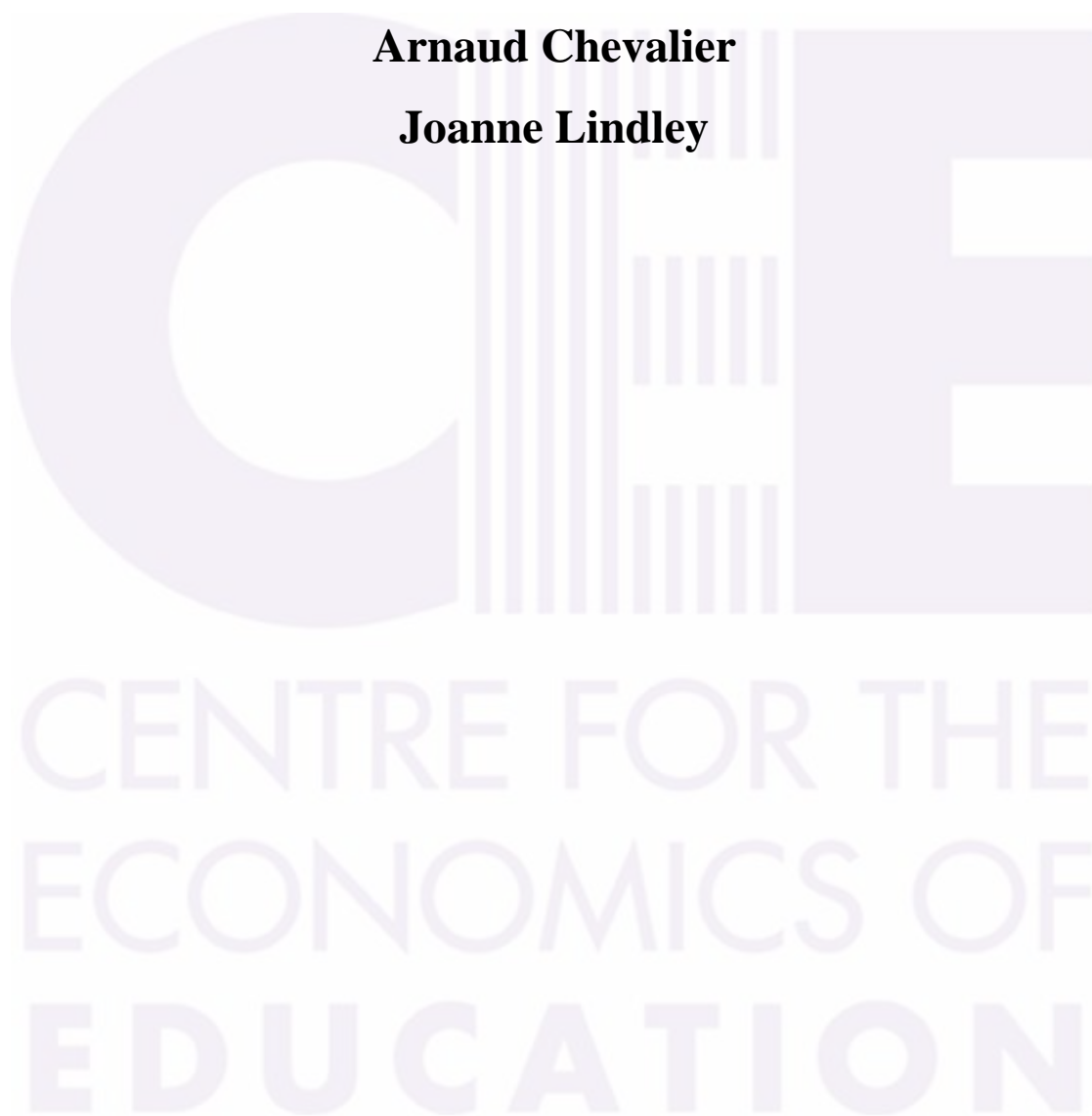


Over-Education and the Skills of UK Graduates

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Executive Summary

The early Nineties have been characterised by a dramatic change in the British higher education landscape. Reforms allowed universities to expand and at the same time new institutions were granted university status. In a five year period, the number of students doubled (from 15% in 1988 to 30% by 1992). This large expansion in the number of students attending higher education was concomitant to a reduction in the unit cost of a graduate.

Questions about the effect of such a rapid expansion have been raised concerning both the supply and the demand of graduates. On the supply side, the issue is about the quality of new graduates. It is feared that post-expansion graduates may have less human capital. This reduction in quality may be a consequence of i) over-crowding and funding reductions, ii) introduction of programs with little academic content, iii) dumbing down of existing programs to accommodate students with lower initial ability. Additionally, the demand for graduates may have failed to accommodate the rapidly increasing supply of graduates.

So far, the literature has assessed the impact of the higher education expansion by measuring the changes in the returns to a degree over time. There had been no significant drop in the returns, which would suggest that the labour market absorbed the extra graduates and that the skills of graduates were appropriate. However, since new cohorts typically represent only a small fraction of the sample, these conclusions may be incorrect. Instead in this paper, we compare the early labour market attainment of two cohorts of graduates, one graduating just at the beginning of the expansion period (1990), whilst the second graduated towards the end of the expansion (1995). The two surveys allow us to measure the evolution in over-education and the wage penalty associated with it between the two cohorts. Additionally, the second survey allows us to assess the skills of new graduates.

Over-education can be defined as not being in a graduate job. The expansion of higher education resulted in a doubling of the over-educated population to 35% but we do not find evidence that over-educated individuals are lacking academic skills. Hence, the expansion did not result in a reduction in the quality of graduates.

Over-educated graduates are a heterogeneous group which can be divided between apparent over-education, where graduates feel that their job matches their skills and genuine over-education, where the graduate is over-skilled for the job. Apparently over-educated individuals are almost indistinguishable from matched graduates, but genuinely over-educated graduates failed to develop management and leadership skills while at university. This latter group, representing 15% of graduates is also found to lack unobservable characteristics associated with higher wages (such as motivation, presentation, punctuality, etc). The wage penalty for being genuinely over-educated is similar in both cohorts and reaches 21%, almost eradicating the financial benefit of higher education for this group.

Most new graduates are in jobs that match their skills. We find no evidence that graduates from new-universities are at any disadvantage in the labour market and globally the labour market has been able to absorb most of the influx of graduates.

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1 Introduction

Before the Eighties, Britain had one of the lowest participation rates in higher education across OECD countries. Consequently, increasing participation in higher education became the mantra of British governments. The proportion of school leavers reaching higher education began to slowly increase during the early Eighties, until it suddenly increased rapidly towards the end of the decade. As illustrated in Figure 1, the proportion of a cohort participating in higher education doubled over a five year period, from 15% in 1988 to 30% by 1992. This rapid expansion was caused by changes in both the demand and the supply of higher education. The reform of GCSE¹ for example led to more individuals having the required qualifications to apply to university, whilst the Education Act of 1988 allowed universities to expand. Additional, reforms in the early Nineties led to the end of the separation between polytechnic institutes and universities. In a publicly funded system, this expansion in the number of graduates was only possible because of a large reduction in the unit cost of a graduate; from £8,000 in 1989 to £5,000 in 2000² (DfES, 2003).

Such a large expansion in the supply of graduates over a short period of time is rather unique. Furthermore it was combined with a rapid decline in per graduate funding. These two concomitant phenomena have led to four concerns about the employability of recent graduate cohorts. On the supply side, the post-expansion graduates may have less human capital as i) some graduates may fail to develop appropriate skills whilst at university due to overcrowding and other quality issues associated with the cost reductions, ii) to attract additional students, universities may have developed programs with little content/valuable skills, iii) to fill up all the additional places, universities may have admitted students coming from the lower part of the ability distribution. Notwithstanding the supply effect, there have also been concerns that iv) the demand for graduates may have failed to increase in the same proportion as the supply. Due to the potential reduction in human capital of newer cohorts of graduates and disequilibrium in the labour market, the proportion of over-educated graduates may have increased drastically and their situation became worse.

¹ The General Certificate of Secondary Education is a national examination typically taken at age 16.

² Funding has since been increasing slowly up to £5,500 in 2004/05. At the same time, private contribution, top-up fees were introduced and from September 2006 were capped at £3,000 a year.

The potential over-production of graduates has attracted a large literature. However, this literature has reached somewhat contradictory conclusions. Whilst over-education has been prevalent, with about 30 percent of graduates over-educated (see Sloane, 2003 for a survey), the returns to higher education have not fallen over time (see Machin, 1999 and Dearden *et al.*, 2002). Most empirical evidence has been based on pre-expansion cohorts. One exception is Walker and Zhu (2005) who estimate that, for young graduates, the returns to degrees, as well as the probability of being in a professional/manager occupation, have been declining in the later part of the Nineties. In this paper, we document the consequences of the higher education expansion on the early labour market experience of graduates (first seven years), by comparing them with a pre-expansion cohort. Additionally, we assess whether the over-educated lack skills which would indicate that the expansion was associated with a reduction in the quality of education or a lower quality input. We further add to the literature by looking at the effect of detailed skills (acquired at university), that can be associated with a greater probability of over-education. This is important since some commentators have questioned the rationale of the higher education expansion (Wolfe, 2002). We also investigate the impact of individual unobserved heterogeneity by relying on the longitudinal element of the data, which allows us to control for fixed unobservable characteristics of the graduates.

Following Chevalier (2003), we adopt a measure of over-education that combines occupation and satisfaction of the match between education and job to capture idiosyncratic characteristics of the job match. We thus define three categories of graduates: those employed in a graduate occupation (matched), those who are not in a graduate occupation but are satisfied with the occupational match (apparently over-educated³) and those not in a graduate occupation and dissatisfied with the occupational match (genuinely over-educated).

The contribution of this paper is twofold. First, we analyse the early labour market experience of the 1995 cohort, since these people graduated at the peak of the higher education expansion period. We find a reduction in the proportion of matched graduates, compared to the 1990 cohort. This suggests that the labour market could not fully accommodate the increased inflow of new graduates, although this did not lead to an increased wage penalty associated with over-education. Hence, the post-expansion cohort had the appropriate skills

³ Apparently over-educated workers are using their graduate skills in their job and this status is thus not associated with skills under-utilisation. It then captures the skill heterogeneity theory as defined in Green and McIntosh (2006).

to succeed in the labour market. Secondly, we are the first to investigate whether the over-education wage penalty remains even after controlling for observable graduate skills, skill mismatch, as well as unobservable characteristics. We find some evidence that genuinely over-educated individuals lack ‘graduate skills’; mostly management and leadership skills. Additionally, the longitudinal element of the dataset is used to create a measure of time-invariant labour market unobservable characteristics which are also found to be an important determinant of the probability to be over-educated. Over-education impacts negatively on the wages of graduates, over and above skill levels (observed or not) which suggests that the penalty cannot be solely explained by a lack of skills but also reflects some job idiosyncratic characteristics. It also increases unemployment by up to three months but does not lead to an increase in job search, as the numbers of job held since graduation is not affected by the current over-education status.

The paper proceeds as follows. The next section details some of the relevant literature, whilst the third section provides an overview of the data and presents some descriptive statistics. Section 4 discusses the empirical results for the incidence of over-education, the determinants of earnings and other aspects of the labour market experience. The final section concludes.

2 Literature Review

The paper builds on an extensive literature on over-education (see Sloane, 2003 for a survey). This literature has documented the extent of over-education in a number of countries, and demonstrated a significant wage penalty associated with working in a job for which one is over-educated compared to individuals with the same level of education.

Most of the UK literature has relied on self-assessment of over-education, and typically finds that 30% of graduates are overeducated⁴. Battu et al. (2000) provide one of the most comprehensive studies of over-education. The average proportion of over-educated individuals across the 36 estimates of their analysis was around one-quarter, with estimates

⁴ Similarly, Sloane et al (1999) reported 31% of UK adults living in urban areas between 1986 and 1987 were over-educated. That is, over-education was not confined to just the highly educated and there was no evidence that the quality of match improved with a change of employer.

ranging between one-fourteenth and as high as two-thirds. For the UK, Battu et al (2000) concluded that over-education has not increased in the early Nineties. This result is supported by Groot and Maassen van den Brink (2000) whose meta-analysis of 25 studies found no tendency for a world-wide increase in the incidence of over-education despite the general improvement in the level of education, although they do suggest it has become increasingly concentrated among lower ability workers, suggesting the over-education is not solely due to mismatch of workers and jobs.

Freeman's pioneering work on over-education (1976) suggests that over-education is a temporary phenomenon due to friction in the labour market, although UK evidence is contrary to this assumption. Dolton and Vignoles (2000) found that 38% of 1980 UK graduates were over-educated in their first job and that 30% remained in that state six years later. Over a longer period there is also evidence that over-education is a permanent feature of some graduates' career (Dolton and Silles, 2003). For graduates the wage penalty associated with over-education ranges between 11 and 30 percent, however, contrary to Freeman's view over-education has not led to a decrease in the UK return to education in general (Machin, 1999 and Dearden *et al.*, 2002) even if recent evidence by Walker and Zhu (2005) report lower returns for the most recent cohort of graduates.

The general consensus is that after controlling for differences in socio-economic and institutional factors, over-education is a consequence of unobservable elements such as heterogeneous ability and skills. There is evidence to support this from studies by Büchel and Pollmann-Schult (2001), Bauer (2002), Chevalier (2003) and Frenette (2004). Most over-educated workers are efficiently matched into appropriate jobs and after accounting for the unobserved heterogeneity, the wage penalty for over-education is reduced. However, a remaining group of workers appear over-skilled for their jobs and suffer from substantial wage penalties.

Some advocate that over-educated workers do have skills that are in less demand in the labour market. Hence, it is not merely that they have *less* 'unobservable' skills, but they have *more* 'undesirable' skills. Consequently, a few studies have attempted to distinguish between a formal education mismatch (over-education) and mismatch between acquired and required skills. Allen and van der Velden (2001) used a 1991 survey of Dutch graduates to show that a mismatch between education and jobs does not necessarily imply a serious mismatch

between available and required skills. Similarly, Green and McIntosh (2006) found that among employees who are over-educated, less than half report having skills and abilities that they are not using in their job. These studies suggest that the apparent effects of over-education are spurious and represent other unobserved ‘ability’ differences, over and above skill mismatch.

3 Data

The data were drawn from a survey of 4,502 UK graduates from UK Higher Education Institutions in 1995 that was undertaken by the Institute of Employment Research (IER) at Warwick University in 2002/3⁵. The graduates were surveyed seven years after their graduation on aspects regarding their education, career paths and current economic situation. They represent around 2% of the total population of 225,000 domestic UK graduates in 1995 and were drawn from 38 different Higher Education Institutions⁶. These data represent the first major study of post-expansion graduates. After eliminating respondents with missing values, the sample is restricted to 2,484 employed graduates⁷. The survey contained a wide range of questions relating to respondents’ individual and employment characteristics. These include socio-demographic questions such as sex, age, ethnicity, region of residence, parental social class; as well as human capital characteristics such as degree subject, class of degree, type of institution attended, and qualification held upon entry to higher education. Employment questions are also asked and these include grouped annual gross salary, nature of employment, job satisfaction, firm-size, type of contract, sector and type of organisation.

⁵ The data were originally collected for a report produced by IER for the then Department for Education and Employment (DFEE), agreed with the Higher Education Careers Services Unit (CSU) and the Association of Graduate Careers Advisory Services (AGCAS), in order to investigate the career paths of graduates in 1995.

⁶ Graduates from two distinct groups of higher education institutions were excluded from participating in the postal survey: those from specialist institutions (art and design colleges, agricultural colleges, and medical colleges) and those from Open University.

⁷ This restriction leads to some potential selection bias as individuals with a greater probability of over-education may be less likely to participate in a postal survey and also to be employed. However the lack of identifying variables prevents us from dealing appropriately with this issue. The criteria by which the sample is selected are reported in Annex 1. The final sample was marginally more successful at university and has experienced 0.30 less months of unemployment since graduation. An important restriction is to restrict the sample to non-mature student so that the first job earnings do not reflect unobserved pre-university characteristics.

Crucially, information is collected on the respondents' current occupation at the four digit Standard Occupational Coding (SOC2000) level. It is therefore possible to identify whether a respondent was employed in a graduate job.⁸ Following the existing literature, we define 'over-education' as not being employed in a graduate job, although we re-classify these into those who felt their qualifications were *ideal* for their current job (apparently over-educated) and those who thought their qualifications were *very inappropriate* (genuinely over-educated). This allows over-educated graduates to be heterogeneous in terms of the type of job that they hold as in Chevalier (2003) and Green and McInstosh (2006).

Figure 2 plots self-assessed qualification match against one digit occupational group, where qualification match is measured on a 7-point scale between very inappropriate (1) and ideal (7). Perhaps not surprisingly, there is clear evidence of a dichotomy between Professional workers and everybody else. Workers employed in Professional occupations were much more likely to find their match ideal. Associate Professionals and Managers are not dissatisfied with their match but few claim it to be ideal, whereas those in Administration/Clerical and Other occupations had a greater propensity to see their match as very inappropriate. Following Chevalier (2003), we define workers not employed in a graduate job as 'apparently' over-educated if they ranked themselves between five and seven on the qualification match scale (satisfied with the match between education and job) and genuinely over-educated otherwise. We class all workers employed in a graduate job as matched. This provides a sample of 1,640 (65 percent) matched workers, 488 (20 percent) that were apparently over-educated and 376 (15 percent) that were genuinely over-educated. This shows a considerable increase in the proportion of over-educated graduates compared to the cohort of 1990 (Chevalier, 2003) with the proportions of genuine and apparently over-educated workers both doubling. This evolution of over-education is also consistent with the evidence presented in Walker and Zhu (2005).

Table 1 provides evidence that this measure of over-education differentiates between different types of worker. Respondents were asked whether the possession of a degree was a *requirement for obtaining* their current job and this provides an alternative self-assessed measure for over-education (as used by Battu et al. 1999, 2000). Panel A reports these statistics for the three groups of graduates. Whether a degree was a requirement differs

⁸ We define graduate occupations in accordance with the Dictionary of Titles. Graduate jobs include all managerial and professional positions as well as IT associate professional, nurses and midwives.

significantly by groups of graduates, with the lowest proportion found for the genuinely over-educated graduates (26.15%). However, apparently over-educated graduates were only marginally less likely to be in a job that required a degree relative to matched graduates (72.19% compared to 78.69%). In panel B, we report up to 13 *reasons for accepting* the current job (more than one reason can be reported). Genuinely over-educated graduates were only half as likely as other graduates to report to be in exactly the job they wanted. They are also less likely to admit that salary level, as well as interesting tasks, were important reasons for accepting their current job. On the other hand they were two to three times more likely to report that one of the reasons for accepting this job was that it is better than being unemployed and that it suited them for the short run.

Apparently over-educated graduates do not differ from matched graduates but there is some evidence that they may have adopted a foot in the door approach and accepted a job to suit their long term career development. They are also more likely to accept a job because it was interesting. Overall these statistics suggest that our definition of over-education distinguishes between different types of graduates and that the over-education population should be split between graduates who choose to be over-educated to suit their long term plans and those who are pushed into jobs for which they are over-educated. Elias and Purcell (2003) also suggest that the market for graduates has become more fragmented. They define four types of graduate jobs (traditional, modern, new and niche) and show that these differ in their skill usage and earnings.

Given the large increase in the proportion of over-educated graduates compared to the 1990 cohort, we now assess the skill levels of the three groups of graduates. The survey provides detailed information on observable skills, whereby each respondent was provided with a list of 13 skills (these include written and spoken communication, numeracy, computer literacy and management skills) and asked to identify which of these skills were gained from their degree course and which were being used in their current job. From this, we have generated a measure of mismatch between skills 'held' from education and skills 'used' in employment.⁹ If a respondent is in possession of a particular skill which is not being utilised we class this individual as 'over-skilled' in that particular skill; similarly if a respondent is using a skill

⁹Respondents were asked whether each skill was developed and used 'not at all', 'some' and 'a lot'. We grouped together 'some' and 'a lot' to form one composite group.

that was not developed from their degree programme we classify that respondent as 'under-skilled'.

Table 2 reports the self assessment of skills developed on the 1995 degree course by over-education category. In general differences in academic skills are small, although more matched graduates report having technical skills (problem solving, IT, numeracy) whilst more over-educated individuals have written communication skills. However, large differences in skills level are observed for non academic skills (entrepreneurial, management and leadership). These are often the skills considered crucial to succeed in the labour market and for which genuinely over-educated individuals seem to be far less well equipped. Genuinely over-educated graduates are about 15 percentage points less likely to have developed these skills at university. Apparently over-educated graduates have similar level of skills compared to matched graduates. Based on these self-reported statements, there is little evidence that over-educated individuals obtained degrees that did not foster academic skills. The expansion of higher education has thus not lead to the creation of under-skilled graduates, at least as far as academic skills are concerned.

A measure of mismatch between skills possessed and skills required in the labour market is provided in Table 3. This reports the difference between skills held and skills used in the job ('over-skilling') by graduate category. In general the match between skills developed and skills used is rather good, with only research skills and foreign languages being under-used. Note also that entrepreneurial, teamwork, management and leadership skills were always fully deployed. Whilst the differences in academic skills held between the over-educated group and the matched graduates were small, the percentage over-skilled was much higher amongst the genuinely over-educated, compared to the other two categories. For the genuinely over-educated, research, creativity and to a lesser extent written communication skills were dramatically under-used. Apparently over-educated graduates use their skills as much as matched graduates.

Despite the expansion of higher education, there is no clear evidence that some graduates fail to develop academic skills whilst at university because the difference found in academic skill level is rather small. However, for genuinely over-educated graduates these skills are under-used in their current job. This does not necessary imply that these graduates have acquired skills of lower quality but simply that their skills are not in demand as in Green and McIntosh

(2006). Moreover, genuinely over-educated graduates have failed to acquire labour market related skills whilst at university and are at a serious disadvantage compared to their peers. The reason for the shortage of skills mostly obtained through extra-curricular activities is unclear.

In addition to these self-reported tangible skills, we also investigate differences in other skills. The residuals from a regression of first job earnings are computed to proxy the unobservable skills of graduates.¹⁰ Since skills obtained during degree are included as covariates, the residual term is by construction orthogonal to the observed skills. These residuals measure characteristics that are perceived by the employer such as motivation, punctuality, but not by the econometrician. This term also incorporates a 'luck' component reflecting the conditions of labour market entry that may affect earnings permanently (at least for the period of time covered by the dataset). Most of the coefficients had the expected sign and are therefore not discussed here.¹¹ In Figure 3, we report the distribution of the normalised residuals separately by over-education group. These differ for the three groups with the distribution being normal for the matched graduates and under-dispersed for the over-educated. Moreover, the mean fluctuates from 0.095 for the matched graduates to -0.127 for the apparently over-educated and -0.255 for the genuinely over-educated, all differences being statistically significant. Hence over-educated graduates differ from matched graduates not only in their observable skills but also in some unobservable component that we can attribute to intangible skills, career expectations and luck.

Moreover, the inclusion of this residual term reduces the possible endogeneity bias on the over-education estimate in a wage equation. For example less motivated individuals may settle for lower wages but also for a job for which they are over-educated. A wage regression not accounting for motivation would attribute the observed wage penalty to over-education. In general, we believe that unobserved characteristics positively correlated with over-education are negatively correlated with pay, so that estimates assuming the exogeneity of over-education will be biased. These residuals also reflect the condition of the local labour

¹⁰ The controls for this regression includes gender, age, ethnicity, social class of parents, type of school attended, A-level score, a dummy indicator for Scottish higher, the type of higher education institution, the class and subject of degree, an assessment of 13 skills that have been learnt at university and region of first job (10 administrative regions + overseas). See Annex 2 for details.

¹¹ The effect of acquired skills on earnings were positive and statistically significant for 'Spoken Communication', 'Foreign Language' 'Numeracy' and 'Leadership' skills, whilst the effect of 'Basic Computer Literacy' and 'Advanced IT' skills were negative and significant.

market when the graduate started working; this 'luck' component may have some long term consequences both on current position and therefore over-education status, and on wages.

4 Results

So far, the description of the raw data suggests that genuinely over-educated workers are less skilled (especially in market skills) and additionally that there may be some element of mismatch between the skills these graduates hold and those demanded by employers. Also, the over-educated appear to have less favourable unobservable characteristics. We now present the results from the econometric analysis on early labour force attainment. We focus on four outcomes: the incidence of current over-education, current wages, number of jobs held and length of unemployment since graduation.

Determinants of over-education

The determinants of over-education are estimated using a multinomial logit. Table 4 reports the marginal effects estimated at the sample means for various models. As found in Chevalier (2003) for the pre-expansion cohort, the probability of over-education is not gender related. However, white graduates are more likely to be apparently over-educated whereas better school credentials (A-levels) reduce the probability of genuine over-education, on average. Surprisingly the class of degree is irrelevant. Whilst in earlier cohorts the type of higher education institution did not affect over-education (Chevalier, 2003), for this first post-expansion cohort we find that attending a 'new university' increases the probability of being apparently over-educated. This is consistent with the idea that these institutions offer degrees in subjects leading to non-traditional graduate occupations but for which 'graduate skills' are nonetheless required. Hence it is not the case that graduates from these institutions were unwanted in the labour force, given that the probability of being genuinely over-educated is identical for all institutions.

Relative to Law, all degree subjects increase the likelihood of over-education. However, mathematics, medicine, engineering, education and 'other' degrees offer greater protection

against the likelihood of genuine over-education. Additional post-graduate qualifications tend to reduce the probability of genuine over-education. Importantly, the social origin and type of school attended, although being an important determinant of higher education participation, are not significantly related to over-education. This suggests that parental social networks are not an important factor in obtaining a matched position. We also found that graduates have a preference for working in central London, and therefore are likely to accept positions for which they are over-educated in order to work in the Capital (although this is not reported in our Table).

Table 4 reports three additional models that differ from the base model by the introductions of skills. Model 2 includes unobserved characteristics, Model 3 includes indicators of skills acquired at university and Model 4 includes both types of skill. Graduates with better unobserved characteristics in 1995 were less likely to be over-educated in 2002, especially where genuine over-education is concerned. Improving the unobservable component by 1 standard deviation (the mean difference between matched and genuine over-educated graduates) reduces the probability of apparent and genuine over-education by 2.8 and 3.6 percentage points respectively. This effect does not disappear when observable skills are added to the model, confirming that these two measures of skills are orthogonal to each other.

Model 3 shows that most academic skills do not affect the incidence of over-education. We suggest that this is because such skills are generic and employers expect all graduates to have them. Surprisingly, having developed written communication skills at university increases the probability of apparent over-education. Skills more directly related to the labour force (such as entrepreneurial, management and leadership) significantly reduce the probability for genuine over-education. Having leadership skills for example reduces the probability of genuine over-education by 10 percentage points. This effect is as large as having a PhD or graduating from medicine or maths. So clearly non-academic skills matter in predicting over-education and genuinely over-educated graduates have a shortage of these. These results are robust to the inclusion of unobserved characteristics (Model 4).

To summarise, the determinants of over-education have remained similar pre- and post expansion. There is no evidence that new-university graduates are of sub-standard quality. They are nonetheless more likely to be apparently over-educated compared to graduates from an old university. Hence a degree acquired from these institutions may develop skills more

appropriate for non-traditional graduate jobs. Subject of degree remains the most important factor, where there is large heterogeneity in the risk of over-education between subjects. Academic skills have a marginal impact on the propensity for over-education. Management and leadership skills substantially reduce the risk of genuine over-education. Moreover, individual unobserved heterogeneity reduces both apparent and genuine over-education.

Over-education, skills and earnings

Figure 4 reports the hourly pay distributions for the three groups of graduates.¹² These are almost identical for matched and apparently over-educated graduates confirming that this latter group does not consist of individuals not using their skills in the labour market. However, genuinely over-educated graduates earned on average almost £3 less than matched graduates (or 20% less at £11.40). The distribution of hourly pay for genuinely over-educated graduates is similarly shaped as for matched graduates but is shifted to the left, thus the differences in the mean are not due to a large tail of 'unlucky' individuals.

Moving on to the determinants of hourly pay provided in Table 5, we estimate a Mincerian model which includes the following controls: gender, social class of parents, ethnicity, the type of schools attended, pre-university credentials, type of higher education institutions, degree grade, subject of degree, additional qualifications as well as employment characteristics such as months of employment and unemployment since graduating, size of employers, and region of residence.

For brevity we do not discuss the full set of estimates, except to say that they all have the expected economic interpretation. In the base specification, the penalties for being over-educated reach 7% and 23% for the apparently and genuinely over-educated respectively, compared to matched graduates. That is, over-educated graduates earn less than their peers who are in a matched job, on average. It is important to note that we do not estimate the return to years of over-education but only compare earnings between graduates. The estimate for genuine over-education is identical to the one found in Chevalier (2003). Comparing

¹² Hourly pay is calculated as annual wage income divided by annual hours worked where annual hours is proxied by assuming that individuals work 52 weeks at the reported weekly number of hours. Pay is reported in 14 categories and mid-points are used for the calculation.

Model 1 with the first column in Table 5, the penalty for being genuinely over-educated remained the same even though the probability of genuine over-education doubled between the two cohorts. In the base model, the wage penalty for being apparently over-educated, at -7.2%, has increased by 40% compared to the estimate for the 1990 cohort.

Model 2 includes some potentially endogenous variables characterising the employment situation of graduates in 2002. These additional controls are sector of employment (public, private or non-profit) and type of contract (permanent, fixed or temporary). Including these variables reduces the penalty for apparent over-education by almost a percentage point but has only a marginal effect on genuine over-education. This suggests that the over-education penalty is not due to a precarious employment situation, whereby individuals are accepting a temporary position as a stepping stone for the better job to which they aspire.

In order to test whether over-education was solely due to a lack of 'graduate skills' we estimated a third specification (Model 3), in which we include unobserved characteristics. Whilst the unobserved skill proxy is highly significant, an increase by one standard deviation in unobserved skills increases the hourly wage by 7%, it reduces the wage penalty by 20% and 10% for apparent and genuine over-education respectively. Hence the over-education wage penalty is not solely due to a lack of unobservable skills. This model is identical to the one estimated in Chevalier (2003) for the 1990 cohorts of UK graduates (provided in the second column of Table 5). The point estimate of the effect of unobserved skills on hourly pay is identical between the two cohorts and the estimates on over-education are less than one percentage point apart (this represents a 15% increase in the wage penalty due to apparent over-education). Despite the doubling of the over-educated population, the wage penalty for being over-educated has not substantially increased suggesting that employers created new positions in traditionally non-graduate occupations in order to utilise the skills of the new graduates (see also Mason, 2002). Additionally, we test whether the impact of unobserved skills are identical for the three groups of graduates by introducing interaction between over-education status and unobserved skills. These interactions were not found to be significant and are therefore not reported in the paper.

Earlier, Table 4 suggested that skills developed at university are a poor predictor of over-education, with the exception of entrepreneurial, management and leadership skills that had some explanatory power. In Model 4 we include all the 13 skills developed at university as

covariates. Academic skills are not individually reported as they were not jointly significant in determining earnings. However, we found that employers favoured graduates with entrepreneurial and management skills, each increasing hourly wage between 7% and 10%. However, the introduction of these skills (that are desirable in the workplace) only marginally reduced the penalty for being in an over-educated position, especially for apparently over-educated graduates.

Model 5 further includes measures of the use of the academic skills on the job and capture both over and under-utilisation. Specifically, for each academic skill we include an over-skill dummy when the skill was developed at university but is not used in the workplace. Similarly, the under-skill dummies are defined for individuals who use skills that were not developed at university. Only the under-skill dummies were jointly significant.¹³ Surprisingly, these measures of over or under skills do not reduce the wage penalty for being over-educated and are thus orthogonal to over-education, confirming the previous findings in Table 4.

Models 6 and 7 follow the same specification as Models 4 and 5 but additionally include the proxy for unobservable characteristics. Even after controlling for observed and unobserved skills, the penalties for over-education are still significant and reached 5% and 18% for the apparent and genuine, respectively. Including all measures of skills reduces the penalty for over-education by 2 to 5 percentage points but does not eliminate it. Hence, we reject the assumption that being over-educated is solely due to a lack of skills. It is nonetheless possible that the unobservable characteristics proxied by the residuals are not fixed over time; for example a worker may lose her motivation if her career progression does not match her initial expectations. We suggest therefore that the observed over-education wage penalty, originates from job idiosyncratic characteristics or employment history of the individual, rather than from a lack of observable and unobservable skills.

In short, comparing the 1990 and 1995 cohorts shows that the wage penalty for over-education has only marginally increased. Considering that the number of graduates doubled, with the proportion of over-educated graduates also doubling, such stability suggests that

¹³ The joint significance of the under-skill dummies originates from the large positive premium for under skill in basic computer literacy and research skills – skills that be reasonably assumed to have been learnt out of university.

employers have upgraded jobs to capture the available human capital. This has led to positions with competitive wages and thus apparently over-educated graduates should not be considered as over-skilled for their occupation. In this sense, apparent over-education should not be seen as a waste of resources. The financial situation of genuinely over-educated has also remained stable but at a much lower level. Even accounting for all skills, these graduates earn 18% less on average than other graduates.

Over-education and labour market experience

If over-education originates from a poor match in the labour market, then for any given individual over-education would be a temporary phenomenon. Over-educated graduates would attempt to find a better match at the first opportunity, see Dolton and Vignoles (2000). We therefore investigate whether over-education and skills are related to the number of employment spells since graduation. The assumption is that over-educated individuals should have had more jobs as they try to obtain a perfect match, compared to their peers¹⁴. Figure 5 reports the distribution of jobs since graduation, separately for the three groups of graduates. There is limited evidence that matched graduates had fewer jobs since graduation. The only exception is for the probability of remaining in the first job which is greater for matched individuals, as they had less incentive to change job and find a better match. In Table 6, we report estimates for a negative binomial model regression on the number of jobs held. The covariates include all variables relating to social background and education, as in the determinants of over-education model discussed earlier (Table 4). Whilst over-educated individuals had more jobs, this is never significant. The proxy for unobservable characteristics included in the second model was not significant either. Models 3 and 4 include observed skills acquired at university. Only individuals with entrepreneurial skills developed at university had more jobs than the others. Hence over-education and skills are not significant determinants of the number of jobs held since graduation.

¹⁴ One could also argue the reverse that individuals who invest the most in the search – and thus change jobs most frequently obtain a better match. In which case, we would observe a negative relationship between over-education and number of jobs. The two effects would thus cancel each other in the short-run. However, in the longer run, matched graduates will stop searching and only over-educated carry on searching and thus are found to have been in more jobs. Since we do not observe individuals through out their life-time, this test may be inconclusive.

Another reason for accepting a non-graduate job might be a shortage of employment alternatives. Hence we hypothesise that over-educated individuals may be more likely to have experienced unemployment spells¹⁵. Figure 6 plots the total number of months unemployed for the three groups of graduates. Graduates are mostly sheltered from unemployment with almost 70% of graduates admitting to have never been unemployed. Genuine over-educated graduates however are 15 percentage points more likely to have had at least one spell of unemployment and almost 9% have experienced more than 11 months of unemployment since graduation. Apparently over-educated are marginally more likely to have been unemployed than matched graduates. Similar differences are found when focusing on the mean unemployment for the three groups. Matched graduates have been unemployed for 1.5 months on average, whilst the figures are 1.75 and 3.00 for the apparent and genuine over-educated respectively.

To model the unemployment experience, we use a tobit model to reflect the left censoring at 0 and use the same covariates as in the number of jobs model (Table 7). Apparently over-educated individuals are not significantly more likely to have come through unemployment (again reflecting that their skills are required in the labour market) but the genuinely over-educated have on average experienced 3.5 extra months of unemployment. Unobserved skills are an important determinant of unemployment duration; one standard deviation reducing unemployment by 1.5 months. Moreover, including the proxy for unobserved skills reduces the impact of over-education on unemployment by 45% and 17% for the apparently- and genuinely over-educated respectively. Entrepreneurial, management and leadership skills all reduce total unemployment by about 2 months each, but academic skills do not have any substantial effects. The introduction of observed skills developed at university significantly reduces the effect of genuine over-education on unemployment. In the final specification, unobserved and observed skills are also included. In this specification the estimates of the effect of over-education on total unemployment are halved compared to the base model.

¹⁵ Additionally, we also estimate probit models on the reason to accept the current jobs. Even after controlling for individual characteristics including observed and non-observed skills, over-educated graduates are 7 and 9 percentage points more likely than matched graduates to admit to have accepted the job because “it is better than being unemployed” or “suits them in the short term” respectively.

5 Conclusion

In the early Nineties, the proportion of the cohort reaching higher education in the UK doubled over a 5-year period. As a consequence, there have been concerns about this rapid expansion and in particular on the extent of graduate skill acquisition, as well as the capacity of the labour market to absorb the influx of extra graduates.

This paper focuses on the first post-expansion cohort of graduates to show that the probability of over-education has doubled compared to the pre-expansion cohort, reaching as much as 35 percent with both genuine and apparent over-education increasing in equal proportions. Over-educated individuals can be split into two groups; namely those who think that their current job is appropriate for their education (defined as apparently over-educated) and the rest of graduates in non-traditional graduate jobs which are defined as genuinely over-educated. The two groups of over-educated differ substantially in terms of the reasons for accepting the current job, their observed and unobserved skills as well as their labour market outcomes.

The first unique contribution of this paper is to compare the skill levels of the different groups of graduates. We find limited evidence that the over-educated (genuine and apparent) lack academic skills. So the expansion of higher education cannot be associated with a reduction in the skills attained by graduates. The main skill differential between the three groups of graduates is that the genuinely over-educated have less management and leadership skills. Using the panel element of the data, we also proxy time fixed effect unobservable characteristics (including motivation, presentation, etc) and find that the genuinely over-educated possess significantly less of these, on average. In addition, the over-educated appear to have had a university experience that did not lead to a shortage of academic skills but nonetheless left them with less favourable labour market related and unobserved skills.

The determinants of over-education have remained similar compared to the post-expansion cohort. We find no evidence that graduates from new universities have “worthless” degrees as they have the same probability of being genuinely over-educated as other graduates. They are nonetheless more likely to be apparently over-educated due to the specificities of some of the degrees provided. There is heterogeneity in the probability of over-education depending on the subject of degree, but most other academic credentials only have a marginal effect.

Unobserved skills and labour market skills, especially entrepreneurial, management and leadership largely reduce the risk of genuine over-education.

Academic skills appear to have had a limited impact on wages, unemployment and number of jobs held. Labour market skills, which genuinely over-educated individuals lack, are on the other hand rather important determinants. Management skills, for example, increase wages by 10% and reduce unemployment by 2 months. Unobserved characteristics similarly play an important role. A one standard deviation increase in unobserved skills (which is the mean difference observed between matched and genuinely over-educated graduates) leads to a pay gap of 7% and reduces unemployment by 1.5 months. Policies to improve the development of these non-cognitive skills amongst students would therefore have a large impact on the labour market achievements of graduates.

A second contribution of this paper is to compare the wage penalties associated with over-education for the pre- and post expansion cohorts. Genuine over-education leads to a reduction in hourly pay of 21% even after accounting for unobserved heterogeneity. This estimate is almost identical to the one calculated for the 1990 cohort. For the apparently over-educated, the pay gap increased by 15% and reaches 6.5%. Despite the doubling of the over-educated population the effect of over-education on wages has remained remarkably stable. This suggests that firms have 'skill upgraded' non-traditional graduate jobs in response to the increased skills available. Surprisingly, we do not find that genuinely over-educated graduates are more likely to change jobs in order to improve their position on the labour market.

A third of the over-education wage penalty can be explained by differences in observed and unobserved skills. We conjecture that the remaining penalty represents idiosyncratic job characteristics as well as time varying unobservable characteristics. Accounting for skills differential, the financial returns to a degree are 5% and 18% lower for an apparently and genuinely over-educated worker respectively compared to a matched graduate. For the latter group, the wage differential is equivalent to the returns to a degree for this cohort (Walker and Zhu, 2005).

Some commentators (Wolfe, 2002) have questioned policies expanding higher education. There has been doubt that the labour market could absorb such a rapidly expanding supply of

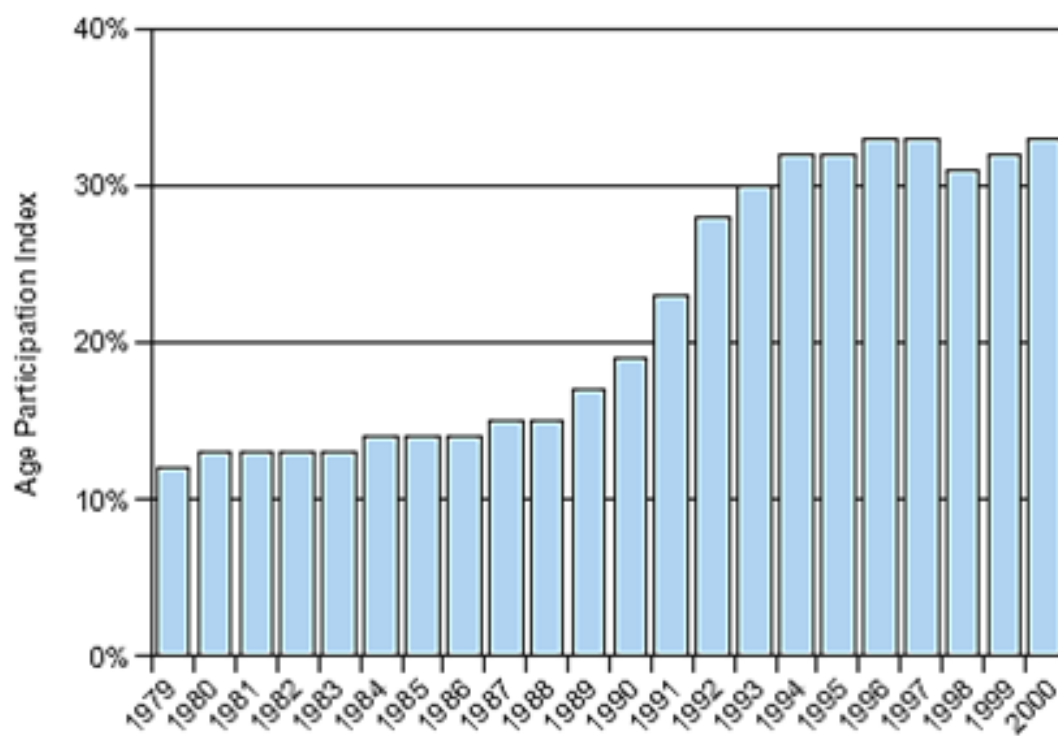
new graduates. Our results suggest that whilst the bulk of new graduates are in jobs matching their skills, there was indeed some wastage, given that 15% of graduates are in jobs that do not require graduate skills and suffer a wage penalty that almost eradicates the financial benefit of higher education. It appears that the labour market nonetheless absorbed most of the expansion in higher education with the skill upgrading of non-traditional jobs. The apparently over-educated workers are mostly indistinguishable from matched graduates on observable characteristics, even though they suffer from a wage penalty of 5%. As for genuinely over-educated graduates, they appear not to suffer from a lower quality university experience but do lack non-academic skills (observed or not) which are necessary to succeed in the labour market. Whilst they suffer from a large financial penalty, their investment in higher education may lead to non-financial returns. Moreover, as current policies have led to increasing higher education fees, the rationale for this group of individuals to invest in higher education may have been reduced.

References

- Allen, J. & R. van der Velden (2001). Educational mismatches versus skill mismatches: effects on wages, job satisfaction, and on-the-job search. *Oxford Economic Papers* **53** (3), pp. 434-452.
- Battu, H., Belfield, C. and Sloane, P. (1999) Over-education among graduates: a cohort view. *Education Economics*, **7**. pp. 21-38.
- Battu, H., Belfield, C. and Sloane, P. (2000) How well can we measure graduate over-education and its effects? *National Institute of Economic Review*, **171**, pp. 82-93.
- Bauer, T. (2002). Educational mismatch and wages: a panel analysis. *Economics of Education Review*, **21**, pp. 221-9.
- Büchel, F. and Pollmann-Schult, M. (2001). Over-education and skill endowments. The role of school achievement and vocational training quality. IZA Discussion Paper number 337.
- Chevalier, A. (2003). Measuring over-education. *Economica* **70** (3), pp. 509-531.
- Dearden, L., McIntosh, S., Myck, M. & Vignoles A. (2002). The returns to academic and vocational qualifications in Britain. *Bulletin of Economic Research*. **54** (3), pp. 249-274.
- Department for Education and Skills (2003) White paper on the Future of Higher Education, Her Majesty Stationary Office
- Dolton, P.J. and Silles, M. (2003). The determination and Consequences of Graduate Overeducation, in F. Büchel, A. de Grip and A. Mertens (eds), *Overeducation in Europe, Current Issues in Theory and Policy*, Edward Elgar.
- Dolton, P.J. and Vignoles, A. (2000). The incidence and effects of over-education in the graduate labour market. *Economics of Education Review* **19** (2), pp. 179-198.
- Elias, P and K. Purcell (2004). A classification of occupations for studying the graduate labour market. Institute for Employment Research, Research Report 6
- Frenette, M. (2004). The overqualified Canadian graduate: the role of the academic program in the incidence, persistence, and economic returns to overqualification. *Economics of Education Review*, **23**, pp. 29-45
- Green, F., McIntosh, S and Vignoles, A. (2002). The utilization of education and skills. Evidence from Britain. *The Manchester School*, **70**, 792-811.
- Green, F. and McIntosh, S (2006). Is there a genuine under-utilisation of skills amongst the over-qualified? *Applied Economics*, Forthcoming.
- Groot, W. and Maassen van den Brink, H. (2000). Over-education in the labor market: a meta-analysis. *Economics of Education Review*, **19**, pp. 149-58.

- Machin, S. (1999). Wage inequality in the 1970s, 1980s and 1990s. In P. Gregg & J. Wadsworth (eds), *The state of working Britain* (pp. 185-205). Manchester, Manchester University Press.
- Mason G. (2002). High skills utilisation under mass higher education: Graduate employment in service industries in Britain, *Journal of Education and Work*, 15, 427-456
- Sloane, P.J. (2003). Much ado about nothing: What does the over-education literature really tell us? In *Over-education in Europe: Current issues in theory and policy*, F. Büchel, A. de Grip and A. Mertens (eds) Edward Elgar
- Sloane, P.J., Battu, H., & Seaman, P.T. (1999). Over-education, undereducation and the British labour market. *Applied Economics* **31** (11), pp. 1437-1453.
- Walker I. and Y. Zhu (2005). The college wage premium, over-education and the expansion of higher education in the UK, IZA DP 1627
- Wolfe, A. (2002). *Does Education Matter? Myths about education and economic growth*. London: Penguin Press

Figure 1: Participation to higher education in Britain (1979-2000)



Source: Department for Education and Skills

Figure 2: Is your current job appropriate for your education?

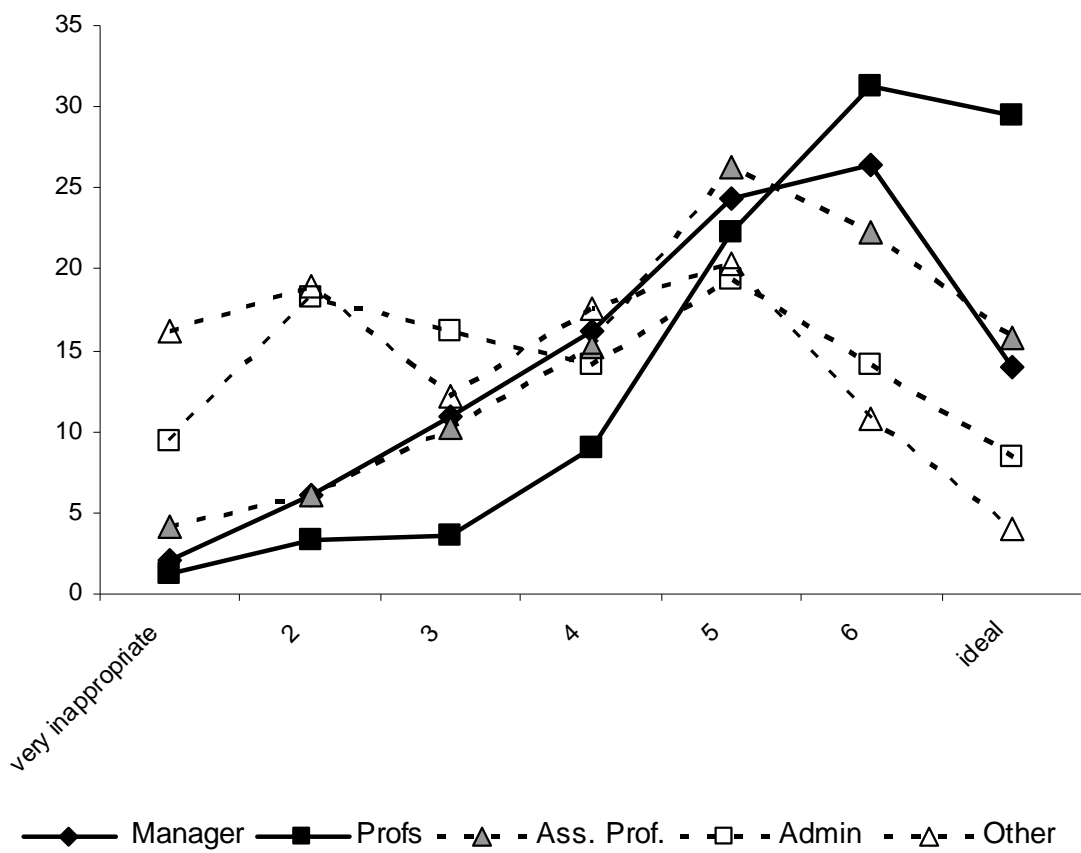
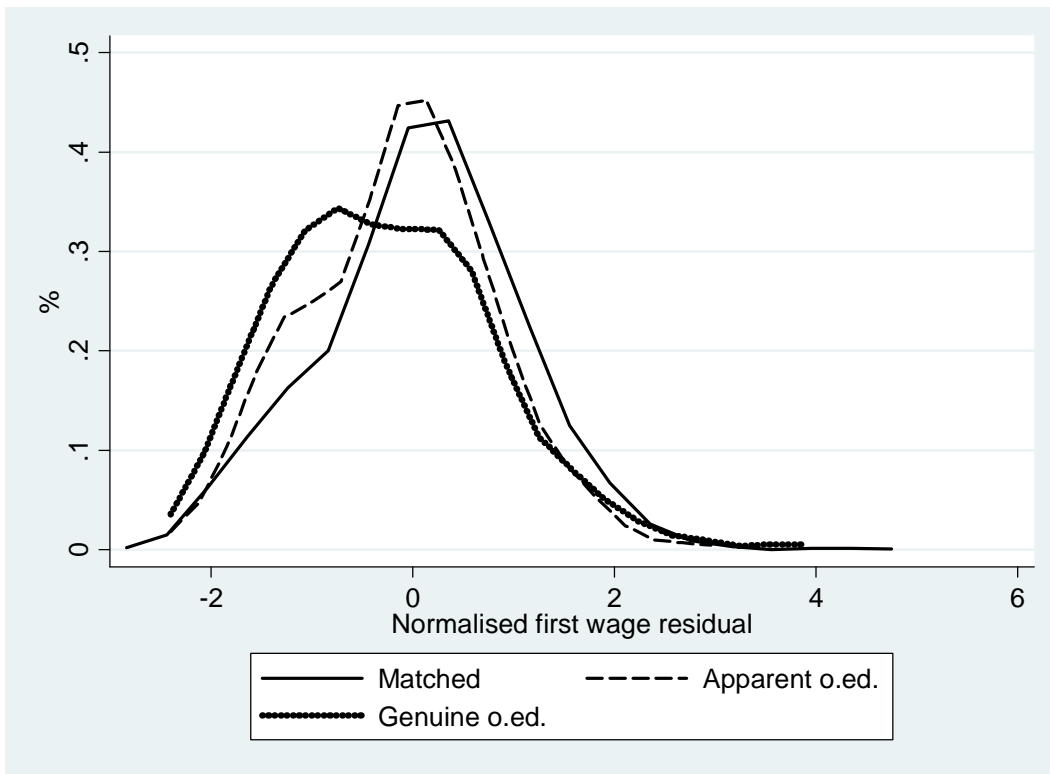
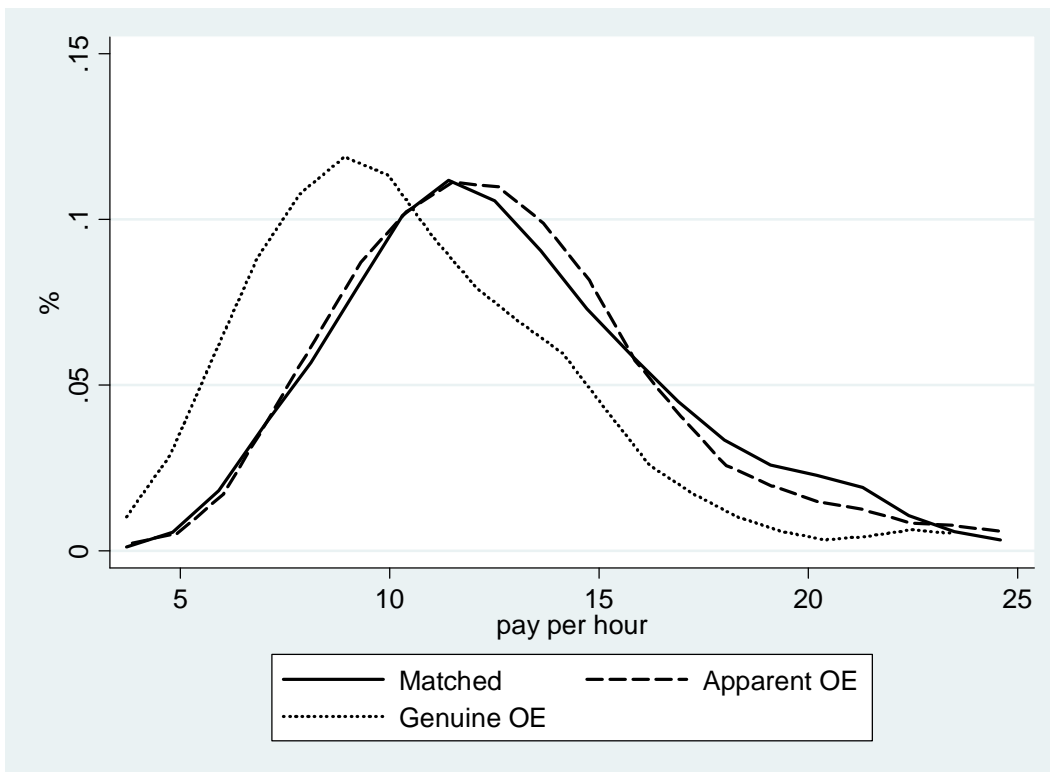


Figure 3: Distribution of unobservable characteristics by over-education group



Note: the distributions of first wage residuals were smoothed using Epanechnikov kernel function

Figure 4: Hourly wage distribution by over-education group



Note: the distributions of hourly wage were smoothed using Epanechnikov kernel function

Figure 5: Distribution of number of jobs held by over-education status

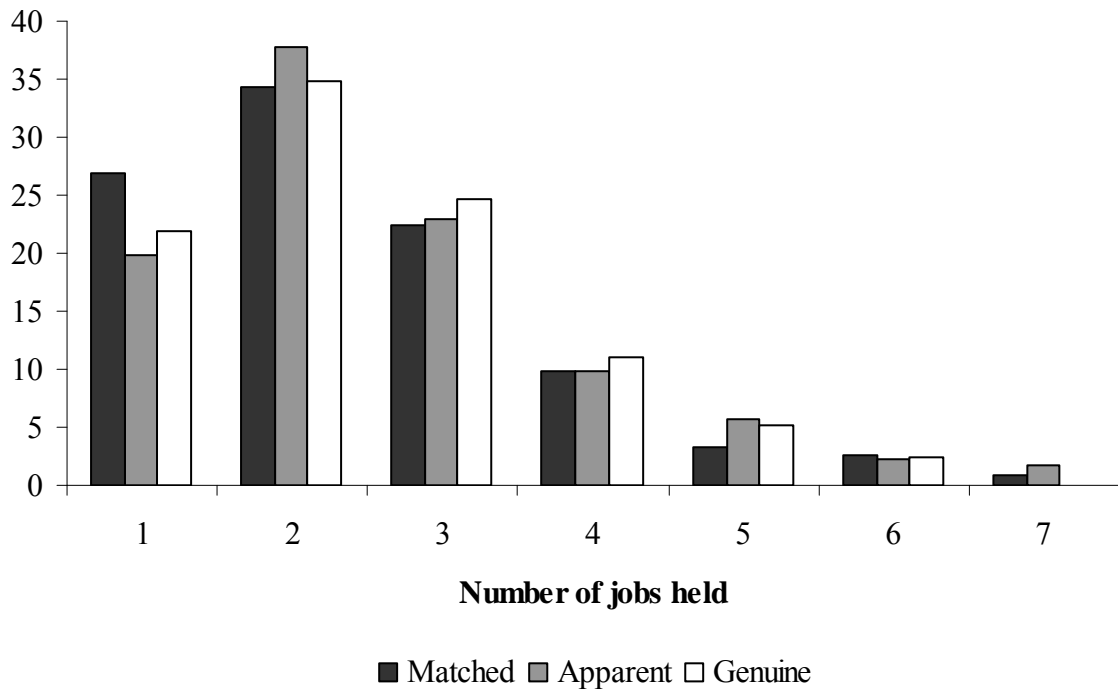


Figure 6: Total number of months of unemployment by over-education group



Table 1: Evidence on the measure of over-education

Panel A	Over-education			
	Matched	Apparent	Genuine	Total
Was a degree a requirement for getting your current job?				
missing	0.12	0.41	0.00	0.16
Don't know	3.57	4.70	6.20*	4.19
Not a requirement	17.61	22.70*	67.65*	26.09
Yes, a requirement	78.69	72.19*	26.15*	69.57
Panel B				
What are the reasons for choosing your current job?				
Exactly job wanted	60.71	59.51	30.19**	55.92
Salary level	46.67	49.69	38.81**	46.10
Other job conditions	37.07	39.26	33.42	36.96
Location	55.85	54.19	52.29	54.99
Employer wanted	25.92	32.31**	26.15	27.21
Interesting work	58.37	62.78*	49.60**	57.93
Career development	61.02	66.67**	46.90**	60.02
Job security	36.08	38.65	37.74	36.84
Partner's career	8.99	5.93**	9.43	8.45
Suits in short run	10.28	11.66	24.53**	12.68
Better than unemployment	7.33	6.13	21.29**	9.18
Other factors	1.79	2.66	3.77**	2.25
Observations	1,624	489	371	2,484

Note: ** and * denote significant difference between matched and other type of graduates at the 95% and 90% confidence intervals respectively. All measures are reported in percentage. For a given group the sum of reasons is greater than 100% as several reasons could be given.

Table 2: Mean Skills Developed on 1995 Degree Course by Over-education.

Skills	Matched	Apparent	Genuine	Total
Problem Solving	86.27	82.62**	79.51**	84.54
Written Communication	92.92	95.91**	95.69*	93.92
Spoken Communication	86.15	88.34	85.18	86.43
Foreign Language	18.35	19.02	19.95	18.72
Numeracy	71.06	66.87*	60.65**	68.68
Basic computer	76.05	76.89	71.70*	75.56
Advanced IT	34.30	30.06*	23.45**	31.84
Research	93.97	92.64	94.34	93.76
Creativity	74.38	76.48	76.28	75.08
Entrepreneurial	51.17	50.31	39.89**	49.32
Teamwork	98.95	98.77	97.84*	98.75
Management	91.19	90.59	75.20**	88.69
Leadership	91.93	91.00	74.39**	89.13
Observations	1,624	489	371	2,484

Note: ** and * denote significant difference between matched and other type of graduates at the 95% and 90% confidence intervals respectively. All measures are reported in percentage.

Table 3: Mean Over-Skilled by Over-education.

Skills	Matched	Apparent	Genuine	Total
Problem Solving	0.68	0.61	3.77**	1.13
Written Communication	0.68	0.61	8.09**	1.77
Spoken Communication	0.18	0	0.54	0.20
Foreign Language	10.34	13.29*	15.09**	11.63
Numeracy	1.85	2.86	7.28**	2.86
Basic computer	0.37	2.45**	3.50**	1.25
Advanced IT	4.31	3.89	4.58	4.27
Research	12.44	12.88	29.11**	15.02
Creativity	3.39	4.29	17.25**	5.64
Observations	1,624	489	371	2,484

** and * Denote significant difference between matched and other type of graduates at the 95% and 90% confidence intervals respectively. All measures are reported in percentage. Over-skilled =1 when degree attained skill = 1 and skill used in present job =0, Over-skilled =0 otherwise. Entrepreneurial, teamwork, management and leadership over-skilling is not reported as for these four skills the match between acquired and used was always perfect.

Table 4: Multi Logit: Determinants of Over-Education

	Model 1: No Skill		Model 2: Unobserved skills		Model 3: Observed skills		Model 4: All skills	
	Apparent	Genuine	Apparent	Genuine	Apparent	Genuine	Apparent	Genuine
Male	-0.019 (0.017)	-0.009 (0.015)	-0.019 (0.017)	-0.012 (0.015)	-0.018 (0.017)	-0.007 (0.014)	-0.017 (0.018)	-0.010 (0.014)
White	0.105 (0.051)**	0.008 (0.034)	0.107 (0.051)**	0.012 (0.034)	0.102 (0.051)**	0.002 (0.033)	0.104 (0.052)**	0.005 (0.032)
Age	-0.005 (0.007)	-0.009 (0.006)	-0.005 (0.007)	-0.009 (0.006)	-0.006 (0.007)	-0.010 (0.006)*	-0.006 (0.007)	-0.010 (0.006)*
A-level score	0.001 (0.001)	-0.003 (0.001)**	0.001 (0.001)	-0.003 (0.001)**	0.001 (0.001)	-0.002 (0.001)**	0.001 (0.001)	-0.002 (0.001)**
Scottish higher	-0.037 (0.044)	0.009 (0.039)	-0.038 (0.045)	0.007 (0.040)	-0.044 (0.045)	0.006 (0.038)	-0.045 (0.046)	0.005 (0.039)
Sixties University	-0.042 (0.036)	0.033 (0.026)	-0.045 (0.036)	0.035 (0.025)	-0.043 (0.036)	0.030 (0.026)	-0.046 (0.036)	0.031 (0.025)
Nineties University	0.050 (0.024)**	0.005 (0.020)	0.050 (0.024)**	0.006 (0.020)	0.050 (0.024)**	0.009 (0.020)	0.050 (0.024)**	0.009 (0.019)
HE College	0.064 (0.038)*	0.032 (0.030)	0.063 (0.038)*	0.035 (0.030)	0.065 (0.039)*	0.044 (0.029)	0.065 (0.039)*	0.046 (0.029)
Subject: Arts	0.201 (0.068)***	0.027 (0.050)	0.202 (0.068)***	0.025 (0.049)	0.198 (0.069)***	0.025 (0.049)	0.198 (0.069)***	0.022 (0.048)
Subject: Humanities	0.172 (0.057)***	0.055 (0.038)	0.174 (0.057)***	0.055 (0.039)	0.154 (0.058)***	0.042 (0.038)	0.155 (0.058)***	0.041 (0.039)
Subject: Language	0.100 (0.067)	0.070 (0.044)	0.102 (0.068)	0.068 (0.045)	0.084 (0.071)	0.060 (0.046)	0.083 (0.072)	0.057 (0.046)
Subject: Social Sciences	0.152 (0.056)***	0.034 (0.037)	0.153 (0.056)***	0.036 (0.038)	0.143 (0.058)**	0.033 (0.038)	0.144 (0.058)**	0.031 (0.038)
Subject: Math, computing	0.137 (0.061)**	-0.161 (0.051)***	0.136 (0.061)**	-0.156 (0.051)***	0.155 (0.066)**	-0.140 (0.054)**	0.155 (0.066)**	-0.141 (0.053)***
Subject: Natural science	0.095 (0.059)	0.016 (0.039)	0.094 (0.059)	0.017 (0.040)	0.096 (0.062)	0.029 (0.040)	0.096 (0.062)	0.026 (0.040)
Subject: Medicine	0.269 (0.059)***	-0.127 (0.053)**	0.269 (0.060)***	-0.121 (0.053)**	0.273 (0.061)***	-0.104 (0.053)**	0.273 (0.061)***	-0.098 (0.053)*

Subject: Engineering	0.100 (0.063)	-0.101 (0.046)**	0.098 (0.063)	-0.096 (0.046)**	0.100 (0.067)	-0.074 (0.049)	0.099 (0.067)	-0.073 (0.048)
Subject: Business	0.232 (0.058)***	0.009 (0.040)	0.234 (0.058)***	0.013 (0.040)	0.234 (0.062)***	0.026 (0.040)	0.237 (0.062)***	0.026 (0.040)
Subject: Education	-0.125 (0.079)	-0.084 (0.047)*	-0.127 (0.080)	-0.083 (0.047)*	-0.140 (0.081)*	-0.063 (0.047)	-0.143 (0.081)*	-0.064 (0.047)
Subject: Other voc.	0.134 (0.064)**	-0.078 (0.050)	0.133 (0.064)**	-0.073 (0.049)	0.125 (0.066)*	-0.058 (0.047)	0.124 (0.067)*	-0.056 (0.047)
Subject: Interdisciplinary	0.151 (0.065)**	0.040 (0.046)	0.153 (0.065)**	0.040 (0.046)	0.146 (0.066)**	0.050 (0.044)	0.148 (0.066)**	0.047 (0.045)
Phd	-0.081 (0.058)	-0.085 (0.055)	-0.078 (0.059)	-0.073 (0.054)	-0.085 (0.059)	-0.109 (0.052)**	-0.082 (0.060)	-0.098 (0.051)*
Post-graduate	-0.034 (0.020)*	-0.088 (0.020)***	-0.034 (0.020)*	-0.089 (0.019)***	-0.035 (0.021)*	-0.085 (0.019)***	-0.035 (0.021)*	-0.085 (0.019)***
Professional qual.	0.039 (0.019)**	-0.002 (0.018)	0.034 (0.019)*	-0.009 (0.018)	0.040 (0.020)**	0.007 (0.017)	0.035 (0.020)*	0.001 (0.017)
Unobserved skills			-0.028 (0.007)***	-0.037 (0.007)***			-0.029 (0.008)***	-0.037 (0.007)***
Problem Solving Skills					-0.034 (0.023)	-0.020 (0.017)	-0.034 (0.023)	-0.023 (0.017)
Written Communication Skills					0.088 (0.041)**	0.027 (0.033)	0.089 (0.041)**	0.029 (0.032)
Spoken Communication Skills					0.013 (0.026)	-0.026 (0.021)	0.013 (0.026)	-0.026 (0.020)
Foreign Language Skills					-0.006 (0.024)	-0.005 (0.019)	-0.007 (0.024)	-0.004 (0.019)
Numeracy Skills					-0.011 (0.023)	-0.012 (0.018)	-0.012 (0.024)	-0.009 (0.018)
Basic computer Skills					0.036 (0.022)	-0.006 (0.016)	0.037 (0.022)*	-0.005 (0.016)
Advanced IT Skills					-0.011 (0.020)	-0.013 (0.017)	-0.012 (0.020)	-0.012 (0.016)
Research Skills					-0.051 (0.032)	-0.009 (0.030)	-0.053 (0.033)	-0.012 (0.029)

Creativity Skills			0.033	0.009	0.033	0.008
			(0.020)*	(0.017)	(0.020)*	(0.017)
Entrepreneurial Skills			-0.016	-0.024	-0.017	-0.024
			(0.017)	(0.014)*	(0.017)	(0.014)*
Teamwork Skills			-0.045	0.017	-0.047	0.012
			(0.074)	(0.052)	(0.076)	(0.051)
Management Skills			0.002	-0.059	0.002	-0.057
			(0.033)	(0.022)***	(0.033)	(0.022)***
Leadership Skills			0.006	-0.107	0.004	-0.107
			(0.033)	(0.022)***	(0.033)	(0.021)***
Pseudo R ²	0.080	0.092		0.107		0.119
Observations			2484			

Note: Robust standard errors reported in parentheses. ***, ** and * indicates significance at the 1%, 5% and 10% level respectively. For models including the unobserved skills variable, the standard errors are obtained by bootstrap with 500 replications.

The specification also includes dummy for missing HE institution, region, school type, social background, subject degree missing, class of degree.

The base individual is a white female who graduated from a pre-sixties university in Law, with a third honour degree, does not possess any further qualification. Her father was a manager, she went to a comprehensive school, and lives in inner London.

Table 5: OLS, Log hourly pay in 2002 – cohort of 1995

	Cohort 1990 in 96	Cohort 1990 in 96	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Apparent OE	-0.051 (0.016)	-0.048 (0.019)	-0.072 (0.018)	-0.064 (0.018)	-0.056 (0.018)	-0.069 (0.018)	-0.068 (0.018)	-0.051 (0.017)	-0.050 (0.018)
Genuine OE	-0.232 (0.022)	-0.216 (0.028)	-0.233 (0.022)	-0.227 (0.022)	-0.208 (0.022)	-0.209 (0.022)	-0.212 (0.022)	-0.181 (0.022)	-0.183 (0.022)
Unobserved skills		0.073 (0.008)			0.073 (0.007)			0.076 (0.007)	0.077 (0.007)
Entrepreneurial Skills						0.077 (0.016)	0.075 (0.016)	0.079 (0.016)	0.077 (0.016)
Teamwork Skills						-0.050 (0.080)	-0.023 (0.081)	-0.054 (0.078)	-0.028 (0.081)
Management Skills						0.105 (0.027)	0.108 (0.027)	0.106 (0.026)	0.109 (0.025)
Leadership Skills						0.035 (0.030)	0.034 (0.030)	0.040 (0.030)	0.039 (0.030)
Sector and contract				F(5,2415) = 24.24					
Skills developed at university						F(9,2407) = 1.04	F(9,2389) = 0.76	F(9,2406) = 1.41	F(9,2388) = 1.08
Over-skill							F(9,2389) = 1.51		F(9,2388) = 1.88
Under-skill							F(9,2389) = 2.12 *		F(9,2388) = 2.22 *
R-squared	0.32	0.37	0.29	0.32	0.32	0.31	0.32	0.34	0.35

Note: Robust standard errors reported in parentheses. For models including the unobserved skills variable, the standard errors are obtained by bootstrap with 500 replications. The regression is based on 2484 observations and also includes control for gender, social class of parents, ethnicity, the type of schools attended, pre-university credentials, type of higher education institutions, degree grade, subject of degree, additional qualifications as well as employment characteristics such as months of employment and unemployment since graduating, size of employers, and region of residence.

Results for the 1990 cohort are reproduced from Chevalier (2003) and are based on 2229 observations from the 1996 survey of the 1990 and 1985 graduate cohorts.

* denotes significance of F-test at the 5% level.

Table 6: Number of jobs held since graduation (Poisson regression)

	Model 1	Model 2	Model 3	Model 4
Apparent OE	0.024 (0.026)	0.023 (0.027)	0.029 (0.026)	0.029 (0.027)
Genuine OE	0.042 (0.027)	0.041 (0.028)	0.045 (0.028)	0.045 (0.030)
Unobserved skills		-0.002 (0.010)		-0.000 (0.010)
Entrepreneurial Skills			0.061 (0.021)	0.061 (0.022)
Teamwork Skills			-0.069 (0.101)	-0.069 (0.103)
Management Skills			0.008 (0.042)	0.008 (0.044)
Leadership Skills			-0.043 (0.043)	-0.043 (0.044)
Skilled developed at				
University			X ² (9)=11.6	X ² (9)=11.4
Pseudo R ²	0.229	0.229	0.229	0.229

Note: Robust standard errors reported in parentheses; for models including the unobserved skills variable, the standard errors are obtained by bootstrap with 500 replications. The model uses 2471 observations. The regression also includes control for gender, social class of parents, ethnicity, the type of schools attended, pre-university credentials, type of higher education institutions, degree grade, subject of degree, additional qualifications and region of residence

* denotes significance of F-test at the 5% level

Table 7: Month of unemployment since graduation (Tobit – left censoring at 0)

	Model 1	Model 2	Model 3	Model 4
Apparent OE	0.996 (0.633)	0.648 (0.609)	0.891 (0.622)	0.557 (0.622)
Genuine OE	3.589 (0.670)	2.991 (0.702)	2.425 (0.690)	1.830 (0.709)
Unobserved skills		-1.550 (0.245)		-1.523 (0.232)
Entrepreneurial Skills			-1.442 (0.511)	-1.462 (0.508)
Teamwork Skills			-0.536 (2.136)	-0.485 (2.169)
Management Skills			-2.155 (0.896)	-2.169 (0.948)
Leadership Skills			-2.252 (0.914)	-2.309 (0.968)
Skilled developed at				
University			X ² (9)=1.63	X ² (9)=1.38
Pseudo R ²	0.019	0.025	0.028	0.033

Note: Robust standard errors reported in parentheses; for models including the unobserved skills variable, the standard errors are obtained by bootstrap with 500 replications. The model uses 2471 observations. The regression also includes control for gender, social class of parents, ethnicity, the type of schools attended, pre-university credentials, type of higher education institutions, degree grade, subject of degree, additional qualifications and region of residence

Appendix:

Table A1: Sample selection

		Characteristics of the dropped population	
	Observations	First and 2.I Honour	Month Unemployed since graduation
Original sample	4502	56.36	2.06
Current occupation missing	3952	54.31	5.45
How appropriate job is - missing	3900	46.16	2.36
Not an employed in 2002	3691	53.84	1.81
Skills missing	3278	52.55	2.01
Not living in UK	3049	58.52	1.94
Age >25 on graduation	2530	54.67	1.42
Earnings in first job missing	2514	75.00	1.38
Earnings in current job missing	2484	53.33	1.60
Final sample	2484	57.89	1.77

Table A2 - First job earnings determinants – OLS

	Ln First Job Pay
Male	0.047 (3.85)
white	-0.079 (2.69)
A-level score	0.005 (5.60)
Scottish higher	-0.031 (0.96)
1960 University	-0.060 (2.64)
1992 University	-0.040 (2.37)
HE College	0.018 (0.69)
Upper second grade	-0.050 (2.49)
Lower second grade	-0.126 (5.85)
Third grade	-0.138 (3.95)
Ordinary or pass grade	-0.105 (2.68)
Other grade	-0.078 (2.62)
Humanities	-0.032 (0.85)
Language	0.047 (1.04)
Law	0.017 (0.37)
Social sciences	-0.015 (0.40)
Math	0.087 (2.07)
Natural science	0.078 (2.02)
Medicine	0.147 (3.63)
Engineering	0.113 (2.71)
Business	-0.027 (0.68)
Education	0.139 (3.46)
Other vocational	-0.002 (0.04)
Interdisciplinary	-0.021 (0.47)
Observations	2514
R-squared	0.22

Note: t-test in parenthesis. The regression also controls for region of work, age, school type, social class, grade of degree missing, subject of degree missing and skills acquired at university