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Time to Graduate Level Employment for New Graduates in the United Kingdom

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ABSTRACT

This paper estimates the time to graduate employment of new graduates from universities in the United Kingdom. Using data from the UK Graduate Outcomes Survey, survival functions are estimated to identify differences in time to graduate employment among different groups of graduates, stratified by institution. Differences in survival functions are confirmed across the different categories of university in the United Kingdom, with Russell Group universities holding a greater probability of employment at each time interval. A Cox Proportional Hazard model is estimated to identify the determinants of the differences in the time to graduate employment, with constant effects associated with secondary school performance, parental degree status, private school status and ethnicity. The remaining effects were shown to be time varying, including institution, degree classification and degree subject, with Russell Group graduates, graduates with high degree classifications and graduates of STEM displaying a persistent advantage in the early career labour market.

1 | Introduction

Based on the most recent data from the Higher Education Statistics Agency (HESA 2022), universities within the United Kingdom produce over 500,000 new graduates[1] each year. The large number of graduates simultaneously entering the labour market creates intense competition for available graduate level employment.[2] The most recent data from the Institute of Student Employers (ISE 2022) indicate an average graduate application to graduate vacancies ratio of 62:1. This varies significantly between sectors with the ratio as low as 47:1 in the Legal and Engineering sectors, while being as high as 88:1 and 90:1 in the Finance and Digital IT sectors, respectively.

Although the data expose the challenge students will face in attaining graduate level employment, what is less clear are the primary determinants that effect how long it will take for a graduate to be employed in a graduate level job. Utilising Survival Analysis, this paper estimates the time to graduate level employment of new graduates in the United Kingdom in their first 15 months after graduating. A Cox regression is estimated to determine the direction and significance of a series of relevant variables on time to graduate employment and in the process differentiates between those imposing a constant effect and those which are time dependent. Such analysis might potentially identify individual or educational traits that might have diminishing or increasing value in the early career labour market. If such factors were to exist, then it might incentivise changes in the job search behaviour of graduates to account for the time dependent value of a given characteristic. Where effects relate to immutable characteristics such as race or gender, this might reflect a degree of discrimination faced by graduates that requires some form of intervention at an institutional or governmental level.

With respect to the broader contribution of this paper, a better understanding of the determinants of minimising the time to employment is essential as research in this area touches upon some of the most serious, contemporary issues facing higher education institutions. As more and more young people engage in

higher education, an extended time to graduate level employment can have detrimental effects on returns to education and the possibility of skills becoming obsolete if they are not utilised. A prolonged time to employment also raises a general question on the value proposition of university from both a private and public standpoint if graduates are having to wait too long, to eventually, if ever, put their degrees to good use. A more refined perspective on the factors impacting the time to employment of new graduates would represent a valuable contribution to the literature in which, analysis estimating time to employment, especially in a UK context is scarcely found. As will be proposed in the conclusion of this paper, any public information campaign to better inform relevant stakeholders on the nature of the early career graduate labour market in the United Kingdom will be reliant on the analysis provided by the academic community as an alternative to more biassed marketing materials from universities themselves.

With respect to individual stakeholders, the findings presented within this paper are of value to several parties. For current and prospective students, it is important to establish a greater understanding of the factors and traits that will impact their early career employment prospects upon graduating. Understanding the effects of variables such as degree subject, degree classification and institution might better inform current and prospective students on their potential strengths and weaknesses relative to the candidates they will be competing against for graduate jobs in the future and as such provide students with the information to alter their behaviour before commencing, or during their studies, to maximise their chances to attain a suitable level of employment shortly after graduating. This would seem especially important given the negative financial, mental health and overall wellbeing effects associated with extended periods of unemployment.

For universities, the results identify the performance of their graduates relative to those produced by competitors. Beyond serving as a benchmark for comparison, the findings may highlight potentially serious issues regarding the current demand for a university's graduates and how best to improve this situation. Solutions for universities could take multiple forms, including enhancements in the provision of employability services to increase the likelihood of graduate employment soon after graduating. Alternatively, the findings may be utilised to justify proposals that have sought to discontinue the provision of some courses that appear to be excess to demand within the current labour market.

The findings of this paper may also be useful at a governmental level. Universities in the United Kingdom are heavily reliant on government funding and subject to some government oversight and regulation, particularly with respect to the level of tuition fees. In the face of poor employability outcomes, the government may rightly question the wisdom of continuing to fund higher education at the current rate of investment. In line with the potential response from universities, the government may seek to influence the diminished provision of so-called low value courses or may reflect upon the findings as a starting point to instigate some larger scale, sector wide reforms, including, but not limited to changes in tuition fees, student loan availability and general structural reform in the prevision of higher education.

The paper is structured as follows: First is a discussion of the related literature. This will focus on reviewing literature on time to employment studies that utilise Survival Analysis and Cox regressions as the primary means of analysis. This review will serve to identify the findings of similar studies to that which is presented within this paper, while also serving to justify the use of Survival Analysis and Cox regressions as the appropriate methodology for estimating time to employment. The methodology is then presented, including a full discussion of the data used and the econometric methods applied in the analysis. Results from the analysis are then presented, followed by discussion and concluding remarks.

2 | Background

Prior to completing their national secondary school examinations,[3] pupils apply to universities using the Universities and Colleges Admissions Service (UCAS). All applications by UK-based pupils for undergraduate study to universities in the United Kingdom are administered through UCAS. Once national exams have been graded,[4] the letter grades (A, B, C, etc.) are then converted into numerical values called UCAS points. Academic entry requirements of all universities in the United Kingdom are expressed in UCAS points, with more selective universities and more demanding degree disciplines[5] requiring that a student attain a higher number of points.

Universities in the United Kingdom are commonly segmented, and indirectly ranked in quality, into one of three categories: Russell Group universities, pre-1992 universities and post-1992 universities. The Russell Group is a self-selected group of 24 of the UK's elite research institutions. Russell Group universities produce over two thirds of the UK's world leading research (The Russell Group 2022), and Russell Group universities frequently dominate national university league tables, while also placing highly worldwide, thereby attracting the highest achieving applicants from within the UK. Pre-1992 universities refer to those institutions that were established prior to 1992.[6] They generally rank behind Russell Group universities in national league tables. Although pre-1992 universities teach similar subjects as Russell Group universities, the entry requirements for these programmes will commonly be lower than those for degree programmes at Russell Group universities. As such, competition for entry is less intensive compared to Russell Group universities. Post-1992 universities are those established after 1992.

The distinction of pre- and post-1992 is due to a structural change within the United Kingdom in the number of universities that took place at that time. The expansion in the number of universities in the United Kingdom in 1992 involved the government elevating the status of a series of polytechnical colleges to universities, thereby allowing them to confer undergraduate, postgraduate and doctoral awards upon their students. The purpose of the post-1992 expansion was largely to expand access to university to a wider audience. The post-1992 expansion increased access to university to students from lower income backgrounds and those who would be the first in their family to attend higher education. Both groups were previously underrepresented in the existing student population at the time. Post-1992 universities fall into a third tier of institutions within the United Kingdom.

They largely rank below Russell Group and pre-1992 universities and require lower levels of entry criteria. This approach to categorising universities is an accepted convention within the literature (Boliver 2015; Raffe and Croxford 2015.

Upon successful completion of university, graduates are awarded their degree with a defined degree classification. Degree classification signifies the quality of the graduate's performance. Classification in England, Wales and Northern Ireland is based on a composite measure of a student's performance in their 2nd and 3rd year of university.[7] In Scotland, classification is a composite measure of performance in a student's 3rd and 4th year of university.[8] Despite differences in the duration of study, the degree classification paradigm is consistent across all universities within the United Kingdom in that degrees will be classified into one of four categories: a first class, an upper second class, a lower second class or a third class. Any grade below a third class is referred to as an unclassified degree. A first class is the highest classification attainable with each subsequent class representing a comparatively lower level of performance. The grade boundaries, which define the classification a graduate is awarded, are usually expressed in the form of an average percentage grade across the graduate's eligible degree modules/components and are generally consistent across all universities in the United Kingdom.[9] The similar boundaries used by universities to define a degree classification should allow for a direct comparison of graduates across universities, assuming equal standards have been applied with respect to the depth and difficulty of material required to attain a given classification.

3 | Literature Review

Although the literature on the time to employment of new graduates is relatively sparse, the research that has been published identifies some consistencies in key determinants across analyses in different countries. The existing research also demonstrates the use of Survival Analysis and Cox regressions as the appropriate methodological approach when estimating time to employment.

Betts, Ferrall, and Finnie (2000) highlighting a scarcity of relevant time to employment literature on graduates employ survival analysis to estimate the time to a graduate's first job in Canada. Their analysis differs from that presented within this paper in that they analyse the time to employment of the full spectrum of graduates across all levels of study.[10] Their data set is also lacking with respect to information on student attainment (grades or any such equivalent). The most significant finding from their analysis is that master's students have a longer time to employment relative to PhD and undergraduates, with PhDs having the shortest time to employment among the trio. The extended time to employment for master's graduates may in part be a consequence of a spike in rates of overeducation observed among populations of graduates in developed countries. Master's students may potentially be holding out longer before they start employment in the belief that they are due a superior job given their status as postgraduates.

Biggeri, Bini, and Grilli (2001) use a large-scale, national Italian data set to find that academic ability identified by final grades while at university is the most significant determinant with regards to minimising time to employment. The economic activity of one's parents and parental level of education were also identified as significant factors in minimising time to employment, as students with at least one parent employed and/or with one parent holding either a secondary certificate or degree were found to have a shorter time than those whose parents were either unemployed or with a sub-secondary school level of education Employing a more regional focus within Italy, Sciulli and Signorelli (2011) use survival analysis to examine the transition from university to work of students within the city of Perugia. Their analysis found that students with higher grades took longer to find a job after graduating. This was interpreted as potentially indicating the higher reservation wage held by such individuals. This finding may be thought to run counter to expectations where the market would be inclined to hire the highest performing graduates first, thereby minimising their time to employment. Other positive determinants of time to employment included completing a degree quickly and having prior employment experience, though the effects were noted as being moderate. Their analysis also revealed differences in time to employment by discipline with law and veterinary science having slower transitions to work, relative to other disciplines. This may reflect the additional time required to engage in further training and professional qualifications after graduating that might be required to professionally practise.

Jasiński et al. (2017) used survival analysis and administrative data to track early career outcomes for graduates in Poland, finding that in the first 2 years after graduation, employment outcomes vary by subject and over time. Specifically, immediately after graduation, prior work experience and place of residence have a significant effect on the likelihood of employment, but these effects dissipate over time. The effect of place of residence is a proxy for the level of economic activity in an area, and therefore the volume of employment opportunities for graduates, with cities and population hubs providing greater options for graduates than more rural areas. They emphasise that in the initial period after graduation, content of your degree and prior experience are the primary determinants of employment, whereas mode of study (part or full time) and institution (institution ranking) are not decisive factors. That institution was insignificant is somewhat unexpected, as differences in institution quality and ranking are commonly thought to impact labour market outcomes.

In a large-scale analysis of nine different European countries, Salas-Velasco (2007) apply a series of methods, including survival analysis, to estimate the time to employment for graduates in Europe. The results identify a North South divide where graduates from Nordic countries experience a shorter time to employment versus those in southern Mediterranean countries such as Italy and Spain. Their findings demonstrate that the intensity of job search by graduates matters, with those more involved in looking for work, finding work sooner. Immutable characteristics also play a role with male and mature graduates having a shorter time to employment compared to female and younger graduates, respectively.

Alemu and Yismaw (2022) examine time to employment for graduates within a developing country. Their analysis within

Ethiopia demonstrated similar findings to analysis conducted in developed countries, specifically, that grades and prior employment experience are the most important determinants. Their findings also noted faster time to employment for males. This may reflect a more male dominated student demographic in a developed country like Ethiopia, where educational opportunities might still be limited for females when compared with those afforded to women in developed countries.

Although the use of survival analysis is common in estimating time to employment, alternative approaches can be utilised to examine the transition from university to work. One example where findings run counter to those previously presented includes Piróg (2016), who used discriminant function analysis to examine the effects of degree capital on the transition from university to work. Variables including specialisation, grade and degree type (BA or MA) were insignificant in explaining differences between employed and unemployed graduates.

4 | Methodology

4.1 | Data

The data used come from the Higher Education Statistics Agency's (HESA) Graduate Outcomes survey, from the 2017/2018 and 2018/2019 waves.[11] This is the largest annual survey of its kind and captures data on the current status of recent graduates of universities within the United Kingdom.[12] All graduates who completed a course are surveyed 15 months after their graduation. The sample includes observations who attended universities across the United Kingdom. Universities are segmented into three aforementioned categories: Russell Group universities, universities established before 1992[13] (pre-1992's) and universities established after 1992 (post-1992's).

Two significant restrictions are applied to the data used to estimate the survival functions and the Cox regression. The first involves an observation's employment status. The data consists only of those who are either employed or who are unemployed and currently looking for work. Observations who declared that they are engaging in further study, taking a gap year, involved in volunteering activities or who are undertaking caring responsibilities were dropped from the sample. To include them within the analysis would misrepresent the duration of time to employment in that it would be inclusive of individuals who are not actively engaged in the process of searching for employment. Although the number of employed individuals would remain the same, their share within the total population would decline, thereby suppressing the percentage of employed graduates at each period. The decision not to engage in job search upon graduation is unlikely to be a random choice. A comparison of the samples of those engaging in job search and those forgoing this process is presented in Table A1. A comparison of Columns 2 and 4 of Table A1 reveals that the characteristics of the job search, and nonjob searching samples are very similar as a proportion of each sample. Only ethnicity and some university categories are substantially different between the two samples, with Whites representing a greater proportion of the job search sample by approximately 7% difference. A greater proportion of post-1992 graduates are likely to engage in job search, whereas a greater proportion of Russell Group graduates are likely to not be involved in job search in favour of volunteering or taking a gap year after graduation.

The second restriction is applied with respect to the education required in the occupations for employed observations. Included within the data is the variable 'wrkqualreq'. This is a self-reported variable where observations were asked about the education requirements that were required upon application for their current job. The purpose of the survival analysis is not to estimate the time to general employment but rather the time to graduate level employment. Graduate level employment is identified using the 'wrkqualreq' variable where those who indicated their occupation required either a university degree in a specific subject, or at least a university degree of any subject, are employed in graduate work. All other observations are treated as unemployed with respect to their graduate-level employment status. This includes those who are employed but who are in occupations that do not require at least an undergraduate degree. This approach is not designed to cast any aspersions on graduates employed in subgraduate level occupations or the work they do. The analysis is only conducted in this manner to purely estimate the time to graduate level employment, which is assumed to be the primary purpose of attending university given the central value proposition put forth by universities, that is, by completing a degree you gain access to jobs you otherwise would not be able to access. This is the assumed most desirable outcome for the vast majority of graduates given the presumed value and status of graduate jobs versus nongraduate jobs.

The remainder of the data consist of variables covering basic demographic details (sex and ethnicity) to more detailed information on a student's education including, UCAS points, private education status, university institution, degree subject and degree classification. As demonstrated by Lalley and McInally (2023), incremental differences in UCAS points have been shown to effect graduate starting salary and therefore also may influence the decision to hire a graduate, with graduates with high UCAS points being hired early in the post-graduation recruitment cycle. Private school status either as a proxy for ability or potentially via the networking effects that may exist among fellow private school alumni may result in graduates who previously attended private school having some added advantage with respect to their time to employment when they enter the labour market (Green, Henseke, and Vignoles 2017). As previously stated, the category of university institution can be thought of a proxy for institutional rankings. Given a previously identified wage premium (Chevalier and Conlon 2003) graduates from higher ranked Russell Group institution might be expected to hold an advantage in terms of time to employment relative to those from pre- and post-1992 universities. The same premise applies to subject choice and degree class as a means of differentiating between the quality of graduates. As subject choice[14] and degree class[15] have been shown to be determinants of salary (Chevalier 2011), it is likely that while being general determinants of employment, they might also be influential factors in determining the time to employment, where higher value subjects and classifications are snapped up by the labour market earlier in the graduate recruitment cycle.

To estimate survival functions and a Cox regression, it is necessary that the data include a binary event variable and a time variable. The binary event variable within the model is the aforementioned graduate employment status, whereas the time variable is months in employment. At the point at which the survey occurs (15 months after graduation), individuals employed for a period greater than 0 months, but less than 12 months, are captured by the variable 'empmonth', where the value of the variable ranges between 1 and 11. Individuals employed for greater than 12 months have a blank value for 'empmonth'. Individuals employed for 12 months or more are instead captured by the variable 'empyear', where a true value for this variable indicates that they have been employed at some point in the first 3 months after they graduated (i.e., either for a duration of between 12 and 13 months, 13 and 14 months or 14 and 15 months). As one cannot discern precisely in which month such individuals became employed, they are collectively assigned to the first time period for employment within the survival estimates. The values of 'empmonth' are then converted to give the amount of time (in months) after graduation that a graduate gained their graduate employment. The conversion simply involves subtracting the value for months in employment, from 13. The reason this value is calculated by subtracting from 13, despite the survey occurring 15 months after graduation, is due to the compression of the employment month of those employed for greater than or equal to 1 year. In the absence of month-to-month data for those employed for greater than or equal to 1 year, such respondents, if one wishes to include them within the sample, must be compressed into a single time period, which has a duration of 3 months as previously defined. Table 1 summarises the full conversion applied to 'empyear' and 'empmonth' data, to give a complete overview of the range of values the dependent variable can take.

Note that the dependent variable is capturing your time to employment of your current job, where your current job is defined as a graduate level job. It is entirely possible for observations to have had employment after graduation, but prior to attaining their current graduate job. This can be captured by the variable first job, which takes a value of 1 if the graduate's current job is their first since graduating and 0 if the graduate has a had at least one job, prior to their current job, since they have graduated. However, this variable only captures whether or not an observation has been previously employed since graduating and does not identify the nature of an observation's previous job, the duration, how the employment ended and whether or not it would qualify as a graduate job within the context of this paper. With respect to graduate job status, one would argue that this may not be a major concern though. Given the time and effort required to attain a graduate level job, it is unlikely that those with prior work experience since graduating would have gone to the effort to attain a graduate job and either voluntarily left or were dismissed prior to attaining their current graduate job. Despite this perceived lack of concern in this one element, one cannot overcome the absence of detailed information on employment since graduating. With no further means to account for such factors, this remains a limitation of the study that cannot be resolved at this time.

TABLE 1 | Dependent variable conversion summary.

empyear	empmonth	Qualitative time interval	Converted time to employment value
1	n/a	Months 0–1, Months 1–2 or Months 2–3	1
n/a	11	Months 3–4	2
	10	Months 4–5	3
	9	Months 5–6	4
	8	Months 6–7	5
	7	Months 7–8	6
	6	Months 8–9	7
	5	Months 9–10	8
	4	Months 10–11	9
	3	Months 11–12	10
	2	Months 12–13	11
	1	Months 13–14	12
	0	Months 14–15	13

Note: Respondents with 'empyear' = n/a and empmonth = 0 are unemployed. Converted time to employment – dependent variable as used in the survival analysis/Cox regression. Converted time to employment = 0 – starting time/graduation day – all respondents unemployed.

4.2 | Kaplan–Meier Estimator

The Kaplan–Meier estimator (Kaplan and Meier 1958) is a non-parametric statistic used to estimate the survival function. The survival function is defined as the probability a subject or object of interest will 'survive' past a certain time. The method can be used to estimate fraction of a sample who remain employed/unemployed over a specific duration. The binary event is graduate employment, which for a newly minted graduate is the assumed primary objective of pursuing a university education; therefore, a shorter survival time is the assumed optimal outcome for any new graduate. For the following analysis, the estimator of the survival function $S(t)$ is given by

$$\widehat{S}(t) = \prod_{i:t_i \leq t} \left(1 - \frac{e_i}{n_i}\right),$$

where t_i is the time where at least one case of graduate employment occurred, e_i is the number of instances of graduate employment that happened at time t_i and n_i is the number of individuals known to remain unemployed up to time t_i, where unemployed is defined as not being employed in a graduate level job. Separate survival functions are estimated based on the university a graduate attended. One anticipates that a graduate who attended a higher ranked institution might experience a shorter unemployment time relative to graduates from less prestigious universities. This approach of estimating different survival functions by institution can be thought of as controlling for the different

'academic treatment' received by graduates of different universities, where the entry requirements, volume of work, depth and difficulty of degree content, style of assessments and grading practices may impact the perception of graduates by employers, and as such impact the amount of time it takes them to attain employment.

4.3 | Cox Proportional Hazard Model

The Cox Proportional Hazard model (Cox 1972) allows for the estimation of the relationship between survival times and a series of explanatory variables. For the purpose of this paper, it will be used to estimate the effects of the explanatory variables outlined earlier in Section 4.1, on the graduate employment rate of new graduates. The rate is referred to as the hazard rate. The Cox model is expressed by the hazard function $h(t)$, where the hazard function, in this case, is interpreted as the chance of graduate employment at any time, t. The model is estimated as follows:

$$h(t) = h_0(t) \times exp\left(\beta_1 x_1 + \beta_2 x_2 + \ \ldots \ \beta_p x_p\right),$$

where t represents the survival time; h_0 is the baseline hazard, which is the hazard rate where all covariates are equal to 0; $h(t)$ is the hazard function determined by the set of p covariates $\left(x_1, x_2, \ \ldots \ x_p\right)$; and the coefficients $\left(\beta_1, \beta_2, \ \ldots \ \beta_p\right)$ measure the impact of the covariates.

The quantities $exp\left(\beta_i\right)$ are referred to as hazard ratios. Hazard ratios can be interpreted as follows:

- Hazard ratio = 1: no effect
- Hazard ratio < 1: reduction in the hazard
- Hazard ratio > 1: increase in the hazard

An underlying assumption of the model is the proportional hazards assumption. The proportional hazards assumption states that the hazard rate for a given variable remains constant over time, regardless of the levels of different predictors or covariates. Where the proportional hazards assumption is not violated, one can identify variables that have a constant effect on the hazard (chance of graduate employment). Where the assumption is violated, the model can be reestimated using time varying covariates, allowing one to differentiate between constant and time varying predictors.

5 | Results

5.1 | Survival Analysis

The estimated survival functions by institution are presented in Figure 1.

Figure 1 illustrates a clear and consistent rank order with respect to the time to graduate employment of new graduates 15 months after graduating. Graduates from Russell Group universities experience a lower probability of unemployment (faster time to graduate employment) than both pre- and post-1992 graduates, with graduates of pre-1992 universities experiencing a lower probability of unemployment relative to post-92 graduates.

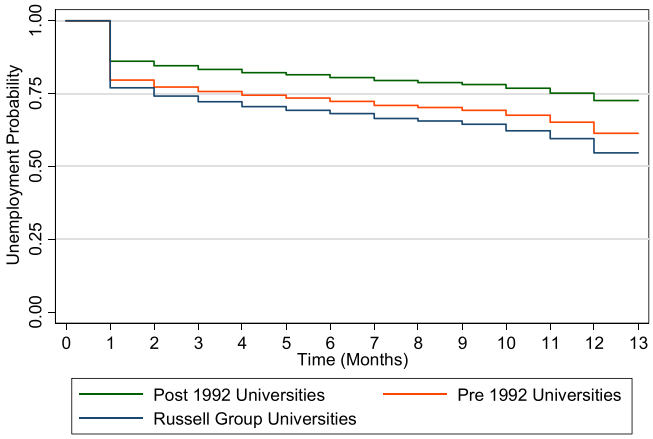

FIGURE 1 | University category survival estimates (graduate jobs). [Colour figure can be viewed at wileyonlinelibrary.com]

As discussed in Section 4.1, the manner of how the months in employment variable is derived has implications for the interpretation of the X axis of Figure 1. Although each increment of the X axis greater than 1 captures a month-to-month change in the probability of unemployment, the first interval, between 0 and 1, collectively captures the probability of unemployment in the first 3 months after graduation. As previously discussed, this is a consequence of the months in employment variable (empmonth) only being quantified for those in employment for less than 12 months. Observations employed for between 12 and 15 months are allocated to a simple binary category via the aforementioned 'empyear' variable. Presenting the data in this manner is the only appropriate course of action to conduct the analysis on the maximum number of eligible observations, given the limitations in the data where the specific number of months in employment for those employed for 12–15 months after graduation is simply not present within the data.

Table 2 summarizes the log rank test for equality of survival functions. This test determines whether the respective survival functions are equal. A significant test statistic indicates that the functions are not equal and, therefore, the difference in the survival functions of graduates from different universities are statistically significant.

The survival functions illustrated in Figure 1 present the spectrum of experiences of graduates seeking graduate level employment. Although a rank ordering pattern can be observed, the most striking result is that regardless of institution, graduates employed in graduate level employment 15 months after graduation are in the minority. This does not speak to their ability to attain graduate level employment in the future, but it is somewhat concerning that even among graduates from the most prestigious universities, that fewer than 50% are employed in occupations requiring a degree. Educated individuals encountering job market saturation such that they are employed in jobs for which they are over-educated has been shown to be a cause of anxiety, frustration

TABLE 2 | Log rank test for equality of survival functions by institution (graduate jobs only).

Group	Events observed	Events expected
Russell Group universities	20,959	28,683.96
Pre-1992 universities	13,993	12,828.19
Post-1992 universities	27,023	20,462.85
Total	61,975	61,975
$Chi^2(2)$	4819.94	
$Pr > chi^2$	0.0000	

Note: A significant test statistic (p value < 0.05) indicates that the survival functions are statistically different from each other.

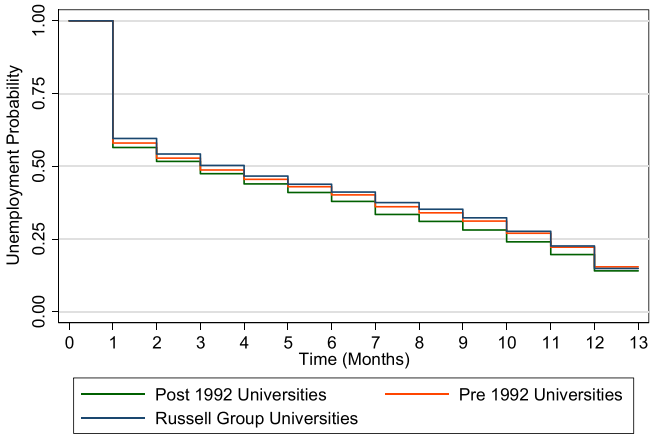

FIGURE 2 | University category survival estimates (all jobs). [Colour figure can be viewed at wileyonlinelibrary.com]

and depression (Muntaner et al. 2012; Bracke, Pattyn, and von dem Knesebeck 2013)

The survival functions also demonstrate the significance of the first 3 months after graduation captured by the first interval between 0 and 1 in Figure 1. Across all categories of university, this interval illustrates the most substantial change in employment compared to any other equivalent time frame in the 15 months after graduation. The change in the probability of employment during this time is in part greater than other intervals, as it combines three time periods, rather than one. With that being said, even if one were to crudely average the change in employment rate in period one, it would appear to be greater than the change in each individual month after period 1, where the month-to-month change, across all universities is relatively modest. Given the significance of the change in employment probably between period 0 and 1, one might conclude that if a prospective graduate's objective is immediate graduate level employment, then their greatest chance of attaining this goal is in the immediate time frame after graduation. It is possible that such individuals will have been engaged in the recruitment process during their final year at university so as to make this swift transition from university into employment in this relatively short period after graduation. It may be that failure to engage with the process of job search while in one's final year of university might resign a graduate to a longer time to employment as was demonstrated by Salas-Velasco (2007).

For the purpose of comparison, a second set of survival functions (Figure 2) was also estimated to include all job searching graduates, regardless of their occupation, that is, including all jobs, not just those requiring a degree as was presented in Figure 1.

As with the estimates from Figure 1, a log rank test for the equality of the survival functions was calculated for the estimates presented in Figure 2. The test, presented in Table 3, produced a significant test statistic. This indicates that the survival functions presented in Figure 2 are statistically different from each other.

When considering all jobs, regardless of whether or not a degree is required, the survival functions of Russell Group and post-1992 universities switch places when compared to the survival estimates presented in Figure 1. While attending a Russell Group university appears to yield a shorter time to graduate level employment, graduates of post-1992 universities appear to have a shorter time to general employment when compared to both pre--1992 and Russell Group universities. This may be a function of labour market preferences across different groups of graduates. Those attending higher ranked Russell Group universities may prioritise the search for graduate level work and may be more inclined to forgo employment in a nongraduate job, thereby resulting in the longer time to employment when considering all jobs. This finding is analogous to that of Sciulli and Signorelli (2011), who found longer time to employment for better performing graduates. Post-1992 graduates, who generally arrive at university with less impressive academic transcripts from secondary school, and who attend generally lower ranked post-1992 universities, may be less selective in their labour market search after graduation.

TABLE 3 | Log rank test for equality of survival functions by institution (all jobs).

Group	Events observed	Events expected
Russell Group universities	62,506	60,530.31
Pre-1992 universities	29,791	30,361.03
Post-1992 universities	49,733	51,138.66
Total	142,030	142,030
$Chi^2(2)$	157.24	
$Pr > chi^2$	0.0000	

Note: A significant test statistic (p value < 0.05) indicates that the survival functions are statistically different from each other.

Cumulatively, the comparison between Figures 1 and 2 reveals very different employment probabilities and times to

employment between institutions depending on what kind of job a graduate is applying for. Although the vast majority of graduates, regardless of university, will be in some form of employment 15 months after graduation, a far smaller proportion of the graduate population will gain access to graduate level employment in this same time period.

5.2 | Cox Regression

Having identified differences in time to employment by university and assuming graduate level employment is the most desirable outcome for new graduates seeking employment, then it follows that developing an understanding of the factors that contribute to minimising the time to employment should be of great interest to both current and prospective graduates. Table 4 presents the results of two variations of a Cox regression estimating the effects of a series of aforementioned variables on the hazard rate associated with the time to graduate employment.

The results presented in Column 1 are those of a base version of the model that is inclusive of all explanatory variables outlined within the data section of this paper. Although the model identified a series of significant explanatory variables, the model violates the previously mentioned proportional hazards assumption. This was identified using the global proportional hazard test, whereby a significant test statistic indicates that the model violates the assumption. Stata allows for an optional detailed version of the test, which revealed the assumption to be violated by the following variables: first job, degree subject, degree classification category, university category and male. The solution in such instances involves reestimating the model, whereby those variables that violate the assumption are interacted with respect to time. This allows one to differentiate between variables that conform with the proportional hazards assumption and thereby yield a constant effect on the hazard over time, compared to those that violated the proportion hazards assumption. Such variables inherently have a variable effect on the hazard rate over time. The time varying version of the model interacts these variables with time to estimate their baseline effect at $t = 1$ and their subsequent effect on the hazard rate in each time period thereafter. The results of the reestimated model presented in Column 2.

Column 2 results can be separated to distinguish between the effects of the previously described time varying covariates, and the effects of those variables that did not violate the proportional hazards assumption, indicating the hazard rate for these terms remains constant over the duration of the analysis. Time invariant effects include those related to the private school status, parental degree status, UCAS points and ethnicity. An increase in UCAS points is shown to be associated with an increased hazard rate (shorter time to employment). Although one may expect UCAS points of a graduate to be irrelevant given they relate to secondary school attainment, this finding is consistent with Lalley and McInally (2023), who demonstrated the role of UCAS points in explaining salary difference among new, high achieving graduates in the United Kingdom. Given that UCAS points in part explain differences in salaries, it is not unexpected that those who perform better in secondary school might be preferred candidates once they graduate, thereby resulting is a

TABLE 4 | Cox regression.

	(1) Base	(2) Base model with time varying covariates
Private school	1.093*** (0.013)	1.127*** (0.013)
Parent with a degree	1.039*** (0.008)	1.058*** (0.008)
UCAS points—200–275	0 (.)	0 (.)
UCAS points—276–350	1.040** (0.014)	1.117*** (0.015)
UCAS points—351–425	1.073*** (0.015)	1.225*** (0.017)
UCAS points—426–500	1.158*** (0.018)	1.395*** (0.021)
UCAS points—501–575	1.194*** (0.022)	1.473*** (0.026)
White	1.023* (0.010)	1.032** (0.010)
STEM	0 (.)	
Arts and humanities	0.677*** (0.006)	
Business and law	0.958*** (0.010)	
First job	1.252*** (0.012)	
Less than a 2.1 classification	0 (.)	
2.1 classification	1.786*** (0.026)	
1st class classification	2.341*** (0.036)	
Post-1992 university	0 (.)	
Pre-1992 university	1.366*** (0.015)	
Russell Group	1.559*** (0.017)	
Male	1.063*** (0.008)	
Time varying covariates		
First job		1.108*** (0.001)

(Continues)

TABLE 4 | (Continued)

Time varying covariates		
STEM		0 (.)
Arts and humanities		0.961*** (0.001)
Business and law		0.992*** (0.001)
Less than a 2.1 classification		0 (.)
2.1 classification		1.079*** (0.002)
1st class classification		1.097*** (0.002)
Post-1992 university		0 (.)
Pre-1992 university		1.037*** (0.001)
Russell Group		1.055*** (0.001)
Male		0.993*** (0.001)
Prob > chi^2	0.0000	0.0000
N	172,392	172,392
Global Proportional Hazard Test	$chi^2(15) = 6555.09$ 0.0000	N/A

Note: Coefficients expressed as hazard ratios. Standard errors in parentheses.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

shorter time to employment. The contribution of the degree status of a parent was also found to yield a positive effect on the hazard rate. This effect could a be a consequence of a myriad of different influences, including a parent who has graduated, having gone through the process previously, may be able to better advise their child on how to attain a graduate job. It could also be possible that a parent with a degree who is likely to be employed within a graduate level role themselves may be able to directly or indirectly influence the duration of their offspring's job search through networking effects that the parent has established over their career (Abrahams 2017). Similar effects are found to exist with respect to attending private school and the influence on employment given the networks that attending such institutions provides for its alumni (Green et al. 2015). Both parent degree status and private school status were also significant determinants as identified by Biggeri, Bini, and Grilli (2001).

In contrast to the variables discussed in the previous paragraph, the remaining estimates in Column 2 represent those of time varying covariates. Each of the time-varying covariates is statistically significant, with all but two (degree subject and male) taking a value greater than 1. A hazard ratio greater than 1 increases the hazard rate thereby decreasing the time to graduate employment. For the purpose of interpretation, the hazard ratios for these variables presented in Column 2 represent the hazard at $t = 1$, with the hazard ratio exponentially increasing for each subsequent point in time thereafter if the hazard ratio is greater than 1 and decreasing exponentially in each time period thereafter where the hazard ratio is less than 1. For example, the hazard ratio of attending a Russell Group university relative to a post-1992 university at $t = 1$ is 1.055, meaning attending a Russell Group university compared to a post-1992 university, increases the hazard rate and decreases the time to employment, and that this effect grows exponentially in each month that follows. An equivalent interpretation aligns to the effects of attending a pre-1992 university,[16] holding a 1st class or 2.1 classification[17] and your current job being your first job after since graduating.

The exponential growth associated with the hazard ratios for institution and classification may be a function of growing scarcity of observations who hold these seemingly highly demanded traits. For if at $t = 1$, observations possessing one or more of these traits are more likely to be employed at $t = 1$ than those who do not, and then, graduates with such highly valued traits will be less abundant in $t = 2$, $t = 3$, $t = 4$ and so on. The preferences of employers for such individuals will not have changed, but given that there are now fewer graduates who meet these criteria, they may become even more favoured relative to other graduates, with the effect growing exponentially as graduates holding these high value traits become more and more scarce with each passing month.

The findings relating to the variable first job indicate that those who have not had previous employment since they graduated are more likely to be employed at $t = 1$, again with the effect increasing exponentially with each passing month. This result is open to interpretation, but there are two hypotheses one would wish to propose. The first can be considered a supply side hypothesis and may reflect the different behaviour of a graduate who has been employed since graduating, versus one who has not. The employed graduate, having already obtained work, may not be intensely engaging in job search to the same extent as the unemployed graduate. They may be comfortable in their current job, and their ability to apply for graduate jobs is compromised by the time they spend working. The lower degree of intensity with which they approach job search will likely result in fewer applications, fewer interviews and a subsequent extended time before which they attain graduate level employment. Conversely, the graduate who has not attained employment since graduating is more likely to have more time and energy with which to dedicate themselves towards searching for a job. They may also be faced with the potential added financial and social pressures associated with being unemployed further accelerating their efforts. This hypothesis is supported by the findings of Salas-Velasco (2007), who highlight intensity of job search as a determinant in minimising time to employment.

A complementary hypothesis may be explained from the demand side. Employers may treat applicants differently based on employment history since graduating. Those who have had prior employment since graduating may be involved in employment that is not looked upon favourably by the employer, with respect to its relevance to the job on offer. A candidate who has had prior employment since graduating may have had multiple jobs

or been dismissed from their previous role. A high job turnover rate or previously losing one's job since graduating may convey a negative signal to graduate employers resulting in such individuals experiencing a longer time to graduate employment. This hypothesis is somewhat supported by Schmillen and Umkehrer (2017), who find that unemployment early in one's career has a negative effect on employability in the future, with more pronounced effects for those with more frequent periods of unemployment. Whereas Schmillen and Umkehrer's findings apply to analysis conducted over several years, employers may evaluate new graduates through the same lens but over a shorter period. Although candidates with no prior work experience since graduating may not hold any special benefits for the employer, they may carry a less substantial scarring effect than those who have been previously been employed and then become unemployed since graduating.

In contrast to the variables discussed previously, the hazard ratio for the variable for male is less than 1. This indicates that being male decreases the hazard rate, thereby increasing the survival times, resulting in a longer time to employment. This finding is consistent with the decline in attainment across all levels of education in the United Kingdom of males relative to females. Females outperform males at every stage of education in the United Kingdom (Carroll 2023). With employers seeking out the most qualified candidates, then it is to be expected that if females outperform males, then males will be more likely to spend a longer time searching for a job. The increased preference for female candidates may also be a function of a shift by employers to better balance their workforce by attempting to achieve specific targets for female representation at all levels of an organisation, including within their graduate cohorts. This finding should not be interpreted as career long issue for males as over the span of a career males tend to experience better labour market outcomes relative to females. Hazard ratios for Arts and Humanities, and Business and Law graduates were estimated relative to STEM graduates, with both taking values of less than 1. This finding reflects the relative value of different disciplines, where different degrees carry different returns with STEM degrees consistently associated with higher probabilities of employment relative to all other degrees (Belfield et al. 2018).

6 | Discussion and Conclusion

Using two waves of the UK's Graduate Outcomes survey, survival functions are calculated to estimate the time to employment for new graduates in the United Kingdom in the 15 months immediately following their graduation. Statistically significant differences in survival functions based on category of university are identified. Following this, variations of a Cox Proportional Hazard model were estimated to identify determinants that have a statistically significant effect on time to employment.

The estimated survival functions presented in Figure 1 highlight differences in time to employment that potentially indicate an evaluation of the graduate labour market from employers based on some form of rank order system, where graduates of higher ranking categories of universities are employed in graduate jobs at a faster rate relative to lower ranked institutions. While teaching largely similar subjects, the different groups of universities can consist of very different cohorts that can be defined by significant differences in observable academic ability upon entry, based on results of secondary school examinations. That Russell Group universities, which normally have the highest entry standards and therefore consist of a largely high academic ability student population, end up producing graduates who have a shorter time to employment relative to competing universities with largely lower entry standards, which is unsurprising assuming graduate employers wish to hire those who appear to be the most capable graduates.

The results imply a clear preference among employers for graduates holding one or more of a series of key characteristics. It is understandable why employers would desire graduates with high grades, good classifications, from high-ranking universities and who have completed subjects defined by their academic rigour and transferable skills. What is more revealing about the findings is not the benefits for those who hold meet such criteria but rather the implications for those who do not and the potential consequences for their pursuit of graduate level employment. This concern is only intensified upon review of Figure 1, which demonstrates that even a majority of graduates from the UK's highest ranking institutions, struggle to attain graduate level employment 15 months after graduation. If the UK's strongest graduates will struggle, then those from lower ranked institutions who are lacking in certain characteristics identified in the Cox regression may find their chances of gaining graduate employment in the 15 months after graduation to be severely constrained. What then happens to the graduates specifically from the sample analysed is unknown, but given they are not employed in graduate level work, the potential implications of this outcome are quite clear. Their likelihood of being employed in nongraduate work increases; therefore, their chances of being overeducated for their occupation are also high, with overeducation leading to a variety of poor professional and personal outcomes that can persist throughout a graduate's career.

The findings also revealed the influence of factors outside of a graduate's control and their effect on their time to employment. Specifically, one's parental degree status and whether or not the graduate was afforded the opportunity to attend a private secondary school positively impact a graduate's time to employment. That those who might be the first in their family to attend university, or who may not have benefitted from a private education are at a disadvantage to those that did, may have negative effects on the ability of education to improve social mobility, even where such individuals have otherwise performed well in their own academic pursuits.

Interventions at a national level to address the possible negative consequences associated with the early career graduate labour market seem both implausible and inappropriate, as what is observed is simply a function of employers' demand for high quality graduates. This represents the optimal response from employers and should not be subject to some form of enforced compromise. As demand side solutions are not viable, policy implications of the findings are likely restricted to supply side interventions. With results indicating that greater than 50% of all graduates are not employed in graduate jobs a year after graduation, the government and the general population may question the decision to continue to invest in students and universities at the present-day

rate. Increased tuition fees, restrictions on student numbers and a decrease in funding of so-called 'low value' degrees are all policies that have been put forth by government ministers in recent years. One would however caution against such an overzealous response to the findings presented in this paper. That the value of a degree does not immediately manifest in the form of a graduate level job does not defeat the purpose of higher education, where the lifetime benefits of higher education, both pecuniary and otherwise, remain. Furthermore, any policy that might aim to address the negative findings presented in this paper by restricting access to higher education must also consider what alternative education and training opportunities would need to be provided to those no longer attending university, which would carry the equivalent value of a degree, both in terms of private and social returns.

The policy implications of the findings may therefore not present as a catalyst for significant first-best government intervention but instead potentially in the form of a public information campaign to further educate both current and prospective students on the implications of their educational decisions and performance, and the consequences this may have on their experience in the early career graduate labour market. This process would likely be best administered at a governmental level, with the support of academic research, such as the kind presented in this paper, to provide information on the returns to education. This would be free of the institutional marketing one commonly finds in a university prospectus where there is an incentive for universities to present an overly optimistic view of the value of a degree. Public information based on the findings may be useful to a prospective student on the fringes of considering one subject field or university versus another. If one of their objectives from studying at university is to maximise immediate returns upon graduation, then the findings presented may shift their preference towards the more valuable fields and institutions identified within the results. This option will be limited though, as a portion of the prospective student population will, either by preference, ability, circumstance or some combination of all three, be unable to migrate so easily across subject fields and institutions when applying to university. What can such students take from the findings? One would argue at the very least, the findings provide greater information of the challenges they may face, prior to commencing their studies, ensuring that as best as possible, prospective students are informed of what may lie ahead after graduation, given the choices they make today and throughout their time at university. For current students who have already commenced their studies, the findings when compared relative to their own status, especially with respect to institution, subject and projected degree class, may highlight a need to refocus their efforts on their education, should they be falling short of the criterion that will aid their transition to the labour market after graduating. Although they may not be able to change their institution or subject, they can at the very least aim to achieve a higher classification to boost their chances on the graduate labour market.

Limitations of the analysis are largely a function of the data, both with respect to the construction of some variables included, and the absence of other variables that may be of significance in explaining differences in time to employment. In the first instance, the results only relate to the first 15 months after graduation. This paper can make no claims about lifetime performance on the job market. The 'empmonth' variable is limited in its ability to capture employment in excess of 1 year, leading to the compromise when constructing the time variable used in the analysis. Absent from the data is any information on a graduates' pregraduation work experience, particularly whether or not a graduate has completed an internship and work placemen, or has worked for their eventual graduate employer prior to graduating, all of which may be a factor when applying for a graduate job, and as such may have an effect on time to employment. The potential significance of such factors is evident from a review of the findings of the 2018 and 2019 Institute of Student Employers surveys (ISE 2018, 2019), which indicate that 66% of respondents hired their interns full time in 2018, with the value increasing to 70% in 2019. Surveyed employers also indicated that 54% hired their year-long placement students with the proportion remaining constant in 2018 and 2019. Such findings indicate the likely significance of prior work experience in impacting time to employment, where one might anticipate such individuals to be hired not long after they have graduated. Furthermore, absent from the data is the existence of a suitable instrument to control for sample selection. As previously mentioned, a portion of the sample have forgone searching for a job after graduation to pursue a gap year, voluntary work or a variety of other commitments. This decision is unlikely to be random, and a Weibull regression could be utilised in order estimate a selection equation. This is however dependent on the availability of an instrument that affects the decision to start searching for a job but does not affect time to employment. No such variable exists within the data set. A final potential limitation may exist based on the assumption that a low time to employment is the optimal outcome. The findings do not and cannot make claims that earlier employment after graduation carries with it any greater level of satisfaction or happiness within the job, relative to those employed later after graduation.

Further research in this area could benefit from the use of further years of the Graduate Outcomes Survey. The analysis presented within this paper was limited to only two waves that were available at the time this research was conducted. With greater waves of the survey and potential improvements in the data collected, there may be opportunities to address some of the limitations raised within this paper. It should be noted though that analysis of the Graduate Outcomes Survey in the years immediately following that which is analysed within this paper may be uniquely compromised due to the effects of the Covid-19 pandemic, where both graduate recruitment and student assessment were adversely affected by the pandemic.

Data Availability Statement

The data that support the findings of this study are available from JISC Data Anlytics. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from https://www.jisc.ac.uk/data-analytics with the permission of JISC Data Anlytics.

Endnotes

[1] A graduate is defined as being a student who has graduated from an undergraduate degree programme. Any reference to a graduate or graduates from this point onwards refers to such individuals. A graduate should not be confused with a graduate student, who is commonly understood to be studying or have completed a graduate (postgraduate) degree.

[2] Graduate employment is defined as that which requires an undergraduate degree, either in general or within a specific field, in order to be considered as a potential candidate by the employer. A further explanation on how this definition is integrated into the analysis presented in this paper is included in Section 4.1.

[3] Scottish highers in Scotland and A-levels in England, Wales and Northern Ireland.

[4] Grading completed by external examiners.

[5] Universities in the United Kingdom do not apply the liberal arts approach common in the United States. Prospective students instead apply to study a specific degree subject, with each subject requiring attainment of certain grades at secondary school to be eligible for application and entry to the degree.

[6] Although all Russell Group universities were established before 1992, they are not included among the pre-1992's category.

[7] The duration of undergraduate degrees in England, Wales and Northern Ireland is commonly 3 years.

[8] Undergraduate degrees in Scotland are 4 years long.

[9] An average grade of 70% or above will yield a first class, 60%–69% an upper second class, 50%–59% a lower second class and 40%–49% a third class.

[10] Undergraduate, Masters and PhD.

[11] Earlier research by Smith, McKnight, and Naylor (2000) used the Destination of Leavers of Higher Education (DLHE) survey (the predecessor to the Graduate Outcomes survey) to examine employment outcomes of graduates in the 6 months after graduation. It should be noted that this analysis was estimated using multilevel regressions rather than survival analysis. An analysis of either the DLHE or the Graduate Outcomes surveys does not appear to exist within the available literature.

[12] Descriptive statistics for both the survival analysis and salary estimation are presented in Table A1.

[13] Although all Russell Group universities were established before 1992, they are not included among the pre-1992's category.

[14] The degree subject variable consists of three categories: STEM, Arts and Humanities, and Business and Law. The decision to compress subjects into three broad categories was necessary given insufficient cell sizes when attempting to estimate the effects of degree subject using more narrow disciplines. This approach can therefore yield the aggregated effects of subject on time to employment among broad subject areas.

[15] The degree classification variable consists of three categories: first class, upper second class and less than upper second class, which captures respondents obtaining any classification below an upper second class. The decision to compress the final category is based on the first and upper second class representing the thresholds for consideration by most graduate employers. Classifications below this threshold, such as the lower second class, third class or unclassified degree, represent a small and declining proportion of all graduates and, given their general exclusion from graduate level jobs, did not exist in significant enough a sample sizes to be individually estimated within the Cox regressions

[16] Relative to a post-1992 university.

[17] Relative to a classification lower than a 2.1 classification

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Appendix A

TABLE A1 | Descriptive statistics

Variable	(1) Sample not engaged in job search frequency	(2) Sample not engaged in job search percentage	(3) Cox regression sample frequency	(4) Cox regression sample percentage
Employed	n/a	n/a	61,975	61.73%
Private school	9215	12.48%	19,578	11.36%
Parent with a degree	40,478	54.81%	90,400	52.44%
UCAS Points—200–275	11,612	15.72%	27,227	15.79%
UCAS Points—276–350	21,531	29.15%	51,618	29.94%
UCAS Points—351–425	20,687	28.01%	50,407	29.24%
UCAS Points—426–500	13,055	17.68%	29,159	16.91%
UCAS Points—501–575	6973	9.44%	13,981	8.11%
Russell Group	28,083	38.02%	59,545	34.54%
Pre-1992 university	16,868	22.84%	36,221	21.01%
Post-1992 university	28,907	39.14%	76,626	44.45%
First class	22,736	30.78%	53,687	31.14%
Upper second class	39,827	53.92%	92,734	53.79%
Lower second class or less	11,295	15.29%	25,971	15.07%
STEM	25,198	34.12%	54,579	31.66%
Arts and humanities	37,960	51.40%	85,053	49.34%
Business and law	10,700	14.49	32,760	19.00%
Male	34,115	46.19%	78,478	45.52%
White	51.948	70.33%	132,763	77.01%
First job	n/a	n/a	27,103	15.72%
Employment month—1	n/a	n/a	31,847	31.72%
Employment month—2	n/a	n/a	3683	3.67%
Employment month—3	n/a	n/a	2662	2.65%
Employment month—4	n/a	n/a	2304	2.29%
Employment month—5	n/a	n/a	1754	1.75%
Employment month—6	n/a	n/a	1689	1.68%
Employment month—7	n/a	n/a	2339	2.33%
Employment month—8	n/a	n/a	1209	1.20%
Employment month—9	n/a	n/a	1651	1.64%
Employment month—10	n/a	n/a	2925	2.91%
Employment month—11	n/a	n/a	3623	3.61%
Employment month—12	n/a	n/a	6289	6.26%