorts according to their enrollment year, ranging from 1960 until 2010. Although we only observe labor market outcomes after 1998, we are able to infer the business cycle conditions that prevailed at the time of enrollment for all of these cohorts. Naturally, observed labor market outcomes will be affected by time, cohort, and life cycle effects. Section 2.3 provides a detailed discussion about how our empirical strategy identifies the effects of the business cycle conditions at enrollment while accounting for time, cohort, and life-cycle patterns in wages.

Our imputation procedure opens up some concerns of misclassification, as some students might exceed the normal length of their university course. If that is the case we would be assigning the wrong starting date and therefore the wrong unemployment rate, to the delayed students. To alleviate these concerns, we compute the relevant unemployment rate at the time of enrollment as the average of the three years preceding the imputed year of enrollment.

Labor market outcomes – Other than information on education achievements and type of university degree, the LFS contains a wide array of information on labor market experience and outcomes, such as wages, employment status, occupation and industry, as well as some demographic information such as gender, nationality, place of residence and ethnic origin.

Sample restrictions – We limit our sample in several ways. First, we restrict our analysis to men only in order to avoid any issues of selection into college and into the labor force which could be particularly relevant across older and younger cohorts of women.[9] Second, we select individuals between 25 and 65 years of age so that we exclude the economically inactive and those still in school.

As mentioned above, we focus our analysis exclusively on individuals whose highest educational achievement is a Bachelor's degree, hence dropping respondents with either a higher or a lower educational level. Naturally, the composition of this sample varies over time according to selection into university and into post-graduate studies. Variation in the margin of selection into university is precisely the variation that we seek to explore in our analysis, and we discuss our identification strategy in detail in Section 2.3. The fact that we drop individuals with post-graduate studies may introduce selection bias if selection into post-graduate education is correlated to business cycle conditions at the time of undergraduate enrollment. In our data, however, the unemployment rate at undergraduate entry seems unrelated to the probability of enrolling into post-graduate studies.[10]

We also drop observations whose imputed year of enrollment in college is inconsistent (e.g. before the individual turned 17) or missing, as well as a small number of observations where the age at university completion is missing, inconsistent (less than 14), or over 45. Individuals for whom the year of university entry is less than four years prior to being interviewed are also omitted, as they may still be pursuing further studies. Finally, we exclude college graduates who obtained their degree outside of the UK, as they would not have been directly affected by the macroeconomic conditions that prevailed in the UK at the time of their enrollment.

After applying these rules, we are left with a sample of 225,994 college graduates. Panel A of Table 1 shows descriptive statistics for this 'full sample', which we use to estimate employment probabilities and field of study selection. The columns correspond to graduates by enrollment decade, and statistics for the entire sample are displayed in the final column. Overall the sample is predominantly white, but ethnic minorities increase throughout the period. Age at graduation is around 23 overall,

[9] We do, however perform our main estimation for women and report the results in Appendix Table A.1.

[10] We estimate a linear probability model for the probability of being observed while studying towards a post-graduate degree controlling for ethnic background, year fixed effects, quadratic in age, cohort specific linear trends, and a set of dummies for geographic residency. The effect of our 3-years average measure for unemployment at college entry in this regression is fairly precisely estimated at zero with an estimated coefficient of -0.001 and a *p-value*¡1%. Results are available upon request.

but it has increased constantly for the last 50 years.

The table also shows the composition across university majors. To categorize university majors we use the International Standard Classification of Education (ISCED) in its 2013 update. ISCED was developed by UNESCO to facilitate comparisons of educational statistics and indicators across countries on the basis of uniform and internationally agreed definitions. The descriptive statistics show that, through time, graduates in Engineering declined, perhaps due to the emergence of related degrees in Information and Communication Technologies, which in the later decades account for almost 10% of university degrees while they were absent for the first decade. It is also worth noting the upsurge of graduates in Business and Law – from 10 to 21% in the 2000s– and the halving of graduates in Natural Sciences that went from 26 to 12% of all male university graduates. The other categories are fairly stable in their graduation numbers. It should also be noted that the majority of our graduates enrolled in the 1980s and 1990s.

Wage information is not collected in all LFS interviews. The LFS is designed as a short panel in which each household is maintained in the sample for five consecutive quarters. Information on wages is collected only in the first and last quarter; hence, earnings questions are only asked of around 40% of the sample at any point in time. Our wage analysis focuses on individuals with relevant wage information who are working full time. Among our sample of college graduates in the relevant waves, the probability of working full time is around 86%. Therefore, the restricted 'earnings sample' includes 52,630 individuals, as shown in Panel B of Table 1. Wages for the early cohorts are higher, as these cohorts are observed at later stages of their life cycle and therefore have, on average, more experience than the younger cohorts. Section 2.3 provides a detailed discussion about how our empirical strategy identifies the effects of the business cycle while accounting for time, cohort, and life-cycle patterns in wages.

For our analysis that considers individuals' degree classifications, we must restrict our attention to post-2005 observations. Information from this sample is presented in Panel C of Table 1. Both high-school and university performance measured as the number of GCSEs and the degree class achieved at graduation respectively, have increased through time and evidently, the majority of college graduates belongs to the highest high-school achievers.

2.2.2 Macroeconomic Conditions at the Time of University Enrollment: Unemployment Rate Data

In order to capture aggregate labor market conditions, we use the national unemployment rate, as measured by the ONS.[11] We consider the national unemployment rate to be the relevant indicator for our population of reference, which is very mobile in the UK context where local labor markets are often geographically adjacent. This indicator is also more readily available to the public and therefore more salient and more likely to be acted upon by families and individuals when choosing whether to enter college. Using the national rate does, however, reduce the variation in unemployment rates available for identification. Having access to more than 50 years of enrollment decisions and corresponding unemployment rates becomes extremely valuable, as it allows us to retain enough variation to identify our key parameters while relying on the most relevant labor market indicator.[12]As mentioned above, our key indicator for the macroeconomic conditions at the time of enrollment into university will be the average unemployment rate in the three years leading up to college enrollment.

Figure 1 plots the UK national unemployment rate for the period 1958–2016. The Figure shows the well documented increase in unemployment in the 1970's and early 1980's and the negative impact of the economic recession of the early 1990's and the financial crisis of 2008–2009. It also shows that even during more recent periods of strong growth, the very low levels of unemployment that the UK enjoyed in the aftermath of WWII were never recovered. Our empirical strategy, discussed in detail in the following subsection, will control for long-run trends and exploit only shorter-term fluctuations in our different variables.

2.3 Empirical Strategy

An individual's labor market outcome can be thought of as being influenced by three sets of factors: (i) current labor market conditions, (ii) labor market experience, and (iii) the cohort that the individual belongs to. All three dimensions cannot be typically controlled for at the same time, as fixing the first two dimensions generally determines the third (see e.g. Kwon et al., 2010). For example, when estimating a wage regression with controls for calendar year and time since entry into the labor market, it is not possible to identify cohort effects associated with the year of labor

[11] See https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment, last accessed 31/07/2017. The survey-based series has only been available on a consistent basis since 1971. Since our data includes cohorts of university graduates who enrolled between 1960 and 2010, we resort to unemployment figures based on administrative sources, available since 1881 (Denman and McDonald, 1996), for the years before 1971.

[12] We are also limited in our ability to use local unemployment rates due the fact that we have no direct information on the location of residence in the years leading up to college enrollment.

market entry, as this is naturally equal to the calendar year minus the number of years since entry. Similarly, if one controls for calendar year effects and age, it is not possible to identify birth cohort effects.

In our analysis, we are interested in how labor market outcomes vary across cohorts that enroll into college at different stages of the business cycle. We therefore focus on cohort effects where cohorts are defined by the year of college enrollment. For the reasons discussed above, controlling for calendar year, cohort effects and years since enrollment is impossible in this setup. However, we do have variation in terms of the age at which individuals enroll into college. Since not all students enter college immediately after high school, the same enrollment cohort consists of students of different ages, depending on when they enrolled.[13] This additional variation allows us to simultaneously control in our analysis for: (i) the current stage of the business cycle (captured by calendar year), (ii) potential labor market experience (captured by age), and (iii) cohort effects. Controlling for age (rather than years since graduation) seems reasonable in this context, as all individuals in the sample have the same level of education, and students who graduate at older ages may have accumulated relevant work experience prior to enrollment.

As in the literature that studies the effect of economic conditions at the time of labor market entry, we are interested in identifying cohort-level variation that is systematically related to business cycle conditions, after controlling for long-term trends in outcomes across cohorts. We control for these long-term trends by allowing for a linear or quadratic trend in outcomes across cohorts, and we capture business cycle fluctuations by using the unemployment rate at the time of enrollment as our key regressor of interest.[14]

Our benchmark estimation therefore takes on the following form:

$$w_{ict} = \alpha + \beta U_c + \lambda_1 a_i + \lambda_2 a_i^2 + \delta c + \tau_t + \gamma x_{ict} + \epsilon_{ict}, \tag{1}$$

where w_{ict} is the labor market outcome of individual i from cohort c observed in year t, α is a constant term, $\lambda_1 a_i + \lambda_2 a_i^2$ is a quadratic function of age at which individual i

[13] As mentioned above, this is one of the advantages of using the UK LFS, where we have information on when each individual graduated. This type of variation would not be available in studies that impute the year of enrollment based on the normal age of college entry.

[14] This is analogous to the approach taken by Oreopoulos et al. (2012) to identify the effects of economic conditions at the time of labor market entry when estimating models using the national unemployment rate. Their main specification exploits regional variation in unemployment rates, which allows them to control for cohort effects at the national level using cohort fixed effects. As mentioned above, we consider the national unemployment rate to be the more relevant measure of the business cycle in our context, and hence we are unable to include cohort fixed effects. An alternative approach would be to follow Kwon et al. (2010) in imposing a zero long-term trend in the cohort effects by dropping the first and the last cohort dummies from the regression. This, however, would not be reasonable in our context, given the major long-term changes in selection into college that have occurred in the UK.

is observed, δc is the linear long-term trend in cohort quality, τ_t captures the calendar year effect of the year in which individual i is observed, x_{ict} is the remaining set of individual-specific characteristics, and ϵ_{ict} is a standard error term. β, the coefficient of interest, captures the impact of the unemployment rate at the time of college enrollment (U_c), measured as the average national unemployment rate in the three years leading to enrollment. In other specifications we replace the quadratic functional form of age with age fixed effects and the linear cohort trend with a quadratic cohort trend or a linear cohort trend with discontinuities at certain key points in time.

Our main coefficient of interest β reflects the extent to which the deviations in the cohort performance from the long-term linear (or quadratic) cohort trend can be explained by the economic conditions at the time of college entry. Our specification hinges on the following assumptions: We assume that (1) the unemployment rate at college entry affects only the short-run deviations from a long-term trend in cohort quality which evolves smoothly in a linear (or quadratic) fashion, and that (2) the age profile of labor market outcomes is constant across cohorts (an assumption that is widespread in any standard specification of the Mincerian wage equation). The identification of the impact of our main variable of interest is therefore obtained from the variation in labor market outcomes of college graduates from different cohorts that are observed in the same year but were exposed to different business cycle conditions at the time of college entry, after controlling for a common age-wage profile, and accounting for long-term trends in cohort quality.[15]

3 Results

3.1 Unemployment at Enrollment and Wage Outcomes

Our benchmark specification estimates Equation (1) using log real weekly earnings as our dependent variable for the sample of full-time college graduate males. The additional control variables included in x_{ict} are a race dummy, a dummy for foreign nationals, and a set of 19 region of residence dummies. In all cases observations are weighted using person weights provided in the dataset, and standard errors are clustered by year of enrollment.

We begin by presenting a specification which does not control for the cohort trend (δc in Equation (1)). This is shown in Column (1) of Table 2. The estimated

[15] As mentioned, our ability to control simultaneously for calendar year effects, age, and trends across enrollment cohorts relies on the fact that there is variation in terms of age at enrollment. As we show below, we obtain broadly similar results if we control only for age (without controlling for cohort trends), or only for cohort trends (without controlling for age). Our results therefore do not solely or crucially depend on identification based on variation in terms of age at enrollment.

coefficient on the unemployment rate is positive and statistically significant. The coefficient implies that cohorts that enroll in times when the unemployment rate is 1p.p. higher have wages that are on average 0.8% higher, after controlling for age effects and calendar year effects. In Column (2), instead of controlling for age effects, we control for a quadratic trend in cohort effects. The results are very similar to those in Column (1).

As discussed in Section 2.3, our data allow us to control for both age and cohort trends. Column (3) shows the results that we obtain when we control for a linear trend in cohort wages along with quadratic age effects, as in Equation (1). As discussed above, identification of β in this setting is obtained solely from (business cycle-related) deviations from the trend across cohorts (within a calendar year, after controlling for common age-wage profiles). Even when allowing for these cohort trends, we find that cohorts that enroll in times with worse economic conditions have statistically significant higher average wages. Column (4) verifies the robustness of our results to including a quadratic trend in cohort quality.

In 2006 the UK introduced tuition fees. This may have changed the patterns of selection into university, with implications for average wage levels across cohorts. The timing of the introduction of the fees could potentially be correlated with the business cycle. To account for this, in Column (5) we add a dummy for the 2005 enrollment cohort (where the composition could differ in anticipation of the introduction of the fees) and a dummy for the post-2006 enrollment cohorts, who enroll during the time where tuition fees are applied.[16] The results show that allowing for these discontinuities in outcomes across cohorts due to tuition fees does not affect our main result.

In Columns (6) and (7) we replace the controls for age and age squared with a full set of age fixed effects, allowing wages to vary fully flexibly over the life cycle (but maintaining the identifying assumption that this life cycle variation is common across cohorts). When including linear or quadratic trends in cohort-level wages, we still find a positive and statistically significant effect of unemployment at enrollment on current wages.

In order to gain insight into the magnitude of the effect, consider an increase of 3p.p. in the unemployment rate at the time of enrollment – approximately one standard deviation in the sample. The estimated coefficients presented in Table 2 imply that cohorts who enroll in college when unemployment is 3p.p. higher earn between 1.7% and 3.5% more on average, depending on the specification. Given average real weekly earnings in the sample of £890 (in 2015 pounds), and using the midpoint of our estimated effects (2.6%), this implies that cohorts that enroll when

[16]The tuition fees were further raised in 2012, but recall that we restrict the sample to cohorts who enrolled up to the year 2010 in order to have sufficient post-graduation wage observations, so these later cohorts are not part of our analysis.

unemployment is one standard deviation higher can expect to earn roughly £23 more per week, or £1,200 more per year, for every working year.[17]

Overall, the results consistently point towards cohorts enrolling in times of higher unemployment having higher earnings ex-post. This result is striking, given the fact that the enrollment into university tends to increase when macroeconomic conditions deteriorate, which would lead us to expect worse selection in terms of quality for these cohorts. Instead, our results robustly suggest that the opposite is true: The cohorts that enroll during worse macroeconomic conditions end up performing better in the labor market.

Before delving deeper into the potential mechanisms that might account for these wage differences across cohorts, we explore the pattern further in Table 3. First, we consider whether the effects of unemployment at enrollment vary with labor market experience. Enrolling in times of high unemployment may generate an initial wage gap after graduation which may fade away over time. In Column (1) of Table 3 we add an interaction term between the unemployment rate at the time of enrollment and years since graduation. This allows us to distinguish between the short and long term effects of enrolling during times of high unemployment. We find that cohorts of graduates who enrolled during times of higher unemployment have a large initial wage advantage, which only slowly disappears with labor market experience. The rate of decline is quite slow, so we focus on the overall average effect in the remainder of the paper.

The composition of cohorts may vary both because of changes in the proportion of high school graduates who decide to enter directly into university, and because of changes in the enrollment decisions of returning students. If the proportion of returning students varies over the business cycle, and these students differ (relative to new high school graduates) in terms of their unobserved ability distribution, this might account for the wage differences that we have identified. In Column (2) we explore whether our main effect of interest is still present if we focus only on non-returning students; that is, we restrict the sample to individuals who enroll in university between the ages of 16 and 21. For this sample, we also find a statistically significant

[17] As mentioned above, our imputation of the year of enrollment assumes that all individuals born in Scotland study in Scotland and hence complete their degrees over a four year period. Based on the analysis of restricted-use LFS data provided by the ONS we know that this assumption is incorrect for around 15% of the Scottish born sample. Hence, in Appendix Table A.2 we check the robustness of our results to excluding the Scottish born. Given that information on the location of birth is only available from 2001 onwards, we replicate our main results for this restricted time period. The results are not affected by excluding the Scottish born. Note also that some individuals born in England and Wales would have the wrong year of enrollment imputed if they studied in Scotland. However, the ONS analysis mentioned above shows that only around 2% of English and Welsh undergraduate degree holders obtained their degrees in Scotland, so this would only be of minor concern.

positive effect of the unemployment rate at enrollment. This implies that, even among the set of graduates that enroll immediately or shortly after high school completion, we observe higher wages for those who enroll during worse economic conditions.

So far we have imposed a linear relationship between unemployment at choice and wages. In Column (3) we relax this assumption and estimate our benchmark model replacing the linear average unemployment rate with dummy variables for quartiles of the unemployment at choice distribution. Our results show that positive cohort effects do not start arising immediately at low levels of unemployment. The second quartile shows no statistically significant differences compared to the first, but the first noticeable differences appear at higher unemployment levels. Cohorts entering university when unemployment is around 8%, the average unemployment rate for the third quartile, earn around 5% higher salaries, while for the highest quartile, when unemployment is around 10%, the positive difference is 6%. Overall these results show that the size of the unemployment shock matters for student outcomes. Unemployment at entry has a marked effect on labor market outcomes only at relatively high levels of unemployment.

One potential driver of the differences between cohorts could be selection into employment. If cohorts who enrolled during worse economic conditions have lower employment probabilities, it may be the case that the subset of full-time workers from these cohorts is more positively selected than among cohorts who enroll into university during better aggregate conditions. To check whether this is the case, in Columns (4) and (5) we estimate regressions analogous to Column (2) of Table 2, but where the dependent variable is a dummy which is equal to one if the individual is in full-time employment. As mentioned in Section 2.2.1, earnings questions are only asked when individuals are in their first and fifth wave in the LFS. For the linear probability model estimation in Column (4) we restrict the sample to individuals in these waves, so that the sample is directly comparable to the one used in our wage equations. The probability of full-time employment within this sample is around 86%. The results in Column (4) show that there is no statistically significant relationship between aggregate conditions at the time of university enrollment and the probability of working full time. Although positive, the estimated coefficient is quite small. In Column (5) we extend the sample to all waves, hence including observations from waves in which earnings questions are not asked. Naturally, this increases the sample size substantially. The results in Column (5) show that the coefficient of interest in this sample is similar to the one estimated in Column (4), and also statistically insignificant. Hence, we conclude that there is no strong evidence that the difference in cohort wages that we observe is driven by differential selection into full-time employment.

In Table 4 we explore whether the positive wage effects that we find in Table 2 are concentrated in certain parts of the distribution. To do this, we run a set of quantile regressions analogous to Column (2) in Table 2. The results for each of the conditional deciles of the log real earnings distribution are presented in Table 4. The estimated coefficients are positive and statistically significant throughout the wage distribution. Thus, it seems that the whole distribution of earnings shifts up for cohorts who enroll during worse economic conditions. The largest effects are found at the 70th and 80th percentiles, suggesting that the effects are slightly larger towards the top half of the distribution.

Overall, the results in this section show robust evidence that the average wages of cohorts of students who decide to enroll into university when aggregate economic conditions are poor are higher than those of cohorts who enroll during better economic conditions. The next section explores a series of potential mechanisms that could account for this result.

3.2 Potential Channels

We now explore three different potential channels through which the differences in wages across cohorts selecting at different points in the business cycle documented above might arise: variation in economic conditions at the time of graduation, changing selection into different fields of study and changing selection into occupations or industries. An additional channel that could potentially explain our results would be an increase in the quality of education experienced by the cohorts who enroll during bad times. This could occur if government expenditures on education were increased following periods of high unemployment. However, our analysis of expenditures on tertiary education in the UK over the period of 1971-2015[18] shows that the correlation between the expenditures and the national unemployment rate is -0.13 with a p-value of 0.43,[19] suggesting that, if there is at all a relationship between the two, and we find none, the UK government tends to invest less into tertiary education during the recessions, not more.

3.2.1 Economic conditions at time of graduation

There is strong evidence in the literature that economic conditions at the time of graduation have large and long-lasting effects on labor market outcomes for university graduates (Kahn, 2010; Oreopoulos et al., 2012; Altonji et al., 2016a; Liu et al., 2016). Our key result regarding differences in average cohort-level wages could potentially

[18] Using the government expenditure on tertiary education (as a percentage of GDP) for the UK available in UNESCO data, extracted on 07 Jun 2018 10:29 UTC (GMT) from UIS.Stat.

[19] Correlation between the expenditure series and the current national unemployment rate as defined in our specification (i.e. three-year average unemployment rate up to the year of enrollment) is -0.19 with a p-value of 0.25.

be driven by the fact that cohorts that enroll in bad times tend to graduate in good times, and hence avoid these negative graduation effects.

In Figure 2 we show the correlation between unemployment rates at entry and exit experienced by each cohort. The two are clearly positively correlated (although less so for higher levels of unemployment). This implies that individuals who enroll in bad times tend to, on average, also graduate during relatively bad times, which would go against the intuition described above.

In order to investigate this more formally, we expand our regression by adding controls for economic conditions at the time of graduation, and their interaction with time since graduation (as in Kahn, 2010). Identification of our coefficient of interest is naturally still possible given that unemployment at time of enrollment and unemployment at time of graduation are not perfectly correlated. The results are presented in Column (1) of Table 5. As in Kahn (2010), we find that the unemployment rate at the time of graduation has a negative and statistically significant effect on wages, and this wage penalty is slowly eroded as years since graduation increase. However, controlling for this pattern has very little impact on our effect of interest. Hence, we can conclude that, even conditional on economic conditions at graduation, cohorts that enroll at times when unemployment is higher have higher average wages.[20]

3.2.2 Major choice

There is also recent evidence in the literature suggesting that economic conditions at the time of enrollment have an impact on students' field of study preferences and choices (Bradley, 2012; Goulas and Megalokonomou, 2015; Blom et al., 2015). It is also well known that earnings vary substantially across majors (e.g. Altonji et al., 2012; Lemieux, 2014). Therefore, a potential explanation for the earnings differences that we have documented would be that students who enroll when economic conditions are poorer tend to select into higher paying majors, thus increasing average earnings at the cohort level.

To explore evidence for this mechanism, we proceed in two parts. First, we analyze whether we observe changes in field of study choices over the business cycle in our dataset. To the best of our knowledge, this is the first paper to explore the effects

[20] One might argue that the unemployment rate in the year of graduation might not fully capture the economic conditions that an individual graduates into, and in particular whether the economy is on an upward or a downward trajectory (which might be correlated with the economic conditions at the time of college enrollment). In order to further control for this, we perform an additional robustness check where we control for economic conditions at the time of graduation by using the average unemployment rate in the year of graduation *and* in the following two years. Results are very similar to those presented in Column (1) of Table 5, and are available from the authors upon request.

of the business cycle on the composition of majors in the UK. Then, we return to our wage regression to determine whether changes in the field of study composition across cohorts can account for the differences in earnings.

To determine whether the composition of fields of study varies according to the business cycle, we estimate a series of linear probability models of students' major choices. The models are estimated separately for each major category. As individual controls we include ethnicity and nationality. In order to account for long-run changes in the composition of majors across cohorts, we allow for a quadratic cohort trend in the enrollment probability into each major. As before, our regressor of interest is the average unemployment rate in the three years leading up to enrollment.

We plot the results for the estimated coefficients on the unemployment rate at the time of enrollment in Figure 3. Our estimates suggest that in periods of higher unemployment more students select into Engineering and out of Education, Business, Social Sciences and Information and Communication Technologies. The impact of the unemployment rate at time of enrollment is significantly different from zero at the 5% level for three out of the nine categories. However, the estimated effects are small. Our estimates imply that a 5% movement in the national unemployment rate – a historical swing, only experienced twice in the last 55 years in the UK – would increase the share of graduates in Engineering, the most responsive category, by 4%, and decrease the share of graduates in Education degrees by 1.5%. To give a full sense of the size of this effect we can consider the enrollment numbers for the year 2015 provided by the British Universities and Colleges Admissions Service (UCAS).[21] Our estimated elasticity implies a reallocation of about 2,000 graduates towards the Engineering and Technologies category as a consequence of a hike of the hypothesized proportions in the unemployment rate.

From this we conclude that even though some reshuffling between majors occurs in bad versus good times, these changes are of modest proportions.[22] Moreover, although Engineering – which is clearly a high-paying field – grows in recessions, other high-paying fields such as Business, Administration and Law tend to shrink. It is also not obvious that marginal students who change their field of study decisions due to the business cycle would earn wages that are similar to the average wages in their new field of choice, given that they might not be as well matched.

In order to determine more directly whether changes in the field of study composi-

[21] https://www.ucas.com/corporate/data-and-analysis/ucas-undergraduate-releases/ucas-undergraduate-end-cycle-data-resources/applications-and-acceptances-types-higher-education-course-2016 accessed 18/08/2017.

[22] This contrasts with the results for the US in Blom et al. (2015), and is likely due to the fact that selection of majors is much more rigid in the UK system, where students' choices are more limited by their course of study during their A-levels. It may also reflect less flexibility at the departmental level to change enrollment as a response to changes in application volumes.

tion explain the differences in wages across cohorts, we return to the wage regression from Table 2 and add controls for fields of studies in order to obtain identification only from variation in wages within majors. Specifically, we replace the simple calendar year fixed effects with fully interacted field of study-calendar year fixed effects. This also controls for changes in the return to different fields and limits identification to variation within major-year cells. To the extent that the effect that we were finding was due to differences in field of study composition and the differences in rewards across fields, these new fixed effects should eliminate our effect.

The results are displayed in Column (2) of Table 5. Interestingly, adding these field-specific calendar year fixed effects does not eliminate our result of interest. Compared to the estimated effect of the unemployment rate in Column (2) of Table 2, the coefficient falls by a little over 10%, suggesting that the effect of changes in the major composition on average cohort wages is relatively small.

Appendix Table A.3 explores whether the positive wage effect is concentrated within certain fields of study. Column (1) shows results that are analogous to Table 2, Column (1), but where all variables are fully interacted with field dummies (except the race, nationality and region of residence dummies, which are not shown in the table for brevity). The results show that cohorts that select into university during periods of higher unemployment earn higher wages *within all fields*: The point estimates are always positive, although not always statistically significant. Interestingly, the results are statistically significant in a subset of high-paying fields, including Natural Sciences, Mathematics and Statistics, and most notably, Engineering. This suggests that the average quality of the cohorts selecting into these highly remunerated fields actually increases when aggregate economic conditions deteriorate. Again, this contrasts with economic intuition which would suggest that a field like Engineering would attract lower quality marginal students as it tends to expand as a reaction to worsening aggregate economic conditions.

The remaining columns in Appendix Table A.3 explore variations in the specification and find consistent results.[23] Overall, the results provide robust evidence that the increase in wages observed for cohorts who select into college during worse eco-

[23]Specifically, Column (2) controls for an overall linear trend in cohort quality, which would capture any general cohort trend that is common across fields (for example, because of changes in the selection of college-goers in general). Column (3) replaces the general cohort trend with field-specific linear trends in cohort quality. In Column (4) we add a full set of cohort dummies. In this case, the effect of unemployment on overall cohort quality is no longer identified; this is absorbed by the cohort dummies. Instead, what we can still identify is the effect of unemployment on *relative* wages across fields. The results once again suggest differential positive selection among college-goers towards higher-paying fields. Finally, Column (5) controls for field-specific effects of economic conditions at the time of graduation (i.e. field-specific impacts of unemployment at graduation, and field-specific interactions of this unemployment rate with years since graduation), along with an overall linear trend in cohort quality.

nomic conditions is *not* driven by reallocation across fields of study. Instead, there appears to be an improvement in cohort quality within many fields, particularly so within high-paying fields such as Natural Sciences, Mathematics and Statistics, and Engineering.

3.2.3 Occupation and industry sorting

The wage differential that we have found for cohorts who enroll in university during worse macroeconomic conditions could be, to some extent, driven by differential sorting into higher paying occupations or industries. For example, Liu et al. (2016) show that business cycle conditions at graduation have important implications for the quality of graduates' initial industry match, and this can explain some of the persistent earnings losses from graduating in a recession.

Here we explore the extent to which differences in the occupation and industry composition of different cohorts can explain the wage differences that we have identified. We do this by adding a set of controls for occupations and industries and determining the extent to which the coefficient on the unemployment at enrollment is reduced.

In Column (3) of Table 5 we add a set of nine broad occupation dummies, interacted with calendar year. This accounts for variation in the return to different occupations over time.[24] The coefficient on unemployment at enrollment is still statistically significant, implying that cohorts who enroll into university during periods of higher unemployment have higher wages, even within occupations. The slight reduction in the magnitude implies that only a small part of the cohort-level wage differences are due to differences in selection into different occupations.

As Liu et al. (2016) emphasize, an important determinant of wages is the quality of the job match with respect to an individual's field of study. In other words, occupational wage premia may differ significantly across individuals with different types of degrees (see also Lemieux, 2014). In order to account for this, in Column (4) of Table 5 we further interact our occupation-calendar year dummies with the full set of field of study indicators. Any remaining effect of unemployment at enrollment would capture cohort-level differences within occupation-field-calendar year cells. The results in Column (4) show that this coefficient does not fall much relative to the baseline estimate in Column (2) of Table 2. Remarkably, the majority of the wage variation that we identify occurs within occupation-field-calendar year cells.

Columns (5) and (6) of Table 5 repeat the analysis using ten broad industry

[24]Having these occupation-time interactions also implies that we do not need to be concerned about changes in the occupational coding schemes over time, given that identification is solely within occupation-year cells.

categories instead of the occupation groups. The results are similar with regards to industry sorting.

4 Understanding the Wage Differences: Ex-Ante Selection or Increased Effort?

The results from the previous sections rule out the possibility that the observed increase in wages for cohorts who select into college during worse economic conditions is driven by economic conditions at graduation, by reallocation across fields of study, or by differential sorting into occupations or industries, even conditional on field of study. In order to rationalize our findings, in this section we explore whether students who enroll during poor economic conditions are of better quality *ex-ante* – i.e. more positively selected from the pool of potential college-goers – or, whether they are of better quality *ex-post*, perhaps because of increased effort during their studies.

Previous literature (Betts and McFarland, 1995; Dellas and Sakellaris, 2003; Clark, 2011; Barr and Turner, 2015; Sievertsen, 2016) has shown that unfavorable labor market conditions encourage college enrollment. Models of educational choice generally think of the highest ability students as having the highest net benefit from going to college, so the higher ability individuals always select into college, regardless of overall changes in outside options.[25] This positive selection into college implies that students who are at the margin of the decision to go to college will be of lower ability. Empirical evidence also supports this intuition. Carneiro et al. (2011) and Carneiro and Lee (2011), for example, confirm that increases in college enrollment lead to a decline in the average quality of college graduates between 1960 and 2000 in the US. When college enrollment is counter-cyclical and there is positive selection into college we would expect that the entry of lower ability marginal students would reduce the average quality of the entering cohort. This is in stark contrast with our main finding that these cohorts perform better in the labor market and receive above-average wages.

Are the cohorts that enter college in poor economic conditions indeed of lower *ex-ante* quality? And if so, do their above-average future economic outcomes imply that their quality is increased during their college years to an above-average level? While average cohort quality is not observable, our data includes information on school performance before college entry and during the college years. This can be used to shed some light on how the observed ex-ante and ex-post cohort ability varies with

[25] While this is a common assumption, one might conceive of a case where worsening outside options in the job market for high school graduates can induce some high ability individuals to select into college who would not have otherwise done so. An example of how changes in outside options may affect selection into a specific profession (teaching) is analyzed in Nagler et al. (2015).

the economic conditions at entry. The two measures of educational performance that we will exploit are: the number of GCSE exams passed in high school, an *ex-ante* measure of performance providing us with an indication of the average ability level for cohorts at entry;[26] and the degree class achieved at the end of tertiary education which measures the *ex-post* cohort quality as they exit college and enter the labor market.

4.1 Ex-Ante Selection: Academic Performance in High School

We begin by analyzing how the average *ex-ante* quality of cohorts varies by determining whether cohorts who enroll at different points in the business cycle differ in terms of the number of GCSEs that they pass. As explained in section 2.1, the GCSE exam marks the end of compulsory education in the UK and it is normally taken at age 16, two years prior to entering university. The LFS measures the number of GCSEs at a grade of C, the passing grade, or above. These are provided in the following interval categories: one to two, three to four, five to seven, or more than eight. We construct a continuous measure using the mid-points of each interval (where we assign a value of nine for the "more then eight" category), and we also present results based on linear probability models where we use a dummy for each of the possible intervals as the dependent variable.

The regression results are presented in Table 6. In Panel A we allow for a linear trend in the outcome variable across cohorts, while in Panel B we allow for a quadratic cohort trend. All regressions include individual-level controls for race, nationality, and region of residence at the time of the survey. Column (1) shows the estimates from the regression that uses the continuous measure as the dependent variable, while the remaining columns show results based on the linear probability regressions for each possible outcome. The estimates in Panel A show that cohorts going to college in high unemployment years have on average passed *fewer* GCSE exams than those going in boom periods. This is driven by a lower probability of having passed eight or more GCSEs, as seen in Column (5), and is statistically significant at the 5% level. In Panel B, where we replace the linear trend with a quadratic trend across cohorts, the estimates still point in the same direction, although they are not statistically significant at conventional levels.

Consistent with our expectation from existing evidence on selection into education, our estimates suggest that the average ex-ante quality of cohorts who enter college

[26] A variable recording the number of A-levels, another measure a pre-university achievements, is also available in the LFS, but it has very limited granularity only recording whether the individual has zero or one of more A-levels. Given that a key prerequisite for university admission is the number of A-levels, this variable presents almost no variation in our particular sample. For this reason, we believe that the GCSE measure is more suitable for our analysis.

during periods of higher unemployment is, if anything, lower than the average quality of those who enter during periods of lower unemployment. Hence, our results do not support the hypothesis that the positive wage effects that we find for these cohorts might be explained by more positive selection among these cohorts in terms of their *ex-ante* academic achievements.

We conclude that the above-average wages of cohorts who enroll in poor economic conditions are not driven by better selection at the point of university entry. We next explore whether the positive wage effects can be explained by better average quality at the time of university exit by analyzing cohorts' academic performance in college.

4.2 Ex-Post Quality: Academic Performance in University

In order to analyze ex-post cohort quality measured by college performance we consider the degree class that students graduate in. Students at British universities are classified according to five possible degree classes at graduation which, in descending order, are: first-class, second-class upper division, second-class lower division, third class, and ordinary degree otherwise called a "pass". Which degree is awarded depends on the weighted average of the grades obtained during the course of study (with a higher weight usually assigned to grades obtained in the later years). Therefore the degree class is a function of students' Grade Point Average (GPA).

As with the GCSE variable, we perform our analysis using a continuous measure which ranges from one to five based on the five degree class categories, where one corresponds to the lowest GPA outcome ("pass") and five to the highest ("first class"). We also present results based on linear probability models for each of the possible degree class outcomes. As before, we allow for cohort trends in the outcome variable. These cohort trends are meant to capture overall trends in the quality of university students and/or in "grade inflation" patterns.

The results based on the continuous degree class measure are presented in Table 7. All specifications include individual-level controls for race, nationality, and region of residence at the time of the survey. Standard errors are clustered at by year of enrollment. We begin in Column (1) by showing results that allow for a quadratic trend in degree class outcomes across cohorts. The estimated coefficient indicates that cohorts who enroll during times of higher unemployment graduate, on average, with higher GPAs. This provides a first piece of evidence supporting the idea that these cohorts end up being of better quality ex-post.

The specification in Column (1) does not control for the fact that some students return to university at older ages. Since older students might be more mature and/or motivated to pursue their studies, in Column (2) we add a control for age at graduation. Our coefficient of interest remains unaltered. As the grade distribution is likely to differ across college majors, in Column (3) we add field of study fixed effects. This would control for the possibility that individuals who decide to enroll into college in times of higher unemployment might select majors where higher grades are easier to achieve. Adding field fixed effects, however, has no impact on our main coefficient. In Column (4) we introduce a full set of field specific linear trends in cohort effects (in addition to the overall quadratic cohort trend), thus allowing for different trends between fields either in terms of cohort quality or in grading leniency. Again, the coefficient of interest remains positive and significant. Finally, in Column (5) we add a full set of dummies for the number of GCSEs passed in high school (in intervaled categories, as discussed in the previous subsection), and their interaction with a linear cohort trend, thus controlling for the (potentially time-varying) relationship between high school and university outcomes at the individual level. Not surprisingly, given the evidence that cohorts who enroll during periods of higher unemployment are more negatively selected in terms of their GCSE achievements, controlling for *ex-ante* achievement measures increases the positive *ex-post* achievement gap in favor of high unemployment cohorts.

Appendix Table A.4 further explores the positive correlation between unemployment at enrollment and university GPA by running separate linear probability regressions for each possible degree class outcome. We focus on the specification in Column (4) of Table 7, which allows for a quadratic overall cohort trend, along with field-specific linear trends. The results show that the positive GPA effect arises from the fact that cohorts that enroll during times of higher unemployment are more likely to graduate with a first class degree, everything else equal, and less likely to graduate with a third class degree.

Given this evidence, one might expect that the higher average wages for cohorts who enroll during periods of higher unemployment might be explained by their better academic performance in university. To determine whether this is the case, we return to our wage regressions, but now add controls for individuals' degree classifications. Given that the degree classification information is only available for a subset of recent years, we first present our baseline estimates using the same specification as before, but restricting the sample to individuals for whom we have non-missing information on degree classification. The results are presented in Column (1) of Table 8. The results for this sub-sample are similar to those for the baseline sample.

In Column (2) we add controls for degree classification, in the form of a full set of degree class fixed effects. Remarkably, the estimated coefficient on the unemployment rate at enrollment does not change in magnitude. In Column (3) we replace the simple degree class fixed effects with fully interacted degree class and calendar year fixed effects. This allows the return to different degree classes to vary over time. Our coefficient of interest remains unaltered. Finally, in Column (4) we control jointly for degree classification and re-shuffling of individuals across fields by including field-specific calendar year fixed effects along with the degree classification fixed effects. Again, our estimated coefficient of interest remains the same.

This implies that, surprisingly, the increased attainment in terms of degree classification does not account for the wage differences across cohorts either. Even conditional on degree class, students who enroll into university during times of higher unemployment still earn higher wages. Therefore, higher average wages of these cohorts seem to be driven by unobservable skills not captured by observed academic ability. Moreover, these unobservable skills would need to explain both higher wages and higher educational achievements for cohorts of individuals whose academic performance in earlier years (prior to college entry) is at best equal, and possibly worse, than that of cohorts enrolling in periods of economic expansion.

4.3 Discussion

We have considered two potential explanations for the favorable wage effect of enrolling in periods of high unemployment. One possibility is that counter-cyclical selection into college: high ability students, who would have entered directly into the labor market after high school when economic conditions are strong, decide to go into further education when aggregate conditions deteriorate, so that the entering cohorts are of above-average ex-ante quality. Alternatively, the ex-ante cohort quality may be pro-cyclical (as expected from theoretical and empirical evidence on selection into college), or acyclical, but the economic conditions might induce differences in the quality of these cohorts ex-post. Our empirical evidence points towards the latter. High unemployment encourages lower ability individuals to pursue a university degree, but these cohorts who enter university during poor economic conditions more than compensate for their initial lower quality and obtain higher grades in university, and earn higher wages conditional on their grades. We interpret this as indicative of an increase in the effort that these cohorts exert during their university studies. The results from the quantile regressions presented in Table 4 also seem consistent with this idea: The increase in effort would move the entire distribution of labor market outcomes upwards, but the lower ex-ante ability composition would imply that the wage gains are smaller at the lower quantiles of the distribution.

We view the increase in effort as being consistent with at least three potential mechanisms: increased competition, increased focus on academic achievement due to the lack of employment opportunities, and changing attitudes due to the impression caused by the poor economic conditions.

Increased competitive pressure – The fact that university enrollment tends to be countercyclical implies that individuals who enroll in university during times of higher unemployment would be part of larger cohorts. This would mean that in order to excel in class – particularly if grading is to some extent done on a curve – students would have to exert extra effort. This extra effort could translate both into higher grades, and even if not reflected entirely in their grades, in higher human capital accumulation that is later reflected in the form of higher wages, conditional on university grades. Exploiting a natural experiment that exogenously led to a substantial increase in the size of an enrollment cohort at Ontario universities, Morin (2015) shows evidence of an increase in the relative effort exerted by male students as a reaction to increased competition for university grades.[27]

Increased focus on academic achievement due to lower employment opportunities – Another reason why effort may increase for cohorts who enroll during poorer economic conditions is the fact that their opportunities for (part-time) employment may be reduced during their studies, hence allowing them to dedicate a larger proportion of their time towards their academic activities. To explore whether this mechanisms might be at play, we focus on individuals who are surveyed in the LFS while they are full time students, and test whether poor labor market conditions are correlated with lower participation in the labor market among this group. The sample used for this set of regressions differs from the one used in previous analysis as here we only look at full-time male university students who are observed in the survey while still at university. In the absence of retrospective information on labor market participation we are forced to restrict our analysis to the period 1998-2015 directly covered by the LFS.

The results of this analysis are presented in Appendix Table A.5 in which we show the OLS estimates for the probability of non-employment among this sample of full-time students. All specifications include individual-level controls for race, nationality, and region of residence. All regressions also allow for a full set of age dummies, a quadratic time trend and an age-specific linear time trend. The estimated coefficient in Column (1) shows that a 1% increase in the current unemployment rate (computed as the average of the unemployment rate in the year of the survey and in the previous two years) is associated with an increase of more than 2% in the probability of a student not working. The coefficient drops to 1.6% when dummies for the four GCSE performance groups are added to the regression in Column (2), while adding an age specific GCSE group trend, in Column (3), slightly increases the estimate for our coefficient of interest. These results suggest that cohorts enrolling in a trough might indeed dedicate more of their time to their education since it is harder for them to find a part-time job while studying.

Changing attitudes – The experience of reaching early adulthood during a time of poor macroeconomic conditions may have a direct impact on the attitudes of in-

[27] A number of papers in the literature instead find that overall cohort sizes tend to be correlated with worse labor market outcomes, mainly attributed to the saturation of the labor market; see for example Welch (1979); Berger (1985); Wright (1991); Brunello (2010); Agarwal et al. (2017).

dividuals who select into college during bad times. This interpretation is consistent with a social psychology hypothesis known as the "impressionable years hypothesis" (Krosnick and Alwin, 1987), which suggests that core attitudes, beliefs, and values crystallize during early adulthood. This hypothesis has already proven useful for explaining changing preferences for redistribution between cohorts (Giuliano and Spilimbergo, 2014), how individuals form expectations about inflation (Malmendier and Nagel, 2016), and how experiences of macroeconomic outcomes have long-term effects on risk attitudes (Malmendier and Nagel, 2011). Following a similar logic, we hypothesize that individuals who select into college during bad times may be particularly susceptible to concerns regarding economic outcomes, and may thus be particularly motivated to excel in their studies. The higher wages that we estimate for these cohorts would be consistent with a change in their educational approach due to their experience of poor economic conditions during their key impressionable years.[28]

5 Conclusions

There is ample evidence that college enrollment rates are countercyclical. Economic intuition would suggest that cohorts who enroll in university during bad times should have lower earnings later in life. Our findings based on UK data show exactly the opposite: Cohorts who enroll in university during periods of higher unemployment earn significantly higher wages ex-post. This wage difference is not explained by changing selection into employment, by differences in the economic conditions at the time of graduation, or by changes in the selection of fields of study, occupations or industries among university graduates. Instead, we find evidence that suggests that there is a genuine improvement in the quality of the cohorts selecting into university during adverse macroeconomic times. This is reflected both in better university degree attainment and in higher wages conditional on GPA.

We interpret these results as reflecting an increase in effort among students who enroll during periods of higher unemployment. The reasons why this increase in effort occurs merits further investigation. We hypothesize that this may be due to the increase in competition, the reduction in opportunities for part-time employment, or a change in attitudes consistent with the impressionable years hypothesis from social psychology. Devising empirical strategies to identify these different channels would

[28]While it would be tempting to further explore the evidence for this type of channel using data on high-school graduates who decide not to enroll into college, an analysis of this type would be challenging. For these individuals, the labor market conditions that they experience during their late teenage years also reflect the conditions that prevail at the time at which they first enter the labor market. It would therefore not be possible to separately identify business cycle impacts due to potential changes in attitudes from the impact of the conditions at entry among this sample.

be a promising avenue for future research. Regardless of the driving force behind the improvement in the academic and labor market outcomes for those who start higher education in bad economic times, our findings send a clear signal to policymakers that it is not a good idea to limit funding for education or curb enrollment to universities during a recession.

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Figure 1: UK Unemployment rate 1958-2016

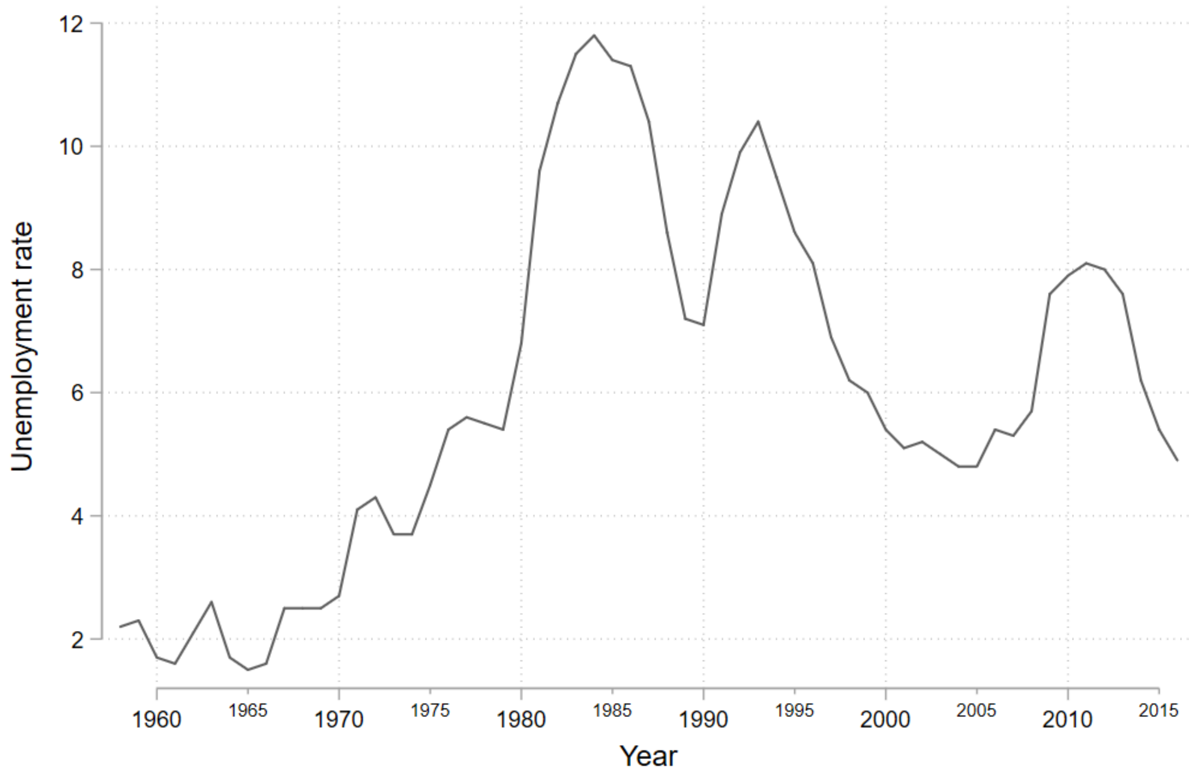
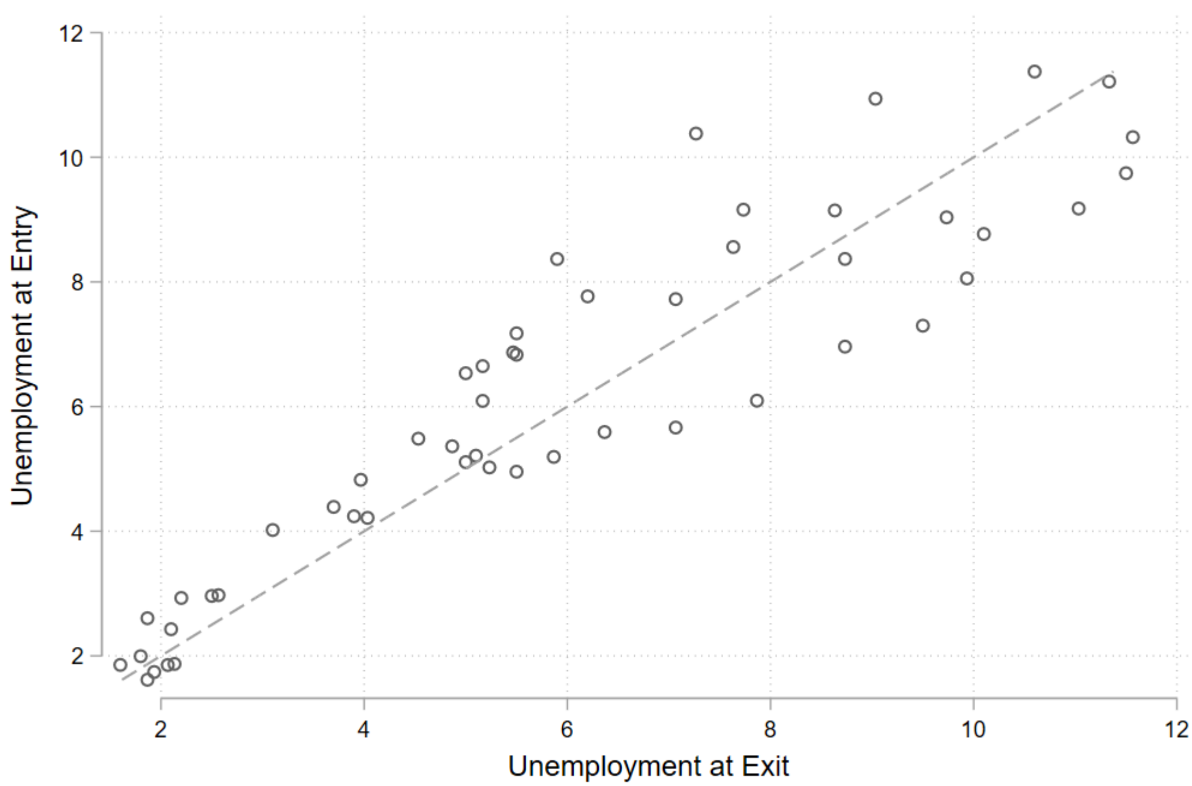
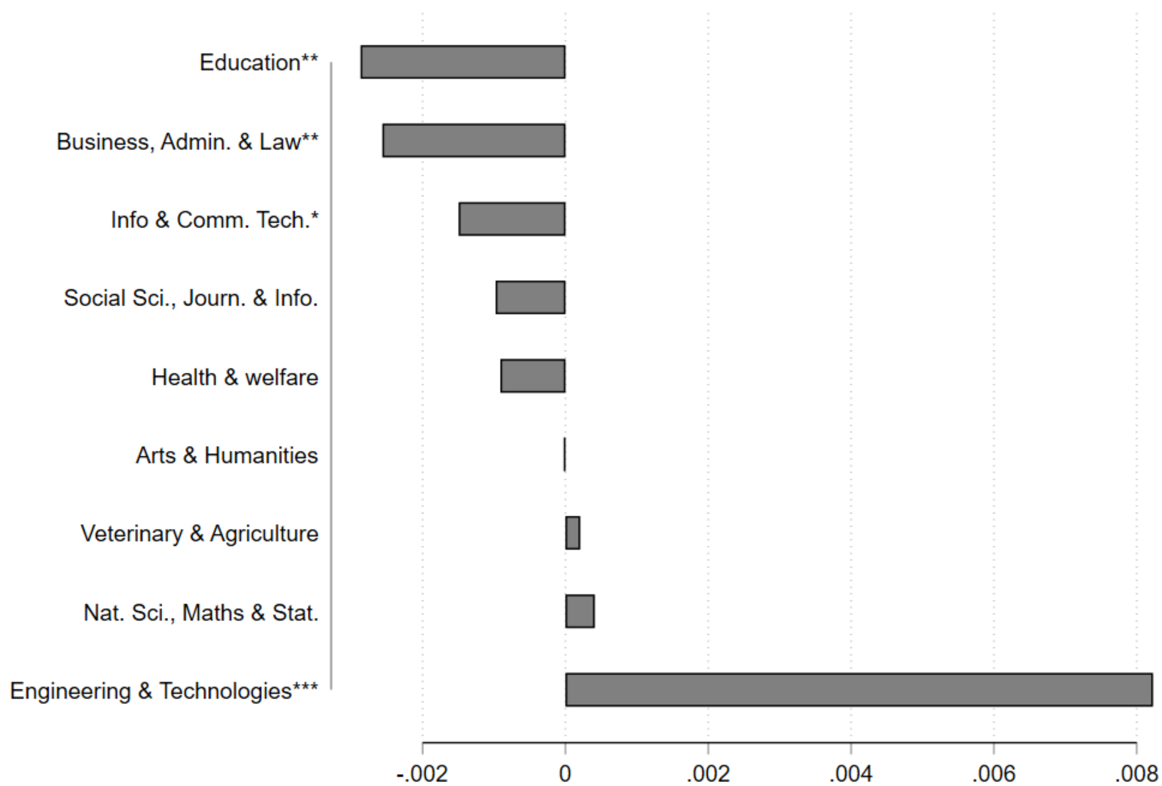


Figure 2: Entry and Exit Unemployment Rates by Cohort



Each dot represents a cohort defined by the enrollment year in college and the unemployment rates at entry (y axis) and exit (x axis) from college.

Figure 3: Change in major selection probabilities



Bars represent the estimated coefficients for the effect of unemployment rate at college entry on the probability of selecting each of the nine major categories. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regressions include a quadratic in cohort trend. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment .

Table 1: Summary Statistics, by Decade of College Enrollment

	Enrollment Decade					
	1960s	1970s	1980s	1990s	2000s	Total
Panel A: *Full sample*						
White	0.98	0.95	0.93	0.89	0.84	0.91
	(0.15)	(0.21)	(0.26)	(0.31)	(0.36)	(0.28)
Foreign	0.09	0.08	0.09	0.11	0.09	0.09
	(0.28)	(0.28)	(0.28)	(0.31)	(0.29)	(0.29)
Age at graduation	2.97	22.43	23.03	24.26	25.83	23.52
	(1.57)	(2.55)	(3.77)	(5.06)	(6.60)	(4.40)
Unemp. at enr.	2.05	4.33	9.76	8.46	5.33	7.10
	(0.28)	(0.92)	(1.79)	(1.08)	(0.36)	(2.76)
University major:						
Health & Welfare	0.06	0.06	0.05	0.04	0.06	0.05
	(0.24)	(0.24)	(0.21)	(0.21)	(0.20)	(0.22)
Soc. Sci., Journ. and Info.	0.10	0.11	0.11	0.11	0.12	0.11
	(0.31)	(0.32)	(0.31)	(0.31)	(0.31)	(0.31)
Business, Admin. & Law	0.10	0.14	0.16	0.20	0.21	0.17
	(0.30)	(0.35)	(0.37)	(0.40)	(0.40)	(0.38)
Arts & Humanities	0.16	0.15	0.15	0.15	0.16	0.15
	(0.36)	(0.35)	(0.35)	(0.36)	(0.37)	(0.36)
Education	0.02	0.04	0.02	0.02	0.02	0.02
	(0.14)	(0.19)	(0.13)	(0.12)	(0.14)	(0.14)
Nat. Sci., Maths & Stat.	0.25	0.23	0.21	0.18	0.16	0.20
	(0.43)	(0.42)	(0.40)	(0.38)	(0.37)	(0.40)
Veterinary & Agriculture	0.02	0.02	0.02	0.01	0.01	0.02
	(0.13)	(0.14)	(0.13)	(0.12)	(0.12)	(0.13)
Info & Comm. Tech.	0.01	0.02	0.05	0.08	0.10	0.06
	(0.08)	(0.15)	(0.22)	(0.27)	(0.28)	(0.23)
Engineering & Techn.	0.28	0.23	0.24	0.20	0.15	0.21
	(0.45)	(0.42)	(0.43)	(0.40)	(0.36)	(0.41)
Observations	17,081	44,472	59,545	77,353	31,353	229,804
Panel B: *Earnings sample*						
Log real earnings	6.81	6.83	6.79	6.58	6.33	6.66
	(0.51)	(0.51)	(0.51)	(0.48)	(0.45)	(0.52)
Observations	2,837	9,224	14,056	19,068	7,445	52,630
Panel C: *Educational achievements sample*						
Number of GCSEs:						
1 to 2	0.01	0.01	0.01	0.02	0.02	0.02
	(0.10)	(0.09)	(0.12)	(0.16)	(0.15)	(0.14)
3 to 4	0.03	0.03	0.04	0.06	0.05	0.05
	(0.18)	(0.17)	(0.19)	(0.23)	(0.22)	(0.21)
5 to 7	0.34	0.30	0.27	0.27	0.21	0.27
	(0.47)	(0.46)	(0.44)	(0.45)	(0.41)	(0.45)
≥ 8	0.61	0.66	0.68	0.64	0.71	0.66
	(0.49)	(0.47)	(0.47)	(0.48)	(0.45)	(0.47)
Observations	5,846	21,761	31,049	47,559	27,105	133,888
Degree class	3.19	3.19	3.35	3.48	3.62	3.42
	(1.17)	(1.14)	(1.07)	(0.94)	(0.96)	(1.03)
Observations	5,528	20,819	30,314	48,686	28,862	134,209

Note: Standard deviations in parenthesis.

Table 2: Earnings and Economic Conditions at Time of College Enrollment

	Outcome: Log real earnings						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Unemp at enrollment	0.008	0.009	0.012	0.006	0.011	0.011	0.005
	(0.002)***	(0.002)***	(0.001)***	(0.002)***	(0.001)***	(0.001)***	(0.002)***
Age, age squared	Yes		Yes	Yes	Yes		
Age Fixed Effects						Yes	Yes
Calendar Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend in cohort effect		Quadratic	Linear	Quadratic	Linear + Fee Years	Linear	Quadratic
Obs.	52,612	52,612	52,612	52,612	52,612	52,612	52,612
R^2	0.184	0.187	0.214	0.214	0.214	0.217	0.217

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. The regressions use all observations for full-time workers with non-missing earnings data.

Table 3: Labor Market Outcomes and Economic Conditions at Time of College Enrollment

	Log real earnings			Pr(FT Employment)	
	(1)	(2)	(3)	(4)	(5)
Unemp at enrollment	0.0280	0.0117		0.0016	0.0011
	(.0047)***	(.0016)***		(.0013)	(.0009)
Unemp at enrollment	-0.0009				
∗ Years since graduation	(.0002)***				
Quartile of unemp.:					
2nd			0.0250		
			(.0081)***		
3rd			0.0673		
			(.0118)***		
4th			0.0734		
			(.0081)***		
Age, age squared	Yes	Yes	Yes	Yes	Yes
Calendar Year FE	Yes	Yes	Yes	Yes	Yes
Trend in cohort effect	Linear	Linear	Linear	Linear	Linear
Sample	Earnings	Restricted	Earnings	Full	Full
Obs.	52,612	42,753	52,612	60,950	250,438
R^2	0.215	0.229	0.214	0.174	0.088

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. The dependent variable in Columns (1) to (3) is log real weekly earnings. The dependent variable in Columns (4) and (5) is a dummy for full-time employment. Columns (1) and (3) use all observations for full-time workers with non-missing earnings data. Column (2) restricts the sample to individuals who enroll in university between the ages of 16 to 21. Column (4) uses the sample from Columns (1) and (3), plus all individuals interviewed during the same waves who are not working full time. Column (5) uses all observations from all waves, including all observations that are not part of the earnings survey.

Table 4: Quantile Regressions of Log Real Earnings on Economic Conditions at Time of College Enrollment

	Quantile								
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unemp at enrollment	0.003	0.009	0.012	0.013	0.013	0.013	0.015	0.017	0.013
	(0.00008)***	(0.00005)***	(0.00004)***	(0.00004)***	(0.00004)***	(0.00004)***	(0.00005)***	(0.00005)***	(0.00006)***
Obs.	52,612	52,612	52,612	52,612	52,612	52,612	52,612	52,612	52,612
Pseudo R^2	0.082	0.117	0.134	0.141	0.145	0.146	0.150	0.157	0.167

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS.

Table 5: Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)
Unemp at enrollment	0.008	0.010	0.009	0.008	0.009	0.009
	(0.002)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Unemp at graduation	-.037					
	(0.005)***					
Unemp at graduation	0.002					
∗ Years since graduation	(0.0002)***					
Age, age squared	Yes	Yes	Yes	Yes	Yes	Yes
Trend in cohort effect		Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes					
Field-specific year FE		Yes				
Occ-specific year FE			Yes			
Occ-field-specific year FE				Yes		
Ind-specific year FE					Yes	
Ind-field-specific year FE						Yes
Obs.	52,612	52,612	52,595	52,595	52,576	52,576
R^2	0.199	0.246	0.312	0.351	0.25	0.298

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variable is log real earnings. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. The occupation, industry, and field of study fixed effects are based on nine occupational categories, ten industries, and nine field of study groups, respectively.

Table 6: Academic Performance in High School

	Continuous	Dummies for number of GCSEs 1-2	3-4	5-7	8+
	(1)	(2)	(3)	(4)	(5)
Panel A: *Linear Cohort Trend*					
Unemp at enrollment	-.020	0.0003	0.001	0.004	-.005
	(0.009)**	(0.0004)	(0.0005)**	(0.002)**	(0.002)**
Obs.	147,641	147,641	147,641	147,641	147,641
R^2	0.017	0.003	0.004	0.021	0.022
Panel B: *Quadratic Cohort Trend*					
Unemp at enrollment	-.012	0.0003	0.001	0.001	-.003
	(0.014)	(0.0005)	(0.0008)	(0.003)	(0.004)
Obs.	147,641	147,641	147,641	147,641	147,641
R^2	0.017	0.003	0.004	0.021	0.022

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variable is based on the number of GCSE exams passed with a score of C or more. This information is only collected starting in the final wave of 2005. Column (1) uses a continuous measure of the number of GCSEs passed, while the remaining columns use indicator variables for the corresponding intervals. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment.

Table 7: Academic Performance in University

	(1)	(2)	(3)	(4)	(5)
Unemp at enrollment	0.010	0.011	0.010	0.010	0.013
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Quadratic cohort trend	Yes	Yes	Yes	Yes	Yes
Age at enrollment		Yes	Yes	Yes	Yes
Field of study FE			Yes	Yes	Yes
Field-specific cohort trend				Yes	Yes
GCSE-specific cohort trend					Yes
Obs.	148,943	148,943	148,943	148,943	135,564
R^2	0.045	0.045	0.057	0.059	0.067

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variable is a continuous measure based on university degree class, with higher values corresponding to higher GPAs. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. In columns (1) to (4), the sample is restricted to individuals with information on their degree classification. In column (5) the sample is restricted to individuals with information on the number of GCSE exams passed. This information is collected starting in the final wave of 2005.

Table 8: Degree class and wages

	(1)	(2)	(3)	(4)
Unemp at enrollment	0.008	0.008	0.008	0.008
	(0.002)***	(0.002)***	(0.002)***	(0.002)***
First Class		0.154		0.172
		(0.014)***		(0.014)***
Upper Second Class		0.076		0.112
		(0.015)***		(0.014)***
Lower Second Class		-.020		0.012
		(0.015)		(0.015)
Third Class		-.081		-.058
		(0.019)***		(0.017)***
Age, age squared	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes		
Trend in cohort effect	Yes	Yes	Yes	Yes
Degree class-specific calendar year FE			Yes	
Field-specific calendar year FE				Yes
Obs.	30,241	30,241	30,241	30,241
R^2	0.218	0.232	0.234	0.263

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variable is log real earnings. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. In all columns, the sample is restricted to individuals with information on their degree classification. This information is only collected starting in the final wave of 2005.

Table A.1: Earnings and Economic Conditions at Time of College Enrollment: Women

	Outcome: Log real earnings						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Unemp at enrollment	0.013	0.004	0.014	0.001	0.012	0.013	0.002
	(0.003)***	(0.003)	(0.002)***	(0.002)	(0.002)***	(0.002)***	(0.002)
Age, age squared	Yes		Yes	Yes	Yes		
Age Fixed Effects						Yes	Yes
Calendar Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend in cohort effect		Quadratic	Linear	Quadratic	Linear + Fee Years	Linear	Quadratic
Obs.	39,626	39,626	39,626	39,626	39,626	39,626	39,626
R^2	0.138	0.151	0.165	0.167	0.166	0.169	0.170

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. The regressions use all observations for female full-time workers with non-missing earnings data.

Table A.2: Earnings and Economic Conditions at Time of College Enrollment: Scotland Adjustment

	Outcome: Log real earnings					
	All	Excl. Scot	All	Excl. Scot	All	Excl. Scot
	(1)	(2)	(3)	(4)	(5)	(6)
Unemp at enrollment	0.008	0.008	0.011	0.011	0.010	0.011
	(0.002)***	(0.002)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Age, age squared	Yes	Yes	Yes	Yes		
Age Fixed Effects					Yes	Yes
Calendar Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Trend in cohort effect			Linear	Linear	Linear	Linear
Obs.	45,254	41,218	45,254	41,218	45,254	41,218
R^2	0.181	0.183	0.213	0.213	0.216	0.216

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment. The regressions use observations for male full-time workers with non-missing earnings data for the waves from 2001 onwards. Columns (2), (4) and (6) exclude individuals who were born in Scotland.

Table A.3: Wage Regressions by Field of Study

	(1)	(2)	(3)	(4)	(5)
Field-specific Coeff on Unemp at Enrollment					
Health & Welfare	0.002	-0.001	-0.002	Base	-0.003
Social Sciences, Journalism & Info	0.001	0.006	0.006*	0.007	0.002
Business, Admin & Law	0.006	0.007**	0.007**	0.009	0.004
Arts & Humanities	0.001	0.006***	0.007***	0.008	0.004
Education	0.003	0.012***	0.009**	0.013*	0.012**
Nat Sci, Math & Stat	0.008***	0.015***	0.015***	0.016***	0.011***
Veterinary & Agriculture	0.016	0.020*	0.020*	0.021*	0.016
Info & Comm Tech	0.024***	0.020***	0.019***	0.022***	0.022***
Engineering & Technologies	0.007**	0.011***	0.010 ***	0.012*	0.007**
Field-specific age profile (quadratic)	Yes	Yes	Yes	Yes	Yes
Field-specific calendar Year FE	Yes	Yes	Yes	Yes	Yes
Overall trend in cohort effect (quadratic)		Yes			
Field-specific trend in cohort effect (linear)			Yes		
Cohort dummies				Yes	
Field-specific scarring effects					Yes
Obs.	52,612	52,612	52,612	52,612	52,612
R^2	0.2172	0.2489	0.2500	0.2506	0.2350

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variable is log real earnings. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment.

Table A.4: University Degree Class Probability

	Ordinary	Third	Lower Second	Upper Second	First
	(1)	(2)	(3)	(4)	(5)
Unemp at enrollment	0.0006	-.003	-.002	0.002	0.003
	(0.001)	(0.0007)***	(0.002)	(0.002)	(0.001)***
Obs.	148,943	148,943	148,943	148,943	148,943
R^2	0.104	0.022	0.025	0.025	0.018

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variables are indicator variables for the degree class obtained at university. This information is only collected starting in the final wave of 2005. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies, as well as a quadratic cohort trend. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year of enrollment.

Table A.5: Probability of non-employment during full time college studies

	(1)	(2)	(3)
Avg. Unemp.	0.022	0.016	0.017
	(0.005)***	(0.005)***	(0.005)***
Age Fixed Effects	Yes	Yes	Yes
GCSE Dummies		Yes	Yes
GCSE × Age			Yes
Obs.	50,593	32,153	32,153
R^2	0.070	0.066	0.070

Note: ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. The dependent variable is an indicator variable for non-employment at the time of the survey. The sample is restricted to male full-time students. All regressions include a race dummy, a dummy for foreign nationals, and 19 region of residence dummies, as well as a full set of age fixed effects, a quadratic time trend and an age specific linear time trend. All regressions are weighted using person weights from the LFS. Standard errors are clustered by year. Columns (2) and (3) further restrict the sample to individuals with information on their GCSE score; this information is only collected starting in the final wave of 2005.