Abstract

There is now a burgeoning literature on the topic of 'overeducation' (and the complementary concept of 'undereducation'), and a growing quantity of UK empirical evidence on this issue. However, as Joop Hartog indicated in his keynote address to the Applied Econometrics Association, "a solid relation [of the overeducation/ undereducation literature] with a formal theory of the labour market is lacking" (Hartog (1997)). Furthermore, the term 'overeducation', in particular, is often used interchangeably with similar but distinct concepts such as 'qualification inflation'. This paper attempts to define and measure 'undereducation' and 'overeducation' more precisely, to quantify the extent of genuine skill and educational mismatch and to link these phenomena into the existing literature on skill-biased change and wage inequality. We provide new empirical evidence on this issue, using data from the International Adult Literacy survey, the recent UK Skills Survey, and the National Child Development Study. Specifically, we find convincing evidence of *skill* under-utilisation in the British labour market. For example, 20% of IALS respondents have reading and comprehension skills that appear to be under-utilised in their jobs. We also show that 'genuine' overeducation is a significant phenomenon in Britain. For instance, a new survey of graduates by the University of Newcastle suggests that just over 20% of recent graduates are genuinely 'overeducated' for their jobs. We discuss the policy and welfare implications of our findings.

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‘Overeducation’ and Skills – Clarifying the Concepts

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‘Overeducation’ and Skills – Clarifying the Concepts

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1. Introduction

The economic role of human capital, particularly education, has long been recognised by economists and policy-makers (Becker (1964)). Hence there is now a considerable amount of empirical research on the closely related topics of education and skills (Murray and Steedman (1998); Prais (1995)) and, more specifically, the increasing role of skilled labour in the economy (Berman *et al* (1994); Green *et al* (1998); Machin (1996a); Machin and Van Reenen (1998)). Much of the evidence supports the view that recent increases in the demand for skills can be primarily attributed to skill-biased technical change, and the accompanying organisational changes in the management of firms. The data also show that, alongside the rapid increase in the demand for skills, there has been a substantial rise in the supply of more educated labour. Yet in the UK at least, the return to education has actually increased since the late 1970s, implying that the demand for skills has accelerated more rapidly than the supply (Manacorda and Manning (1999)). The policy implications appear to be that nations need to continue or even increase their investment in education and training, in order to remain competitive in the world economy. Yet alongside the huge literature on the role of human capital and the impact of skill-biased technological change, a smaller literature on ‘overeducation’ (and the complementary concept of ‘undereducation’) has emerged. This literature has sometimes appeared to challenge the assumption that the labour market demand for education and skills has exceeded the increase in the supply of this human capital.

Indeed, there is now a substantial amount of American and European empirical evidence on the topic of overeducation. However, as Joop Hartog indicated in his keynote address to the Applied Econometrics Association, “a solid relation [of the overeducation/undereducation literature] with a formal theory of the labour market is lacking” (Hartog (1997)). Another problem is that the term ‘overeducation’, in particular, is often confused with quite distinct concepts such as ‘credentialism’ or ‘qualification inflation’. Furthermore, as we show in this paper, even the existence of genuine ‘overeducation’ does not necessarily imply that individuals have been in some sense acquiring excess education or that the social return to education is too low. Although the term ‘overeducation’ has often appeared to be pejorative (Coffield (1999)), the concept strictly only applies to the human capital investment component of education. Economists assume that part of the purpose of undertaking education is to raise an individual’s productivity level and thereby increase their future earnings, and it is the appropriateness and effectiveness of this investment decision that the concept of overeducation refers to. Clearly education yields other non-pecuniary benefits[1] which may more than justify an individual’s decision to acquire education, regardless of the effect on their labour market outcomes.

In this paper, we attempt to disentangle the notions of ‘credentialism’, ‘overeducation’, ‘undereducation’ and genuine ‘up-skilling’ and link these concepts into labour market theory and the evidence of skill-biased change. We provide new empirical evidence on these issues from a

1. Acquiring education may also impose non-pecuniary ‘costs’ on individuals, *eg* learning costs.

number of different data sources, including the International Adult Literacy survey, the recent UK Skills Survey, the Newcastle Alumni Survey and the National Child Development Study. We find convincing evidence that both *skill* under-utilisation and genuine overeducation are significant phenomena in the British labour market. However, we also conclude that some of the incidence of overeducation is attributable to heterogeneity within education levels. In other words, for a given level of education, overeducated workers are less able, less productive and therefore have lower wages than their similarly educated peers.

2. Definitions Of Over- and Undereducation

Richard Freeman (1976) and Ronald Dore (1997) were two of the first economists to express concern about the problem of 'over-investment' in higher education. Freeman, for example, argued that the large fall in the rate of return to a US degree in the 1970s indicated that there had been over-investment in higher education, resulting in an excess supply of graduates. He also maintained that, although over-investment in education was possible in the short run, in the longer run the fall in the return to a degree, for example, would cause a decline in the supply of graduates. Yet the decline in graduate numbers never materialised in the US. Throughout the 1980s the supply of graduates increased, as did their relative salaries (Murphy and Welch (1989)). This suggested a strong and growing demand for this type of labour and allayed fears that the US had 'too many' graduates. Yet interest in this issue has persisted in Europe and the US. Specifically, the rapid expansion of higher education in many European countries in the last two decades has raised fears of an over supply of this type of labour. Undoubtedly, Freeman's work, and the ensuing debate about the US graduate labour market, acted as a catalyst for research into the related issue of 'overeducation'. However, almost from the start, there has been some confusion about the precise definition of 'overeducation' and its corollary 'undereducation'.

2.1 Standard definitions of over- and undereducation [2]

Most researchers have defined an individual as being overeducated if s/he has education in excess of that required ***to do*** his/her job, irrespective of the salary paid to the worker. Conversely, an individual is defined as undereducated if s/he has less education than is required to do his/her job. These apparently concise definitions are problematic for a number of reasons. First, they require an estimate of the education required ***to do*** a particular job, a conceptually difficult estimate to make. In practice, the necessary years of schooling (or educational qualifications) to do a job have been assessed in several alternative ways. Some analysts have used self-assessment techniques (Duncan and Hoffman (1981); Sicherman (1991); Sloane (1995)), whereby survey respondents are asked to make their own assessment of the minimum education level or qualifications needed for their job. In most cases, this subjective method focuses on the qualifications required for recruitment to the job, but an additional issue is whether the qualifications are deemed necessary for actually doing the job. The distinction between these two concepts is discussed further below. Other researchers have used external methods to assess the required education for a particular class or type of job, generally using job

2. This paper focuses largely on overeducation. However, most of the arguments apply equally to the concept of undereducation.

analyst data. Rumberger (1987), for example, used the US Dictionary of Occupational Titles, which provides information on the educational requirements of a wide range of occupations. Another, more questionable, method was adopted by Verdugo and Verdugo (1989). They calculated the mean years of education (and standard deviation) for a range of occupations (using 1980 census 3-digit occupation codes) and defined an individual as overeducated if s/he had more than one standard deviation above the mean education level for her/his occupation.[3] Each of these methods has its limitations, and these have been the focus of much discussion in the literature.[4]

Self-assessment or survey measures of over- and undereducation are, by definition, subjective. One person's assessment of the education required to do their job may not match that of another person doing a similar job. Even if individuals can make accurate assessments of the educational requirements of jobs, survey methods may be biased because respondents who are genuinely overeducated may, for example, feel more negative about their jobs and be less likely to respond to questions on this issue. However, external measures of over- and undereducation have even greater limitations and Halaby (1994) shows that external measures of overeducation are not perfect predictors of self-assessment measures of overeducation, although the two are significantly correlated with one another.[5] A major problem with external measures of over- and undereducation is that workers sharing the same job or occupation title generally do not undertake exactly the same work. Furthermore, external measures generally assume that all years of schooling have equal value, *ie* that the curriculum content and quality of the schooling is irrelevant and that all workers with the same number of years of schooling are substitutes. Such homogeneity appears unlikely. Another problem is that jobs change over time and sources of job analyst data are often out of date. Perhaps the weakest method is the approach used by the Verdugos'. The choice of one standard error as the cut off point between those who are and are not overeducated is arbitrary. More importantly, this method tends to yield symmetric estimates of the incidence of over- and undereducation, as if simply measuring the tails of a normal distribution (Hartog (1997)).

2.2 Conceptual problems

However, the ***conceptual*** problems in the literature are even more significant. The exact meaning of the terms 'overeducation' and 'undereducation' have often depended on the assumptions made by the researcher about the workings of the labour market. From a pure human capital theory perspective, it is assumed that labour markets are fully efficient and that every worker is paid the value of their marginal product. In this world, the concept of over- or undereducation may be meaningless. Profit maximising firms will fully utilise all their workers' skills and education, and so a particular job does not have a specific educational 'requirement' attached to it. This also implies, from a theoretical point of view, that variables measuring job characteristics should not

3. Conversely, an individual was defined as undereducated if s/he had less than one standard deviation below the mean education level for her/his occupation.

4. Perhaps the best discussion of the pros and cons of various measures of overeducation or worker underutilisation comes from the parallel sociological literature on this issue (Burris (1983), Clogg and Shockey (1984) and Halaby (1994)).

5. Clarke *et al* (1988) found that a significant number of graduates who claimed not to need a degree for their job were doing jobs which a standard occupational classification would describe as 'graduate' (and vice versa). However, Hartog (1997), in a broader ranging survey, concluded that external and self-assessment methods produce "comfortably close" results.

appear in any model of earnings. Even in this scenario, however, there may still be periods when individuals or society as a whole over- or under-invests in education, in relation to the demand for educated workers. This, as described by Freeman (1976), is only a short run dynamic problem,[6] which will eventually lead to firms changing their production methods to use more (or less) skilled labour and/or a fall (rise) in the rate of return to education. This process will in turn result in a reduction (increase) in the level of investment in education. Thus evidence of ***over investment*** in education, for example, can be found by simply tracking the rate of return to education over time. If the supply of more educated (skilled) labour exceeds demand, individuals will not be truly underutilised, in terms of their education or skills, rather they will simply receive a lower rate of return to their education due to an excess supply of that type of labour.[7]

However, human capital theory may not necessarily be incompatible with the concept that some individuals are temporarily or permanently in jobs that actually underutilise their skills or education. Institutional rigidities, for example restrictive working practices, may mean that firms neither fully utilise every individual's education and skills, nor pay every individual the value of their potential marginal product. For instance, if a firm takes on a graduate in a secretarial role, that graduate may be no more productive than a less educated secretary. In this instance, the graduate's skills will be underutilised, in that he or she will be less productive and earn less than s/he would in a 'graduate' level job. It is this phenomenon that we term ***overeducation***.[8] The crucial question of why a graduate would accept such a job (and lower pay) is discussed later, although for the moment we assume that this mismatch in the labour market is essentially a random phenomenon, perhaps caused by poor information. In this scenario, asking individuals about the education and skill requirements of their jobs has some validity. Information on workers' salaries is also essential. Salary data is needed to verify that an individual is indeed genuinely overeducated. This is because, according to our definition, the overeducated worker has education that is being underutilised and s/he should be both less productive and lower paid than a worker with the same level of education who is doing a job for which s/he is not overeducated.

Human capital theory may also be compatible with the twin concept of ***undereducation***. An undereducated individual is defined as someone doing a job for which they have insufficient education. Assume that undereducated workers therefore have less human capital[9] than other workers who are doing the same job but who are not undereducated. As such, one would expect undereducated workers to be less productive and therefore lower paid than a worker doing the same job with the correct level of education. Firms might place someone in a job for which they are undereducated because there is a shortage of workers with the correct level of education. Alternatively, one might expect that some jobs have become more complex over time, thus raising the education level required. Older workers, and those with long job tenures, who are in jobs which have become more complex over time, may acquire the skills needed to do the job from on the job training and work experience. In this instance the undereducated worker is actually substituting additional years of experience for the education they lack. One might expect that in this situation, although an undereducated person might earn less than someone doing the

6. It is of course possible that there might also be a long run misalignment of the social and private rates of return.
7. In many analyses only the private return to education is calculated and externalities are ignored. One cannot interpret a fall in the private rate of return to education as necessarily indicating overinvestment in education by society as a whole.
8. 'Under-utilisation' may be a more appropriate term, however we follow the rest of the literature and call this phenomenon 'overeducation'.
9. This is a testable assumption, since education is just one form of human capital possessed by workers.

same job with the correct level of education, they would earn more than someone with the same level of education doing a lower level job.

Signalling models of the role of education (Spence (1973)) suggest a still different view of the labour market. If education performs a signalling role, then part of its function is to distinguish between workers of differing innate ability. The basic signalling model therefore requires that the costs of education must be lower for higher ability workers. A negative correlation between innate ability and costs of schooling can be generated in a number of ways. For example, assume that workers incur pecuniary and non-pecuniary costs when acquiring education (*eg* tuition fees and learning costs respectively). Higher ability workers are likely to face lower non-pecuniary costs than lower ability workers, thereby generating a negative relationship between ability and costs of schooling. Assume that there is then an exogenous reduction in the costs of acquiring education. This may come about if the academic requirements to enter higher education are lowered, thereby reducing the learning costs associated with acquiring the necessary qualifications to enter higher education. This will encourage lower ability workers to invest in more education than previously, thereby raising the average education level of labour market entrants. If firms find that requiring a certain level of education will no longer ensure that they get workers of the correct ability, they will tend to upgrade their educational requirements leading to so called ***qualification inflation***.[10] This can be illustrated in the diagrams below (Spence (1973)). Assume that firms know that there are two types of individuals in the labour market, high and low productivity workers. When hiring workers, firms offer wage level w1 to the low productivity workers and w2 to the higher productivity workers. To distinguish between the two groups of workers when hiring, firms set a minimum education level for high productivity jobs (E*), on the assumption that the costs of acquiring this education are negatively correlated with the person's level of productivity.[11] This is shown below. Low productivity workers face an education cost schedule c1, where as higher productivity workers face cost schedule c2. For low productivity workers, the wage they would earn with no education (w1) exceeds the net wage they would earn if they acquired E* years of education (x1). Equally higher productivity workers earn more (x2) if they invest in E* years of education than if they acquired no education (w1). Figure 1 therefore shows one possible equilibrium, where the educational requirements of firms serve to distinguish workers of differing abilities.

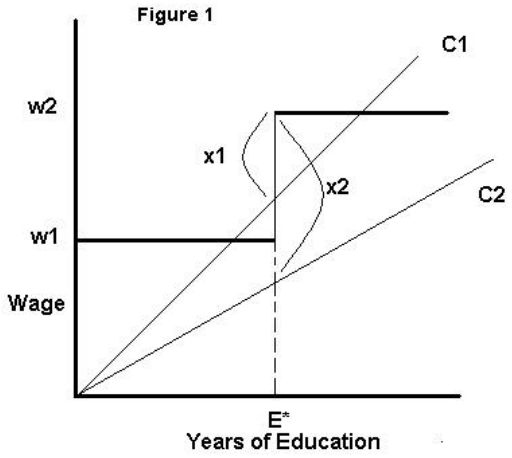
Assume that the costs of acquiring education are reduced for both groups of workers. Figure 2 illustrates this. Low productivity workers now face cost schedule c1' and high productivity workers face cost schedule c2'. As is evident, low productivity workers now earn more (x3) if they invest in education than if they do not. Education is no longer acting as a signalling/sorting mechanism to distinguish between different types of workers. The firms will therefore have to raise their educational requirements to perhaps E2*,[12] in order to ensure that

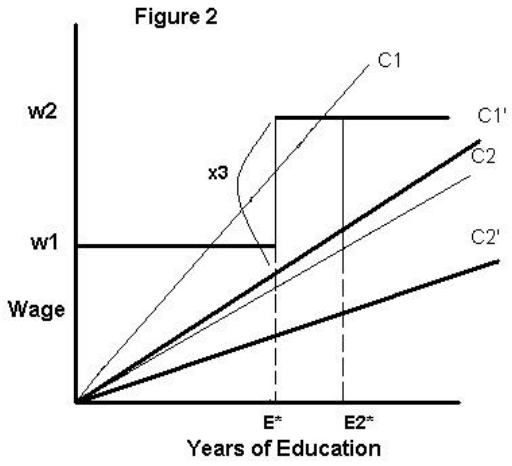
10. The terms qualification inflation and credentialism are generally interchangeable, although some of the literature (Berg (1970)) has suggested that credentialism occurs when education is used merely as an entry ticket in to higher paying occupations – a sort of rationing device. Education in this framework has no social value at all since it does not increase total output in the economy, nor necessarily serve to identify higher ability workers, although individuals have a private incentive to invest in education because they end up in better jobs. Most other variations on the signalling/ screening/ filtering argument share the common assumption that education is used to identify higher productivity individuals.

11. The employer will offer higher wages to more educated workers, based on a set of conditional beliefs. Equilibrium will only be reached however, when the employer's conditional beliefs are confirmed. This occurs when the employer's wage schedule (conditional on education levels) matches the distribution of true marginal productivity (given education levels) of the workers s/he has hired.

12. There are multiple equilibria solutions to this model and E2* is just one possibility.

they can identify high and low ability workers. The net result is qualification inflation, *ie* an increase in the educational requirements of jobs without any change in job content.





Assume that in the extreme, education is only a signalling device. If so, qualification inflation will increase the resources allocated to education, as higher ability workers invest in still more education, but it will not raise productivity levels.[13] In this case, all individuals may be considered overeducated, in the sense that education merely identifies innate ability rather than actually providing the skills or knowledge to do the job. However, if education also makes individuals more productive, qualification inflation simply complicates assessments of the incidence of overeducation. If firms upgrade the educational requirements of jobs in response to an increase in the supply of qualifications, without changing the job content, assessments of overeducation based on ***employers'*** perceptions of the educational requirements of the job may underestimate the incidence of true overeducation. Equally, estimates of undereducation would

13. The signalling element of education serves to sort high and low ability workers, which may raise total output (Spence (1973)), although raising the average education level may not improve the quality of the signal.

be overestimated if existing employees do not have the higher qualifications specified by employers.

Lastly, there has been much discussion about standards in education. If the quality of a given qualification or year of education has fallen (or increased) this too may encourage employers to upgrade (downgrade) the educational requirements of jobs. For instance, if there has been a genuine fall in the educational standard at A level, employers may start to ask for a degree for jobs that previously required just an A level education. This ***grade drift*** or deterioration in educational standards should not be confused with the above concept of qualification inflation. Grade drift is based on a genuine change in the educational and skill content of a particular qualification. Qualification inflation is a concept based on the assumption that educational content is less important than its power to signal innate ability. Unfortunately, empirically quantifying the extent of grade drift has proved difficult (Green *et al* (1998)). It is possible, for instance, that some of the incidence of apparent undereducation actually reflects the occurrence of grade drift. Older workers, who acquired education when standards were higher, require less education to do the same job as younger workers who acquired their education in a period of lower standards. One way to avoid the problem of grade drift is to focus on skills rather than education. If one can obtain a measure of an individual's actual skill level, one can then evaluate whether these skills are being fully utilised in their job. This abstracts from the issue of how those skills were acquired and generates an indication of the incidence of 'skill-underutilisation', as opposed to overeducation.

This section has identified a number of conceptual difficulties that make collecting data on over- and undereducation particularly problematic. Specifically, it appears that separating out the impact of qualification inflation, changes in the educational standards associated with certain qualifications and genuine over- and undereducation is difficult. This paper uses various data sets to try to determine the true incidence of over- and undereducation, taking all these conceptual and definitional problems into account. However, before considering this new empirical evidence, we first discuss some of the existing literature on this issue.

3. Existing Evidence

3.1 The increase in supply of qualifications

There has been a substantial increase in educational participation over the last 50 years. As is shown in Table 1, the skill composition of the stock of UK labour has changed substantially over time. In 1985, for example, nearly 35% of the working age population had no qualifications at all, around 6% had A levels or equivalent and just under 8% had a degree or higher degree. Yet by 1997 these figures had changed quite dramatically. In particular, there had been a large fall in the proportion of the work force with no qualifications.[14] In 1997, just under 20% of the working age population had no qualifications at all, more than 8% had A levels and over 12% had a degree or higher degree. These changes in the composition of the total stock of labour are quite dramatic, given that most of the increase in the supply of more qualified labour comes from the

14. Some caution is required here. There have been changes in the definition of the 'no qualifications' category in the Labour Force Survey. Individuals with certain lower level qualifications may now be included in the 'other qualifications' category, where as before they would have been counted in the 'no qualifications' category. However, the general downward trend in the proportion of the workforce with no qualifications is certainly genuine.

entry of younger and more qualified workers on to the labour market, rather than from adults upgrading their qualifications. Indeed, with some 30% of present cohorts targeting degrees, the stock of degrees qualifications in the labour force is set to rise rapidly in the coming decade. This point is illustrated in Graph 1, which shows the percentage of each age cohort who hold selected types of qualifications. The cohorts range from individuals born in 1937-1941 who attended school in the 1950s and who were aged 56-60 in 1997, through to individuals born in the late 1960s, who attended school in the 1980s and who were aged 26-30 in 1997.[15] As is evident from the graph, older workers are much more likely to have no qualifications than younger workers, and younger workers are much more likely to have degrees in particular. This evidence confirms that there has been a rapid increase in the supply of qualifications in the UK labour market and that this upward trend will continue as younger, more qualified workers, displace older, less qualified workers.

3.2 The rise in the demand for skills

As a first piece of evidence on changes in the demand for skills, we calculated the wage premiums from holding qualifications at certain levels. The ratio of the average wage of individuals with higher education or NVQ4 qualifications, compared to individuals with no qualifications, increased from 1.93 in 1985 to 2.32 in 1995 in the UK.[16] This is despite the rapid increase in educational participation, described above, that might have been expected to depress the wages of the more educated. Graph 2 plots the wage premium for various levels of education over time.[17] The ISCED classification used is as follows: ISCED0/1 (the base case) includes individuals with no qualifications, ISCED 2 includes those with O levels and NVQ2, ISCED 3 includes A levels and NVQ3 and ISCED5+ includes anyone with higher education qualifications or an NVQ4.[18] As is evident from the graph, even after the very rapid increase in the number of graduates from 1989 onwards, the premium from having a higher education qualification did not fall.[19]

Since the overall rate of return to education, particularly higher education has increased, it would appear that the demand for education and skills has at least kept pace with the supply, if not exceeded it (Manacorda and Manning (1999)). This would appear to be inconsistent with evidence of widespread overeducation. However, in addition to increasing wage inequality between education levels (higher returns to education), there also appears to be increasing wage inequality within education levels (Machin (1996b)).[20] An increase in the variation in the return to education suggests increasing heterogeneity within each educational group. This could be due to greater variation in the quality of educational qualifications (grade drift) or to the decline in labour market institutions that have traditionally compressed wage structures, such as collective

15. We cannot look at younger cohorts because they may still be in the process of acquiring their qualifications.
16. From the General Household Survey.
17. The graph shows the conditional percentage wage premium earned by each education level relative to the base case of individuals with no qualifications, *ie* the coefficient on the education variable in a regression of age, age squared, gender and education on earnings.
18. There is no ISCED level 4.
19. Estimates of the private rate of return to a degree in the UK vary, according to the assumptions made about the costs of higher education. In the early 1990s, estimates of the return to a degree were between 7% and 25%, depending on the assumptions made and the background of the individual graduate (London Economics (1993)). The Dearing Report (1997) estimated that the average private return to a degree in the UK was around 10% (prior to the introduction of tuition fees).
20. The standard deviation of wages has increased over time, controlling for age and education level.

bargaining and minimum wages. Equally, however, it is consistent with greater mismatch in the labour market, in the sense that a greater proportion of individuals may be overeducated, less productive and lower paid than their peers with similar levels of education. If a rise in the proportion of overeducated workers has generated greater variation in the return to education, there must be a reason why such 'overeducated' workers are not substitutable with their peers with the same education level. If there is potential substitution between these two groups, a significant number of workers in jobs for which they are overeducated would tend to depress the wages of those workers with the same level of education who are not overeducated. Evidence on this is considered below.

Some studies have attempted to measure the demand for skills directly. Ashton *et al* (1999) describe several measures in the 1997 Skills Survey that do this. As well as the measure of required education to perform a job, used in some of the analysis below, the survey asks respondents for the time they have spent training for their job, and the time spent learning to do the job well. The answers were compared to identical questions in the 1986 Social Change and Economic Life Initiative (SCELI). This reveals that there has been a decrease in the proportion of respondents claiming only a short training time (less than three months) to do their job, an increase in the proportion claiming a long training time (over two years), and a fall in the proportion who claim that they could learn to do their job well within a month. All of these indicators suggest a rise in the complexity of jobs, and hence skill requirements. The Skills Survey also asked respondents about the importance of a number of skills or job requirements, both in their current job, and in their job five years previously. The answers to these questions revealed an increasing use of computers, and at an increasingly higher level of complexity, and a rising importance of communication skills, social skills and problem-solving skills in 1997, compared to 1992. Other research to have attempted to directly measure skills, and to have revealed a rising demand for skills in work, includes Gallie (1991), using survey data.

A number of studies have a more indirect approach to examine the demand for skills, using a basic demand and supply framework to impute the rise in the demand for skilled labour implied by their changing levels of relative employment and relative wage rates. For example, Autor *et al* (1998) use this approach for the US, Berman *et al* (1998) for a wide range of countries, Machin (1996a) for the UK, and Machin and Van Reenen (1998) for a limited number of OECD countries. All these papers measure 'skill' achieved qualifications and/or occupation. The typical occupation split is into non-production and production workers, on the assumption that non-production workers are more highly skilled.[21] The results invariably show that there has been a steady rise in the share of skilled labour over time.[22] Machin (1996a) charts the decline in the relative wage of skilled workers in the UK from 1950 to 1980, and Berman *et al* (1998) describe similar trends in many OECD countries in the 1970s. Since 1980, however, there has been a reversal of this trend, with skilled relative wages rising strongly in the UK, and to a certain extent in all countries in Berman *et al*'s (1998) sample, with the exception of Sweden, Finland and Belgium. In a basic supply and demand framework, the fact that the relative employment of skilled workers has risen at the same time as their relative wage suggests that the relative demand for skilled workers must have shifted outwards during the 1980s and 1990s. This is analysed most fully by Autor *et al* (1998). Using a CES production function with skilled

21. Machin (1996a) calculates the correlation coefficient between the proportions of workers that are non-manual, and proportions that have a degree, at the industry level, as 0.631. The results are qualitatively similar, whichever measure of skills is used.

22. See also Parsons and Marshall (1996) and Haskel (1996).

and unskilled labour as its inputs, they calculate the change in the relative demand for skilled workers in the US, defined as college graduates, for various time periods. They calculate the implied change in relative demand, based on knowledge of the change in supply of the two skill groups, and the change in their relative wages. A strong increase in demand for skilled workers emerges, to reconcile their rising supply and their rising relative wage. This trend in demand is apparent throughout the period 1950-96, but there is some evidence to suggest that it has been particularly strong since 1970.

As is well known, these researchers have also attempted to ***explain*** the rise in the demand for skilled labour. When the change in the demand for skilled workers is decomposed into a 'within-industry' and a 'between-industry' component, there is clear evidence that the rate of growth of 'within-industry' demand for skilled workers has increased since 1970. This 'within-industry' component is associated with the skill-biased technological change explanation for the rising demand for skilled labour, *ie* as most industries upgrade their workforces. The second explanation for the rising demand for skills is linked to trade. It is hypothesised that increases in international trade and competition from less developed countries have led more developed countries to move towards advanced, high-value added goods and services, in which they have a comparative advantage, and that this has consequently led to an increase in the demand for skilled labour. If this reasoning is correct, this would show up in a dominant role for the between-industry changes in the demand for skilled labour. However, the evidence points to most of the increase in the demand for skills occurring within industries, suggesting skill-biased technological change is the major driving factor behind the demand for skills.

The link between within-industry changes in the demand for skills and skill-biased technological change (sbtc), while plausible, does not prove that sbtc has indeed been the main reason for the rise in the demand for skilled labour. However, there is additional evidence on this issue. For example, Machin (1996a) finds that in the UK, a variable measuring R&D expenditure at the industry level has a statistically significant positive effect on industries' non-manual wage bill and employment shares, and similarly for counts of innovations. At the establishment level, he shows that an increase in computer usage leads to increasing employment of non-manual employees, particularly senior professionals, and declining employment of manuals, particularly unskilled manuals. Machin and Van Reenen (1998) obtain similar results in each of the seven countries that they analyse, in terms of the effects of R&D expenditure and computer usage on the increase in demand for skilled labour. They also include a measure of import penetration in their estimated equations, but in no case does it attract a correctly signed coefficient that is statistically significant. Indeed, often they find that the industries that have witnessed the greatest rise in foreign competition are also *reducing* their numbers of skilled workers, contrary to the idea of the international trade argument that they should be responding by concentrating more on skilled production or services.

Autor *et al* (1998) focus specifically on computers as the cause of the rise in the demand for skilled labour. They point out that, in the US in the 1980s, the shift towards more educated workers, or workers in professional occupations, occurred in industries that have had the greatest increase in computer usage. In regression equations explaining the industry-level change in the employment share of educated workers, they find that the coefficient on a variable measuring computer usage is positive and statistically significant, even when controls for changes in the overall capital intensity and the growth in industry shipments are added. Overall, Autor *et al* estimate that the rise in computer usage can 'explain' about one-third of the increase in the within-industry skill upgrading in US manufacturing from the 1970s to the 1980s.

Finally, Berman *et al* (1998) argue that for sbtc to have led to an increasing share of skilled workers in employment *and* a higher relative wage, it must have been pervasive across all countries, so that countries as a whole can behave as a single closed economy, to obtain the necessary price and wage effects for the above results. The authors therefore calculate cross-country correlations of the industry-level changes in the proportion of non-production workers in the 1980s. Nearly all of the correlation coefficients are positive, and 11 out of 36 are statistically significant at the 5% level. They show that the key industries driving this result, by having large increases in the proportion of non-production workers in each country, are machinery (and computers), electrical engineering, printing and publishing and transportation. Case studies suggest significant skill-biased technological change in these industries, and in fact, it is these industries that had the highest rates of investment in the US in the 1980s (after the defence and space industries). As final proof of the pervasiveness of skill-biased technological change, the authors obtain similar results when they also consider less developed countries.

3.3 The incidence of over- and undereducation

From the evidence above it is clear that, in the UK at least, there has been a substantial rise in both the supply and demand for skills, coupled with a rise in the rate of return to education. However, there is also evidence that suggests that overeducation is a relatively widespread phenomenon. For the UK, research suggests that around 30-40% of graduates are, in some sense, overeducated.[23] For example, 30% of a random sample of 1980 graduates claimed to have more education than required to get their job (Dolton and Vignoles (forthcoming)). Furthermore, the authors compared these results with similar data from the 1970s, and it appears that the incidence of overeducation more than doubled between the two decades. This might indicate that graduate overeducation is a growing problem, perhaps as a result of the expansion of higher education. However, evidence from Green *et al* (1999) suggests that the incidence of overeducation amongst graduates has actually stabilised in the late 1980s and 1990s. For example, they found that 30% of graduates were overeducated in 1986, compared to 32% in 1997. Green *et al* (1999) also found that in the 1980s and 1990s, around a quarter of workers with some sort of qualification were doing jobs which required no qualifications at all. Using the same data for the 1980s,[24] Sloane *et al* (1995) found that approximately 30% of respondents of *all* education levels were overeducated, confirming that overeducation is not merely a graduate problem. Groot (1996) and Groot and Maasen Van Den Brink (1997a) used the Verdugo method to assess the incidence of overeducation using the British Household Panel Survey. They found a somewhat lower incidence of overeducation, ranging from 13-15% for males and 8-10% for women. However, there is a problem in interpreting some of these results in that the definition of overeducation tends to vary from study to study.

In a major survey of the literature, Hartog (1997) showed convincing evidence that, in Europe at least, the incidence of overeducation has increased over time (*ie* particularly since the 1970s) but that the incidence of undereducation has fallen. The evidence on undereducation in the UK is more limited but Sloane *et al* (1995) found a 17% incidence of undereducation, for the labour market as a whole. Groot and Maassen van den Brink (1997) found a lower estimate of 8-10% undereducation. These results are consistent with the stylised fact observed in almost all studies, namely that the incidence of overeducation significantly exceeds that of undereducation.

23. The exact definition of overeducation varies between studies so the term is used loosely in this context.
24. UK 1986 Social Change and Economic Life Initiative (SCELI) data set.

From the employers' side, Rigg, Elias, White and Johnson (1990) showed evidence which suggested that in the late 1980s about 25% of employers had substituted graduates for non-graduates, and only about a third of these jobs had been upgraded in terms of content. Another study by Geoff Mason (1995) looked at UK graduate recruitment and utilisation in particular sectors. He defined graduates as being underutilised if they were in jobs previously held by non-graduates, which had not been upgraded and for which they were paid the same as non-graduates. The latter point implies that the overeducated individual earns a nil return to their degree and is a stronger definition of overeducation than adopted by many researchers. Nonetheless he found overeducation to be significant in the financial services sector, although it was minimal in the steel industry. For example, he found evidence of graduates in financial services being appointed to unmodified mid-level clerical job at salaries of up to one third less than their graduate peers and into basic clerical jobs at the going clerical rate. Mason did, however, find that some previously non-graduate jobs had been upgraded in terms of job difficulty. Lastly, the Institute of Personnel and Development (IPD (1997)) undertook a survey of employers, recruitment firms, outplacement agencies and graduate careers offices. One in ten employers felt that they had a problem attracting too many over qualified people to their job advertisements. This problem was even greater among medium and large firms, with one in four reporting a problem with over qualified applicants. It is difficult to interpret this finding since employers may use the term 'over qualified' to politely indicate that a candidate is, in their view, too old or experienced for the job.

3.4 The effect of overeducation and undereducation on earning

As already discussed, there are a number of problems with measuring the incidence of over- and undereducation. Furthermore, the literature is open to the accusation that surveys that rely on the opinion of the individual as to whether he or she is overeducated are inherently subjective. To counter this, many researchers have investigated the effect of being over- or undereducated on earnings. Almost universally, the results suggest that overeducated individuals earn less than their peers who are not overeducated. This clearly strengthens the argument that overeducation is a genuine phenomenon. Individuals who claim to be overeducated ***are*** a distinct subset of any education category, earning less than their similarly educated peers. This could be because they are genuinely underutilised and hence less productive. Alternatively, individuals who claim to be overeducated could be inherently less productive for some other reason. Our evidence in the next section explores both these explanations. The literature also indicates that undereducated workers earn less than workers doing the same job who are not undereducated. Yet the undereducated also appear to earn more because of their higher level job, *ie* they earn more than their peers with the same level of education who are doing lower level jobs. Before considering new empirical evidence on these issues, we review the existing evidence on the effect of over- and undereducation on earnings.

Economists studying over- and undereducation have used a formulation of the earnings function that is based loosely on assignment theory. Assignment theory (Sattinger (1993)) predicts that, due to the wide diversity of jobs, technologies and individuals, worker productivity will in fact vary by both job and individual. In an assignment view of the world, workers and jobs are heterogeneous and total output in the economy is determined by the supply of human capital, firms' demand for different types of labour and also by the mechanism which allocates workers to jobs. Assignment theory therefore suggests that "the parameters of the wage function

are determined by the underlying distribution parameters of supply and demand (for education)" (Hartog (1997)). Full structural models of the allocation of workers to jobs, as required by assignment theory, are distinctly lacking in the literature (Hartog (1997)). However, a re-formulation of the standard Mincer earnings function does allow researchers to test a reduced form version of the assignment approach relative to human capital theory. Rather than regressing actual schooling against earnings in the normal way, the educational requirements of the person's job are included in the model (S_r), separately from any surplus (S_s) or deficiency (S_d) of education the individual might have.

$$Y_i = a + bS_{ri} + b_1 S_{si} + b_2 S_{di} + u_i$$

Most researchers have found that there is a positive return to surplus education that is less than the return to required education and a negative return to each year of undereducation, although this negative return is less in absolute value than the positive return to required education (Hartog (1997)). In fact the return to surplus education in the US appears to be approximately half the return to required education (Duncan and Hoffman (1981) and Rumberger (1987)). Using UK data, Sloane *et al* (1995) found positive returns to overeducation of the magnitude of 2.8%, compared to returns of 19.4% on required education. Verdugo and Verdugo (1989) suggested that there was actually a negative return to overschooling but other researchers have since questioned this interpretation of their results (Cohn, Khan and Shahina (1995)).[25] A meta-analysis, by Groot and Maasen Van Den Brink (1997b), concluded that the literature as a whole has estimated the rate of return to surplus education to be around 2.6% over the last thirty years.[26] Once again, these results are consistent with two possible explanations regarding overeducation. Either the utilisation of an individual's education in their job does partly determine their earnings, or individuals who have more education than required for their jobs are in some way less productive (see next section). The negative return from a year of undereducation appears to vary considerably by country and Hartog (1997) provides a summary of these empirical results.

3.5 Is overeducation temporary?

Human capital theory suggests that overeducation is only a temporary phenomenon caused by a short-term disequilibrium in the labour market. This seems to contradict the empirical evidence, which indicates that at any point in time a significant proportion of the workforce is overeducated.

One possible explanation is that there is persistent overeducation in the labour market as a whole, but that overeducation is only temporary for the individual. Perhaps an individual may opt to be overeducated in order to secure a better job in the future. Overeducation might therefore be considered a form of human capital investment (workers gain experience and on-

25. Since almost all the literature in this field has found a positive return to surplus education it is worth mentioning several articles by Wim Groot with others (Groot (1993); Groot (1996); Groot and Maasen Van Den Brink (1997a)). These studies have found the converse, *ie* negative returns to surplus education but as yet we have no explanation for this. In either case this supports the view that overeducated workers are genuinely underutilised in terms of their skills.

26. For the US and selected European countries.

the-job training). Workers may accept or even seek a period of overeducation so that they are then able to move on to a better job and achieve higher earnings in the future. For example, a graduate may accept a position on the shop floor in order to obtain the necessary experience to get promoted to a managerial role. In this instance workers are essentially substituting education for other types of human capital that they may lack, such as work experience (the substitution hypothesis).

A contrasting explanation for overeducation is based on matching theory. Overeducation may be the result of a bad match between firm and employee, and likely to end in a quit as the worker seeks out a more favourable match. Overeducation may occur in the first place because there are informational problems in the labour market that cause the worker and the firm to agree to a bad match. The coexistence of both over- and undereducation may support the view that these are both measures of the incidence of mismatch in the labour market. In this case, or indeed if the substitution hypothesis mentioned above is correct, one would expect overeducation to be only temporary for the overeducated worker.

Certainly there is evidence that the overeducated have a higher job turnover rate (Sicherman (1991); Alba-Ramirez (1993) and Sloane *et al* (1995)). Sicherman (1991) also found that overeducated workers have less job tenure[27] and are more upwardly mobile, *ie* more likely to get better jobs in another company or to be given an internal promotion. However, Sloane *et al* (1995) found that, although the overeducated do change jobs more often, they do not necessarily improve the quality of their match.[28] This issue can be addressed more directly. Using data from a sample of 1980 male graduates, Dolton and Vignoles (1997) estimated a model of overeducation duration and examined the factors that influenced the speed of transition into a graduate level job. The data came from the 1986 UK National Survey of Graduates and Diplomates, a one in six random sample postal survey of all individuals who graduated in 1980 (1 in 4 sample of polytechnic graduates).[29] Using these data, graph 3 plots the survival function for the sample of males who were overeducated in their first job after graduation. The exit-state is to a graduate level job. The majority of male graduates who were overeducated in their first job after graduation did not make the transition into a graduate job within six years of graduation. It appears, therefore, that overeducation is a relatively permanent problem[30] for individuals who end up in jobs for which they are overeducated. This is consistent with the view that the overeducated are in some way less able than other individuals with the same level of education. It appears to contradict the hypothesis that individuals may be temporarily overeducated due to a bad match or because they are substituting extra education for other forms of human capital that they currently lack.

27. The evidence on the relationship between tenure and overeducation is generally mixed and inconclusive (Hartog (1997)).

28. Sloane *et al* (1995) defined a 'good' and a 'bad' match in the following manner. He assumed that if an individual left a previous job voluntarily then the current job must represent a better match. If they left the job involuntarily it is assumed to represent a worse match.

29. The survey was undertaken by Social and Community Planning Research (SCPRR) on behalf of the Employment Market Research Unit (EMRU) of the Department of Employment, in association with the Department of Education and Science.

30. Only the first six years of these graduates' careers are observed.

3.6 Summarising the evidence

In summary, and not withstanding the conceptual and empirical difficulties of measuring overeducation, the micro evidence suggests that overeducation is a widespread phenomenon both in Europe and the United States of America. Since various estimates of the incidence of overeducation have been measured at a number of different points in time over the last 20-30 years, this indicates that overeducation may not simply be a one-off problem caused by a particularly steep downturn in the economic cycle. Furthermore, Hartog (1997) suggests that in many European countries it has actually increased over recent decades. This is certainly confirmed by a UK study which found that the incidence of overeducation more than doubled between the 1970s and 1980s (Dolton and Vignoles (forthcoming)), although Green *et al* (1999) find no increase between 1986 and 1997. An increase in overeducation is one possible explanation for the increased dispersion of wages within educational categories (Machin (1996b)). If a greater proportion of each education level are overeducated, and hence earning less than those who have the appropriate qualifications for their job, this may widen the distribution of earnings within educational categories.

4. New Empirical Evidence

In this section we present new empirical results that illustrate how the conceptual difficulties discussed previously impact on estimates of over- and undereducation.

4.1 What is the incidence of over- and undereducation?

Our empirical evidence is based on a number of different surveys. Here we outline the main characteristics of the data sets and provide some descriptive statistics on the incidence of over- and undereducation.

We first use data from a 1998 survey of 2,200 Newcastle University graduates and postgraduates,[31] most of whom graduated in the 1990s.[32] We constructed dummy variables indicating whether or not the individual was overeducated, or indeed undereducated in their 1998 job. These variables are based on the respondent's answer to a question concerning the educational requirements to actually ***do*** their job. If an individual has a postgraduate[33] qualification, and claims to only need a degree for their job, s/he is classified as overeducated. In total just under 60% of postgraduates claimed to only require a first degree or below for their job. This appears high but most of the total sample of postgraduates were doing jobs that needed at least a first degree or above (84%) suggesting that they were doing 'graduate', if not 'postgraduate' jobs. Twenty six per cent of the sample with a first degree claimed that their job required a sub-degree qualification or no qualifications at all. This estimate is consistent with much of the other literature on graduate overeducation in the UK (see above). Overall, 46% of the sample claimed to be overeducated. Equally, of those who had just a first degree, 10%

31. This data was commissioned and supplied by the University of Newcastle-upon-Tyne, and funded by Peter Dolton and the Alumni Office at the University of Newcastle-upon-Tyne, and the Government Office North East.
32. Descriptive statistics are contained in Appendix A. Only individuals who graduated after 1970 are included in the sample.
33. Academic and vocational postgraduate qualifications are covered by this term.

claimed to be in a job which required a postgraduate qualification, *ie* were undereducated. As all of the sample are graduates, this survey is not ideal to look at the issue of undereducation.

We then use data from the UK 1986 Social Change and Economic Life Initiative, and the more recent UK 1997 Skills Survey. These surveys were specifically designed to illicit respondents' assessments of the skills they use at work. Since the surveys also asked about the educational requirements of jobs, we were able to construct a measure of over- and undereducation[34] which yields remarkably consistent results with the rest of the literature and over time (table 2). The incidence of overeducation, in particular, is around 30% in both decades, a figure that has been obtained by several other researchers (see previous section).

We also use data from the National Child Development Study,[35] which contains detailed information on the cohort of children born in 1958. Individuals were surveyed at ages 0, 7, 11, 16, 24 and 33. Furthermore, a follow up survey at age 37 was carried out on 10% of the original sample.[36] This generated a sample of just over 1,600 individuals on whom we have comprehensive information on their lives since birth. The survey asked about the educational requirements of the person's job. We were therefore able to construct a variable measuring whether the individual was either undereducated, in a job which matched their education, or overeducated. The table below shows a summary of individuals' responses to the question "What were the minimum qualifications that were required when you started working with this employer?". Respondents were given a relatively lengthy list of possible responses to this question, some of which were quite detailed. For example, the options included CSE grade 1, GCSE grades A-C, GCE A level etc. The problem with this approach is that the individual is unlikely to be able to specify so precisely the educational requirements of the job. Such a long and detailed list of possible responses may therefore cause some individuals to not respond to the question at all, or perhaps to simply tick the "none" option. This is confirmed by table 3, which shows a relatively high proportion of missing values. Furthermore, it appears that a surprisingly large proportion of respondents claim to require no qualifications at all. However, this figure needs to be put in context. Nearly 12% of the sample actually have no qualifications and around 60% have just O levels/ NVQ3 or below. It is unsurprising, therefore, that so many of these individuals are in low-level jobs.

Table 4 shows the under- and overeducation variable constructed from the NCDS data. A value of –1 indicates that the individual has less education than is required for their job (undereducation), a value of 0 indicates that the individual has an education level which matches that of their job and a value of +1 indicates that the individual is overeducated.[37] As is evident, the proportion of overeducated workers appears very high in this sample (and the proportion of undereducated very low), due to the large number of respondents who claimed to require no qualifications to get their job. Other data sets have found the proportion of overeducated individuals to be between 30 - 40%, for example. It is likely that the wording of the NCDS

34. Individuals are defined as overeducated if their actual education exceeds that required to *get* the job they are currently doing (and vice versa for undereducation).

35. Full information on the NCDS data is provided in Appendix B.

36. This survey was commissioned by City University and conducted by MORI. The data were kindly given to us by the Centre for Longitudinal Studies at the Institute of Education.

37. To construct this variable we collapsed the education categories into the following four levels; no qualifications/NVQ1, O level or NVQ2, A level or NVQ3 and higher education diploma/ NVQ4 or above. See Steedman (1996) for a discussion of the difficulties of classifying UK qualifications into ISCED type levels and the problem of equivalency across countries.

question on overeducation caused some individuals to incorrectly claim that they needed no qualifications for their job.

4.2 Is there qualification inflation?

As we have indicated, empirical evidence on over- and undereducation might be confounded by widespread qualification inflation. We are able to explore this issue through the use of job-holders' judgements about their jobs' skill requirements, using both the Newcastle alumni data and the Skills Survey data.

The Newcastle Alumni respondents data were asked both about the educational requirements to ***get*** their current job and also about the educational requirements to actually ***do*** their job. Since employers' requirements for new entrants may be affected by qualification inflation, ideally one wishes to know the job holder's view of the actual education required to ***do*** the job, rather than the education required to ***get*** the job. Specifically, one would expect the requirements to ***get*** a job to exceed the job-holder's assessment of the requirements to ***do*** the job, if there has been a process of qualification inflation. In the past, the literature has rarely acknowledged that the educational requirements to do and get a job may be different. The Newcastle data allows us to investigate whether this conceptual distinction is of any empirical importance.

Table 5 shows the graduate's own assessment of the education required to *get* his or her current job. Approximately 20% of these graduates and post-graduates claimed to need no qualifications or only a sub-degree level qualification to get their job.

However, we have already indicated that, conceptually, asking individuals about the requirements to get their job may not be appropriate to estimate the incidence of over- or undereducation. Table 6 shows the respondent's assessment of the education needed to actually do their job. Using this variable, almost exactly the same numbers of graduates/ post-graduates claim to need a sub-degree qualification or no qualifications at all, *ie* 20%.

This might indicate that, on average, employers' requirements for the job generally match the job-holder's assessment of the education needed to do the job.[38] To confirm this we checked the consistency of individuals' responses to these two questions on educational requirements (table 7). The majority of individuals (76%) gave the same response to the question "What is the education required to do your job?" and "What is the education required to get your job?". For example, amongst those who claimed that their employer required them to have a degree to get their job, 79% agreed that a degree was also needed to actually do the job. However, 10% claimed that the education level required to get the job was higher than that required to do the job. Fourteen per cent claimed the converse was true.[39] In other words, asking individuals about the educational requirements to get and do their job yields a similar response in about three-quarters of cases. Moreover, there is no evidence of systematic bias; the requirements to get a job do not always exceed the requirements to do a job. These data therefore do not provide convincing evidence of qualification inflation, *ie* employers on the whole do not specify much higher educational requirements than are actually needed to do the job. However, in just over

38. Alternatively, our results may indicate that these type of survey questions are unable to illicit such detailed information from respondents.

39. Since the data is censored this statistic is difficult to interpret. An individual who required a postgraduate degree to do a job could not specify that an even higher level of qualification was required to get the job.

40. Disaggregated analysis shows that qualifications inflation was especially prevalent in the Real Estate industry over this period (Green *et al*, 1999).

20% of cases the two different questions do illicit different responses, suggesting that employers' assessments of the educational requirements of jobs do not always match those of the job incumbent.

Broadly similar findings emerge with regard to qualifications inflation throughout the spectrum of qualifications, using a related approach that is feasible with the Skills Survey data. After stating which qualifications would be necessary for someone to **get** their job, respondents were asked "How necessary do you think it is to possess **those** qualifications to **do** your job competently?" (emphases annunciated), against a 4-point Likert scale of "Totally unnecesary', "Not really neceessary', "Fairly necessary" or "Essential". For example, as is reported in Green *et al* (1999), it was found that 78% of those in jobs which required degrees thought that a degree was either fairly necessary or essential for doing the job — a figure that seems consistent with the broad match at degree level reported in the case of the Newcastle alumni. In addition to being able to look at other qualification levels, the particular advantage of the Skills Survey approach is that it is possible to compare responses to this question with those from an identical question asked in the SCELI survey of 1986. If qualifications inflation is present, we would expect that, for each given level of required qualification, there would be a decreasing tendency for respondents to deem the required qualification as necessary for doing the job.

To investigate this issue, it was important to control for changing factors which might affect the responses, but which would not themselves be indicative of credentialism. We therefore ran ordinal probit regressions, with the response to the above question as the dependent variable, on a pooled data set of SCELI and Skills Survey respondents. As controls we included gender, age, whether the job-holder actually held the required qualification, and a set of industry dummies. The hypothesis that qualifications inflation exists is then tested by inclusion of a dummy for 1997 (plus an interaction with gender). A negative dummy coefficient constitutes evidence of credentialism. The results are shown in Table 8.

Looking at the estimated 1997 Year Dummy coefficients, these results show that for males there has been some significant qualifications inflation ($p<0.10$) at Levels 1 and 3; the coefficient is also negative though insignificant at Levels 4 and 5. For females, there is significant qualifications inflation at Levels 1 and 4. As for the controls, as might be expected the job-holder who actually holds a required qualification is more likely to regard that qualification as necessary. This can be interpreted in two ways; either that through personal knowledge of what the qualification entails the job-holder is better able to judge its necessity, this on balance leading to thinking the qualification is more necessary than otherwise; or that the respondent's self-esteem in holding (or not holding) a qualification affects the judgement as to its importance. In all cases, the older worker is likely to judge a qualification more necessary than a younger one, though this effect is only significant at Level 2.

Given that over the last 10 years there has been a more rapid increase in the supply of education than in previous decades, it is perhaps unsurprising to find some evidence here of qualifications inflation. If qualification inflation was a significant problem in the labour market, it is likely that it would have been most evident during this period. Nevertheless, its extent is not so great as to suggest that the trend in overeducation is badly underestimated.[40] On average, the proportions judging the required qualification to be "essential" dropped from 43 percent to 39 percent from 1986 to 1992, with the drop being matched by a gain in the proportions thinking the qualifications to be "fairly necessary" from 32 percent to 36 percent. At the degree level, the fact that in one in four cases where a degree is required it is thought to be "not really necessary" or "totally unnecessary" suggests that the true extent of overeducation is somewhat underestimated;

but the extent of this underestimation will not have risen a large amount. Moreover, the Newcastle Alumni data, which show no significant difference on average to the "get" and the "do" questions, imply no understimate of overeducation. In summary, we conclude that the evidence for qualification inflation is mixed and therefore that this phenomenon is not likely to impact hugely on empirical estimates of the incidence of over- and undereducation.

4.3 How does being overeducated and undereducated affect wages?

The literature has consistently found that individuals who are overeducated earn less than their peers who are not. This, as we have argued, strengthens the evidence that the overeducated are a genuinely distinct sub-set of each education group. Using data from the recent UK Skills Survey (Ashton *et al* (1999)) we also show that the individual's assessment of the extent of their under- and overeducation is associated with a large effect on their hourly wage. Furthermore, including data on individuals' own assessments of the skills utilised in their jobs, adds considerably to the explanatory power of any model of earnings.

Column 1 of table T1 in the table appendix shows that, for women, a model which includes the following variables; age (a proxy for work experience), age squared and education level, explains 30% of the variation in earnings (hourly wages). The adjusted R^2 of the model increases to 41% once the individual's assessment of the skills used in their job are included (column 2 of table T1). Like the rest of the literature, the results indicate that being overeducated significantly reduces the return to one's education, whilst being undereducated does the opposite. This story is replicated for males (columns 3 and 4), although the explanatory power of the person's education level is considerably lower.

4.4 Are the overeducated less able?

A possible explanation for overeducation is related to the fact that the quality and type of education acquired differs by institution, and according to the curriculum studied. Not all school leavers or graduates are equal in terms of their skills and productivity. In other words, educational human capital cannot be characterised as a homogenous stock. Worker productivity and earnings will therefore vary according to the quality and type of education obtained (grade, place of study, curriculum studied) and equally the demand for these different types of skills. For example, there is UK evidence that the employability of graduates (likelihood of being in permanent employment) varies significantly across higher education institutions (Johnes *et al* (1987)). Furthermore, Dolton and Vignoles (forthcoming)) found that among the cohort of 1980 UK graduates, those with a certain types of higher education were much more likely to be overeducated. For example, graduates with lower classes of degree, a degree from a polytechnic, and those with social science, arts or language degrees were all more likely to be overeducated. This evidence suggests that although overeducated workers do have a higher level of education than is required for the job, perhaps they are not genuinely overeducated because this education is of a lower quality or of the wrong type.

As well as the type and quality of education acquired, a person's 'innate' ability may also determine whether s/he is overeducated or not. In other words, the overeducated may be in some ways less able workers and lack some of the abilities/skills required to do a job commensurate with their level of education. Again this would imply that these so-called overeducated workers are not in fact 'overeducated' at all. Rather they have jobs that are appropriate to their actual

(lower) abilities. Until now, the literature has not been able to test this argument directly due to lack of data. However, we are now able to do so using data from the National Child Development Study. Despite the potential problems with the NCDS data discussed above, the benefit of using the unique NCDS data to examine the issue of overeducation is that it contains information on the individuals' abilities and skills,[41] as well as their education level. In this section we investigate whether individuals who are overeducated are in any way less able or skilled than workers who have the correct education for the job. Since the sample of undereducated individuals is very small, these respondents are excluded from the analysis. Individuals with no qualifications are also excluded since they cannot, by definition, be overeducated. Table T2 in the table appendix shows the results of several probit models in which the dependent variable is equal to one if the person is overeducated and zero if he or she is not.[42] Column 1 shows the relationship between the probability of being overeducated and several personal characteristics of the indvidual; namely, gender, marital status, whether the person has any children, their education level and standardised maths and reading ability scores. These maths and reading tests were administered to the respondents at age 16 and we include them as one possible measure of a person's ability, as distinct from their educational level.

The first point to note is that, although all the equations are statistically significant, the explanatory power of the models is relatively low. This indicates that personal characteristics do not explain a great deal about the likelihood of becoming overeducated.[43] With this proviso, however, the results indicate that individuals who scored more highly on the mathematics test at age 16 are significantly less likely to be overeducated later in life. The size of the coefficient on the mathematics test variable is non-negligible. For instance, a 10% higher score on the mathematics test[44] is associated with a 2% lower probability of being overeducated. This would seem to indicate that the overeducated are indeed less able. However, the reading test coefficient has the opposite sign, although the coefficient is insignificant. One explanation is that the probability of being overeducated actually depends on the type of skills and abilities a person has. An individual with good mathematics skills is therefore less likely to be overeducated than an individual with a similar level of education but better reading skills. The results also indicate that women are less likely to be overeducated, although the coefficient is only significant at the 10% level. Other research has indicated that women with children may be more likely to be overeducated but our data does not support this[45].

The second column in table T2 includes other explanatory variables, namely sector and whether the person works part-time. The base case is a worker in the public sector, who works full time. Private sector workers are more likely to be overeducated, as are part-time workers. This certainly counters the argument that overeducation is simply a public sector phenomenon due to the uncompetitive nature of the labour market in that sector. Once again, individuals who score more highly on the mathematics test have a significantly lower probability of being overeducated. The coefficient on the reading test is still insignificant. The third column in table T2 tests these relationships for a particular sub-group of workers, namely those with a higher

41. The age 37 NCDS follow-up survey collected data on respondents' skills, using literacy and numeracy tests.
42. For summary statistics and unconditional correlations between the variables see Appendix B. Excluding individuals who have no qualifications yields a sample of just over 1000 individuals, although missing data reduces the sample size in some equations.
43. Note that individuals with higher education levels are more likely to be overeducated.
44. Descriptive statistics can be found in Appendix B. The mathematics test scores range from zero to thirty.
45. Obviously this was tested by interacting the female and children dummy variables. The coefficient was insignificant.

education qualification or NVQ4. Once again, the least able in mathematics are significantly more likely to be overeducated.

The last two columns in table T2 use a contemporary measure of ability and skill. Basic literacy and numeracy tests were administered to the 10% sub-sample of the NCDS at age 37. These tests were designed to assess problems with adult literacy and numeracy (Parsons and Bynner (1997) and (1998)). Since the tests were designed to assess basic skills, they are less able to distinguish between higher ability individuals. For example, the literacy test scores range from zero to 23 and nearly 20% of the sample achieve the top score (Appendix B for descriptive statistics). The results using these test scores are similar to those using the age 16 scores. However, the numeracy score is only significant at the 10% level.

It appears that personal characteristics are not very good predictors of the probability of being overeducated. However, for a given level of education, those who are more numerate do appear to be less likely to be overeducated. This is consistent with the argument that individuals may be overeducated, in the sense that their education exceeds that required for the job, but that this is because their precise skills and abilities do not match those needed to do other jobs at their education level. These workers therefore are forced to take lower level jobs, which are actually more consistent with their actual skills.

4.5 And what about actual skill levels?

The previous section revealed that the overeducated are, to some extent, less able than the adequately educated. If this is the whole story behind the existence of overeducation, then such individuals are in fact doing the appropriate job for their skills, and the labour market is successfully matching the demand and supply of skills. A new data s*et al*lows us to investigate whether this is indeed the case.

The International Adult Literacy Survey (IALS) contains variables that measure the skills that individuals have. Data from this survey are so far available for twelve countries, with the fieldwork being undertaken in either 1994 or 1995. Skills are measured by tests administered to all respondents, producing three measures of literacy: prose literacy, the knowledge and skills needed to understand and use information from texts, document literacy, the knowledge and skills required to locate and use information contained in various formats, and quantitative literacy, the knowledge and skills required to apply arithmetic operations to numbers embedded in printed materials.[46] Each respondent is given a score between 0 and 500 for each of the tests, and additionally classified to one of five skills levels based on these scores, again for each type of literacy. The tests were designed in such a way as to make the results comparable across countries. Here, however, we concentrate on the British data, which were gathered as part of the second sweep of countries in 1995. We produced a composite measure of skills, by simply averaging the three literacy scores.

IALS also asks respondents about the skills they use in their work. In particular, they are asked how often they use each of seven reading skills, four writing skills, and two arithmetic skills. Responses are on a five-point scale, with higher numbers indicating greater frequency. Details of these questions are provided in Appendix C. We used the responses to these questions to derive a variable measuring required skills on the job, by simply summing the scores between 1 and 5 for each question, providing a composite measure of skill requirements with a range of 13 to 65.

46. Further details of the tests can be found in OECD (1995, 1997)

If the overeducated are simply less able, and are actually performing jobs appropriate to their skills, then we should see a close relationship between the actual skills variable and the required skills variable. Table 9 shows the correlation between these two variables, separately for each ISCED level. It also shows that the relationship between actual and required skills is far from perfect, although it does achieve statistical significance for ISCED groups 2, 3 and 5. Ignoring the ISCED 0-1 group, which is small in size, there is a monotonic decline in the correlation coefficient as the ISCED level rises. Thus, the mismatch between actual and required skills in work is greater for those with a higher level of education.

The measure of the required skills was then reduced to four levels, as described in Appendix C. These skill requirement levels were then compared to the actual skill levels of the respondents, as measured by the four IALS literacy levels. As an indicator of the incidence of over- and underskilling, we defined someone as overskilled if their skill level was 2 or 3 levels higher than their job requirement level, and similarly the underskilled have a skill level 2 or 3 levels less than their job requirement level. The results indicate that 20.5% of the British population are overskilled and 4% are underskilled. These results are obviously dependent on our arbitrary definitions, and we attach more weight to the wage results presented below.

It could be argued that the questions asking about skills requirements are very specific, and may not capture a lot of the real requirements of an individual's job, thus reducing the worth of this variable. It may be the case that more complicated skills in particular are not being captured, which would offer a potential explanation for the pattern of correlation coefficients across ISCED levels observed above, on the assumption that the more highly educated are more likely to be in a job with such complicated skills. One way to investigate this issue is to estimate a wage equation including measures of over- and underskilling, similar to the equations estimated for over- and undereducation above. For example, consider the overskilled, ie those whose actual skill levels are high but their job skill requirements are low. If it is the case that the complicated skill requirements associated with their job are simply not measured, and they are in fact performing jobs commensurate with their skills, then we should not observe these people suffering a wage penalty relative to the apparently adequately skilled. On the other hand, if such a wage penalty does exist, this would provide evidence of genuine overskilling.

Wage equations are presented in table T3 in the appendix. IALS respondents were simply asked within which quintile of the wage distribution their own wages lay. However, they were given the ranges of these quintiles, and so we can use these ranges to perform a maximum likelihood wage regression for a grouped or interval-based dependent variable, as described in Stewart (1983). Entering the wages linearly, rather than in log form, produced a higher (less negative) log likelihood, and so the former functional form was used. Column 1 includes only gender, age, age-squared and education as explanatory variables, plus an indicator of whether the respondent worked part-time. It could be argued that obtaining a full-time, rather than a part-time job, represents part of the return to education or ability, and so this should not be controlled for. However, the wage data come in the form of annual earnings, and so it was felt that some sort of indicator of hours had to be included. The results on the other variables were not qualitatively sensitive to the inclusion or otherwise of this variable. The results show the premiums to education, relative to the omitted category of those at ISCED 0-1. The coefficient for ISCED 2 individuals is statistically insignificant, but those at ISCED 3 and ISCED 5-7 earn £2,700 and £6,600 per annum more than the low-qualified, respectively. The remaining coefficients indicate lower wages for women and those working part-time, and an inverted-U relationship with respect to age.

Column 2 adds variables measuring the skill level of the individuals, using the levels provided in IALS, averaged across the three literacy measures, and grouping those at IALS levels 4 and 5 together, indicated by literacy level 4 in the table. The results reveal that when ability is controlled for, the returns to education fall, to £1,600 (statistically significant at the 10% level only) and £4,700, for ISCED levels 3 and 5-7 respectively. As ability rises, wages rise, with those at the highest skill level earning on average £4,300 per annum, more than those at the lowest skill level. The variables measuring skill are individually and jointly statistically significant.

Column 3 introduces job requirements, via the over- and underskilling variables, by comparing the level of actual skills with level of skills required for the job. The over-and under-skilling variables have an important effect, and their inclusion significantly improves the fit of the equation, as indicated by the likelihood-ratio test at the foot of the column. Therefore, the requirements of the job being performed are an important determinant of earnings, which are thus not driven purely by personal characteristics. Individuals who are overskilled for their jobs will have positive values for the 'extent overskilled' variable, which takes the value of 1, 2 or 3, according to the level of overskilling. This variable takes the value of zero for those individuals who are not overskilled (either well-matched or underskilled). The 'extent underskilled' variable is defined similarly for those whose actual skills are at a lower level than the skill demands of their jobs. This equation is therefore analogous to the over- and undereducation equations presented above. The results show that there is a £2,200 wage penalty per level of overskilling. Thus an individual working in a job with a required skill level one level below his or her actual skills, will earn £2,200 less than a similarly skilled individual working in an appropriate job. If an individual is underskilled, s/he earns an additional £530 for each level that his or her job requirements exceeds his or her actual skill level. Thus the extra return to working in a job with a higher skill requirement than actually held, is less than the wage penalty of working in a job with requirements below those actually held. This is the same finding as that found by all researchers who have estimated over- and undereducation equations.

Column 3 assumes that there is a linear relationship between the extent of over- and underskilling and wages. Column 4 develops the over- and underskilling results further, by examining the wage bonus or penalty associated with each combination of skills held and skill requirements. The variable Overskilled 2-1, for example, indicates an individual at skill level 2, performing a job with skill requirements at level 1. The other overskilled variables are defined in the same manner. Similarly, the variable Underskilled 1-2 indicates an individual whose actual skills are at level 1, but who is performing a job with skill requirements at level 2, and so on for the other underskilled variables. The omitted category is formed of individuals who have the appropriate level of skills for their job.

The wage results show that the returns to a skill level are higher in column 4 than in column 2, *if the individual is in an appropriate job*. For example, the ability level 4 – level 1 return is now £8,300 per annum, if that person is performing a level 4 job. However, if that individual is in a level 3 job, he or she loses £1,800 of this differential. If the person is in a level 2 job, the fall in the skill wage differential is £3,500 per annum, while if a person with level 4 skills is performing a level 1 job, he or she loses £7,000 per annum, of the £8,300 skill differential. The results show that all the overskilled coefficients are statistically significant, so that there is always a wage penalty associated with performing a job that requires a lower level of skills than an individual possesses. This penalty is greater, the larger the difference between actual and required skills.

The results on the underskill variables are smaller in size, and only once achieve statistical significance. If an individual with level 1 skills is working in a level 3 job, he or she will earn £2,500 per annum more than a similarly skilled individual in a level 1 job.

The results in this section suggest that 20% of the British population have a skill level greater than that needed for the jobs that they are performing, by our definition. The well-educated are particularly likely to be mismatched to the skill requirements of their jobs. Also, there is a significant wage penalty associated with such underutilisation of skills, suggesting such overskilling is real. Why then do individuals perform such jobs? Evidence presented above has suggested a growing demand for skilled individuals, so why are these individuals not filling this demand? It is our conjecture that although they may be well educated, and have become highly skilled through this education, they do not have the skills that are being demanded by the labour market, and so cannot gain entry to the jobs with the highest skill requirements. This conclusion is consistent with evidence presented in the previous section, which showed that the overeducated are lacking in certain skills, in particular, numeracy skills. The IALS data can be used to provide further evidence that is also consistent with our conjecture. In particular, we can unpack individuals' overall literacy scores, to examine which skills they possess. Table 10 shows the percentages of those who are overskilled and well-matched that do not possess high levels (IALS levels 4 or 5) of each skill, separately by overall IALS level.

Those with higher scores for the individual skills are clearly more likely to have a higher overall score, and so are more likely to be overskilled. Hence it is important to control for overall literacy, and look within average literacy levels, in this analysis.[47] The table shows that amongst those at average literacy level 4, of those correctly placed in a job suitable for such skills,[48] only 8% do not possess high level quantitative skills. However, amongst those at this average level who are overskilled, 15% do not possess good quantitative skills. Therefore, while obviously most at average literacy level 4 have high levels of all skills, there is a tendency for the overskilled amongst them to be lacking in good quantitative skills, relative to the correctly matched. This is mirrored by the results on the prose variable. Of the highly skilled, 28% have gained appropriate jobs without having high-level prose skills, whilst among the overskilled, only 16% lack good reading skills. Thus, those who have got into the high skill bracket through having good prose and document skills as opposed to quantitative skills, face a higher risk of being overskilled. A similar picture emerges when we consider individuals at average literacy level 3. While not being conclusive, these data are consistent with the notion that quantitative ability is required for an individual to find a job commensurate with their skills.

Further evidence is provided by analysing respondents' fields of study. A long list of possibilities for field of study was offered to respondents. Table 11 shows the percentage, of respondents who answered this question, who have studied in each field, separately for the overskilled and the not-overskilled. Only certain selected fields of study are displayed, by way of examples to pick out some of the key differences between the overskilled and the not-overskilled.

This question was only asked of those to have undertaken a spell of education or training in the twelve months prior to the survey, and so the question is not asked of 53% the respondents. We therefore do not want to make too much of these results as they only apply to a

47. Since the overskilled have, by definition, an average skill level at least two levels above the required level, those with average literacy of 1 or 2 cannot be overskilled, and so only levels 3 and 4 are considered here.
48. Individuals at average literacy levels 3 and 4 cannot, by definition, be underskilled, so all those who are not overskilled are well matched in their jobs.

specific group who comprise just under half of the sample, but merely point to the fact that they are consistent with our previous findings.[49]

The table shows that 14% of the overskilled trained in engineering or applied science qualifications, compared to 22% of those who are not overskilled. Individuals who trained in commerce, management or business administration, and health, science or technology, are similarly less likely to be overskilled. On the other hand, there are higher percentages who trained in fine and applied arts or humanities among the overskilled. Similalrly, students who trained in an uncommon ('other') or non-specialist area are also more likely to be overskilled. These data are again consistent with the hypothesis advanced above, that some individuals may be obtaining a high level of skills, but they are not the appropriate skills for the labour market, which demands quantitative, technological and scientific skills in particular

In summary, we find evidence of genuine underutilisation of skills. Furthermore, the mismatch between actual skills and skills required for the job is greater for more highly educated people. The evidence is all the more convincing due to the wage effects associated with our measure of skill underutilisation. Individuals who are lacking good quantitative skills seem to be more likely to be overskilled.

5. Conclusions

Our key conclusions are that:

- There is little evidence of widespread qualification inflation, *ie* of employers systematically upgrading the educational requirements of jobs in response to the increase in the supply of more educated labour, without changing the job content.
- There is a significant and genuine incidence of mismatch in the labour market, in that some workers are overskilled for their jobs.
- Overeducated and/or overskilled workers earn less than workers who are not mismatched.
- Overeducated workers are less numerically able and/or skilled than workers who are adequately educated for their jobs.

A survey of the literature also suggests several other key observations about the UK labour market in recent years:

- there has been a large increase in the demand for skilled labour,
- there has also been a substantial increase in the supply of more educated workers,
- the return to education has remained high and even risen since the 1970s,
- there is clear evidence of increasing income inequality,
- there is also rising wage inequality within educational groups,

Our evidence on overeducation and overskilling is consistent with these latter trends. It is our hypothesis that individuals in jobs that underutilise their education and skills may actually lack

49. Note that the fact that an individual has received education or training in the twelve months prior to the survey may be related to whether they are overskilled or not, so that there may be sample selection issues involved in this analysis that are not considered here.

the appropriate skills required by the labour market. For instance, individuals who are more numerate are less likely to be found in jobs that underutilise their education. Furthermore, there is evidence that individuals who studied certain types of curriculum are more likely to be overeducated than others. For example, graduates who take degrees in arts subjects are much more likely to end up in jobs that do not need a degree. We do not claim that their education has been in any way wasted, both in terms of the enjoyment they may have got from their education, and in terms of the capacity for learning new skills that they may have acquired.[50] However, the skills and knowledge acquired from their education appear not to be fully meeting the demands of the labour market. Hence, while workers with appropriate education and skills see a rising return to their education, workers with skills that do not match the needs of the market become overeducated and earn less. The rise in the proportion of overeducated workers documented in the literature indicates an increased mismatch in the labour market, which could be associated with the increasing wage inequality within education groups.

The evidence we present is of course consistent with a story of skill-biased technological change. If such technical change is driving the demand for skills, it is perhaps unsurprising that individuals who are more numerate or who have had a more scientific education are in greater demand. These individuals are therefore more likely to be in jobs that fully utilise their education. Other analysts who have argued that there is mismatch in the labour market are almost certainly correct in their analysis that the increase in demand for skills has exceeded the increase in the supply of skills. Yet it appears to be the appropriateness of the skills supplied that matters. It is not just a question of more education, rather of what type of education. From a policy perspective, it is has long been argued that students need to be as well informed as possible of the likely benefits of education. Our evidence suggests that students need to be aware of the fact that not only does the return to education differ by qualification type and curricula studied, but also that the likelihood of being overeducated varies according to the skills acquired and the curricula studied. Clearly further research is still needed on this issue to better inform students of the demand for different types of skills.

50. However, there is also evidence that overeducated workers are more dissatisfied with their jobs, even after controlling for the pecuniary and non-pecuniary rewards associated with their job (Tsang, Rumberger and Levin (1991)).

Table 1
Stock of UK qualifications – changes over time

	1985	1990	1997
Higher Degree	1.22	1.33	3.01
First Degree or NVQ5	6.73	7.12	9.34
BTEC, HNC, HND	2.10	2.37	5.00
Teaching Qualification	1.89	1.44	1.09
Nursing or similar qualification	2.33	2.44	1.99
BTEC, ONC, OND	2.06	3.24	2.52
City & Guilds – all levels	7.95	9.31	10.84
A level or equivalent	5.94	5.78	8.06
NVQ/ GNVQ level 3			0.64
NVQ/ GNVQ level 2			1.65
Trade Apprenticeship	7.94	10.95	5.21
O level or GCSE Grade A-C	16.22	14.51	17.67
CSE below Grade 1,GCSE below Grade C	5.56	4.15	3.09
Other professional/ vocational qualifications	4.23	10.66	10.60
No qualifications at all	34.55	25.90	18.68
Don't know	1.29	0.80	0.60
Total	**100**	**100**	**100**

Note: The data used here are from the UK Labour Force Survey and are weighted.
Each figure is the percentage of the total UK working age population with that particular qualification.

Table 2
Over- and undereducation in the SCELI and UK Skills surveys

Under/overeducated	SCELI (1986)	Skills Survey (1997)
Undereducated (-1)	806 (20%)	485 (20%)
Adequately educated (0)	2040 (51%)	1189 (48%)
Overeducated (+1)	1179 (29%)	808 (32%)
Total	**4025**	**2482**

* These data come from the 1986 Social Change and Economic Life Initiative (1986) and the UK Skills Survey (1997).

Table 3
Educational requirements of jobs in the NCDS

Education Required for the Job	No of individuals	% of total sample
No qualifications required	843	52.3
CSE or equivalent	87	5.4
O level/GCSE or equivalent	200	12.4
A level or equivalent	58	3.6
Higher education diploma, degree or above required (NVQ4+)	209	13.0
Missing values	215	13.3
Total	**1612**	**100**

* These data come from the 1995, Age 37 follow up survey of the National Child Development Study (see Appendix B).

Table 4
Over- and undereducation in the NCDS

Under/overeducated	No of individuals	% of total sample
Undereducated (-1)	30	1.9
Adequately educated (0)	566	35.1
Overeducated (+1)	766	47.4
Missing Values	250	15.5
Total	**1612**	**100**

* These data come from the 1995, Age 37 follow up survey of the National Child Development Study (see Appendix B).

Table 5
Education required to get the job

Education required to get current (1997) job	No of individuals	Percentage (%)
None	220	10.51
Sub-degree qualification	206	9.84
Degree level qualification	1093	52.22
Post graduate qualification	574	27.42
Total	**2093**	**100.00**

*These data come from the 1998 University of Newcastle survey of alumni.

Table 6
Education needed to do the job

Education needed to actually do current (1997) job	No of individuals	Percentage (%)
None	135	6.44
Sub-degree qualification	295	14.07
Degree level qualification	1033	49.28
Post graduate qualification	633	30.20
Total	**2096**	**100.00**

*These data come from the 1998 University of Newcastle survey of alumni.

Table 7
Different definitions

Education required to do the job

Education Required to Get the Job	None	Sub-degree qualification	Degree	Postgraduate qualification	Total
None	97 (4.7)	53 (2.6)	52 (2.5)	14 (0.7)	**216 (10.4)**
Sub-degree qualification	12 (0.6)	119 (5.7)	64 (3.1)	70 (0.3)	**202 (9.7)**
Degree	23 (1.1)	109 (5.3)	852 (41.0)	101 (4.9)	**1085 (52.3)**
Postgraduate qualification	2 (0)	9 (0.4)	52 (2.5)	507 (24.5)	**570 (27.5)**
Total	**134 (6.5)**	**290 (14.0)**	**1020 (49.2)**	**629 (30.3)**	**2073 (100)**

* The bracketed figures indicate the percentage of the total sample in that cell. These data come from the 1998 University of Newcastle survey of alumni.

Table 8
Determinants of the necessity of required qualifications-ordinal probit estimates.

	Required Qualification Level †				
	(5) Degree	(4) Other Professional‡	(3) A-Level	(2) GCSE Grade A-C	(1) GCSE Grade D & below
1997 year dummy	-0.18 (0.11)	-0.21 (0.13)	-0.24 (0.10)**	0.00 (0.10)	-0.28 (0.14)**
Female	-0.16 (0.14)	0.22 (0.14)	-0.23 (0.12)*	-0.09 (0.09)	-0.26 (0.17)
Female and 1997	0.13 (0.19)	-0.05 (0.20)	0.41 (0.18)**	0.10 (0.13)	-0.09 (0.23)
Holds required qualification	0.49 (0.09)**	0.43 (0.10)	0.23 (0.08)**	0.24 (0.07)**	0.19 (0.15)
Age	0.0044 (0.0050)	0.0059 (0.0047)	0.0064 (0.0040)	0.006 (0.0029)**	0.0170 (0.0050)
15 industry dummies	YES	YES	YES	YES	YES
n	658	623	783	1141	446
Pseudo-R^2	0.07	0.05	0.04	0.02	0.04

** indicates significance at the 5% level, * at the 10% level.
† Qualifications are grouped into five levels roughly equivalent to those stated.
‡ Any of Higher National Certificates or Higher National Diplomas (HNC/HND, or SHNC/SHND), or a nursing qualification, or a teaching or other professional qualification (*eg* law, medicine).

Table 9
Correlation between actual and required skills, by ISCED level

	Correlation coefficient	Number of observations
ISCED 0-1	0.105	71
ISCED 2	0.273 ***	1281
ISCED 3	0.190 ***	586
ISCED 5	0.110 **	335
ISCED 6-7	-0.035	480

Notes: data source is the British data from the International Adult Literacy Survey, 1995. ***, ** and * represent statistical significance at the 1%, 5% and 10% significance levels respectively.

Table 10
Percentage of those overskilled and well-matched who do not possess each skill

Average Literacy	Overskilled			Well-matched		
	Prose	Document	Quantitative	Prose	Document	Quantitative
3	89	93	96	91	93	86
4	16	4	15	28	3	8

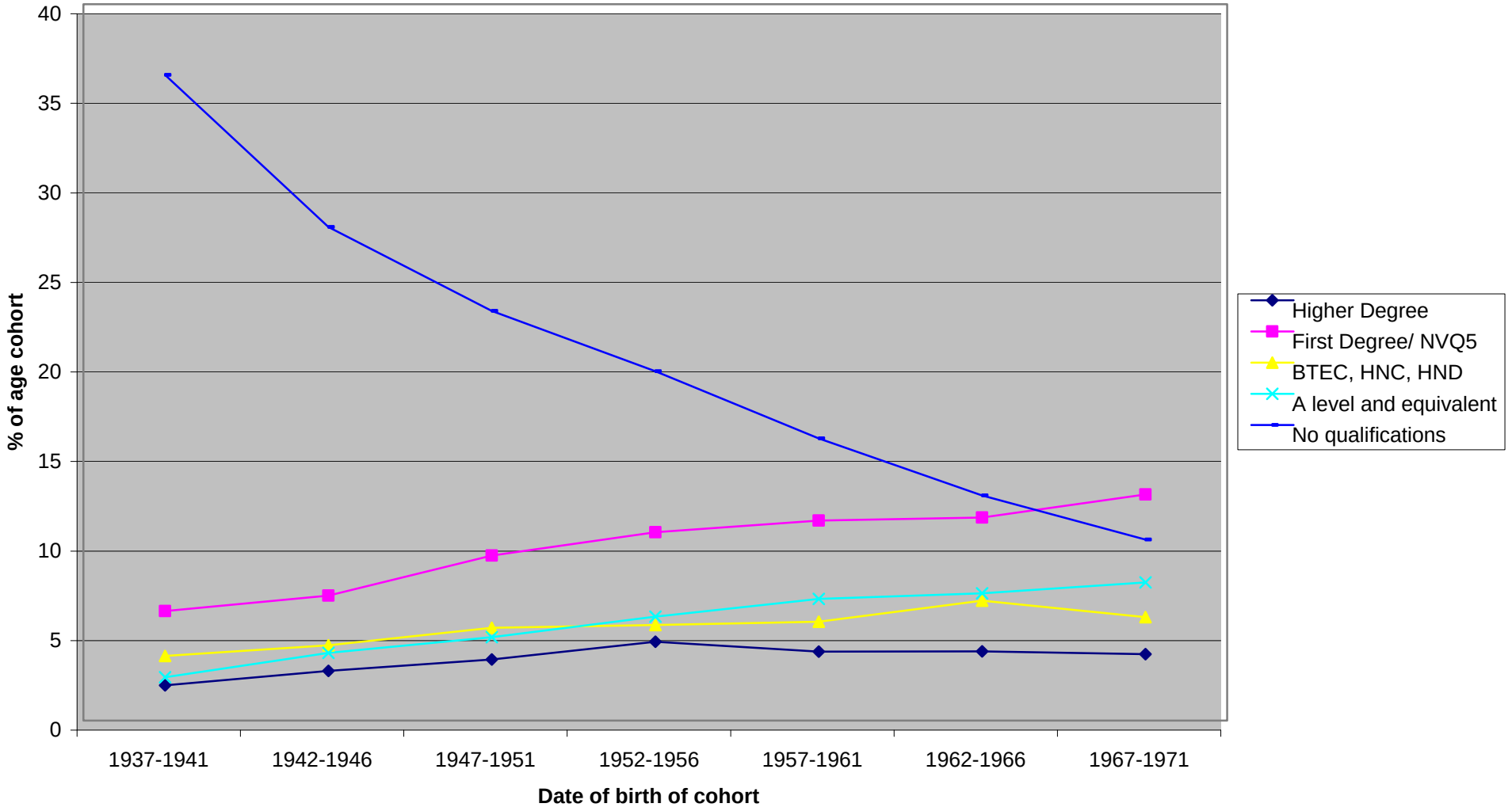
Notes: data source is the British data from the International Adult Literacy Survey

Table 11
Fields of study by overskilled status

Field of study	Overskilled (%)	Not-overskilled (%)
Fine and applied arts	2.55	0.86
Humanities and related fields	6.25	2.15
Commerce, management and business administration	15.16	19.92
Engineering and applied sciences	14.35	21.65
Health professions, sciences and technology	11.38	16.43
Other	16.60	10.75
No specialisation	4.84	2.48

Notes: data source is the British data from the International Adult Literacy Survey

Graph 1: The Supply of Selected UK Qualifications Across Cohorts (1997 Labour Force Survey)



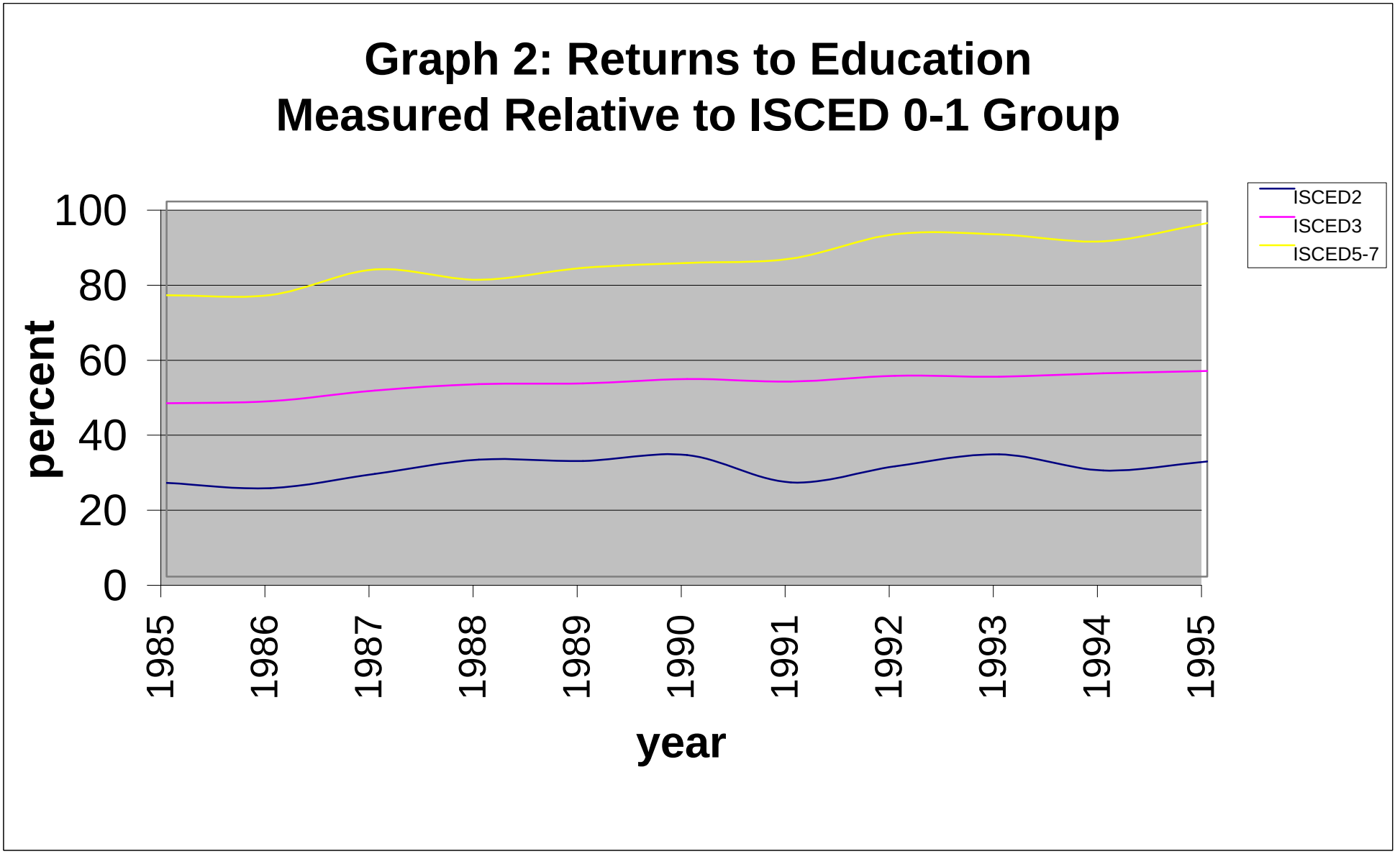

Graph 2: Returns to Education
Measured Relative to ISCED 0-1 Group
100
80
60
40
20
0
percent
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
year
ISCED2
ISCED3
ISCED5-7

Table T1
The effect of under- and overeducation on earnings

	Female Wage Equations				Male Wage Equations			
Explanatory Variables	**Coeff**	**Std Error**	**Coeff**	**Std Error**	**Coeff**	**Std Error**	**Coeff**	**Std Error**
Age	0.05	0.01 ***	0.04	0.01 ***	0.09	0.01 ***	0.09	0.01 ***
Age Squared	0.00	0.00 ***	0.00	0.00 ***	0.00	0.00 ***	0.00	0.00 ***
NVQ1 or equivalent	0.15	0.05 ***	0.19	0.05 ***	0.18	0.07 ***	0.22	0.07 ***
NVQ2 or equivalent	0.24	0.04 ***	0.35	0.04 ***	0.19	0.05 ***	0.26	0.05 ***
NVQ3 or equivalent	0.42	0.05 ***	0.59	0.05 ***	0.37	0.05 ***	0.46	0.05 ***
Sub-degree	0.69	0.05 ***	0.80	0.05 ***	0.53	0.06 ***	0.61	0.06 ***
Degree	0.84	0.05 ***	1.00	0.05 ***	0.71	0.06 ***	0.83	0.06 ***
Overeducated			-0.12	0.01 ***			-0.05	0.02 ***
Undereducated			0.16	0.02 ***			0.12	0.02 ***
constant	0.29	0.19	0.44	0.17 **	-0.27	0.22	-0.16	0.22
Number of obs	1064		1051		1144		1134	
F(5, 1058)	66.82		82.85		44.65		42.22	
R-squared	0.31		0.42		0.22		0.25	
Adj R-squared	0.30		0.41		0.21		0.25	

Notes: The dependent variable is the log of hourly wages.
Data source is UK Skills Survey (Ashton, D., Davies, B., Felstead, A., and Green, F. (1999).
Work Skills in Britain. Oxford: Centre for Skills, Knowledge and Organisational Performance.
***, ** and * represent statistical significant at the 1%, 5% and 10% significance levels respectively.
Estimation is by ordinary least squares.

The overeducation variable is constructed by taking the level of the person's actual education level (1-5 scale) and subtracting the education the individual assesses is required to do the job (1-5 scale), if their actual level of education exceeds that required. Conversely the undereducation variable is constructed in the same manner if the person's actual level of education is less than that required to do their job. Hence the overeducation and undereducation variables range from 0 to 5.

Table T2
Predicting the likelihood of being overeducated

Explanatory Variables	dF/dx	Standard Errors		dF/dx	Standard Errors		dF/dx	Standard Errors		dF/dx	Standard Errors	
							Note that this equation only includes graduates or postgraduates					
Age 16 mathematics score	-0.007	0.003	**	-0.009	0.004	**	-0.011	0.005	**			
Age 16 reading score	0.002	0.004		0.003	0.004		-0.013	0.010				
Adult numeracy test score										-0.015	0.008	*
Adult literacy test score										0.004	0.018	
Education level^	0.060	0.019	***	0.069	0.021	***	-	-		0.066	0.015	***
Female	-0.062	0.033	*	-0.098	0.044	**	-0.248	0.059	***	-0.038	0.029	
Married/cohabiting	0.015	0.066		0.056	0.076		0.127	0.110		0.031	0.058	
One or more children	0.009	0.042		0.002	0.048		-0.071	0.069		0.031	0.037	
Working part time				0.131	0.047	***						
Working in the private sector				0.157	0.039	***						
Log likelihood	-572.49			-464.12				-195.03			-746.82	
Number of obs	874			719				300			1144	
LR chi2(6)	14.70		**	36.55		***		24.21	***		22.05	***

Explanatory Variables	dF/dx	Standard Errors	
Adult numeracy test score	-0.018	0.009	*
Adult literacy test score	0.006	0.020	
Education level^	0.073	0.017	***
Female	-0.092	0.038	**
Married/cohabiting	0.071	0.065	
One or more children	0.019	0.042	
Working part time	0.137	0.041	***
Working in the private sector	0.150	0.035	***
Log likelihood	-602.06		
Number of obs	939		
LR chi2(6)	49.80		***

Notes: The dependent variable in each equation is a dummy equal to one if the person is overeducated and zero if not. Data source is the National Child Development Study, 1995 sweep. ***, ** and * represent statistical significant at the 1%, 5% and 10% significance levels respectively. Estimation is by maximum likelihood probit.

^ The education levels are; no qualifications/NVQ1, O level/GCSE/NVQ2, A level/NVQ3, higher education diploma or NVQ4 or above.

Table T3: The Effects of Education, Actual Skills and Required Skills on Earnings

Variable	Column 1	Column 2	Column 3	Column 4
Female	-3256 (278) ***	-3002 (271) ***	-2813 (263) ***	-2884 (263) ***
Age	1006 (66) ***	936 (64) ***	859 (62) ***	847 (63) ***
$(Age)^2 / 100$	-1111 (84) ***	-1010 (82) ***	-914 (79) ***	-900 (79) ***
ISCED 2	1157 (903)	550 (878)	219 (852)	303 (856)
ISCED 3	2674 (930) ***	1569 (906) *	1029 (881)	1107 (885)
ISCED 5-7	6571 (933) ***	4731 (917) ***	3745 (894) ***	3766 (897) ***
Part-time	-8788 (341) ***	-8851 (332) ***	-7935 (328) ***	-7812 (329) ***
Literacy level 2	-	1654 (384) ***	2691 (389) ***	3125 (571) ***
Literacy level 3	-	3154 (376) ***	5298 (426) ***	5389 (564) ***
Literacy level 4	-	4265 (438) ***	8435 (566) ***	8304 (1138) ***
Extent Overskilled	-	-	-2181 (196) ***	-
Extent Underskilled	-	-	529 (253) **	-
Overskilled 2-1	-	-	-	-2087 (518) ***
Overskilled 3-1	-	-	-	-5074 (552) ***
Overskilled 4-1	-	-	-	-6987 (1289) ***
Overskilled 3-2	-	-	-	-1084 (463) **
Overskilled 4-2	-	-	-	-3466 (1095) ***
Overskilled 4-3	-	-	-	-1845 (1095) *
Underskilled 1-2	-	-	-	654 (662)
Underskilled 1-3	-	-	-	2533 (836) ***
Underskilled 1-4	-	-	-	2971 (2549)
Underskilled 2-3	-	-	-	32 (578)
Underskilled 2-4	-	-	-	426 (976)
Underskilled 3-4	-	-		345 (703)
Constant	-7239 (1422) ***	-7792 (1388) ***	-6725 (1356)***	-6875 (1379)***
Number of obs	2274	2274	2274	2274
Full model LR test	1759 ***	1873 ***	2011 ***	2032 ***
Additional variables LR test	-	114 ***	138 ***	159 ***

Notes: data source is the British data from the International Adult Literacy Survey 1995. ***, ** and * represent statistical significance at the 1%, 5% and 10% significance levels respectively. Estimation is by maximum likelihood for grouped dependent variables (see Stewart (1983)).

Appendix A – Newcastle Alumni Survey

This paper uses data from a 1998 survey of 2200 Newcastle University graduates and postgraduates, most of whom graduated in the 1990s. However, only individuals who graduated after 1970 were included in the sample. This data was commissioned and supplied by the University of Newcastle-upon-Tyne and sponsored by the University of Newcastle-upon-Tyne Alumni Office and Project North East.

The survey asked respondents about the educational requirements to ***get*** their current job and also about the educational requirements to actually ***do*** their job. The categories of response are as follows:

Education required level 1 – none
Education required level 2 – sub-degree qualification
Education required level 3 – degree or equivalent
Education required level 4 – post-graduate academic or professional qualification.

Using this information, combined with a variable indicating whether the respondent had just a first degree or a post-graduate qualification, we constructed a dummy variable indicating whether the individual was overeducated. If a postgraduate required just a first degree or below to do their job they were classified as overeducated. If a graduate required a sub-degree level qualification or below, they were classified as overeducated.

Appendix A: Newcastle Alumni Survey - Descriptive Statistics

Type of Qualification Held	No of obs	%
First Degree	1416	64.5
Postgraduate qualification	781	35.6
Total	**2197**	**100.0**

Year of Graduation	No of obs	%	Cum %
1970	28	1.3	1.3
1971	29	1.3	2.6
1972	18	0.8	3.4
1973	19	0.9	4.3
1974	24	1.1	5.4
1975	31	1.4	6.8
1976	23	1.1	7.9
1977	34	1.6	9.4
1978	41	1.9	11.3
1979	26	1.2	12.5
1980	32	1.5	13.9
1981	41	1.9	15.8
1982	47	2.1	17.9
1983	88	4.0	21.9
1984	75	3.4	25.4
1985	81	3.7	29.1
1986	101	4.6	33.7
1987	108	4.9	38.6
1988	111	5.1	43.7
1989	117	5.3	49.0
1990	115	5.3	54.2
1991	109	5.0	59.2
1992	167	7.6	66.8
1993	146	6.7	73.5
1994	156	7.1	80.6
1995	180	8.2	88.8
1996	230	10.5	99.3
1997	15	0.7	100.0
Total	**2192**		

Faculty of Degree	No of obs	%
Engineering and technology	367	16.7
Science	831	37.8
Social Science	533	24.3
Languages	88	4.0
Humanities and arts	269	12.2
Education	109	5.0
Total	**2197**	**100.0**

Appendix B – National Child Development Study

This paper makes use of the longitudinal data set from the UK National Child Development Study (NCDS), which consists of a sample of all children born in the UK in one particular week in March 1958. Five follow-up surveys were undertaken when the subjects were aged 7, 11, 16, 23 and 33. The original 1958 NCDS target sample was approximately 17,000, although only 15,500 babies and their parents actually participated in the first survey. Attrition had reduced the sample to 11,500 in 1991. However, for this analysis, we only use the 10% random sub-sample who were re-interviewed at age 37 in 1995[1].

Some descriptive statistics for the variables used in our analysis are given in this appendix. Here we describe some of the key variables in more detail.

In the probit models used for this paper, the individual's actual education level is a categorical variable constructed as follows:

Qualification level 1 - no qualifications at all or NVQ1
Qualification level 2 - O level/GCSE/ NVQ2 or equivalent
Qualification level 3 - A level/NVQ3 or equivalent
Qualification level 4 - Higher education diploma or above/NVQ4 or equivalent

NCDS respondents were also asked about the education required to do their job and their responses were classified, using the same coding system as for their actual education level. This allowed us to construct a dummy variable equal to one if the person's actual qualification level exceeded the education level required for their job, and zero otherwise. This variable is the dependent variable in the probit equations.

Some other key variables used in the analysis are the age 16 ability scores. We use the respondent's score from two standardised tests of reading ability and mathematical ability administered at age 16. Some descriptive statistics are given in this appendix and further details can be found in (Ferri (ed) (1993)). We also use the respondent's score on several tests of adult literacy and numeracy, administered to the 10% sub-sample in 1995. These tests evaluated the respondent's reading and comprehension and their basic numerical ability. They were specifically designed to highlight literacy and numeracy problems among adults. Further details of these tests can be found in Parsons and Bynner (1997) and some descriptive statistics are provided in this appendix.

[1] This survey was commissioned by City University and conducted by MORI. The data were kindly given to us by the Centre for Longitudinal Studies at the Institute of Education.

Appendix B

Age 16 Reading Test Score

Score	No of obs	%	Cum %
2	2	0.2	0.2
3	2	0.2	0.3
4	3	0.3	0.6
5	5	0.4	1.0
7	4	0.3	1.4
8	3	0.3	1.6
9	4	0.3	2.0
10	7	0.6	2.6
11	6	0.5	3.1
12	10	0.9	4.0
13	11	0.9	4.9
14	14	1.2	6.1
15	9	0.8	6.9
16	18	1.6	8.4
17	23	2.0	10.4
18	24	2.1	12.5
19	31	2.7	15.1
20	36	3.1	18.2
21	34	2.9	21.1
22	33	2.8	24.0
23	35	3.0	27.0
24	46	4.0	30.9
25	68	5.8	36.7
26	69	5.9	42.7
27	61	5.2	47.9
28	79	6.8	54.7
29	71	6.1	60.8
30	80	6.9	67.6
31	98	8.4	76.1
32	89	7.6	83.7
33	101	8.7	92.4
34	64	5.5	97.9
35	25	2	100

Age 16 Mathematics Test Score

Score	No of obs	%	Cum %
0	7	0.60	0.60
1	8	0.69	1.29
2	19	1.64	2.93
3	17	1.47	4.40
4	24	2.07	6.47
5	44	3.79	10.26
6	59	5.09	15.34
7	61	5.26	20.60
8	82	7.07	27.67
9	83	7.16	34.83
10	72	6.21	41.03
11	73	6.29	47.33
12	48	4.14	51.47
13	51	4.40	55.86
14	59	5.09	60.95
15	53	4.57	65.52
16	41	3.53	69.05
17	40	3.45	72.50
18	34	2.93	75.43
19	39	3.36	78.79
20	30	2.59	81.38
21	39	3.36	84.74
22	34	2.93	87.67
23	30	2.59	90.26
24	29	2.50	92.76
25	23	1.98	94.74
26	19	1.64	96.38
27	13	1.12	97.50
28	10	0.86	98.36
29	12	1.03	99.40
30	7	0.60	100.00

Appendix B

Adult literacy test score

Score	No of obs	%	Cum %
0	2	0.12	0.12
3	3	0.19	0.31
5	4	0.25	0.56
6	1	0.06	0.62
7	4	0.25	0.87
8	2	0.12	0.99
9	1	0.06	1.05
10	6	0.37	1.43
11	5	0.31	1.74
12	15	0.93	2.67
13	10	0.62	3.29
14	11	0.68	3.97
15	31	1.92	5.89
16	53	3.29	9.18
17	68	4.22	13.40
18	86	5.33	18.73
19	133	8.25	26.99
20	207	12.84	39.83
21	284	17.62	57.44
22	370	22.95	80.40
23	316	19.60	100.00

Adult numeracy test score

Score	No of obs	%	Cum %
0	51	3.16	3.16
1	21	1.30	4.47
2	22	1.36	5.83
3	20	1.24	7.07
4	29	1.80	8.87
5	27	1.67	10.55
6	24	1.49	12.03
7	27	1.67	13.71
8	39	2.42	16.13
9	47	2.92	19.04
10	59	3.66	22.70
11	97	6.02	28.72
12	145	9.00	37.72
13	171	10.61	48.33
14	185	11.48	59.80
15	210	13.03	72.83
16	190	11.79	84.62
17	160	9.93	94.54
18	88	5.46	100.00

Appendix C – Job Skill Requirements in the International Adult Literacy Survey

To derive the required skill variable used in the text, use was made of the following questions in IALS. Respondents were asked how often, in their main job, they are required to undertake the following tasks:

Read or use (i) letters or memos
(ii) reports, articles, magazines or journals
(iii) manuals or reference books, including catalogues
(iv) diagrams or schematics
(v) bills, invoices, spreadsheets or budget tables
(vi) material written in a language other than the language of the interview
(vii) directions or instructions for medicines, recipes, or other products

Write or fill out (i) letters or memos
(ii) forms or things such as bills, invoices or budgets
(iii) reports or articles
(iv) estimates or technical specifications

use maths to (i) measure or estimate the size or weight of objects
(ii) calculate prices, costs or budgets

Answers were given on a five point scale as follows:
5 every day
4 a few times a week
3 once a week
2 less than once a week
1 rarely or never

Summing the responses across all thirteen job requirements provided us with our measure of the skill requirements of the individual's job, as used in the text This was further classified into four levels, by taking the average score across all thirteen questions. An average score less than 2 was classified as skill requirement level 1, an average score greater than or equal to 2 but less than 3 as level 2, an average score greater than or equal to 3 but less than 4 as level 3, and an average score greater then or equal to 4 as level 4.

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