The Wage Effects of Graduate Competition

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ISER Working Paper
2006-58

Acknowledgement:

We are grateful to Karl Ulrich-Meyer and to Alison Booth for comments on early versions of this paper. We are also grateful to the Leverhulme Trust for the funding which enabled this research to be undertaken. The work also forms part of a programme of research funded by the Economic and Social Research Council, whose assistance is gratefully acknowledged.

Readers wishing to cite this document are asked to use the following form of words:

> Brynin, Malcolm and Longhi, Simonetta (December 2006) 'The Wage Effects of Graduate Competition', ISER Working Paper 2006-58. Colchester: University of Essex.

The on-line version of this working paper can be found at http://www.iser.essex.ac.uk/pubs/workpaps/

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The support of both the Economic and Social Research Council (ESRC) and the University of Essex is gratefully acknowledged. The work reported in this paper is part of the scientific programme of the Institute for Social and Economic Research.

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ABSTRACT

Higher education has expanded considerably in recent years. Human capital theory implies that this expansion has been the result of a growth in demand for higher level technical and managerial skills – commonly known as the *technology bias thesis*. Evidence of a positive coefficient for higher education relative to lower educational levels in Mincer-type wage equations and the maintenance of this differential over time are treated as supportive of the technology bias thesis. A more sociological approach might take into account increased social demand for education, which should result in increased competition between graduates for jobs. Moreover, the jobs which face the most competition from graduates are likely to be those which already have a high proportion of graduates, as graduate density itself becomes a signal of status. Using British Labour Force Survey data spanning ten years, when a measure of graduate density within occupations is incorporated in a wage equation, it appears that the higher the proportion of graduates in an occupation the lower the salary each individual receives, even controlling for education. This suggests a social rather than a material explanation of the expansion of higher education.

NON-TECHNICAL SUMMARY

The most commonly cited explanation for the huge expansion of higher education in the UK and other countries in recent years is that these countries are moving into what has been called the 'post-industrial' phase which requires a new, better trained workforce. There is a premium on higher skills, greater flexibility, and improved management, while employers are prepared to pay more for those who fit the bill. Graduate wages go up and people respond to these market signals, so that despite the greater costs demand for higher education continues to rise. At the same time, governments invest in universities in order to ensure that the system as a whole can expand.

This demand-led account of change is a reasonable story which, though, in its emphasis on material motivations underplays social factors. Not everyone seeks to go to university because they believe it will pay. Not everyone has even a clear idea what sort of financial benefits they will obtain. Their motivations are probably guided by some notion of the general status of a job rather than the salary attached to it. This status can be identified by the typical education of those doing that work. For instance, the more graduates in the occupation, the more obviously graduate the work expected for that job is, and so the more attractive to graduates this sort of job will be. However, this also means that graduate jobs are likely to become overcrowded as their graduate densities rise. Instead of getting higher wages, as the story about demand for more technical and managerial skills implies, they face an increasingly competitive environment and as a result receive somewhat lower wages. This is a supply rather than a demand led view of the graduate market.

This is tested using Labour Force Survey data over a number of years. The results show that on average graduates earn no premium for working in an occupation with a high graduate density, but non-graduates do! This implies that there is some productivity effect, but it is not graduates who gain. Further, the costs and benefits of graduate density are not distributed equally. Men appear to gain very little if at all, while women gain something. However, when graduate density is extremely high women appear to lose out – suggesting perhaps that they do less well in sectors dominated by male graduates. Further, while some gains can be made by working in relatively new types of graduate job, people who work in traditional graduate occupations suffer a pronounced penalty. They benefit from working in a graduate job but lose some of this gain through overcrowding. These results seem to support a theory which suggests that the social demand for education is important. We need a more complex story than that provided by simple material explanations for the expansion of higher education.

INTRODUCTION

Higher education has expanded considerably in many countries in recent years. Why? Under human capital theory (Becker, 1975) potential students relate their demand for higher education to the expected financial returns this will provide. This offers a materialist explanation which is extremely influential within economics, clearly predicated on a specific view of rational behaviour.[1] But, strangely, the theory is almost too successful in predicting the current expansion. According to human capital theory (HCT), the attraction of a degree should be reduced as student numbers increase through intensified competitive pressures between graduates themselves. This should limit wage growth for graduates and ultimately demand for university places. Yet over a long period the graduate premium has persisted. This is especially the case in the US (Haveman, Bershadker and Schwabish, 2003: 134-5). Despite considerable expansion in access to education the ratio of college to high-school earnings rose in the US from 1.50 in 1975 to 1.88 in 2003 for men, and from 1.45 to 1.74 for women (Wolff, 2006: 12-13). In the UK financial returns as well as the more general effects of education are similar to the US (Nickell and Bell, 1995; Blundell, Dearden, Goodman and Reed, 2000; McIntosh, 2005), and they are generally high in Europe; while the rate of return varies considerably across countries it is also rising in the majority of these (Harmon, Walker and Westergaard-Nielsen, 2001: 8-10). To explain this combination of growth with rising relative wages it is generally assumed that the demand for higher technical and managerial skills has been increasing relative to other educational levels. The expansion of higher education can therefore be viewed as a central element in the growth of the knowledge society (Bell, 1973). Thus, what is often called the 'technology bias thesis' (TBT) is increasingly linked to human capital theory (Nickell and Bell, 1995; Machin, 1996; Green, 2006).

A sociology of the value of education might differ from this account in several respects. First, in an important study, Weeden (2002) alters the individualist thrust of HCT through an emphasis on group effects. High demand for education at a particular level in an occupation excludes lower educational levels, and thus becomes a means of occupational closure; occupational incumbents seek to restrict entry through raising the educational

[1] Though this is not uncontested within the discipline. Queuing theory (Thurow, 1979) is perhaps sociologically more realistic than human capital theory. According to this account there can be a long-term excess of skills for specific jobs. Adjustments between demand and supply are made not through wages but through allocation to available jobs, so that some graduates might end up not doing traditional graduate work. Very differently, Wolff (2006: 17) argues that increasing wage dispersion reflects a "growing disconnect between earnings and schooling", which is itself the result of a shift from labour to capital.

threshold for entry into the occupation. This weakens the link that economists assume between productivity and wages and suggests that increasing supply can be associated with positive rather than negative returns at any given level of demand. Second, and looking at the individual rather than the occupational level, it is unlikely that people are quite as rational as HCT assumes. Status considerations might be an important incentive to acquire education (Bourdieu and Passeron, 1990), which implies a form of calculation certainly, but not necessarily monetary. It is also unlikely that students generally, or at least necessarily, have a clear idea of what job they want before they decide to enter university. A study of students decisions at one American university, for instance, found not only much switching of career ideas over time but that non-material factors, including in this case religious background, influenced career choices, while monetary gain was given relatively low prominence (Blaikie, 1971). Third, the TBT component of the theory of the causes of educational expansion has been subject to considerable criticism, largely because its implicit technological determinism masks the social causes of change (Latour, 1986; Grint and Woolgar, 1995). Fourth, institutional factors strongly influence access to education (Allmendinger, 1989; Shavit and Müller, 1998; Müller and Gangl, 2003),[2] especially to higher education. For instance, Germany has high proportions of graduates relative to many other European countries in older cohorts but lower amongst younger cohorts because higher education in Germany has been more tightly controlled than elsewhere (Müller and Wolbers, 2003: 39). Higher education in most countries is rationed, whether by high entry requirements, price, or lack of infrastructure. The evidence which economists provide in support of the TBT, traditionally through data on returns to a degree over time, might therefore show not rising demand by employers for technical and managerial skills but simply a rise in consumption as a result of reduced barriers to entry. In principle this need not coincide with increased demand. While some economists explicitly deny the consumption value of education (e.g. Machin and Vignoles, 2005: 4), this surely reflects not empirical facts (which are scarce) but the theoretical prominence within economics of HCT, which has a fundamentally material base.[3]

As a result of these four factors we might expect the growth in higher education to cause competition between graduates, and therefore some sort of wage loss. This is therefore

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[2] A point developed not only by sociologists but also for example by political scientists (e.g. Thelen, 2004).
[3] Though some economists (e.g. Carneiro, Hansen and Heckman, 2003) are now trying to model the non-pecuniary benefits of education.

a different thesis to that of Weeden (2002), a point we elaborate on below, but it is also distinctly different to what we would expect from HCT and from the TBT. Together, these are used to explain the existence and maintenance of the graduate premium. It is assumed that new enrolments in university are encouraged because people observe a consistent wage differential. However, we argue that this is not the case. The growth of competition need not reduce the graduate premium because the differentials it produces distinguish between different types of graduate, not between graduates and non-graduates.

The research we present below uses British Labour Force Survey data to calculate graduate densities in occupations and to assess their wage effects first generally, and then by gender and for different types of graduate.

RELATING GRADUATE DENSITY TO WAGES

Human capital theory implies that there cannot be a long-term excess of highly qualified people, as competition between those qualified at that level would drive down their wages and eventually decrease supply. But even if such processes of adjustment occur, do people calculate the returns to their own future education as precisely as this? The notion seems unrealistic. Manski (1993: 49), having witnessed "the struggles of econometricians to learn the returns to schooling" finds it difficult to accept the proposition that adolescents are endowed with this knowledge (1993: 49). Further, the fact that the returns to higher education are not stable but seem partly cyclical (Freeman, 1989)[4] suggests that at least the TBT component of how HCT operates is inadequate, as this implies that the upward trend in productivity is not the sole determinant of the demand for education. There are also signs that at least in Britain (Purcell, Elias, Davies and Wilton, 2005: 109) and the US (Wolff, 2006: 12-13) the graduate premium is beginning to tail off. Indeed, there is considerable evidence of a significant level of overqualification amongst graduates (though not only at this level of education), which suggests that a substantial proportion of graduates do not consider that they are doing graduate work (e.g. Dolton and Vignoles, 2000). While there is no sign of a rising trends in this proportion, the finding is common to studies in many countries (Hartog, 2000). Under HCT, which assumes long-run equilibrium, there should be no general tendency towards overqualification. Indeed, one measure of the national 'stock' of human

[4] This also implies that people do indeed adjust their demand for education according to the market (if with a lag). On the other hand, this was in the US. In other countries where the provision of higher education is more constrained, it is possible to imagine that both demand and supply are less fully satisfied.

capital goes so far as to base this on the estimated aggregate wage return to work on the assumption that all working-aged individuals use their human capital *at its capacity* (Haveman et al., 2003: 3). Of course, they do not. The persistence of overqualification is compatible with the idea of a social or consumption basis to the demand for education.

Insofar as young people do calculate a potential return to their investment in education, what information are they using to do this? Is it actual wage data? (In which case, where do they obtain this from, and how reliable are the data?). Or the wages they believe are obtained by some reference group such as a past set of students? (Hardly easy to obtain or reliable either.) Or a generalised notion gained through the media, informal contacts, and so on? In this, more likely case, it is possible that people are attracted by a general rather than a particular view of the efficacy of education, indicating potential prosperity rather than a precise market value. This might in turn reflect a sense of the relative status attached to certain types of job. Doctors have high status; people need not know exactly or even roughly how much they earn. We further argue that the prestige of a job is likely to be signalled by the typical education associated with it as much as by the content of the job itself. The knowledge people have of the value of a job therefore probably derives in part from the typical education of those currently doing that job. In the case of graduate work, the higher the graduate density of an occupation the more obviously graduate it is, and the more attractive it becomes. This theory is therefore related to that of Weeden (2002) insofar as it suggest the importance of the power of certain occupations to attract high proportions of educated people, and we therefore likewise argue that there are important group effects of education. However, we expect these to be negative rather than positive. Rising proportions of graduates in occupations probably do, as Weeden suggests, reduce competition from other educational levels within these; but this is an effect of occupational closure, not educational closure, while in fact the university and college sector is expanding. It is surely difficult to maintain barriers to entry under these conditions.

Why, though, if graduate density is self-reinforcing in this way, do the wages of graduates not fall relative to those of non-graduates? The TBT emphasises the role of rising demand. However, this assumes that higher education is a quantity that can be released at will, which is obviously unrealistic. Governments generally control access to higher education. In fact, we believe that this control provides the explanation for the persistence of the graduate premium. When this central rationing is relatively extreme, graduates are automatically allocated to high-level or ‘elite’ jobs, which implies high wages. However, in

this case there is not only suppressed demand for education by potential students but for graduates by potential employers. As rationing is gradually lifted both supply and demand rise at the same time. This is demonstrated in Figure 1, where demand rises from D_1 to D_2 and supply from S_1 to S_2. More graduates are supplied at B than at A but at the same relative wage[5]. Of course, if both demand and supply rose by the same amount independently the same result would apply, but there is no obvious reason why this should happen. Indeed, the latter scenario is the situation implied by the TBT, which occurs via C, but this requires a precise response by potential students to market demands. If we think of the expansion of higher education partly as a political artefact (evidenced by its enormous variation across countries), no such coincidence is needed. Under rationing neither unmet demand nor unmet supply have an influence on wages, because they are suppressed; they provide no signals to the market. When the barriers are reduced demand for education rises. Employers absorb the new graduates, who 'bump down' or 'crowd out' those in the same jobs but with lower qualifications (Sloane, 2002). It is of note that Wolff (2006: 232) argues that in the US the maintenance of the graduate premium represents less a rise in graduate wages than a fall in non-graduate wages. This is consonant with the theory of bumping down, even if no casual link of this sort can be easily proven.

FIGURE 1 ABOUT HERE

We cannot therefore use returns to education as the sole indicator of the demand for high-level skills. Other evidence is needed. One important area which has opened up within economics in recent years is the theory of overqualification mentioned above. It has been argued that this is compatible with HCT, as it might be that people over-invest in education either to guarantee work or to have a slight market advantage (Sicherman, 1991; Daly, Büchel and Duncan, 2000). However, these assertions have increasingly given way to more detailed accounts which suggest that overqualification earns no positive return. Instead, at the individual level it might reflect relatively low ability or motivation. In this case 'excess' education would be penalised in the labour market (e.g. Büchel and Mertens, 2004). Paradoxically, therefore, higher education can indicate reduced rather than increased skills.

[5] Some credence is given to this through looking at different levels of provision of higher education across countries rather than over time. At least when the returns to education are defined by occupational prestige, Gangl (2003: 178-81) finds little variation in these across countries which differ considerably in their provision.

In the analysis below, rather than overqualification, we use a different measure to test the relationship between education and wages. This is a direct indicator of graduate competition, measured by the density of graduates in an occupation. It therefore provides additional information on both the social and the market value of higher education. Where graduate density is high the job becomes more socially desirable, but this increases competition between graduates, which leads to a wage cost. However, this need not be observed, and so no brake on the process occurs. It does not lead to an erosion of the graduate premium itself. The new wage differentials are between graduates themselves, and thus the penalty is hidden.

THE EXPECTED WAGE EFFECTS OF GRADUATE DENSITY

The previous section argued that HCT is only compatible with the recent major expansion of higher education in the UK and many other countries on the assumption of the TBT. Against this we have set a more sociologically and institutionally based theory. In this view, a major factor in the demand for higher education is not related, or is at best only loosely related, to expected wages: it derives rather from a general belief in the efficacy, high social standing, and inherent value of education. Status itself is measured by the proportion of graduates in a job, making the job more attractive to those with higher education. In a sense, therefore, when graduates add their own human capital to the stock of human capital within an occupation, this can be interpreted as an investment *in the occupation*. For the sake of symmetry we would, if this term did not have another meaning within sociology (Putnam, 2000), call the theory that encapsulates this, *social* rather than human capital.[6] Instead, we call it the 'occupational capital thesis' (OCT). People invest in an education which helps achieve socially desirable jobs, where education appears to be valued, without necessarily knowing much about the material rewards this might bring. The general status of the occupation rises through each individual investment, because the average education of that occupation rises, but over time an individual price is paid for this in the form of, on average, lower wages. The status comes at a cost.

[6] This term traditionally describes the cumulative impact of the network of friends, family and acquaintances on an individual's integration into civic society. It is possible that an extension of this could be developed as an explicit contrast to the individualised basis of human capital theory. For example, the take-up of higher education depends on what individuals perceive as appropriate for the social networks to which they belong.

We test this theory through four hypotheses which we would expect to hold true if the HCT-TBT thesis, which we now shorten to HCT, is correct. We express the purpose of the hypotheses in this way because it is extremely difficult to see how it is possible to test the OCT directly. It would be necessary to prove a socially oriented motivation of education choices, which is as far as we know impossible. It should be noted, though, that HCT cannot be proven directly. It is generally accepted that the positive coefficient to education in a standard Mincer wage regression is proof of HCT, and indeed Mincer's formulation derives from the human capital framework, but of course this proof is indirect. It should also be noted that the two theses, HCT and OCT, are not mutually exclusive. Educational decisions are certainly a matter of individual attempts to balance material and non-material motivations. However, the theses have clearly different implications for the returns to education. These in particular concern their distribution. Three of the four hypotheses that we outline below in fact have to do with the expected distributional effects of graduate density. Broadly speaking, under the HCT we would expect there to be no, or to be only limited distributional effects, for instance by gender, or by graduate density itself, as we would not expect the technical derivation of demand to be socially varied.

Hypothesis 1

Under HCT it is to be expected that larger numbers of able people are selected into higher education over time, that these have a competitive edge in employment, and thus obtain higher wages. HCT therefore implies a positive (at least never negative) relationship between graduate density and wages. In the case of the OCT this might be negative and is at least unlikely to be more than zero, because increased graduate density implies intensified competition rather than intensified productivity.

> *If HCT is correct, a high proportion of graduates in an occupational group implies a high level of demand for graduates in general, stemming from the value of graduates in raising productivity. We might therefore expect a positive wage effect of graduate density additional to that of education as the latter might not fully pick up the productivity effect. In contrast, if the OCT is correct, high graduate density implies 'overcrowding', and therefore a negative effect could occur.*

Hypothesis 2

Unless graduate density is one hundred per cent, which is rare, it describes jobs in which non-graduates also work. As non-graduates will be working in sectors with both low and high graduate density, if HCT is true employees with less than university education should benefit in some measure from the productivity rise implicitly associated with graduate density. Indeed, Acemoglu and Angrist (1999) and Moretti (2004) show that low-skilled workers who work in jobs with a higher percentage of graduates earn higher wages. It is in fact unclear whether any positive effect of graduate density on non-graduates would be the result of such 'spillovers' or of selection by more able non-graduates into sectors containing relatively high proportions of graduates, but there is no reason to expect a positive return to non-graduates working in jobs with high proportions of graduates under the OCT, as high proportions of graduates do not *necessarily* imply a productivity differential.

Contrary to the social closure thesis of Weeden (2002) we argue that a high proportion of well educated people within occupations indicates overcrowding, producing a negative wage effect. However, Weeden looks at a very broad educational level and its effects in occupations on all people within these, whether they are at that level or not. We look for the effects of graduates but on graduates and non-graduates separately. As we observe below, this distinction is important, because high proportions of graduates could entail either spillover or selection effects. In both cases, graduate density denotes a high productivity level which raises wages generally. Thus:

> *The HCT should entail a positive productivity effect of graduate density at all educational levels. This is less likely in the case of the OCT as high levels of graduate density imply high levels of competition, with no spillover effects.*

Hypothesis 3

A similar argument applies to gender, though this is more complex. In Esping-Andersen (1993) account of the growth in public-service jobs, in which women predominate, it is possible that women could gain more than men from working in sectors of high graduate density. Indeed, there has at least been some decline in the gender wage gap (Spain and Bianchi, 1996), which could perhaps be accounted for in part by the rise in female graduations. The Esping-Andersen view implies a demand-led change, which is broadly in line with HCT. However, this increase in female employment derives from the growth of the welfare state. While this could imply some increase in demand for management skills, in fact

the demand is somewhat different - for technical and caring skills, as for instance in nursing or social work. Graduates form an increasing proportion of these. But at the same time, Esping-Andersen notes that the rise in the demand for such work in the public sector fits in with women's needs, for instance for flexible work hours. Thus, this gender bias in employment derives from a combination of demand and supply factors. In contrast, HCT implies a different and more inflexible imperative.

We hypothesise the following:

Under HCT the effects of graduate density should be equal for men and women, as there is no reason why the implied productivity gains should be unequally distributed. Such inequality is possible, though, under the OCT, even if this is not actually required.

Hypothesis 4

These effects of graduate density might vary over its range. Elias and Purcell (2003, 2004) classify occupations into five broad categories on the basis of the skills required in each occupation. The five categories are identified by grouping occupations on the basis of the percentage of graduates in each occupation, therefore by graduate density itself, as well as by change in these proportions over time. The five categories identified by Elias and Purcell are: traditional graduate occupations; modern graduate occupations; new graduate occupations; niche graduate occupations; and non-graduate occupations. While a degree is typically needed for those jobs classified as 'traditional' and 'modern', a degree is not necessary for the remaining three categories. However, Elias and Purcell find that that some jobs are becoming *increasingly* graduate and these they classify as 'new' graduate occupations. More uncertainty characterises the category of 'niche' since normally a degree is not needed for those jobs but graduates might be supplying 'niche' skills in these. Elias and Purcell regard graduate level of education as completely inappropriate for the 'non graduate' occupations.[7]

Where graduates work in sectors characterised by low levels of graduate density we have two possible explanations for this. Either these jobs are in the process of becoming professionalized and (increasingly) require high-level skills, which should therefore be associated with a high wage premium, or graduates working in them are overqualified. HCT

[7] The results were validated by surveys in which workers were asked whether skills they acquired through higher education were necessary to perform their job (see Elias and Purcell, 2003 for details).

implies the former, the OCT the latter and therefore no wage premium, though not necessarily a penalty because clearly at low levels of graduate density there should be less overcrowding. The difference should be more extreme where graduate density is high. If the OCT is correct, traditional graduate jobs, which have high social status, are likely to become overcrowded. If this were the case, we would expect the greatest negative effects of competition amongst graduates to be in jobs defined as traditionally graduate. This should not be expected under HCT, as the traditional graduate job implies exceptionally high productivity and therefore a wage premium.

If HCT is correct, graduate density could be associated with an influx of new graduates and should attract a premium, which would not be apparent under the OCT. If the OCT is correct, graduate density should lead to a wage penalty especially in traditional graduate jobs, whereas such jobs attract a premium under the HCT.

DATA AND METHODS

To test these hypotheses we run Mincer wage equations which include a measure of graduate density as an explanatory variable. We therefore first create a measure of graduate density. This is not inherently difficult and has already been undertaken, for different purposes, by Elias and Purcell (2003, 2004). We follow Elias and Purcell in using data from the quarterly Labour Force Survey (LFS) for the UK. The data available with wages cover 33 quarters, from winter 1992/1993 to winter 2000/1. The analysis is restricted to workers aged under 70, and for whom data on hourly wages, education and occupation have been successfully collected, and also for whom earnings are between £2 and £100 per hour.

We compute graduate density as the share of graduate employees[8] in occupations, producing the following measure:

$$GD_t = \frac{G_{ot}}{G_{ot} + NG_{ot}} \qquad (1)$$

[8] Because of difficulties in measuring the hourly wages of the self-employed, only employees are selected, not only in the wage equations but in the formulation of graduate density. Although we could interpret competition between workers to include jobs typically undertaken by the self-employed, there is in practice a significant demarcation between the two forms of work.

where G_{ot} is the number of graduates, and NG_{ot} is the number of non-graduates employed in occupation *o* at time *t*. Graduate density varies from 0, when no graduate is employed in that job, to 1, when all workers employed in that job have a degree. It is computed using occupations based on the three-digit codes of the 1990 Standard Occupations Classification (SOC). This contains more than 300 units. This provides a fairly refined calibration of graduate density. The jobs each occupational code describes are given in the Annex, though to reduce space, for white-collar jobs only. It can be seen that the codes define occupations fairly closely. Thus, for instance, while someone who manages a hairdressers is counted as a manager, this type of job, which has a very low graduate density, is coded separately from other managerial jobs. Descriptive statistics are shown in Table 1. To avoid bias from excessively small cell sizes, in all measures of graduate density cells with less than 10 individuals are dropped. We also tested two other measures. One was a broader grouping of occupations using the two-digit codes, which produces less than 80 units, while the second used one-digit codes, but because graduate density might apply differently across industries in these very broad groupings, we added the one-digit codes of the Standard Industry Classification (SIC) classification to the matrix. This measure of graduate density results in around 85 types of job. We also produce descriptive statistics for these other two measures. These show that the more aggregated measures restrict the range of graduate density. We found that the first measure in fact produces the most consistent results, and so we therefore show these results only.

TABLE 1 ABOUT HERE

FIGURE 2 ABOUT HERE

We display in Figure 2 average trends in graduate density (effectively the percentage of jobs taken up by graduates) using the three measures. This shows the expected trend increase in graduate employment for the three measures described above. Graduate density increases by about 4% over this short period. GD SOC3 is our preferred measure. GD SOC2 describes the more aggregated occupational groups, and GD SOC1 their combination with industry codes. The trend is the same in all three cases.

To analyse the impact that graduate density might have on individual wages we estimate a Mincer equation in which our measure of graduate density appears among the explanatory variables:

$$\ln w_t = \alpha + \beta_1 GD_i + \boldsymbol{X}_i \gamma + \boldsymbol{IO}_i + \boldsymbol{T}_i + \varepsilon_i \quad (2)$$

where the dependent variable is the natural log of hourly wages (w_i) of individual i, and GD_i is the graduate density in the job where individual i is employed, while in some models we include the square of graduate density (GD_i^2) to capture any non-linear effects. However, as the effects of graduate density might vary along its range in more complex ways, we also use (five) splines as an alternative to the squared term. The vector $\boldsymbol{X}_i$ contains individual characteristics such as gender, age and its square, a dummy for being married, a dummy for part-timers, and years of tenure in the job. The matrix $\boldsymbol{IO}_i$ contains dummies for occupation, which are defined on the basis of the measure of graduate density selected. Using our preferred measure of graduate density $\boldsymbol{IO}_i$ contains dummies for the minor units of the SOC.[9]

RESULTS

Hypothesis 1 suggests a positive effect of graduate density if HCT is correct, a negative effect if not (and which would be an outcome which favours the OCT). In Table 2 we show the general effects with all the controls, with the exception of the occupation and time dummies, and for the whole sample, including non-graduates. Higher graduate density implies a general productivity effect which benefits the individual over and above the effect of their own education. This result is consistent with that which Weeden (2002) found in respect of the effect of occupational credentials.

TABLE 2 ABOUT HERE

However, this does not mean that graduates necessarily benefit from this. Table 3 shows the effects separately for graduates and non-graduates - more specifically, in order to obtain a maximum contrast, in the latter case for those with only compulsory levels of education (i.e. with either none or very limited qualifications). Further, here we use splines to estimate the slope across ranges of graduate density.

[9] When graduate density is measured by the major groups of the SOC classification, $\boldsymbol{IO}_i$ contains dummies for these major groups, and also for the major divisions of the SIC where these are used to define graduate density. However, as stated above we here show only the results for the first measure.

TABLE 3 ABOUT HERE

We can now see that there appears to be no positive and statistically significant effect of graduate density at any level of density on graduates themselves. Most of the effects are negative, though less so at the lower levels. In contrast, there is a positive effect for those with only compulsory education. Given the broad equality over most of the range of graduate density amongst non-graduates, which shows that the regression slope does not change until the highest level, this would not seem to be the result of spillover effects (or indeed of bumping down, as discussed above). These are surely most likely at relatively high levels of graduate density. While more non-graduates can benefit from working with graduates when graduate density is low, more can confer the benefit when it is high. Also, of course, we have no evidence here that graduate density says anything about workplaces or organisations, that is productivity effects occurring through actual contiguity of work. It denotes types of jobs. A more plausible interpretation of the effects on non-graduates, therefore, is that working with more graduates encourages (or requires) more able or motivated workers; that is, it is a selection effect. This gives some limited support for HCT. However, this does not to extend to graduates themselves. Graduates do not obtain a premium from working in sectors populated by other graduates. This finding veers far more towards the OCT than towards HCT.

According to hypothesis 3, under HCT graduate density should have an equal effect on the wages of men and women. While men predominate in more technical graduate jobs such as engineering, women predominate in some public-service sectors such as teaching. Despite considerable job segregation, as well as the different wages and different returns to education men and women experience, HCT implies that neither gender should be more subject to the effect of overcrowding than the other. The results for gender are given in Table 4. Here we first show the difference through use of a single graduate density measure as well as with the squared term. Men appear to gain nothing by working in a sector with high graduate density, while women gain up to a certain point (as the squared term is negative), though this effect is not statistically significant. This is therefore clearly contrary to hypothesis 3, which implies no gender effects at all. It is possible that women gain from graduate density, but only at the lower levels. At the higher levels the slope changes direction quite considerably. This implies some sort of ‘glass ceiling’, here not defined by an

individual's occupational position relative to that of others, but rather by the educational density in which the job places them.

TABLE 4 ABOUT HERE

When we alternatively make use of splines in Table 5 the outcome is more mixed. The results for men are nearly zero or even negative except in the case of the middle spline, which produces a substantial positive and statistically significant effect. Women never gain a clear wage premium but, as before, it can be seen that they lose out from graduate competition higher up. Overall, women perhaps gain more than men from working in jobs which appear more clearly graduate but not where these are occupied by especially high proportions of graduates. In this case women seem to pay a wage penalty. It is difficult to see how growing demand for technical or managerial skills should cause this difference.

TABLE 5 ABOUT HERE

It should be noted that this last result has nothing to do with the well-known fact of the gender wage differential. On average men earn more than women, partly because of more limited promotion prospects for women. This reflects individual factors such as career breaks but also implies some sort of tradition or prejudice on the part of employers. Its cause is ultimately social. At the same time it is often found that women's returns to higher education are higher than those of men (Harmon et al., 2001: 11), so presumably women are more likely than men to use their education well or enter graduate professions, particularly in the public sector, where pay is relatively high. However, here we are dealing with a different concept where these individual, social and occupational factors play no direct role. Pay varies by gender on the basis of the density of graduates working in certain types of jobs. If the expansion of higher education is a response to increased demand for skills, this should affect men and women equally.

Finally, we look at types of graduate job as discussed in respect of hypothesis 4. Table 6 provides estimates of the wage impact of graduate density separately by three groups of jobs, first 'traditional' graduate jobs, second 'modern' and 'new' graduate jobs combined, both of which contain relatively low proportions of graduates but are viewed by Elias and Purcell (2003, 2004) as growing areas for graduate employment, and third 'non-graduate

jobs; any graduate working in such jobs could be considered to be overqualified. The results imply a wage penalty for such overqualification in the case of both men and women, which is however not statistically significant. But graduates, both men and women, are penalised for working in a sector defined as traditionally graduate. This is more negative for women. One possible explanation for this might possibly be a problem of entry into traditional male occupational strongholds. However, the squared term reduces this negative impact at higher levels of graduate density. (Though conjectural, it is possible that this effect represents 'high-powered' women who have moved beyond the glass ceiling.) Whatever the basis of these gender differences, the overall effect strongly implies some sort of overcrowding in these sorts of jobs. In contrast, there is perhaps a slight gain from working in modern or new graduate jobs, at least for women, though this is again not statistically significant. Thus, as hypothesised if HCT were true, there is a benefit to working in the new graduate sectors, but contrary to the HCT, there is a cost to working in traditional graduate sectors, and this is far greater. Moreover, the gender differences are also clear. It is only women who gain from working in the new sectors (if at all). If they work in traditional graduate jobs, the outcome swings into reverse. They do far worse compared both to men and to other female graduates.

Overall, even though we can offer no direct support for a social and institutional basis for the expansion of higher education, if HCT were true we would not expect most of the results we have demonstrated. The thesis we term the occupational capital thesis seems to fit our results better.

CONCLUSIONS

In recent years there has been a substantial expansion in the provision of higher education. It is not unreasonable to assume that this is the result of a new equilibrium where employers demand more skills and individuals respond to these market signals in making their educational decisions. The role of such signals is in fact central to the formulation of human capital theory, which is in turn fundamental to much thinking by economists on how education meshes with society. Equilibrium is achieved between supply and demand for skills at the graduate level not only by (generally accurate) perceptions by individuals of the value of a specific degree but through a desire to make such an estimation in the first place. If instead people fail to make such an evaluation, either because they cannot or, more important, do not wish to, then demand and supply need not balance. Oversupply is likely, and this implies some sort of wage cost.

The fact that for a long period of expansion in higher education no such cost has been apparent in the analysis of the returns to education has led to the assumption that demand for skills is kept buoyant by the growing importance of technical and managerial skills in the economy. This 'technology bias thesis' therefore offers a very particular and important view of the relationship between the economy and society in which the former is primary. An alternative approach might place more emphasis on the social. In this view the social demand for higher education – for the direct status it confers, or the probability that it will lead to a job with high social status, or simply reflecting the treatment of education as a consumption good – would expand the supply of graduates beyond the immediate needs of employers.

Why, in this case, do relative wages not fall? There are two main reasons. The first is historical. The rationing of higher education by governments has led to the partitioning of the graduate market such that before and after major expansions two independent equilibria can exist. Wages remain the same because these are effectively different markets. A second explanation derives from the possibility that the individual costs of oversupply might not be visible, so new entrants into higher education perceive no negative signals. This could occur if negative wage impacts were the result of graduate density rather than of having a degree itself. Thus on average graduates earn and retain a clear premium over school-leavers and over those with vocational qualifications, but some graduates earn less than others because of overcrowding, despite doing similar jobs. Our definition of graduate density is based on 300 job categories and thus defines jobs which are quite closely competitive with each other. If we take two people in similar jobs which have slightly different graduate densities and find that the higher density is associated with a relative wage loss, then we can reasonably assume that this is caused not by the nature of the job but by graduate density itself. Such differentials would not at the margins be visible.

Graduate density itself, though, *is* visible. It seems likely that people know whether a degree is expected for a particular job, and this expectation would be more certain the higher the proportion of graduates in that occupation. Thus jobs with a high graduate density are likely to be especially attractive in terms of occupational prestige. This could mean that certain jobs, such as the 'niche' graduate jobs discussed earlier become 'new' graduate jobs in time and ultimately traditional graduate jobs – not because of their inherent skill content but because these become areas which graduates increasingly colonise. In the early stages of this process of professionalisation there is a gain to be made by applying your degree to these

growth areas, but in time this diminishes and even goes into reverse. Thus we are entitled to think in terms of *occupational* rather than human capital. People invest in occupational entry points and ultimately in occupations themselves, so that these change character. The nature of an occupation – the historical 'capital' it contains – depends on the sum of these individual decisions, but in turn influences these decisions.

We cannot prove this social thesis for the basis of education directly, though we can demonstrate that its main alternative, human capital theory, is implausible. It is in fact extremely unlikely that there is a means of proving a social basis to the expansion of higher education. It should be pointed out, though, that direct evidence of the validity of human capital theory is similarly elusive. The validity of the theory is inferred from the return to education itself. There is no body of evidence to suggest that students think or behave in the manner the theory assumes. In much the same way, we take the results we obtain from the use of graduate density in wage equations as an indicator not of an individualised, material basis for selection into higher education but of a social basis. High status occupations with high levels of graduate density attract more graduates, who then overcrowd the market. They gain from having a degree, but less than they might if the graduate market were not overcrowded.

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FIGURES

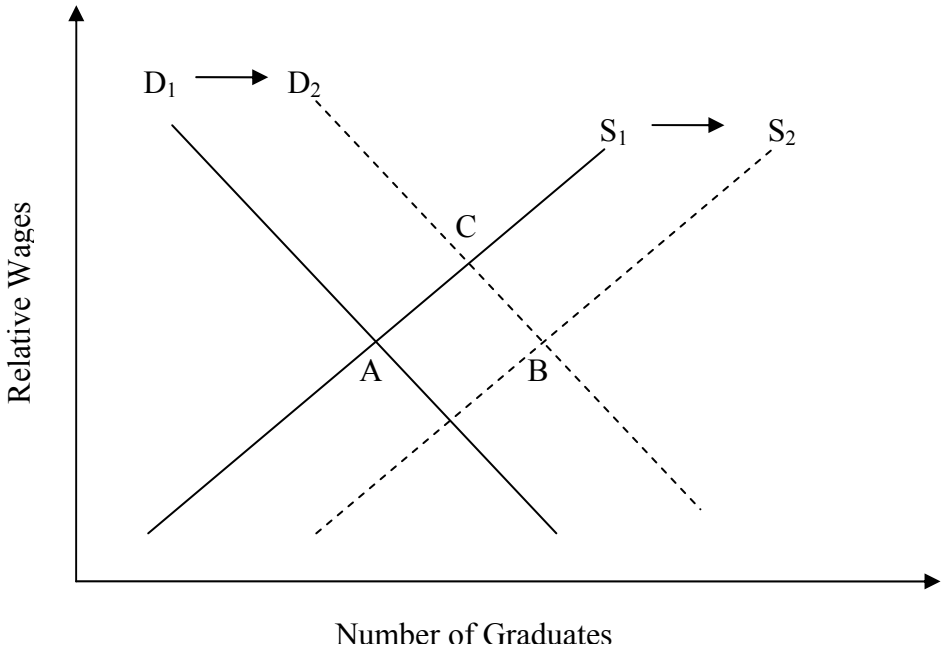

FIG. 1. SUPPLY AND DEMAND IN THE GRADUATE LABOUR MARKET

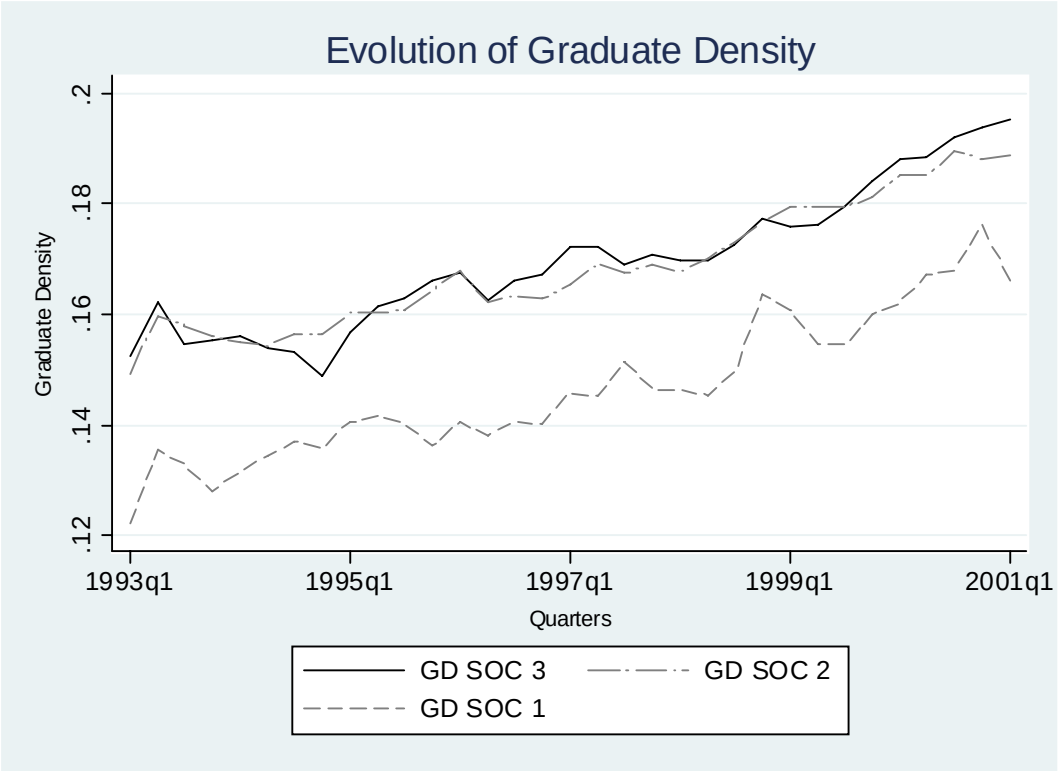

FIG. 2. EVOLUTION OF GRADUATE DENSITY OVER TIME

TABLES

TABLE 1
SUMMARY OF DIFFERENT GRADUATE DENSITY MEASURES
1993 AND 2001, FIRST QUARTERS

Measure	Year	Cells	Mean	SD	Min	Max
GD_{SOC3}	1993	344	0.15	0.24	0	1
	2001	313	0.19	0.25	0	1
GD_{SOC2}	1993	77	0.15	0.23	0	0.93
	2001	77	0.19	0.24	0	0.95
GD_{SOC1}	1993	85	0.12	0.17	0	0.68
	2001	84	0.17	0.19	0	0.73

TABLE 2
WAGE IMPACT OF GRADUATE DENSITY, FULL MODEL

Dependent variable: ln Hourly Wages	Coefficient	Standard Error
Graduate density	0.12***	0.04
Graduate density squared	-0.07	0.05
Female	-0.15***	0.00
Age	0.04***	0.00
Age squared	-0.00***	0.00
Married	0.04***	0.00
Working < 30 hours a week	-0.03***	0.00
Job tenure	0.01***	0.00
Degree-level education	0.21***	0.00
1994	-0.01***	0.00
1995	0.02***	0.00
1996	0.04***	0.00
1997	0.07***	0.00
1998	0.10***	0.00
1999	0.14***	0.00
2000	0.19***	0.00
2001	0.22***	0.00
R^2: 0.582		
Observations: 388965		

Robust standard errors in parenthesis;
* Significant at 10%, ** Significant at 5%, *** Significant at 1%
Other explanatory variables: dummies for quarter within year; and dummies for occupation

TABLE 3
WAGE IMPACT OF GRADUATE DENSITY
(GRADUATES VS THOSE WITH ONLY COMPULSORY EDUCATION)

Dependent variable: ln Hourly Wages	Graduates	Compulsory education
Spline: 0-20%	-0.23	0.23***
	(0.16)	(0.06)
Spline: 21-40%	0.07	0.40***
	(0.09)	(0.09)
Spline: 41-60%	0.10	0.40**
	(0.07)	(0.16)
Spline: 61-80%	-0.21**	0.35
	(0.10)	(0.33)
Spline: 81-100%	-0.08	0.60
	(0.13)	(0.84)
Adjusted R^2	0.45	0.45
Observations	65642	181483

Robust standard errors in parenthesis;
* Significant at 10%, ** Significant at 5%, *** Significant at 1%
Other explanatory variables: a dummy for female; age and its square; a dummy for whether married; a dummy for working less than 30 hours per week; years of tenure in the job; dummies for occupation; and dummies for year and quarter of the data

TABLE 4
WAGE IMPACT OF GRADUATE DENSITY,
BY GENDER

Dependent variable: ln Hourly Wages	Men	Women
Graduate density	0.01	0.16
	(0.14)	(0.15)
Graduate density squared	0.07	-0.26*
	(0.12)	(0.13)
Adjusted R^2	0.44	0.42
Observations	37039	28590

Robust standard errors in parenthesis;
* Significant at 10%, ** Significant at 5%, *** Significant at 1%
Other explanatory variables: age and its square; a dummy for whether married; a dummy for working less than 30 hours per week; a dummy for whether has a degree; years of tenure in the job; dummies for occupation; and dummies for year and quarter of the data

TABLE 5
WAGE IMPACT OF GRADUATE DENSITY, BY GENDER
(FIVE SPLINES)

Dependent variable: ln Hourly Wages	Men	Women
Spline: 0-20%	-0.21	-0.23
	(0.22)	(0.21)
Spline: 21-40%	0.00	0.16
	(0.11)	(0.14)
Spline: 41-60%	0.27***	-0.01
	(0.10)	(0.09)
Spline: 61-80%	-0.00	-0.52***
	(0.13)	(0.14)
Spline: 81-100%	0.00	-0.21
	(0.17)	(0.18)
Adjusted R^2	0.44	0.42
Observations	37043	28599

Robust standard errors in parenthesis;
* Significant at 10%, ** Significant at 5%, *** Significant at 1%
Other explanatory variables as in Table 4

TABLE 6
WAGE IMPACT OF GRADUATE DENSITY,
BY TYPES OF GRADUATE JOB AND GENDER

Dependent variable: ln Hourly Wages	Men		
	Traditional	Modern and New	Non-Graduate
Graduate density	-1.08	-0.25	-0.49
	(1.31)	(0.29)	(0.58)
Graduate density squared	0.70	0.37	1.18
	(0.83)	(0.27)	(1.36)
Adjusted R^2	0.36	0.36	0.47
Observations	9371	15386	4560
	Women		
	Traditional	Modern and New	Non-Graduate
Graduate density	-4.32***	0.15	-0.98
	(1.30)	(0.32)	(0.78)
Graduate density squared	2.43***	-0.22	3.09
	(0.82)	(0.30)	(2.76)
Adjusted R^2	0.26	0.27	0.29
Observations	7668	11195	5081

Robust standard errors in parenthesis;
* Significant at 10%, ** Significant at 5%, *** Significant at 1%
Other explanatory variables: age and its square; a dummy for whether married; a dummy for working less than 30 hours per week; a dummy for whether has a degree; years of tenure in the job; dummies for occupation; and dummies for year and quarter of the data

ANNEX: SOC 1990 codes (White-collar Jobs Only)

10 General Managers and Administrators in National and Local Government, Large Companies and Organisations
100 General administrators; national government (Assistant Secretary/Grade 5 and above)
101 General managers; large companies and organisations
102 Local government officers (administrative and executive functions)
103 General administrators; national government (HEO to Senior principal/Grade 6)

11 Production Managers in Manufacturing, Construction, Mining and Energy Industries
110 Production, works and maintenance managers
111 Managers in building and contracting
112 Clerks of works
113 Managers in mining and energy industries

12 Specialist Managers
120 Treasurers and company financial managers
121 Marketing and sales managers
122 Purchasing managers
123 Advertising and public relations managers
124 Personnel, training and industrial relations managers
125 Organisation and methods and work study managers
126 Computer systems and data processing managers
127 Company secretaries

13 Financial Institution and Office Managers, Civil Service Executive Officers
130 Credit controllers
131 Bank, Building Society and Post Office managers (except self-employed)
132 Civil Service executive officers
139 Other financial institution and office managers nes

14 Managers in Transport and Storing
140 Transport managers
141 Stores controllers
142 Managers in warehousing and other materials handling

15 Protective Service Officers
150 Officers in UK armed forces
151 Officers in foreign and Commonwealth armed forces
152 Police officers (inspector and above)
153 Fire service officers (station officer and above)
154 Prison officers (principal officer and above)
155 Customs and excise, immigration service officers (customs: chief preventive officer and above; excise: surveyor and above)

16 Managers in Farming, Horticulture, Forestry and Fishing
160 Farm owners and managers, horticulturists
169 Other managers in farming, horticulture, forestry and fishing nes

17 Managers and Proprietors in Service Industries
170 Property and estate managers
171 Garage managers and proprietors
172 Hairdressers. and barbers. managers and proprietors
173 Hotel and accommodation managers
174 Restaurant and catering managers
175 Publicans, innkeepers and club stewards
176 Entertainment and sports managers
177 Travel agency managers
178 Managers and proprietors of butchers and fishmongers
179 Managers and proprietors in service industries nes

19 Managers and Administrators NEC
190 Officials of trade associations, trade unions, professional bodies and charities
191 Registrars and administrators of educational establishments
199 Other managers and administrators nes

20 Natural Scientists
200 Chemists
201 Biological scientists and biochemists
202 Physicists, geologists and meteorologists
209 Other natural scientists nes

21 Engineers and Technologists
210 Civil, structural, municipal, mining and quarry engineers
211 Mechanical engineers

212 Electrical engineers
213 Electronic engineers
214 Software engineers
215 Chemical engineers
216 Design and development engineers
217 Process and production engineers
218 Planning and quality control engineers
219 Other engineers and technologists nes

22 Health Professionals

220 Medical practitioners
221 Pharmacists/pharmacologists
222 Ophthalmic opticians
223 Dental practitioners
224 Veterinarians

23 Teaching Professionals

230 University and polytechnic teaching professionals
231 Higher and further education teaching professionals
232 Education officers, school inspectors
233 Secondary (and middle school deemed secondary) education teaching professionals
234 Primary (and middle school deemed primary) and nursery education teaching professionals
235 Special education teaching professionals
239 Other teaching professionals nes

24 Legal Professionals

240 Judges and officers of the court
241 Barristers and advocates
242 Solicitors

25 Business and Financial Professionals

250 Chartered and certified accountants
251 Management accountants
252 Actuaries, economists and statisticians
253 Management consultants, business analysts

26 Architects, Town Planners and Surveyors

260 Architects
261 Town Planners
262 Building, land, mining and general practice surveyors

27 Librarians and Related Professionals

270 Librarians
271 Archivists and curators

29 Professional Occupations NEC

290 Psychologists
291 Other social and behavioural scientists
292 Clergy
293 Social workers, probation officers

30 Scientific Technicians

300 Laboratory technicians
301 Engineering technicians
302 Electrical/electronic technicians
303 Architectural and town planning technicians
304 Building and civil engineering technicians
309 Other scientific technicians nes

31 Draughtspersons, Quantity and Other Surveyors

310 Draughtspersons
311 Building inspectors
312 Quantity surveyors
313 Marine, insurance and other surveyors

32 Computer Analysts/Programmers

320 Computer analysts/programmers

33 Ship and Aircraft Officers, Air Traffic Planners and Controllers

330 Air traffic planners and controllers
331 Aircraft flight deck officers
332 Ship and hovercraft officers

34 Health Associate Professionals

340 Nurses
341 Midwives
342 Medical radiographers

343 Physiotherapists
344 Chiropodists
345 Dispensing opticians
346 Medical technicians, dental auxiliaries
347 Occupational and speech therapists, psychotherapists, therapists nes
348 Environmental health officers
349 Other health associate professionals nes

35 Legal Associate Professionals

350 Legal service and related occupations
360 Estimators, valuers

36 Business and Financial Associate Professionals

361 Underwriters, claims assessors, brokers, investment analysts
362 Taxation experts
363 Personnel and industrial relations officers
364 Organisation and methods and work study officers

37 Social Welfare Associate Professionals

370 Matrons, houseparents
371 Welfare, community and youth workers

38 Literacy, Artistic and Sports Professionals

380 Authors, writers, journalists
381 Artists, commercial artists, graphic designers
382 Industrial designers
383 Clothing designers
384 Actors, entertainers, stage managers, producers and directors
385 Musicians
386 Photographers, camera, sound and video operators
387 Professional athletes, sports officials

39 Associate Professional and Technical Occupations

390 Information officers
391 Vocational and industrial trainers
392 Careers advisers and vocational guidance specialists
393 Driving instructors (excluding HGV)
394 Inspectors of factories, utilities and trading standards
395 Other statutory and similar inspectors nes
396 Occupational hygienists and safety officers (health and safety)
399 Other associate professional and technical occupations nes

40 Administrative/Clerical Officers and Assistants in Civil Service and Local Government

400 Civil Service administrative officers and assistants
401 Local government clerical officers and assistants

41 Numerical Clerks and Cashiers

410 Accounts and wages clerks, book-keepers, other financial clerks
411 Counter clerks and cashiers
412 Debt, rent and other cash collectors

42 Filing and Records Clerks

420 Filing, computer and other records clerks (including legal conveyancing)
421 Library assistants/clerks

43 Clerks (Not Otherwise Specified)

430 Clerks (nes)

44 Stores and Despatch Clerks, Storekeepers

440 Stores, despatch and production control clerks
441 Storekeepers and warehousemen/women

45 Secretaries, Personal Assistants, Typists, Word Processor Operators

450 Medical secretaries
451 Legal secretaries
452 Typists and word processor operators
459 Other secretaries, personal assistants, typists, word processor operators nes

46 Receptionists, Telephonists and Related Occupations

460 Receptionists
461 Receptionist/telephonists
462 Telephone operators
463 Radio and telegraph operators, other office communication system operators

49 Clerical and Secretarial Occupations Nes

490 Computer operators, data processing operators, other office machine operators
491 Tracers, drawing office assistants