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An Application of the Gottschalk-Hansen Model to Young British Graduates between 2001-2010

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ABSTRACT

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There is an apparent inconsistency in the existing literature on graduate employment in the UK. While analyses of rates of return to graduates or graduate mark-ups show high returns, suggesting that demand has kept up with a rapidly rising supply of graduates, the literature on over-education suggests that many graduates are unable to find employment in graduate jobs and the proportion over-educated has risen over time. Using a simple supply and demand model applied to UK data that defines graduate jobs in terms of the proportion of graduates and/or the graduate earnings mark-up within occupations, we find that there has been a shift in the likelihood of young British university graduates being employed in non-graduate jobs in the recent years of our analysis. This finding is in contrast to existing studies.

JEL Classification: I2, J0, J3

Keywords: education, wages, graduates, mismatch

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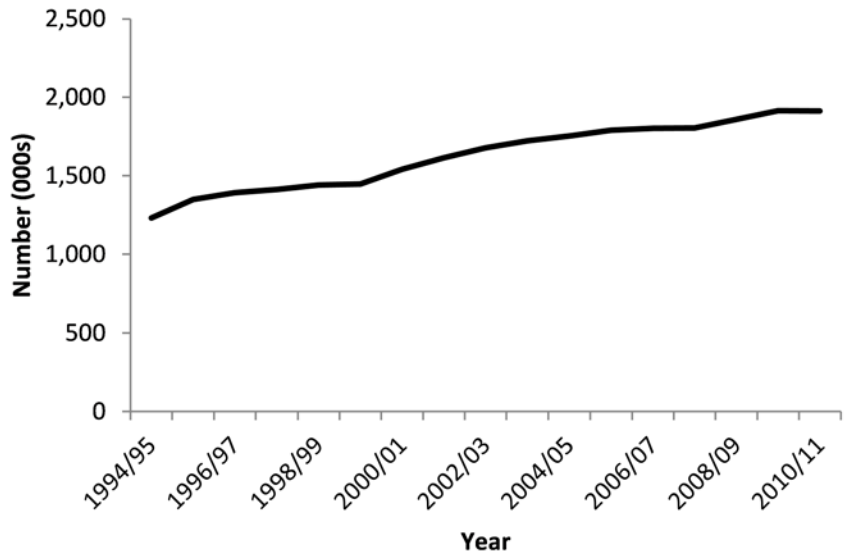
1. Introduction

There are two separate strands in the literature on the employment of graduates in the UK which at first sight seem inconsistent. First, there is a literature which attempts to estimate the returns to being a graduate relative to some base category, which is frequently taken to be those whose highest educational attainment is two or more A-Levels, and, therefore, qualified to enter higher education, but who for one reason or another chose not to do so (see for instance O'Leary and Sloane, 2005). This literature is motivated by the fact that the supply of graduates has risen rapidly in recent years. Elias and Purcell (2003) report that between 1990/91 and 2000/01 the number of male graduates increased by over a third and the number of female graduates almost doubled, and from Figure 1 we can clearly see that this trend has continued. Showing a time series from 1994/95 (the earliest year a consistent set of data are available) through 2001/02 to 2010/11 (the sample used in the empirical investigation that follows), the total number of enrolled undergraduate students in UK higher education institutions increased from 1.23 million, through 1.61 million in 2001/02, to 1.91 million. While the expansion in student numbers in the decade 2001/02 to 2010/11 has not been as great as the preceding decade, this still represents an increase of 187,615 undergraduates (or 11.61% of the 2001/02 stock). Measured from 1994/95, this represents 571,852 more undergraduates, an increase of 46.42%.

Figure 1
Total Number of Undergraduate Students Enrolled in UK Higher Education Institutions, 1994/95-2010/11



Source: Higher Educations Statistics Agency

Against the backdrop of such a rapid increase in supply, we would expect, *ceteris paribus*, a downward influence to be exerted on the graduate pay premium. However, various studies such as Elias and Purcell (2004) and Walker and Zhu (2008) suggest that graduate earnings have held up remarkably well and the graduate pay premium remains high by international standards. This is consistent with the demand for graduates rising in line with the increased supply. This has been confirmed by more recent studies such as Walker and Zhu (2011) who analyse returns for the UK up to 2009 and by O'Leary and Sloane (2011) who, however, counsel that returns for the most recent cohort who graduated after much of the recent expansion of higher education in the UK had been completed had moderated.

The second strand is the literature on over-education, which suggests that a substantial proportion of the working population is mismatched in the sense that individuals have higher qualifications than are necessary either to obtain or perform their current job. Thus, Felstead *et al*. (2007) estimated that for the whole working population the proportion over-educated rose from 30% in 1986 to 40% in 2006, while the proportion undereducated fell from 18% to 14%. The extent of over-education tended on the whole to be higher at lower levels of qualifications, with degree level over-education rising from 20% in 1986 to 30% in 2006 according to their data. Further, there is evidence that much of the over-education is a long-run phenomenon (see Sloane, Battu and Seaman, 1999 and Battu, Belfield and Sloane, 1999). This has led some to claim that the supply of graduates is outstripping the demand for them and thus that the expansion of higher education has been overdone.

Interpretation of the concept of over-education is not, however, straightforward. Most studies are based on the so-called subjective measure derived from employees' responses to questions on the level of education required either to obtain or do their job. For some jobs a minimum level of education may be specified and a respondent with a higher level of education than the minimum may respond negatively to such a question, implying that he or she is over-educated, though individuals with a higher level of qualifications than the minimum may progress faster in the job. Alternatively, educational requirements may be rising over time and be higher now than when the individual was appointed in the past. Another possibility is that the individual is less able than many of those with the same level of qualifications and was unable to obtain a job matched with that level of qualifications. The current job might, however, match his or her level of skills and abilities.

Some authors distinguish between different types of over-education by sub-classification. Thus, Chevalier (2003) adopts a measure of over-education which combines occupations and satisfaction

with the job match. Hence, there are three categories of graduate according to this classification: those who are matched in a graduate occupation; those who are not in a graduate occupation but who are satisfied with the match (`apparently' over-educated); and those who are not in a graduate occupation and are dissatisfied with the match (`genuinely' over-educated). Green and Zhu (2010) distinguish between real over-qualification and formal over-qualification according to whether or not over-qualification is accompanied by under-utilisation of skills. Data from the British Skills Survey reveal that real over-qualification is associated with greater wage penalties than formal over-qualification and, unlike formal over-qualification, is associated with job dissatisfaction. While formal over-qualification has increased over time, real over-qualification has been steady or rising only slowly. While the concept of over-education and skill mismatch is clearly a complex and multi-faceted issue, the approach adopted in our present analysis avoids these ambiguities.

Similar questions have been raised in the US with the claim made that college-educated workers are increasingly likely to be in non-college occupations. Gottschalk and Hansen (2003) challenged this assertion by developing a simple yet appealing theoretical framework that modelled the demand and supply conditions in the college graduate and non-graduate labour markets. Their model classifies occupations as graduate or non-graduate on a different basis. Specifically, an occupation is deemed to be a graduate occupation if it fulfils either of two conditions: first that 90% or more of workers in that occupation are graduates or second, failing this, that there is a significant pay premium to being a graduate of at least 10%. Where neither condition applies occupations are deemed to be non-graduate. Gottschalk and Hansen note that there has been growing wage inequality in the US (as is also the case in the UK) and this was true for both college and non-college educated workers. Thus, it is possible for college-educated workers to obtain a higher wage than they could in the graduate sector if they obtain a job at the top of the pay distribution in the non-graduate sector. Equally productive workers can be found in both graduate and non-graduate jobs as long as there is heterogeneity in preferences.

Using US data from 1983 to 1996, they showed that the proportion of college-educated workers in non-college occupations declined over this period, a result which stands “in stark contrast to those in previous studies” (page 450). This result is consistent with the substantial increase in the college wage premium observed over the same period. These findings are important for two reasons. First, they go against the perceived doctrine that expansion of higher education leads to labour market mismatch. Importantly, their methodology allowed for the classification of jobs into college or non-college to vary over time, a crucial consideration during times of change where the nature of jobs is

changing, whether that be driven by exogenous considerations or by the abilities of the workers now performing these tasks. Second, it provides support for the skill-biased technological change hypothesis, where the conclusion would be that ever increasing numbers of graduates are needed to fill high-skill (graduate) jobs brought about by technological change. In an analysis of the labour market in Portugal over a comparable period (1986-1999), Cardoso (2007) found remarkably similar results to those of Gottschalk and Hansen for the US.

The aim of this current paper is to therefore apply the framework of Gottschalk and Hansen to Britain and examine the early career outcomes of graduates whose career choices and labour market outcomes will be most keenly affected by growth in graduate supply. This will be done using the UK Labour Force Survey, a large scale micro dataset, over the years 2001 to 2010.

2. Model

The Gottschalk and Hansen model examines supply and demand conditions for both graduate and non-graduate workers. Considering first the demand side, assume firms belong to either sector 1 (the graduate sector) or sector 2 (the non-graduate sector). Firms in each sector produce output (Q) using capital (K) and labour (L) inputs according to the following production functions:

$$Q_1 = f_1 (K_{1,} \beta_{1g} L_{1g} + \beta_{1n} L_{1n}) \quad [1]$$

$$Q_2 = f_2 (K_{2,} \beta_{2g} L_{2g} + \beta_{2n} L_{2n}) \quad [2]$$

where equation [1] refers to sector 1, equation [2] refers to sector 2 and the subscripts g and n denote graduate and non-graduate workers respectively. The number of graduate workers employed in each sector is described by L_{sg} where *s* denotes the sector and is equal to either 1 or 2, while L_{sn} is equal to the number of non-graduates employed in each sector. Both types of labour are assumed to be perfect substitutes,[1] although the efficiency of labour, denoted by β, is likely to vary with graduates more productive in the graduate sector. We then define sector 2 as the non-graduate sector by imposing the condition:

$$(\beta_{2g} / \beta_{2n}) < (\beta_{1g} / \beta_{1n}) \quad [3]$$

[1] This assumption seems reasonable in the context of the over-education literature when workers can and do move between sectors.

That is, we assume the productivity of graduates is more similar to that of non-graduates in sector 2 than in sector 1. Assuming profit maximisation and denoting the sectoral wage on offer as W_s, this will imply that the first order conditions are such that $W_{sg}=\beta_{sg}F'_s$ and $W_{sn}=\beta_{sn}F'_s$ and so the graduate pay premium in either sector will therefore be related to the efficiency parameter β as follows:

$$(W_{sg}/W_{sn}) = (\beta_{sg}/\beta_{sn}) \quad [4]$$

Given the assumption given in equation [3] that the efficiency of graduates and non-graduates is more similar in sector 2 (the non-graduate sector), this implies that the graduate wage premium will also be smaller in sector 2 than in sector 1. A non-graduate occupation can therefore be defined as one that offers a low graduate premium, which is true of those occupations in sector 2.

In terms of the supply side, workers are assumed to have heterogeneous preferences in their decision over which sector to work in and they will base this decision on the relative wage offered to them in each sector in addition to an exogenous parameter α. So, for example, the decision of graduates and non-graduates to choose employment in sector 1 will be formulated by the following considerations:

$$\ln L_{1g} = \alpha_g + \gamma_g \ln(W_{1g}/W_{2g}) \quad [5]$$

$$\ln L_{1n} = \alpha_n + \gamma_n \ln(W_{1n}/W_{2n}) \quad [6]$$

Thus, any rise in wages offered in sector 1 will encourage sector 2 workers to relocate and vice versa. The equilibrium condition, therefore, depends on the sector specific wage premium offered to graduates and the relative wage between sectors. Consequently, it will be optimal for some graduates to choose employment in the non-graduate sector. Any change in wages across sectors will then influence the allocation of graduates between the two sectors. For instance, if there is a skill-biased technological change in sector 1, then the efficiency parameter β_{1g} will increase as graduates become more productive in sector 1. This in turn increases the premium paid to graduates in sector 1 (see equation [4]), which encourages graduates in sector 2 to move there and so reduces the proportion of graduates in non-graduate occupations. Indeed, Gottschalk and Hansen find evidence to support this prediction using their US data up to 1996. In contrast, an increased supply of graduates may cause graduate workers to move from sector 1 to sector 2 if relative wages decrease more quickly in sector 1 than in sector 2. Under such a scenario, the observed graduate

premium will also fall and will lead to more graduates being employed in non-graduate jobs. We proceed to examine if this is the case for graduates in Britain over the course of the previous decade.

3. Data and Methodology

The first stage of the analysis is to classify occupations as graduate or non-graduate, which requires the estimation of wage equations to determine whether there is a significant graduate wage premium. The second stage is to determine whether the probability of graduates being employed in graduate or non-graduate jobs is changing over time. To do this we use individual level data from the UK Labour Force Survey (LFS) between 2001 and 2010. Such a time period represents the most contemporary time period over which a consistent occupational classification, namely on the basis of SOC 2000 codings, is available.[2] The LFS is a nationally-representative household survey that is administered by the UK Office for National Statistics and has been conducted on a quarterly basis since 1992. Over the course of the survey respondents are interviewed on five separate occasions, commencing in the quarter they enter the survey and then once more in each of the next subsequent four quarters. Following their fifth interview respondents are replaced by a new cohort. However, we ensure that we select respondents only once during their participation within the survey and we do this by selecting only those individuals who are in their first wave of interviews.

The sample consists of both men and women in full-time or part-time paid employment (the LFS does not collect earnings data for the self-employed) who are less than 35 years of age at time of interview[3] and who have obtained at least two or more A-Levels. This level of educational attainment is typically the entrance requirement set by universities and so the sample will contain both university graduates and those with the qualifications necessary to have attended university but who either chose not to do so or who failed to get a place. To ensure sufficiently large sample sizes to enable a greater number of occupational classifications to be isolated, each year of the data is merged with the previous and succeeding years.

We begin the analysis by classifying each occupation as either graduate or non-graduate. In aggregating occupations, those with at least 30 graduates and 30 non-graduates are classified as

[2] From 2011, the LFS classifies occupations as defined by SOC2014 codings. Immediately prior to 2001, SOC90 codings were used and while such coding frames are broadly comparable they cannot be combined to provide a wholly consistent set of occupational classifications.

[3] This age restriction is imposed to allow us to focus upon the early labour market experiences of graduates while at the same time retaining a sufficient number of observations to construct meaningful occupational classifications. With such a cut off at 35 years of age, 97.6% of graduates in the sample have 15 years or less potential labour market experience.

separate occupations, while those with less are merged with a related occupation.[4] In addition, occupations where 90% or more of employees are graduates are automatically classified as graduate occupations and are retained as unique 4-digit occupations, while those with 10% or less are classified as non-graduate occupations and similarly retained at the 4-digit level. By merging LFS years over a three-year moving window it is possible to isolate 134 occupational categories subject to these criteria. A full list of the occupations used is presented in Appendix Table A1.

Using the occupational classifications described above, a wage equation is estimated for each year and each occupation:

$$\text{Ln}Y_{it} = \rho_0 + \rho_1 X_{it} + \rho_2 \text{Degree}_{it} + \rho_3 \text{Higher}_{it} + \varepsilon_{it} \quad [7]$$

where Y_{it} are the gross hourly earnings (in constant January 2011 prices) of individual *i* in year *t*, X is a vector of personal and job related characteristics that influence earnings, full details of which are reported in Appendix Table A2, ε is a random error term and the terms in ρ are estimated regression coefficients. The two remaining controls, entered as dummy variables, denote educational attainment: the variable Degree takes the value of 1 if individual *i* has an undergraduate university degree, and 0 otherwise; the variable Higher takes the value of 1 if a degree holder has a higher degree (Masters or PhD), and 0 otherwise.[5] Within such an estimation framework, the estimated coefficient on ρ_2 will represent the premium that a (first) degree holder will enjoy over the excluded baseline of an individual with two or more A-levels and this estimated premium is subsequently used to determine whether an occupation is classified as graduate or non-graduate: where there is an insignificant premium or a coefficient less than 0.1 is estimated (or where 90% or more of employees are non-graduates), then such occupations are non-graduate; graduate occupations are defined as those with a significant degree coefficient of 0.1 or above (or where 90% or more of employees are graduates). This method allows the classification of occupations to change over the sample time period.

[4] Gottschalk and Hansen (2003) used a minimum cell count of 50 to classify occupations but we chose 30 to increase the number of occupations classified. However, when the analysis is repeated with an increased minimum of 50 graduates and non-graduates in each occupation the underlying trend discussed in the next section is unaltered.

[5] The data does not distinguish between types of higher degrees but of the sample of those who have a first degree, 22.5% also possess a postgraduate qualification.

4. Occupational Classification

Occupations are first classified as either graduate or non-graduate by estimating a wage regression separately for each occupation and each three-year window. While it is impractical to present all wage equation estimates by occupations and by year, Table 1 shows a pooled sample over all of these dimensions and the results presented here would accord with our *a priori* expectations: hourly earnings increase with potential labour market experience (though at a decreasing rate), and working on a part-time basis, being non-white, or being of a marital status other than married are all associated with lower earnings, *ceteris paribus*; there are large regional variations in wages, with the highest wages being found in London and the South East and the lowest in Wales; and earnings increase with higher educational qualifications.[6] Relative to the comparator group of someone whose highest educational qualification is two or more A-Levels, young (first degree) graduates receive a substantial hourly earnings premium (an estimated coefficient of 0.321). There is also an additional benefit derived from possessing a higher degree (0.085), over and above the substantial premium already identified for undergraduate degrees.

To provide some background detail on how degree returns have evolved over time, Figure 2 plots the trend in the estimated degree premium between 2001 and 2010. These are derived from an identical wage specification as used in Table 1 but estimated separately for each individual year. Over the ten year period the estimated degree premium declines marginally from 0.317 in 2001 to 0.303 in 2010, ranging from a high of 0.347 (in 2003) to a low of 0.276 (in 2008).[7] The magnitude of these estimates is in keeping with those of O'Leary and Sloane (2005), who also used LFS data for 1994 to 2003, and found a degree mark-up of around 20 per cent for men and 35 per cent for women. However, while such a recent trend confirms results for the UK by O'Leary and Sloane (2011), it is in contrast to the US findings of Gottschalk and Hansen (2003) and results for Portugal by Cardoso (2007), who found significantly increasing graduate wage returns over time. However, both of these papers analysed periods well before the beginning of the data used here, during which times there were also increasing educational returns in the UK (see for example Gosling, Machin and Meghir, 2000).

[6] The estimated returns for individual occupations also exhibited the same general pattern and there were no instances where degree premiums were negative. This might occur if graduates are effectively penalised in some occupations for having time out of the labour market. Gottschalk and Hansen, for instance, found significantly negative degree premiums for farm occupations and carpenters in their 1983 estimations.

[7] A simple linear regression of these estimates shows a marginally negative trend over time, with a slope parameter of -0.004 being statistically significant at the 95% confidence level.

Table 1
Wage Equation Estimates: LFS 2001q1-2010q4

	Coef	t-stat
Potential experience	0.091	72.68
Potential experience squared	-0.003	-44.31
Non-white	-0.015	-1.82
Marital status: married	(E)	
Marital status: single	-0.092	-26.20
Marital status: widowed/divorced/separated	-0.062	-5.28
Part-time work	-0.191	-32.78
Male	0.099	30.15
Region: North	(E)	
Region: Yorkshire and Humberside	0.014	1.61
Region: East Midlands	0.035	3.80
Region: East Anglia	0.024	2.15
Region: London and South East	0.221	28.55
Region: South West	0.035	3.92
Region: West Midlands	0.029	3.23
Region: North West	0.026	3.07
Region: Wales	-0.012	-1.21
Region: Scotland	0.044	5.06
Qualification: 2+ A-levels	(E)	
Qualification: degree	0.321	64.22
Qualification: higher degree	0.112	20.59
Constant	1.734	176.17
R^2	0.379	
Observations	44,759	

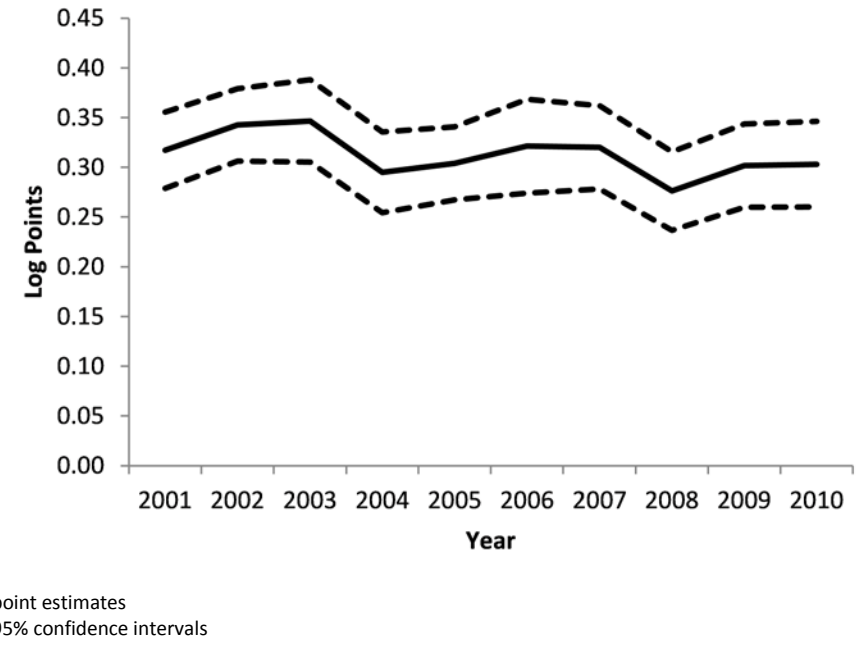
Notes: dependent variable is the log of hourly earnings; (E) denotes an excluded reference category: 11 controls for year of interview are included but not presented; t-statistics reported are calculated with heteroscedastic robust standard errors.

When each occupation is classified as graduate or non-graduate using the method outlined above, the distribution of occupations between the two designations by year is shown in Table 2. So, for example, in 2001-2003 59 occupations are classified as graduate occupations and 22 as non-graduate.[8] By 2008-2010, the number of graduate occupations has decreased to 53 and the number

[8] While a crucial feature of the framework adopted is that there is constancy in the occupational classifications, it still allows for a different number of occupations due to the 10%/90% threshold criteria. Thus, occupations such as SOC 1152 (office managers in financial institutions) are classified as graduate occupations in all years (to ensure a consistent classification system) and this occupation is observed in each and every year. However, SOC 2215 (dental practitioners) is also deemed to be a graduate occupation but it does not appear in 2 out of the eight years presented in Table 2. Thus, while the number of combined occupational categories from which degree premiums are derived is constant, the number of 4-digit occupations that are classified depending upon the proportion of graduates in them are not. There is therefore no need for the total number of occupations to sum to 132 in any year (which in itself represents an absolute maximum) and there is similarly no need for the total number of occupational groups to be equal across years.

of non-graduate occupations has increased to 30.[9] Thus, 75.56% of graduates are in jobs classified as graduate occupations in 2008-2010 as compared to 84.60% in 2001-2003. This increase in the number of graduate occupations is predominantly due to increasing wage premia within occupations. Classified solely on this criterion, the proportion of graduates in graduate jobs falls from 44.18% to 36.34% and the proportion of graduates in non-graduate jobs increases from 14.67% to 21.29%. While there are fluctuations around the estimates for each of the years, the same general pattern is routinely exhibited: it is occupations changing classification due to changes in the estimated degree premium that are the driver behind changes in the incidence of graduate occupations and the proportion of graduates within them.

Figure 2
Earnings Premiums and 95% Confidence Intervals for Graduates Relative to 2+ A-Levels by Year



Finally, it should also be noted that the occupational degree premium and the average graduate wage are positively but not necessarily strongly correlated. As shown in the bottom row of Table 2, while there is variation in the coefficient of correlation across years, it is typically between 0.41-0.55.

[9] Eight fewer occupations have an estimated degree premium less than 0.1 and an additional four see the degree premium rising to 0.1 or above. Of the occupations no longer deemed to be graduate in nature, quality and SOC 114 (customer care managers) and SOC 116 (managers in distribution, storage and retailing) are interesting examples but ones that are entirely consistent with the notion that it is not the descriptor of management that defines the nature of a job but rather the duties performed.

Table 2
Classification of Graduate and Non-Graduate Occupations:
LFS 2001-2003 – 2008-2010

	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010
No. of graduate occs	59	61	57	55	53	52	53	53
% of workers	84.60	89.32	82.42	81.19	77.43	71.25	74.10	75.56
No. of graduate occs (>90%)	34	33	33	33	33	33	33	32
% of workers	40.28	41.70	40.36	38.55	43.26	37.06	40.07	39.22
No. of graduate occs (>0.1*)	25	28	24	22	20	19	20	21
% of workers	44.18	48.12	42.06	42.64	34.17	34.19	34.03	36.34
No. of non-graduate occs	22	24	24	28	34	37	29	30
% of workers	15.54	10.18	17.58	18.81	22.57	28.75	25.90	24.44
No. of non-graduate occs (<10%)	11	16	13	14	18	20	13	15
% of workers	0.87	2.00	2.11	1.62	2.04	2.49	1.68	3.15
No. of non-graduate occs (<0.1*)	11	8	12	14	16	17	16	15
% of workers	14.67	8.18	15.47	17.19	20.53	26.26	24.22	21.29
Average earnings/ premium correlation	0.444	0.422	0.470	0.380	0.409	0.469	0.504	0.550

This reflects the fact that some occupations pay only a small graduate premium but offer relatively high wages to all workers, and vice versa.

5. The Probability of Graduate Employment

Having classified occupations as graduate or non-graduate, the probability that graduates will be employed in non-graduate occupations over time is estimated by merging all years of the data. Restricting the sample to graduates only and dropping the previously defined subscript *i* for convenience, equation [8] is estimated using a logit model:

$$\text{Prob}(N=1) = \theta_0 + \theta_1 \text{Time} + \theta_2 \text{Time}^2 + \theta_3 \text{Male} + \gamma_4 \text{Non-white} + \theta_5 \text{Parttime} + \theta_6 \text{Unemp} + \mu \qquad [8]$$

where N is equal to one if a graduate is employed in a non-graduate occupation (zero otherwise) and the quadratic in Time is a time trend (measured in years deviation from 2001) that captures changes in the probability of graduates being employed in non-graduate jobs over time. In addition, dummy variables to denote male graduates (Male), those from a non-white ethnic minority group (Non-white) and those employed on a part-time basis (Parttime) are also included. A measure of the unemployment rate (Unemp) is included to capture the influence of the macroeconomic environment and μ is a conventionally defined random error term.[10]

The marginal effects from the logit estimation are presented in Table 3 which contains a baseline specification (column 1) and a number of alternative specifications to provide robustness checks of the results. Starting with the baseline specification contained in column 1, the degree premium threshold for defining graduate occupations is taken at 0.1 which is deemed statistically significant at the 5% level.[11] While no significant difference is found in the likelihood of non-graduate employment along the lines of gender, those in part-time employment (0.023) and those from a non-white ethnic background (0.043) are more likely to be in a non-graduate job. Unemployment also exerts a positive influence (0.011), indicating that as unemployment rises young graduates are more likely to be found in non-graduate occupations, in line with prior expectations. Meanwhile, the marginal effect of the linear component of Time is significantly positive (0.122), indicating that the probability of a graduate being employed in a non-graduate occupation has increased, *ceteris paribus*, and the

[10] More specifically, the unemployment rate is entered as a gender-specific measure within the standard region of work. These unemployment rates are available from the Office for National Statistics and their inclusion is in contrast to both Gottschalk and Hansen (2003) and Cardoso (2007) who used simply gender-adjusted unemployment rates. As an alternative, age-adjusted unemployment rates by gender were also incorporated but these did not qualitatively affect the nature of the results reported here.

[11] These are the same threshold and significance level that has been adopted in all previous discussion up until this point.

Table 3
Marginal Effects of Graduate being in a Non-Graduate Occupation:
LFS 2001-2010

	column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8
threshold	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1
significance	5%	5%	5%	10%	1%	5%	5%	5%
time	0.122	0.118	0.099	0.120	0.157	0.121	0.086	0.010
	(18.30)	(17.78)	(16.57)	(18.67)	(23.12)	(17.27)	(12.27)	(8.20)
time2	-0.013	-0.014	-0.014	-0.014	-0.018	-0.013	-0.007	-0.005
	(-14.39)	(-15.30)	(16.19)	(-15.51)	(-19.20)	(-13.80)	(-7.72)	(-1.12)
time3	-	-	-	-	-	-	-	-0.001
								(-2.13)
male	0.011	0.045	0.080	-0.012	0.060	0.009	-0.029	0.006
	(0.76)	(2.82)	(5.33)	(-0.85)	(3.76)	(0.59)	(-1.96)	(0.42)
non-white	0.043	0.065	0.071	0.020	0.044	0.037	0.025	0.042
	(2.44)	(3.56)	(4.29)	(1.23)	(2.41)	(1.96)	(1.42)	(2.37)
parttime	0.023	0.123	0.055	0.009	0.034	-	0.028	0.024
	(1.64)	(8.47)	(4.10)	(0.65)	(2.27)		(1.89)	(1.65)
unemp	0.011	0.005	0.010	0.013	-0.002	0.010	0.004	0.013
	(2.08)	(1.00)	(1.87)	(2.64)	(-0.28)	(1.95)	(0.84)	(2.45)
aggregation controls	No	No	No	No	No	No	Yes	No
observations	12,835	12,835	12,835	12,835	12,835	11,445	12,835	12,835

Notes: column 1 – baseline specification; columns 2, 3, 4, 5 – threshold sensitivity; column 6 – part-time sensitivity; column 7 – aggregation sensitivity; column 8 – time trend sensitivity.

negative effect on the quadratic term of Time (-0.013) would imply that this increase has occurred at a diminishing rate. So, with the 134 occupations defined and a premium threshold of 0.1 marking the distinction between graduate and non-graduate jobs, it is clear that there has been a movement towards greater graduate employment in non-graduate occupations over the 10 year period between 2001 and 2010.

The remaining columns of Table 3 examine the sensitivity of these findings and in all instances the results are robust to specification and assumption changes. In columns 2 through 5 the threshold for denoting a graduate occupation is adjusted: in columns 2 and 3, the wage premium threshold is raised to 0.2 and 0.3 respectively (at the same 5% significance level); in columns 4 and 5, the significance level is changed to 10% and 1% respectively (using the 0.1 premium as in the baseline specification). For the first two of these (columns 2 and 3), all marginal effects are signed as previously but whereas the influence of gender was statistically insignificant it is now significant in both instances. In contrast, the marginal effect of unemployment fails to achieve significance when the graduate premium threshold is set at 0.2. Likewise, unemployment also has an insignificant effect when the significance level is raised to the 1% level (column 5) but tellingly across none of the columns does the sign and significance to the time trend change.

In column 6, the same baseline is used as in column 1 to investigate whether the results are sensitive to the exclusion of part-time workers (who are themselves more likely to be in non-graduate employment). The results would suggest that the inclusion or exclusion of such workers has little effect upon the estimated marginal effects. Column 7 addresses the issue of the grouping of occupations and again compares against the baseline results from column 1. As such, a series of additional controls are entered into the logit equation where 4-digit SOC codings have been merged.[12] While the estimated marginal effects on the included aggregation controls are significant and positive, indicating that the combining of 4-digit occupational categories increases the likelihood of it being defined as a non-graduate occupation, the direction and influence of the time trend is unaffected, even if some of the other controls are. For instance, the effect of gender is now significantly negative, implying that male graduates are less likely to be in a non-graduate occupation. The implication of this would be that men are therefore more likely to be in an occupation which is aggregated across 4-digit SOC codes. Finally, column 8 relaxes the assumption of

[12] The aggregation dummies used in column 7 refer to 4-digit occupations grouped within the same 3-digit occupation, 4-digit occupations grouped across 3-digit occupations, and an aggregation below the 3-digit level. These are all measured relative to the case where no aggregation has taken place.

a quadratic functional form on Time and includes a higher polynomial term. As before, the implications from the estimated marginal effects are unaltered.

As for the question of what is behind this reduced likelihood of graduate employment, Table 4 shows that with a fixed classification of graduate occupations there would be very little change in the proportion of graduates in graduate jobs. These counterfactual figures have been constructed from the actual distribution of graduates across occupations in each year but on the assumption that the assignment of occupations to graduate and non-graduate status is held constant as defined in 2001-2003. While there is a slight dip in the proportion of graduates in graduate occupations around the recessionary years of 2006-2009, the decline is very modest and certainly less than the figures discussed previously in Table 2. Outside of this, the counterfactual proportion in 2008-2010 has fallen to just 83.05% from 84.60% at the beginning of the time period.[13] This figure is over 7 percentage points higher than the proportion when the occupational classification is allowed to vary over time. Thus, it is not a changing distribution of graduates across occupations that drives our central finding, but rather it is the fall in the graduate premium. Over the decade from 2001 there has been an ever increasing number of university qualified entrants to the labour market and the returns available to such qualifications have been moderated for young graduates over this period.

7. Concluding Comments

This paper departs from earlier papers in the UK by classifying occupations as graduate and non-graduate on the basis of the graduate earnings premium. Using recent data available from the LFS between 2001 and 2010 to define a consistent set of occupations, it has been shown that young university graduates in Britain have been more likely to find employment in occupations which are classified as non-graduate and not designed for their education level. Such a finding is in contrast to the US findings of Gottschalk and Hansen (2003) and also with the findings of Cardoso (2007) for Portugal. To the extent that the continued expansion of the UK higher education sector has seen a moderation of the wage premiums available to university graduates in recent years, it would appear that, on average, graduates are to a greater extent taking up jobs that do not fully utilise their educational investment.

[13] As a check, the counterfactual simulation has also been calculated with the graduate premium threshold raised to 0.3. The results are shown in the bottom row of Table 4. While the proportion of graduates in non-graduates jobs naturally increases, the same flat trend between 2001-2010 is observed if the occupational classification is held constant.

Table 4
Counterfactual Estimation of Employment in Non-Graduate Jobs:
LFS 2001-2003 – 2008-2010

	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010
Predicted probability	84.60	89.32	82.42	81.19	77.43	71.25	74.10	75.56
Constant occupation structure – 0.1	84.60	84.24	84.07	84.29	84.69	82.90	82.09	83.05
Constant occupation structure – 0.3	52.15	53.93	52.71	50.32	54.27	48.94	51.10	51.93

Crucially, the classification of occupations is allowed to vary over time and this has important implications for observed trends in employment in non-graduate jobs. With a fixed measure of what graduate and non-graduate occupations are, there is no appreciable change in patterns of graduate employment over the sample period analysed here. However, recognising the fact that it is the nature of the job performed and the skill-set that graduates bring to the labour market allows for an introspective measure of the duties performed and a more accurate representation of whether skills are being utilised. Failure to do so paints an incomplete and misleading picture of the prospects facing some of the most recent graduates to leave university.

As a closing caveat, we might note that the trend identified in the previous analysis is only observed over the course of one decade and it may be that extending the time frame over a longer horizon allows an alternative conclusion to be drawn. The evidence presented here, coupled with the increasing phenomenon of over-education and the noted moderation in premiums for the most recent cohorts of graduates as identified in existing sources, is compelling though. There is certainly no evidence that the outcomes of young graduates in Britain have continued to improve in spite of the increasing supply of highly educated labour. However, this is not to say that graduates do not still receive substantial rewards for their skills. The graduate wage premium remains, on average, high and it is still the case that some three quarters of graduates will take up employment in graduate occupations where their skills and abilities are suitably utilised.

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Appendix Table A1
Aggregation of Occupations using SOC 2000 Codings

4-digit SOC	Occupation
111 (rem), 112	Corporate managers and senior officials; production managers
1114	Senior officials of special interest organisations
1131,1132	Financial managers and chartered secretaries; marketing and sales managers
1133,1134, 1135,1136, 1137	Purchasing managers; advertising and public relations managers; personnel, training and industrial relations managers; information and communication technology managers; research and development managers
114,1151	Quality and customer care managers; financial institution managers
1152	Office managers in financial institutions
116	Managers in distribution, storage and retailing
117,1181, 1184,1185, 123 (rem)	Protective service officers; hospital and health service managers; social services managers; residential and day care managers; managers and proprietors in other service industries
1182	Pharmacy managers
1211,1219, 122	Farm managers; managers in animal husbandry, forestry and fishing nec; managers and proprietors in hospitality and leisure services
1212	Natural environment and conservation managers
1233	Hairdressing and beauty salon managers and proprietors
2111,212	Chemists; engineering professionals
2112	Biological scientists and biochemists
2113	Physicists, geologists and meteorologists
213	Information and communication technology professionals
2212	Psychologists
2213	Pharmacists/pharmacologists
2214	Ophthalmic opticians
2215	Dental practitioners
2216	Veterinarians
2311	Higher education teaching professionals
2312	Further education teaching professionals
2313,2317, 2319, 244 (rem), 2451,323	Education officers, school inspectors; registrars and senior administrators of educational establishments; teaching professional nec; public service professionals; librarians; social welfare associate professionals
2314	Secondary education teaching professionals
2315	Primary and nursery education teaching professionals
2316	Special needs education teaching professionals
2321	Scientific researchers
2322,242	Social science researchers; business and statistical professionals
2329	Researchers nec
2411	Solicitors and lawyers, judges and coroners
2419	Legal professionals nec
2431	Architects
243 (rem), 312,3421	Architects, town planners, surveyors; draughtspersons and building inspectors; graphic designers
2443	Probation officers
2452	Archivists and curators

311	Science and engineering technicians
313	IT service delivery occupations
3212	Midwives
3214	Medical radiographers
3215	Chiropodists
321 (rem), 3229	Health associate professionals; therapists nec
3221	Physiotherapists
3222	Occupational therapists
3223	Speech and language therapists
3311	NCOs and other ranks in protective service occupations
331 (rem)	Protective service occupations
3412	Authors, writers
341 (rem), 3422,343, 344	Artistic and literary occupations; product, clothing and related designers; media associate professionals; sports and fitness occupations
3514	Train drivers
351 (rem), 3543,3544	Transport associate professionals; marketing associate professionals; estate agents, auctioneers
352, 3535, 3536,3537, 3539	Legal associate professionals; taxation experts; importers, exporters; financial and accounting technicians; business and related associate professionals nec;
3531,3532, 3533,3534	Estimators, valuers and assessors; brokers; insurance underwriters; finance and investment analysts/advisers
3541,3542	Buyers and purchasing officers; sales representatives
3551	Conservation and environmental protection officers
3561,3562	Public service associate professionals; personnel and industrial relations officers
3563,3564, 3566,3567, 3568,3552	Vocational and industrial trainers and instructors; careers advisers and vocational guidance specialists; statutory examiners; occupational hygienists and safety officers; countryside and park rangers
3565	Inspectors of factories, utilities and trading standards
4111,4112	Civil service executive officers; civil service administrative officers and assistants
4113,4114	Local government clerical officers and assistants; officers of non-governmental organisations
412	Administrative occupations in finance
4131	Filing and other records assistants/clerks
4132,4133, 4134	Pension and insurance clerks; stock control clerks; transport and distribution clerks
4135,4136, 4137	Library assistants/clerks; database assistants/clerks; market research interviewers
414,415	Administrative occupations in communications; general administrative occupations
5212	Moulders, core makers, die casters
5213	Sheet metal workers
5214	Metal plate workers, shipwrights, riveters
5215	Welding trades
5216	Pipe fitters
5221	Metal machining setters and setter-operators
5223	Metal working production and maintenance fitters
5231	Motor mechanics
5232	Vehicle body builders and repairers

5233	Auto electricians
5234	Vehicle spray painters
5241	Electricians, electrical fitters
5243	Lines repairers and cable jointers
5311	Steel erectors
5312	Bricklayers, masons
5313	Roofers, roof tillers and slaters
5314	Plumbers, heating and ventilating engineers
5315	Carpenters and joiners
5316	Glaziers, window fabricators and fitters
5321	Plasterers
5322	Floorers and wall tilers
5323	Painters and decorators
5411	Weavers and knitters
5413	Leather and related trades
5422	Printers
5431	Butchers, meat cutters
5434	Chefs, cooks
5494	Musical instrument makers and tuners
5 (rem)	Skilled trades occupations
6113	Dental nurses
611 (rem), 613	Healthcare and related personal services; animal care services
6121	Nursery nurses
612 (rem), 621,6232, 6291	Childcare and related personal services; leisure and travel service occupations; caretakers; undertakers and mortuary assistants
6221	Hairdressers, barbers
6222	Beauticians and related occupations
6231	Housekeepers and related occupations
6292	Pest control officers
711, 712 (rem)	Sales assistants and retail cashiers; sales related occupations
7124	Market and street traders and assistants
721	Customer service occupations
8112	Glass and ceramics process operatives
8116	Plastics process operatives
8117	Metal making and treating process operatives
8118	Electroplaters
8121	Paper and wood machine operatives
8123	Quarry workers and related operatives
8125	Metal working machine operatives
8126	Water and sewerage plant operatives
8132	Assemblers (vehicles and metal goods)
8134	Weighers, graders, sorters
8135	Tyre, exhaust and windscreen fitters
8136	Clothing cutters
8137	Sewing machinists
8141	Scaffolders, stagers, riggers
8211	Heavy goods vehicle drivers

8216	Rail transport operatives
8217	Seafarers (merchant navy); barge, lighter and boat operatives
8221	Crane drivers
8222	Fork-lift truck drivers
8223	Agricultural machinery drivers
8 (rem), 9 (rem)	Process plant and machine operatives; elementary occupations
9131	Labourers in foundries
9141	Stevedores, dockers and slingers
9232	Road sweepers
9239	Elementary cleaning occupations nec
9244	School mid-day assistants
9245	Car park attendants

Appendix Table A2
Definitions of Variables in Wage Equations

Variable	Definition
Earnings	The natural of gross hourly earnings from paid employment (in main job) expressed in constant January 2011 prices
Potential experience	The number of years of potential labour market experience of the respondent since leaving full-time education. Entered in linear and quadratic form.
Non-white	A dummy variable denoting that the respondent is from an ethnic minority background other than white.
Marital status	A series of dummy variables denoting the marital status of the respondent: legally married or living as married (excluded reference group); single; widowed, divorced or separated.
Part-time work	A dummy variable denoting that the respondent works part-time in his/her main job.
Male	A dummy variable denoting that the respondent is male.
Region	A series of dummy variables denoting the region of residence of the respondent: North (excluded reference group); Yorkshire & Humberside; East Midlands; East Anglia; London & South East; South West; West Midlands; North West; Wales; Scotland.
Qualifications	A series of dummy variables denoting the qualifications obtained by the respondent: a maximum of two or more A-levels (excluded reference group); at least an undergraduate university degree; a postgraduate university degree.