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An Application of the Gottschalk-Hansen Model**

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## **ABSTRACT**

### **Graduate Employment in the UK: An Application of the Gottschalk-Hansen Model**

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 markups 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 markup within occupations, we find that the employment of graduates in non-graduate jobs has declined over time. Hence, there is no evidence of an over-production of graduates in the UK.

JEL Classification: I2, J0, J3

Keywords: education, wages, employment, graduates

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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 whom 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. Thus, between 1990/91 and 2000/01 the number of male graduates increased by over a third and the number of female graduates almost doubled. (Elias and Purcell, 2003) and further increases have occurred subsequently, so that up to 2005/06 male numbers went up by a further six percent and female numbers by a further eleven percent. *Ceteris paribus*, we would expect such a rapid increase in supply to exert a downward influence on the graduate pay-premium. Yet various studies such as Walker and Zhu (2003, 2005) and Elias and Purcell (2003, 2004) 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.

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 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 (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 employee 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 (2008) 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. 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 model which 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 the above classification, Gottschalk and Hansen find that the probability of a graduate being employed in a non-graduate job actually fell in the US between 1983 and 1996, 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.<sup>1</sup> In this paper we follow the Gottschalk and Hansen approach in order to establish whether there is evidence consistent with the predictions of their model in the UK.

## 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 using capital and labour 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 and equation [2] to sector 2. The number of graduate workers employed in each sector is denoted 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

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<sup>1</sup> Cardoso (2007) has applied the Gottschalk and Hansen model to a Portuguese linked employer-employee dataset and obtained very similar results.

employed in each sector. Both types of labour are assumed to be perfect substitutes,<sup>2</sup> although the efficiency of labour, denoted by  $\beta$ , 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:

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

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, the demand equations imply that the graduate pay premium will be:

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

which will be smaller in sector 2 (the non-graduate sector) than in sector 1. A non-graduate occupation can therefore be defined as one that offers a low graduate premium, which is true of 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. They will base this decision on the relative wage offered to them in each sector:

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

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

Any rise in wages offered in sector 1 will encourage sector 2 workers to relocate. 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  $\beta_{1g}$  will increase as graduates become more productive

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<sup>2</sup> This assumption seems reasonable in the context of the over-education literature when workers can and do move between sectors.

in sector 1. This in turn increases the premium paid to graduates in sector 1, which encourages graduates in sector 2 to move there. Gottschalk and Hansen find evidence to support the model's predictions, namely that skill-biased technological change over time will reduce the proportion of graduates in non-graduate occupations. We proceed to examine if this is also the case for the UK.

### **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. We use the Labour Force Survey (LFS) 1993-2005 to estimate the probability that a graduate will be employed in a non-graduate occupation. This particular time period was chosen because of changes to the highest qualification question in 1993 and because of the change in the collection of LFS data from a seasonal-quarterly to a calendar-quarterly basis in 2006. The sample consists of both men and women in full-time or part-time paid employment<sup>3</sup> who have two or more A-Levels, in order to limit the analysis to graduates and those who had the qualifications necessary to attend university but chose not to do so. Due to the rotating sample design of the LFS, only final wave responses are used to ensure that respondents are only picked up once during their participation within the survey. 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. This has the advantage of increasing the number of occupations but reduces the number of years in the estimation, which will now run from 1994 to 2004.

We begin the analysis by classifying each occupation as either graduate or non-graduate. Given the change in occupation coding that occurred in the LFS in 2000, it is necessary to use two separate occupation classifications over the sample period. Separate estimations are therefore conducted for 1994-1999 using SOC 1990 codings and for 2002-2004 using SOC 2000 codings, although this in itself will not

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<sup>3</sup> The Labour Force Survey does not collect earnings data for the self-employed.



compromise the results as occupations are classified as either graduate or non-graduate separately in each year. A similar procedure to that adopted by Gottschalk and Hansen is used in aggregating occupations: those with at least 50 graduates and 50 non-graduates are classified as a separate occupation, while those with less are merged with a related occupation. In addition, occupations where 90% or more of employees are graduates are classified as graduate occupations, and those where 90% or more are non-graduates are classified as non-graduate occupations. A full list of the occupations used for both time periods is presented in Appendix Table 1. By merging LFS years it is possible to isolate 79 SOC 1990 and 93 SOC 2000 occupations. As an alternative, occupations were also classified using single year data. While the increase in the number of occupations resulting from merging years is considerable, with 31 more SOC 1990 and 42 more SOC 2000 occupations, the results derived in the analysis that follows are quantitatively similar.<sup>4</sup>

The change in the occupational classification system reflects the fall in manufacturing occupations and an increase in service occupations. However, there are many similarities between the occupation classifications that have been created for the two periods presented in Appendix Table 1. For instance, there are 20 categories of Managers in both classifications, with separate categories for Marketing and Sales Managers and Personnel, Training and Industrial Relations Managers in both. Each classification also has separate categories for Vets, Pharmacists, and Dental Practitioners. The SOC 1990 classification has more categories for Trades and for Operatives, which we may expect to remain non-graduate occupations throughout the sample time period. In contrast, SOC 2000 includes more categories for administrative and research occupations.

Using the occupational classifications described above, a standard wage equation (equation 7) is estimated for each year and each occupation:

$$\text{Ln}W_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 \text{Degree}_{it} + \beta_3 \text{HND}_{it} + \varepsilon_{it} \quad [7]$$

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<sup>4</sup> Managers in particular are more finely specified, with separate occupations with the merge for Treasurers and Company Financial Managers, and Advertising and Public Relations Managers, which were previously captured under an aggregated Specialist Manager category.

where  $W_{it}$  are the gross weekly earnings (in constant 2005 prices) of individual  $i$  in year  $t$ ,  $X$  is a vector of personal characteristics that influence earnings, full details of which are reported in Appendix Table 2, and  $\varepsilon$  is a random error term. The education variables are a series of dummies, ( $\text{Degree}_{it} = 1$  if  $i$ 's highest qualification is a university degree, and  $\text{HND}_{it} = 1$  if  $i$ 's highest qualification is a HND or equivalent)<sup>5</sup>. Each occupation is then classified as either non-graduate, where an insignificant premium or a coefficient less than 0.1 is estimated (or where 90% or more of employees are non-graduates), or graduate, for occupations 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. Occupational Classification**

Occupations are first classified as either graduate or non-graduate by estimating a standard wage regression, separately for each occupation and year. To compare the graduate premium between years, a regression combining all occupations in each year was also estimated. Although it is not practical to present all such results, explanatory variables are signed in the expected way:<sup>6</sup> part-time workers, women, ethnic minorities and those with a long-term health problem all have lower wages; wages increase with tenure and age; and those employed in the South East and London can expect higher pay relative to those who work in the West Midlands. There are no instances where degree premiums are negative, which might occur if graduates are effectively penalised in some occupations for having time out of the labour market. Gottschalk and Hansen, for instance, find significantly negative degree premiums for farm occupations and carpenters in their 1983 estimations, whereas in the analysis conducted here the graduate premia in these occupations are insignificantly different from zero. In addition to finding a significant premium for undertaking a degree, we also find that those with a HND or equivalent qualification also receive a small but significant earnings premium.

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<sup>5</sup> We use only the degree premium to classify occupations as graduate or non-graduate, but we include a HND dummy variable as previous studies have found that there is a significant return to gaining this qualification. Failure to include it in the model would, therefore, bias the estimated degree premium. Around 28% of our sample of workers with two or more A-Levels report their highest qualification to be a HND.

<sup>6</sup> These results are available from the authors on request.

Figure 1 plots the trend in the estimated degree premium coefficient between 1994 and 1999 and between 2002 and 2004. This has followed a steady upward trend, with the degree coefficient increasing from 0.27 in 1994, to 0.30 in 1999, and remaining relatively stable at around 0.31 between 2002 and 2004. These estimates are in keeping with those estimated by O’Leary and Sloane (2005), also using the LFS, who found a degree markup of around 20 per cent for men and 35 per cent for women using data for 1994 to 2003.

[Figure 1 here]

Next, the estimation is conducted for occupations separately, each of which is classified as graduate or non-graduate using the method outlined above. Table 1 presents the degree premium and the percentage of graduates working in each occupation for the periods 1994-1999, with occupations for which the smallest and insignificant premiums have been calculated for 1994 presented first. Table 2 presents the equivalent estimates for 2002-2004. Many occupations move from being classified as non-graduate in 1994 (with a premium of less than 0.1) to graduate in 1999. These include Managers and Proprietors in Service Industries, Artistic and Sports Professionals, and Managers in Transport. Confirming the shift towards a greater number of graduate occupations in this classification system, the proportion of graduates working in graduate occupations increases from 49.0% in 1994 to 69.9% in 1999.<sup>7</sup>

[Table 1 here]

Turning to Table 2, occupations that were classified as non-graduate in 2002 but graduate in 2004 include Youth and Community Workers, Therapists, Personal Assistants and IT Operation Technicians. Conversely, occupations classed as graduate in 2002 but not in 2004 include Sales and Secretarial and Related. The largest graduate premiums are estimated in both years for Engineering Professionals. Overall in 2002, 60.1% of graduates were in occupations with a significant premium of 0.1 and over. This increased in 2004 to 70.7% of graduates. The average wage for all workers and graduates is also presented for each occupation. The occupational degree premium and the average graduate wage are positively but only weakly correlated,

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<sup>7</sup> The increase in the number of graduate occupations is predominantly due to increasing wage premia within occupations. Of the 12 occupations that changed their classification from non-graduate to graduate between 1994 and 1999, nine instances were because the estimated premium rose above the 0.1 threshold. Similarly, nine of the 11 changes between 2002 and 2004 arose because of an increased graduate premium.

with a correlation coefficient of 0.14 for 2004. This reflects the fact that some occupations pay only a small graduate premium but offer relatively high wages to all workers, and vice versa.

[Table 2 here]

Appendix Table 3 lists those occupations where at least 90% of employees are graduates. In both the 1994-1999 and the 2002-2004 classifications, Veterinarians, Dental Practitioners and Legal Professionals all fall into this category. With the change in occupational codings from 2000, there are seven more 90% graduate occupations compared to the earlier codings, which now include Architects, Psychologists and Research Professionals. Taken together, these descriptive results indicate a movement towards a greater percentage of graduates being employed in graduate occupations, and illustrate how some occupations that previously paid no significant premium to graduates now appear to do so.

## 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 data for 1994-1999 and 2002-2004. Restricting the sample to graduates only and dropping the previously defined subscript  $i$  for convenience, equation [8] is estimated using a logit model:

$$\text{Prob}(Y=1) = \gamma_0 + \gamma_1 \text{Time} + \gamma_2 \text{Time}^2 + \gamma_3 \text{Female} + \gamma_4 \text{Ethnic} + \gamma_5 \text{Unemp} + \mu \quad [8]$$

where  $Y$  is equal to one if a graduate is employed in a non-graduate occupation (zero otherwise) and the quadratic in  $\text{Time}$  is a time trend (measured in years deviation from 1993) that captures changes in the probability of graduates being employed in non-graduate jobs over time. In addition, dummy variables to denote female graduates and those from a minority ethnic group are included. The gender and age-adjusted unemployment rate ( $\text{Unemp}$ ) is also included<sup>8</sup> and  $\mu$  is a conventionally defined random error term.

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<sup>8</sup> 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. When a similar measure is used here, in keeping with Cardoso, we also

The coefficients and the marginal effects from the logit estimation are presented in Table 3. The variable Female is significantly negative indicating female graduates are less likely to be employed in a non-graduate occupation than their male counterparts. While significant in both time periods, the coefficient (and subsequently marginal effect) on the Ethnic variable changes sign, from a positive effect in the earlier period, meaning that ethnic minority graduates are more likely to find employment in a non-graduate job, to a negative effect in the later period. The age-adjusted unemployment rate indicates that graduates are more likely to be employed in a non-graduate job when the unemployment rate is high, in line with expectations.

[Table 3 here]

Time is significantly negative, indicating that the probability of a graduate being employed in a non-graduate occupation fell between 1994 and 1999, and also between 2002 and 2004. As the quadratic of Time is positive, but only significantly so in the earlier sample, this decline has occurred at a diminishing rate. Figure 2 presents the predicted probabilities over time and shows a fall overall during the sample time period.<sup>9</sup> These results are consistent with those presented in Gottschalk and Hansen (2003) using US data, and Cardoso (2007) using data from Portugal. Despite the increase in the number of graduates, the probability that a graduate is employed in a non-graduate occupation has fallen over the 11 year period.

[Figure 2 here]

As we are particularly interested in the experience of recent graduates, the sample is next restricted to those graduates with less than 10 years potential labour market experience. Table 4 reports the logit results of being employed in a non-graduate occupation for each year. These show that the probability also fell for early career graduates, although at a smaller rate. This is in line with expectations as younger

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find counter-intuitive results, in that graduates are *less* likely to be employed in non-graduate jobs when unemployment is high. It may be that the gender-adjusted unemployment rate is not a good indicator of the true unemployment rate facing the sample used here, as the age profile of the graduate population has been falling and the economy-wide unemployment rate may not accurately reflect the labour market opportunities facing this ever younger stock of workers.

<sup>9</sup> There is a marked break in the level of the probabilities calculated for the 1994-1999 and 2002-2004 periods. Given the change in the SOC codings used in the two time periods, and the finer disaggregation available for administrative and research occupations in particular, this means that the underlying model in the latter period is likely better able to predict the employment outcome of graduates who are themselves more likely to gain graduate employment. As is pointed out at later, though, this in itself does not give cause for concern because we are interested in probability *changes* within any time period and not the magnitude of predicted probabilities between time periods

graduates with less labour market experience are more likely than experienced graduates to accept non-graduate employment.

[Table 4 here]

Estimates have also been recalculated excluding part-time workers to ensure their inclusion is not influencing the results. Table 5 reports the model for full-time workers only, with the coefficients on Time and its square being very similar to the case when part-time workers are included.

[Table 5 here]

Results so far have been based on classifying occupations as graduate if they pay a significant earnings premium of 0.1 log points or more. To test whether conclusions hold for other thresholds, occupations are re-classified as graduate if they pay a significant premium of 0.15 log points or over. This has the inevitable effect of reducing the number of graduates employed in graduate occupations. In 1994, 49.0% of graduates were employed in graduate occupations at the 0.1 threshold, but this falls to 46.6% with the higher threshold. We are, however, more interested in the *change* in the proportion of graduates in graduate occupations over time rather than the distinction between graduate and non-graduate at any particular moment. Using the previous method (with the lower threshold), the proportion increased from 49.0% in 1994 to 69.9% in 1999 and from 60.1% in 2002 to 70.7% in 2004. Raising the graduate premium threshold, the proportion increases from 46.6% to 59.0% in the earlier period and from 56.3% to 60.1% in the later period. Therefore, the level at which the premium threshold is set does not appear to affect the general conclusions. Table 6 reports the results when the logit model is re-estimated with the higher threshold and once again the Time variable remains significantly negative. This is true for both the earlier and later time periods.

[Table 6 here]

As the analysis is based on classifying occupations as either graduate or non-graduate, we would expect the aggregation of occupations to be an important consideration within the model. To ensure that the aggregation of occupations is not influencing the conclusions drawn, a series of controls were included to indicate those occupations that have been aggregated. For 1994-1999, a series of 0-1 dummy variables were created equal to one if the occupation is aggregated down to a 2-digit (Aggtwo) or a 1-digit (Aggone) occupation, with Aggthree (where no aggregation is needed to the 3-digit classification) the excluded baseline category. For 2002-2004, an additional

dummy variable is created (Aggfour), which denotes that no aggregation is needed to the 4-digit SOC 2000 coding and in this time period this is the excluded reference category. Table 7 reports the logit estimates.

[Table 7 here]

While the aggregation dummies are all significant, the Time controls nevertheless consistently remain significant and negative. Thus, although the aggregation of occupations does have an impact upon the probability that a graduate is employed in a non-graduate occupation, it is not driving the time trend. The sign and magnitude of the aggregation dummies indicates that the more aggregated occupations have the greatest positive impact upon a graduate being employed in a non-graduate occupation. This is particularly the case for the 1-digit aggregation (Aggone), where many of the manual occupations (codes 8 and 9 especially) are aggregated into 1-digit occupations.<sup>10</sup>

The change in the proportion of graduates employed in non-graduate occupations that has been identified over time is the result of two separate factors in the model. Firstly, it may arise from the fact that the classification of occupations as graduate or non-graduate is allowed to change over time. Secondly, it may result from changes in the allocation of graduates across occupations. In keeping with Gottschalk and Hansen (2003), it is possible to adopt a decomposition technique that separates out these two effects.

With the change in occupational codings from 2000 onwards, the decomposition is performed for the 1994-1999 period only. First, the percentage of graduates in non-graduate occupations in 1994 based upon the graduate classification of occupations for 1994 is calculated. This is repeated for graduates in 1999, based upon the graduate occupation classification for 1999 and reveals that the proportion of graduates employed in non-graduate occupations fell by 20.9 percentage points over the six-year period: 51.0% of graduates were employed in non-graduate occupations in 1994, falling to 30.1% in 1999. Occupations are then reclassified as graduate or non-

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<sup>10</sup> Similar results are observed when this process is repeated for early career graduates, in that although aggregation dummies are significant, the Time coefficient remains significantly negative.

graduate in 1999 using the 1994 graduate occupation classification.<sup>11</sup> The difference between the proportion of graduates in non-graduate occupations in 1999 using the 1999 classification and using the 1994 classification is the share that is due to changes in the allocation of graduates across occupations, holding the classification constant. The remainder will be due to changes in the classification of occupations.

Within this accounting framework, 25.8% of the fall in the proportion of graduates in non-graduate occupations can be attributed to changes in the allocation of graduates across occupations.<sup>12</sup> We are therefore able to conclude that both changes in the allocation of graduates and changes in the classification of occupations as graduate or non-graduate are important determinants of the fall in the probability of graduates being employed in non-graduate occupations.

## **6. Conclusions**

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. The evidence presented here shows that the probability of a graduate being employed in a non-graduate occupation declined in the UK between 1994 and 2004. Crucially, this classification of occupations is allowed to vary over time, thus taking account of any technological change that we may expect with an increasingly skilled and educated workforce. Approximately one quarter of the fall in the probability of graduates being employed in non-graduate jobs is due to changes in the allocation of graduates into non-graduate occupations, with the remainder due to changes in the classification of occupations. Both are therefore significant factors.

In terms of the calculated earnings premiums, results are consistent with those presented in the previous literature, with a slight increase in the degree premium over time from 27% to 30% for men and women combined. Thus, the findings presented here point to an increase in the demand for graduates, with employers increasing the premium they are prepared to pay for them, and a reduced likelihood that graduates

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<sup>11</sup> That is, a counterfactual for 1999 is constructed using the graduate premia and employee concentrations calculated for 1994.

<sup>12</sup> This is very similar to the 22% calculated by Gottschalk and Hansen (2003) for the US and the 18% calculated by Cardoso (2007) for Portugal.



are forced to accept employment within non-graduate occupations. Therefore, there is no evidence from these results to suggest that the UK is producing too many graduates.

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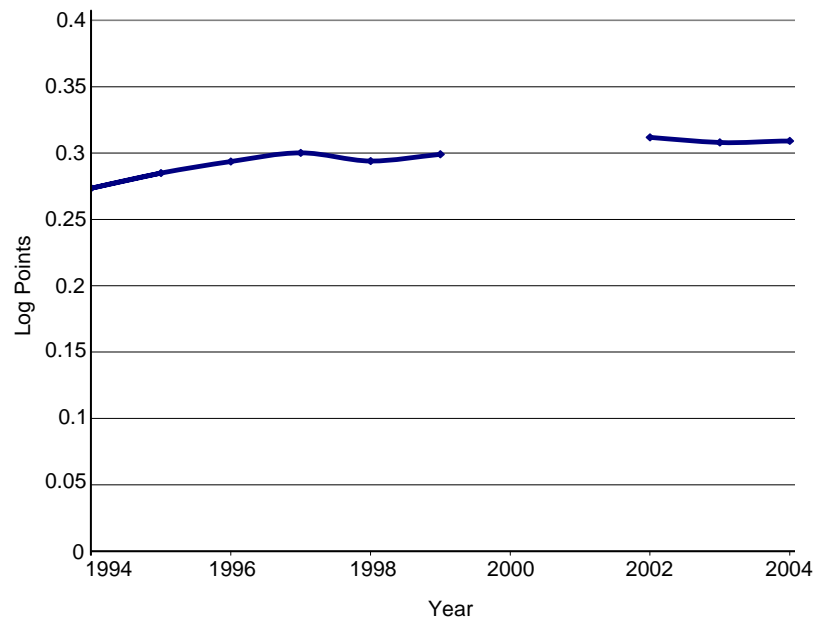
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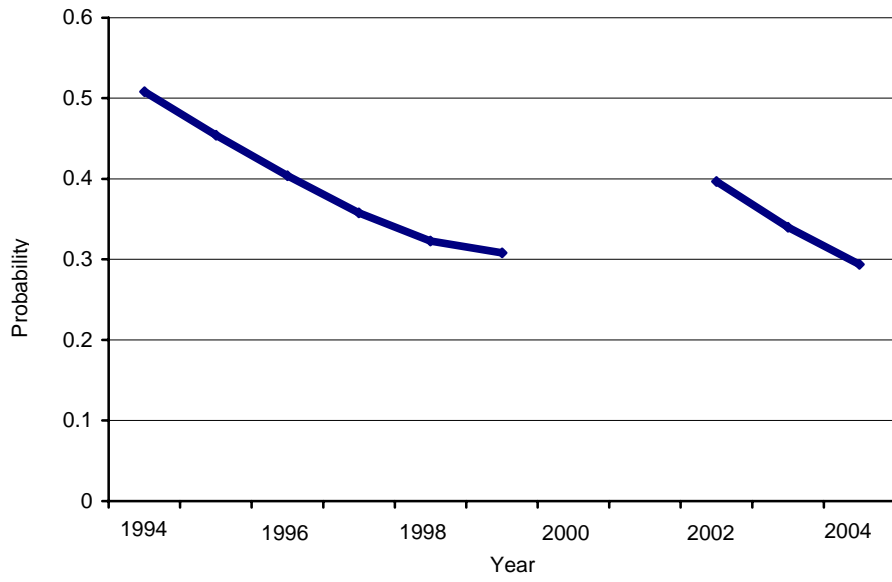
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**Figure 1**  
**Graduate Premium Coefficients: LFS 1994-1999 and 2002-2004**



**Figure 2**  
**Predicted Probability that a Graduate will be Employed in a**  
**Non-Graduate Occupation: LFS 1994-1999 and 2002-2004**



**Table 1**  
**Degree Premium, Percentage of Total Graduates and Average Wage: LFS 1994-1999**

SOC 1990		1994				1999			
		Graduate premium	Percentage of total graduates	Average hourly wage	Average hourly graduate wage	Graduate premium	Percentage of total graduates	Average hourly wage	Average hourly graduate wage
214	Software engineers	-0.250	1.08	15.05	14.42	0.021	2.06	17.92	18.03
380	Authors, writers, journalists	-0.204	0.85	13.01	12.64	0.220***	0.80	13.69	14.31
11	Other production managers	-0.078	0.77	14.50	15.65	0.132	0.72	16.20	17.95
72	Sales assistants and checkout operatives	-0.075	0.71	5.93	5.38	-0.023	0.93	5.60	5.64
3	Other associate professionals	-0.062	0.56	18.73	18.45	0.068	0.57	18.19	19.20
216	Design and development engineers	-0.023	0.93	12.22	12.42	0.165	0.78	14.14	14.71
15	Protective service officers	-0.022	0.59	17.07	16.98	0.199**	0.52	17.68	18.85
101	General managers	-0.008	1.40	25.77	25.09	-0.063	1.04	30.30	32.28
71	Sales representatives	0.001	1.00	11.67	11.96	0.271***	1.09	13.47	15.44
26	Architects, town planners and surveyors	0.018	1.82	13.01	13.63	0.205***	1.57	14.10	15.01
320	Computer analysts	0.020	2.46	12.90	13.10	0.122***	2.91	14.24	14.53
459	Other secretaries nec	0.021	0.62	8.48	8.65	0.017	0.75	9.31	10.06
361	Underwriters, claims assessors, brokers	0.023	1.08	15.97	17.05	0.116**	1.08	18.33	19.55
6	Other personal and protective service occupations	0.024	1.26	8.56	7.60	0.092***	1.61	6.55	6.97
233	Secondary education teaching professionals	0.032	10.22	14.64	14.61	0.503***	8.92	15.00	14.89
610	Police officers (below sergeant)	0.051	0.43	11.97	12.32	0.014	0.48	12.93	13.11
123	Advertising and public relations	0.052	0.50	15.93	17.37	-0.093	0.58	16.01	15.51

	managers								
179	Managers and proprietors in service industries	0.056	0.91	12.26	11.97	0.118**	1.06	10.96	12.43
9	Other occupations	0.057	0.42	6.42	6.40	0.135	0.53	5.88	5.97
4	Other administrators	0.059	1.03	7.48	7.59	0.059*	1.22	7.06	6.97
400	Civil service administrative officers and assistants	0.060	0.61	7.43	8.20	0.061	0.72	7.98	8.25
13	Other financial and office managers, civil service executive officers	0.060	0.52	10.75	11.44	0.120***	0.50	11.06	11.80
430	Clerks nec	0.061	0.92	7.41	8.13	0.034	1.43	7.66	7.65
411	Counter clerks and cashiers	0.075	0.54	8.16	7.79	-0.014	0.52	7.67	7.58
126	Computer systems and data processing managers	0.078	1.87	17.18	17.82	0.074	1.92	20.04	20.37
38	Other literacy, artistic and sports professionals	0.091	1.05	10.40	10.81	0.186***	1.19	12.60	13.87
19	Managers and administrators	0.096	0.89	12.47	12.93	0.196**	0.77	13.06	13.80
231	Higher and further education teaching professionals	0.099	2.85	15.47	16.18	0.169	2.07	13.80	14.03
30	Other scientific technicians	0.103	0.62	10.14	9.85	-0.016	0.53	10.68	10.16
293	Social workers, probation officers	0.104	1.47	10.52	10.92	0.124**	1.40	11.65	11.94
36	Other business and financial associate professionals	0.123	0.83	15.21	16.57	0.198**	0.71	15.53	17.55
14	Managers in transport and storing	0.134	0.38	11.61	13.81	0.311***	0.51	14.21	16.41
210	Civil, structural, municipal, mining and quarry engineers	0.144	1.20	12.76	13.69	0.327***	0.84	14.26	15.05
37	Social welfare associate professionals	0.149	0.85	10.25	10.43	0.234***	1.43	9.85	10.39
2	Other professionals	0.157	5.46	13.60	13.93	0.066	5.25	16.09	16.57
10	Other general managers and administrators	0.127**	0.93	15.66	16.97	0.243***	0.87	16.62	18.07
8	Plant and machine operatives	0.156	0.77	8.47	9.00	0.094**	0.73	7.74	7.98

131	Bank, building society and post office managers	0.158**	0.87	17.47	19.17	0.162**	0.53	19.17	21.30
124	Personal, training and industrial relations managers	0.159*	1.61	15.34	16.34	0.234***	1.60	17.11	18.19
5	Other Trades	0.161**	0.63	8.77	9.65	0.193***	0.52	8.94	9.49
1	Other managers	0.163*	0.99	9.77	11.56	0.153**	1.10	10.90	12.18
139	Other financial institution and office managers nec	0.189***	1.29	13.48	15.86	0.171***	1.89	14.66	16.63
110	Production, works and maintenance managers	0.204***	2.36	15.43	16.43	0.368***	2.36	17.26	18.68
410	Accounts and wages clerks	0.207***	1.64	9.04	10.29	0.107***	1.53	7.67	9.32
401	Local government clerical officers	0.209***	0.40	8.18	8.87	0.101**	0.45	8.06	8.28
391	Vocational and industrial trainers	0.227***	0.43	10.74	11.19	0.084	0.63	12.16	12.94
199	Other managers and administrators nec	0.228***	1.00	13.63	15.30	0.242***	1.27	14.56	15.77
31	Draughtspersons, quantity and other surveyors	0.247**	0.62	10.60	12.42	0.263***	0.62	11.82	12.87
20	Natural scientists	0.267***	3.28	13.38	13.87	0.495***	2.71	13.97	14.60
121	Marketing and sales managers	0.272***	3.73	15.79	17.11	0.030	4.14	17.96	18.62
7	Other sales occupations	0.275***	0.42	10.03	11.56	0.170**	0.58	10.40	11.60
211	Mechanical engineers	0.276	0.73	14.35	14.83	0.289*	0.52	14.43	15.18
39	Other associate professional and technical occupations	0.277***	1.18	11.00	12.21	0.127*	1.42	15.34	13.07
120	Treasurers and company financial managers	0.278**	1.52	22.11	23.24	0.317***	1.50	25.24	26.30
250	Chartered and certified accountants	0.284***	2.16	14.24	15.17	0.229***	1.99	15.54	16.63
347	Occupational and speech therapists	0.297**	0.60	11.24	11.69	0.351***	0.78	11.99	12.41
52	Electrical/electronic trades	0.312***	0.58	10.58	11.51	0.326***	0.47	11.57	15.44
34	Other health associate professionals	0.320***	1.40	11.14	11.18	0.302***	1.27	11.46	11.97
363	Personal and industrial relations	0.325**	0.53	10.59	11.40	0.091	0.51	10.98	11.53

	managers								
102	Local government officers	0.328**	1.37	13.98	16.09	0.193***	1.05	13.82	15.15
219	Other engineers and technologists nec	0.331**	0.69	12.80	13.81	0.382***	0.67	13.67	14.68
12	Other specialist manages	0.364***	1.01	15.09	16.62	0.101	0.63	19.51	21.40
300	Laboratory technicians	0.403***	0.95	9.08	10.28	0.433***	0.62	10.54	12.14
218	Planning and quality control engineers	0.495***	0.57	12.40	13.78	0.0002	0.29	13.10	13.56
21	Other engineers	0.596***	1.13	13.47	13.93	-0.003	0.91	15.05	16.03
234	Primary and nursery education teaching professionals	0.655***	6.02	14.71	13.96	0.616***	6.34	14.02	13.49
22	Other health professionals	0.722*	3.07	15.20	15.49	0.427**	2.89	18.34	18.49
23	Other teaching professionals	0.813**	1.44	14.78	15.13	0.434***	1.74	14.54	14.73

Note: \*/\*\*/\*\* denotes significance at the 10%/5%/1% level.



**Table 2**  
**Degree Premium, Percentage of Total Graduates and Average Wage: LFS 2002-2004**

SOC 2000		2002				2004			
		Graduate premium	Percentage of total graduates	Average hourly wage	Average hourly graduate wage	Graduate premium	Percentage of total graduates	Average hourly wage	Average hourly graduate wage
244	Public service professionals	-0.155	0.91	12.33	12.34	-0.088	0.94	13.16	
322	Therapists	-0.122	1.30	13.83	13.55	0.335***	1.30	14.22	14.30
1136	Information and communication technology managers	-0.094	2.36	21.36	21.41	0.059	2.39	21.71	22.97
113	Other functional managers	-0.018	1.49	19.24	19.84	0.153	1.62	19.98	20.52
4215	Personal assistants and other secretaries	-0.012	0.56	9.78	9.67	0.102**	0.53	10.25	10.63
35	Other associate professionals	-0.008	1.63	15.43	15.86	0.078	1.64	15.46	15.95
9	Elementary occupations	0.0003	1.22	6.11	6.35	0.042	1.19	6.69	7.37
7111	Sales and retail assistants	0.004	0.65	5.90	6.03	0.012	0.78	6.16	6.44
331	Protective service occupations	0.011	0.75	13.01	12.53	0.003	0.85	13.59	13.10
62	Personal service occupations	0.022	0.32	8.10	8.30	0.051	0.36	8.25	9.21
412	Other admin occupations: finance	0.042	0.41	8.21	8.81	0.027	0.36	8.32	8.89
4112	Civil service admin officers and assistants	0.063	0.57	8.60	9.29	0.032	1.19	8.55	8.63
3131	IT operations technicians	0.068	0.74	13.38	13.97	0.149**	0.73	13.87	14.41
72	Customer service occupations	0.070	0.70	8.12	8.50	0.051	0.64	7.82	7.85
117	Protective service officers	0.070	0.51	17.60	18.52	0.149*	0.53	19.81	21.28
5	Other trades	0.076	0.38	8.32	8.41	0.091	0.36	8.33	8.53
312	Draughtspersons and building inspectors	0.080	0.30	11.83	12.30	0.082	0.29	12.23	12.20
1184	Social services managers	0.087	0.41	15.67	16.56	0.160	0.56	16.40	17.51

243	Quantity surveyors and chartered surveyors	0.096	0.90	15.38	15.89	0.188*	0.87	16.43	17.69
1163	Retail and wholesale managers	0.109	0.76	13.47	16.48	0.050	0.81	13.48	14.65
8	Process, plant and machine operatives	0.139	0.65	9.02	9.52	0.136***	0.61	8.87	9.04
2421	Chartered and certified accountants	0.101	1.42	19.01	19.54	0.148*	1.50	19.84	20.88
1231	Property, housing and land managers	0.120	0.46	16.63	18.31	0.138	0.49	17.77	19.32
3543	Marketing associate professionals	0.123	0.94	13.63	14.32	-0.012	0.87	14.11	14.68
3231	Youth and community workers	0.128	0.59	11.43	11.80	0.441***	0.75	11.88	12.14
111	Corporate managers and senior officials	0.130	1.30	29.81	31.48	-0.035	1.22	28.63	29.10
2314	Secondary education teaching professionals	0.132	7.34	16.20	16.04	0.497***	7.66	16.60	16.46
34	Other artistic, design, media and sports professionals	0.139	2.64	12.76	13.54	0.125**	2.60	13.49	13.97
2312	Further education teaching professionals	0.146	1.73	14.83	15.42	0.079	1.53	15.43	15.93
3132	IT user support technicians	0.152	0.40	11.59	12.23	-0.070	0.36	12.20	12.57
1181	Hospital and health service managers	0.161	0.67	16.66	18.61	0.216	0.71	17.55	19.65
311	Other science and engineering professionals	0.205	0.63	12.25	13.44	0.305***	0.52	11.96	12.87
411	Other admin occupations: government	0.097*	0.80	11.39	11.87	0.104**	0.73	11.78	12.25
71	Other sales occupations	0.103*	0.48	7.50	8.31	0.191	0.56	7.87	8.74
421	Other secretarial and related occupations	0.122**	0.71	8.85	10.20	0.042	0.66	9.40	9.99
4113	Local government clerical officers and assistants	0.139***	0.58	9.02	9.48	0.135***	0.61	9.47	9.84
242	Other business and statistical professionals	0.145*	2.01	19.85	20.72	0.174**	2.04	20.31	20.90
1152	Office managers	0.150***	1.01	15.48	16.65	0.212***	1.04	14.84	16.43
4131	Filing and other records	0.159**	0.39	8.83	9.52	0.141**	0.48	8.97	9.49

	assistants/clerks								
353	Other business and finance associate professionals	0.163***	1.81	15.34	17.27	0.165***	1.80	16.87	18.28
4122	Accounts and wages, clerks, book-keepers, other financial clerks	0.172***	1.34	11.28	12.95	0.139***	1.19	11.19	12.47
212	Other engineering professionals	0.185**	1.74	15.40	16.37	0.233***	1.56	16.23	17.06
61	Other personal service occupations	0.187***	1.02	7.52	8.61	0.249***	1.31	8.09	9.18
3211	Nurses	0.197***	2.03	11.33	11.93	0.495***	2.30	11.95	12.84
3111	Laboratory technicians	0.205**	0.53	9.47	10.51	0.171*	0.51	10.43	11.08
3542	Sales representatives	0.211***	0.74	12.63	13.90	0.194**	0.75	14.11	14.80
1135	Personnel, training and industrial relations managers	0.216***	1.28	19.86	21.56	0.200**	1.33	20.95	22.95
1132	Marketing and sales managers	0.219***	3.51	21.19	22.92	0.191***	3.38	20.84	22.57
231	Other teaching professionals	0.219**	1.57	15.49	16.23	0.270***	1.77	15.47	16.43
3232	Housing and welfare officers	0.221***	0.91	10.93	11.61	0.166***	0.99	11.66	11.91
52	Other metal, vehicle and electrical trades	0.223***	0.53	11.51	21.51	0.157**	0.43	11.36	12.30
112	Other production managers	0.224**	0.80	17.68	18.89	0.104	0.79	19.32	20.03
1151	Financial institution managers	0.237***	0.90	20.39	23.60	0.203***	0.86	22.32	25.53
3534	Finance and investment analysts/advisers	0.240***	0.85	15.91	17.43	0.166**	0.82	17.33	18.56
118	Other health and social service managers	0.251**	0.40	12.70	14.34	0.254**	0.44	13.98	16.62
114	Quality and customer care managers	0.256***	0.70	16.02	16.94	0.245***	0.67	16.33	17.41
12	Other managers	0.261***	0.78	11.35	12.89	0.147**	0.82	11.97	13.81
611	Healthcare and related personal services	0.270***	0.63	8.17	8.57	0.176***	0.78	8.40	8.71
1121	Production, works and maintenance managers	0.281***	2.15	18.79	20.05	0.234***	1.90	19.27	20.85
354	Sales and related associate	0.289**	0.41	13.67	15.04	0.110	0.37	14.53	14.73

	professionals								
1131	Financial managers and chartered secretaries	0.291***	1.94	25.85	27.82	0.250***	1.79	25.35	28.40
245	Librarians and related professionals	0.291*	0.64	12.10	12.42	0.205*	0.53	11.72	12.11
2126	Design and development engineers	0.317**	0.77	15.02	16.12	0.293*	0.59	15.77	16.99
321	Other health associate professionals	0.321***	0.74	12.31	12.30	0.210**	0.81	12.84	13.07
116	Other managers in distribution, storage and retailing	0.334***	0.45	15.54	18.07	0.129**	0.37	16.51	18.63
2442	Social workers	0.338***	1.07	12.54	13.11	0.129	1.08	13.69	13.96
1239	Managers and proprietors in other services	0.350***	0.52	15.71	18.05	0.598***	0.54	14.65	17.10
211	Other science professionals	0.356***	1.60	13.87	14.48	0.261**	1.53	14.45	14.97
2122	Mechanical engineers	0.460**	0.44	16.28	16.72	0.712***	0.35	15.89	16.54
2316	Special needs education teaching professionals	0.496***	0.93	16.75	16.67	0.268	0.06	17.64	17.92
2315	Primary and nursery education teaching professionals	0.625***	5.73	15.54	14.98	0.157	6.17	15.88	15.52
2129	Engineering professionals	0.736***	0.64	15.51	16.18	0.434**	0.55	17.12	17.83

Note: \*/\*\*/\*\* denotes significance at the 10%/5%/1% level.

**Table 3**  
**Logit Estimates of the Probability that a Graduate is Employed in a**  
**Non-Graduate Occupation: LFS 1994-1999 and 2002-2004**

**1994-1999**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.425	13.35	
Time	-0.201	14.22	-0.048
Time <sup>2</sup>	0.015	5.71	0.003
Female	-0.195	15.29	-0.046
Ethnic	0.057	1.93	0.014
Unemp	0.060	19.65	0.014
<i>No. of Obs.</i>	<i>111,077</i>		

**2002-2004**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.680	24.27	
Time	-0.252	6.22	-0.057
Time <sup>2</sup>	0.010	0.51	0.002
Female	0.167	8.96	0.038
Ethnic	-0.151	3.93	-0.033
Unemp	0.047	8.99	0.010
<i>No. of Obs.</i>	<i>51,780</i>		

**Table 4**  
**Logit Estimates of the Probability that an Early Career Graduate is Employed**  
**in a Non-Graduate Occupation: LFS 1994-1999 and 2002-2004**

**1994-1999**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.537	8.62	
Time	-0.121	4.98	-0.029
Time <sup>2</sup>	0.008	1.77	0.002
Female	-0.307	14.44	-0.074
Ethnic	0.220	4.89	0.054
Unemp	0.064	13.13	0.016
<i>No. of Obs.</i>	<i>37,316</i>		

**2002-2004**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.786	14.82	
Time	-0.477	6.58	-0.109
Time <sup>2</sup>	0.092	2.59	0.021
Female	0.145	4.33	0.033
Ethnic	-0.122	2.00	-0.028
Unemp	0.075	10.48	0.017
<i>No. of Obs.</i>	<i>15,998</i>		

**Table 5**  
**Logit Estimates of the Probability that a Graduate is Employed in a**  
**Non-Graduate Occupation Excluding Part-Time Workers:**  
**LFS 1994-1999 and 2002-2004**

**1994-1999**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.444	13.26	
Time	-0.187	12.51	-0.044
Time <sup>2</sup>	0.013	4.82	0.003
Female	-0.236	16.97	-0.055
Ethnic	0.025	0.81	0.006
Unemp	0.059	18.24	0.014
<i>No. of Obs.</i>	98,786		

**2002-2004**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.647	21.48	
Time	-0.332	7.53	-0.074
Time <sup>2</sup>	0.038	1.77	0.008
Female	0.171	8.32	0.038
Ethnic	-0.188	4.50	-0.041
Unemp	0.039	6.81	0.009
<i>No. of Obs.</i>	44,314		

**Table 6**  
**Logit Estimates of the Probability that a Graduate is Employed in a**  
**Non-Graduate Occupation with Higher Premium Threshold:**  
**LFS 1994-1999 and 2002-2004**

**1994-1999**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.504	15.90	
Time	-0.062	4.44	-0.015
Time <sup>2</sup>	0.004	1.56	0.001
Female	-0.247	19.90	-0.061
Ethnic	0.090	3.12	0.023
Unemp	0.082	26.84	0.020
<i>No. of Obs.</i>	<i>111,077</i>		

**2002-2004**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.646	23.52	
Time	-0.095	2.40	-0.023
Time <sup>2</sup>	0.011	0.60	0.003
Female	0.161	8.96	0.039
Ethnic	-0.106	2.90	-0.026
Unemp	0.075	14.79	0.018
<i>No. of Obs.</i>	<i>51,780</i>		



**Table 7**  
**Logit Estimates of the Probability that a Graduate is Employed in a**  
**Non-Graduate Occupation including Aggregation Controls:**  
**LFS 1994-1999 and 2002-2004**

**1994-1999**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.263	7.84	
Time	-0.238	16.24	-0.056
Time <sup>2</sup>	0.015	5.75	0.004
Female	-0.216	16.27	-0.051
Ethnic	0.036	1.15	0.008
Unemp	0.038	11.87	0.009
Aggtwo	-0.575	32.24	-0.129
Aggone	1.611	74.60	0.381
<i>No. of Obs.</i>	<i>111,077</i>		

**2002-2004**

	<b>Coefficient</b>	<b>t-stat</b>	<b>Marginal Effect</b>
Constant	-0.738	25.00	
Time	-0.263	6.37	-0.059
Time <sup>2</sup>	0.010	0.49	0.002
Female	0.218	11.43	0.049
Ethnic	-0.177	4.46	-0.039
Unemp	0.022	4.11	0.030
Aggthree	0.131	5.85	0.031
Aggtwo	0.231	16.84	0.050
Aggone	0.531	30.18	0.159
<i>No. of Obs.</i>	<i>51,780</i>		

**Appendix Table 1**  
**Aggregation of Occupations**

<b>SOC 1990</b>	<b>Occupation</b>
101	General managers
102	Local government officers
Other 10	Other general managers and administrators
110	Production, works and maintenance managers
Other 11	Other production managers
120	Treasurers and company financial managers
121	Marketing and sales managers
123	Advertising and public relations managers
124	Personal, training and industrial relations managers
126	Computer systems and data processing managers
Other 12	Other specialist managers
131	Bank, building society and post office managers
139	Other financial institution and office manager nec
Other 13	Other financial and office managers, civil service executive officers
Other 14	Managers in transport and storing
Other 15	Protective service officers
179	Managers and proprietors in service industries
199	Other managers and administrators nec
Other19	Managers and administrators
Other 1	Other managers
20	Natural scientists
215	Chemical engineers
210	Civil, structural, municipal, mining and quarry engineers
211	Mechanical engineers
214	Software engineers
216	Design and development engineers
218	Planning and quality control engineers
219	Other engineers and technologists nec
Other 21	Other engineers
223	Dental practitioners
224	Veterinarians
220	Other health professionals
230	University and polytechnic teaching professionals
231	Higher and further education teaching professionals
233	Secondary education teaching professionals
234	Primary and nursery education teaching professionals
Other 23	Other teaching professionals
241	Barristers and advocates
250	Chartered and certified accountants
Other 26	Architects, town planners and surveyors
293	Social workers, probation officers
Other 2	Other professionals
300	Laboratory technicians
Other 30	Other scientific technicians

31	Draughtspersons, quantity and other surveyors
320	Computer analysts
340	Nurses
347	Occupational and speech therapists
Other 34	Other health associate professionals
361	Underwriters, claims assessors, brokers, investment analysts
363	Personal and industrial relations officers
Other 36	Other business and financial associate professionals
37	Social welfare associate professionals
380	Authors, writers, journalists
Other 38	Other literacy, artistic and sports professionals
391	Vocational and industrial trainers
Other 39	Other associate professional and technical occupations
Other 3	Other associate professionals
400	Civil service administrative officers and assistants
401	Local government clerical officers
410	Accounts and wages clerks
411	Counter clerks and cashiers
420	Filing, computer and other records clerks
430	Clerks nec
459	Other secretaries nec
Other 4	Other administrators
52	Electrical/electronic trades
Other 5	Other Trades
60	NCOs and other ranks, Armed Forces
610	Police officers (sergeant and below)
640	Assistant nurses
643	Dental nurses
650	Nursery nurses
Other 61	Other personal and protective service occupations
71	Sales representatives
72	Sales assistants and checkout operatives
Other 7	Other sales occupations
8	Plant and machine operatives
9	Other occupations

<b>SOC 2000</b>	<b>Occupation</b>
111	Corporate managers and senior officials
1121	Production, works and maintenance managers
Other 112	Other production managers
1131	Financial managers and chartered secretaries
1132	Marketing and sales managers
1135	Personnel, training and industrial relations managers
1136	Information and communication technology managers
Other 113	Other functional managers
114	Quality and customer care managers
1151	Financial institution managers

1152	Office managers
1163	Retail and wholesale managers
Other 116	Other managers in distribution, storage and retailing
Other 117	Protective service officers
1181	Hospital and health service managers
1184	Social services managers
Other 118	Other health and social services managers
1231	Property, housing and land managers
1239	Managers and proprietors in other services
Other 121	Other managers
2113	Physicists, geologists and meteorologists
Other 211	Other science professionals
2122	Mechanical engineers
2126	Design and development engineers
2129	Engineering professionals
Other 212	Other engineering professionals
2131	IT strategy and planning professionals
2132	Software professionals
2211	Medical practitioners
2212	Psychologists
2213	Pharmacists
2214	Ophthalmic opticians
2215	Dental practitioners
2216	Veterinarians
2311	Higher education teaching professionals
2312	Further education teaching professionals
2314	Secondary education teaching professionals
2315	Primary and nursery education teaching professionals
2316	Special needs education teaching professionals
Other 231	Other teaching professionals
232	Research professionals
241	Legal professionals
2421	Chartered and certified accountants
Other 242	Other business and statistical professionals
2431	Architects
2432	Town planners
Other 243	Quantity surveyors and chartered surveyors
2442	Social workers
Other 244	Public service professionals
245	Librarians and related professionals
3111	Laboratory technicians
Other 311	Other science and engineering technicians
312	Draughtspersons and building inspectors
3131	IT operations technicians
3132	IT user support technicians
3211	Nurses
Other 321	Other health associate professionals
Other 322	Therapists

3231	Youth and community workers
3232	Housing and welfare officers
Other 331	Protective service occupations
Other 34	Other artistic, design, media and sports professionals
Other 35	Other associate professionals
3534	Finance and investment analysts/advisers
Other 353	Other business and finance associate professionals
3542	Sales representatives
3543	Marketing associate professionals
Other 354	Sales and related associate professionals
3561	Public service associate professionals
3562	Personnel and industrial relations officers
3563	Vocational and industrial trainers and instructors
Other 35	Other associate professionals
4112	Civil service admin officers and assistants
4113	Local government clerical officers and assistants
Other 411	Other admin occupations: government
4122	Accounts and wages clerks, book-keepers, other financial clerks
Other 412	Other admin occupations: finance
4131	Filing and other records assistants/clerks
Other 413	Other admin occupations: records
Other 41	Other admin occupations
4215	Personal assistants and other secretaries
Other 421	Other secretarial and related occupations
5223	Metal working production and maintenance fitters
Other 52	Other metal, vehicle and electrical trades
Other 5	Other trades
611	Healthcare and related personal services
Other 61	Other personal service occupations
62	Personal service occupations
7111	Sales and retail assistants
Other 71	Other sales occupations
721	Customer service occupations
8	Process, plant and machine operatives
9	Elementary occupations

**Appendix Table 2**  
**Explanatory Variable Definitions**

<b>Variable</b>	<b>Definition</b>
Age	The age of the respondent (entered in linear and quadratic form).
Ethnic	Dummy variable indicating of ethnic origin other than white.
Healthprob	Dummy variable indicating a long-term health problem.
Married	Dummy variable indicating the respondent is married (excluded).
Single	Dummy variable indicating respondent single.
SDW	Dummy variable indicating respondent separated, divorced or widowed
Westmids	Dummy variable indicating respondent lives in the West Midlands (excluded).
Yorks	Dummy variable indicating respondent lives in Yorkshire.
Eastmids	Dummy variable indicating respondent lives in the East Midlands.
Eastanglia	Dummy variable indicating respondent lives in East Anglia.
Innerl	Dummy variable indicating respondent lives in Inner London.
Outerl	Dummy variable indicating respondent lives in Outer London.
Southeast	Dummy variable indicating respondent lives in the South East.
Southwest	Dummy variable indicating respondent lives in the South West.
Wales	Dummy variable indicating respondent lives in Wales.
Scotland	Dummy variable indicating respondent lives in Scotland.
Nireland	Dummy variable indicating respondent lives in Northern Ireland.
Tenure1	Dummy variable indicating respondent employed in current job for one year or less (excluded).
Tenure2	Dummy variable indicating respondent employed in current job between two and five years.
Tenure3	Dummy variable indicating respondent employed in current job for more than five years.
Bc1940	Dummy variable indicating respondent born before 1940 (excluded).
Bc4049	Dummy variable indicating respondent born between 1940 and 1949.
Bc5059	Dummy variable indicating respondent born between 1950 and 1959.
Bc6069	Dummy variable indicating respondent born between 1960 and 1969.
Bc7079	Dummy variable indicating respondent born between 1970 and 1979.
Bc1980	Dummy variable indicating respondent was born in 1980 or later.
2Alevel	Dummy variable indicating highest qualification equivalent to 2 or more A levels (excluded).
Degree	Dummy variable indicating highest qualification is a degree.
HND	Dummy variable indicating highest qualification equivalent to a HND (including HNC and Teaching qualification that is not a degree).
Pt	Dummy variable indicating respondent works part-time (less than or equal to 30 hours per week).
Female	Dummy variable indicating respondent is female.
Datayr	Dummy variables indicating the year; in each estimation, the earliest Datayr dummy is excluded.

**Appendix Table 3  
Occupations with Over 90% Graduate Employees**

**1994-1999**

<b>SOC 1990</b>		<b>1994</b>		<b>1999</b>	
		<b>Percentage of total graduates</b>	<b>Average hourly wage</b>	<b>Percentage of total graduates</b>	<b>Average hourly wage</b>
215	Chemical engineers	0.20	17.05	0.14	15.43
223	Dental practitioners	0.17	20.02	0.12	20.79
224	Veterinarians	0.12	11.93	0.14	12.26
230	University and polytechnic teaching professionals	0.12	15.62	2.97	15.48
241	Barrister and advocates	0.10	18.55	0.03	16.92
340	Nurses	0.93	10.81	1.74	10.40

**2002-2004**

<b>SOC 2000</b>		<b>2002</b>		<b>2004</b>	
		<b>Percentage of total graduates</b>	<b>Average hourly wage</b>	<b>Percentage of total graduates</b>	<b>Average hourly wage</b>
2131	IT strategy and planning professionals	1.14	22.07	1.10	22.54
2132	Software professionals	3.18	16.61	2.99	16.60
2211	Medical practitioners	2.10	22.79	2.12	24.12
2212	Psychologists	0.42	18.30	0.33	19.43
2213	Pharmacists	0.41	16.41	0.37	16.85
2214	Ophthalmic opticians	0.17	20.63	0.14	20.93
2215	Dental practitioners	5.13	24.79	0.11	25.19
2216	Veterinarians	0.11	18.39	0.06	17.59
2311	Higher education teaching professionals	2.30	17.70	2.41	18.09
232	Research professionals	1.07	13.73	1.20	14.26
241	Legal professionals	1.72	21.92	1.52	22.79
2431	Architects	0.50	16.65	0.42	17.05
2432	Town planners	0.37	14.35	0.34	15.19