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**THE EFFECTS OF OVER-EDUCATION ON EARNINGS IN THE
GRADUATE LABOUR MARKET**

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The Effects of Over-Education on Earnings in the Graduate Labour Market

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Abstract

The massive transition to higher education and the large number of university graduates taking school-leavers' jobs has led many to question the widely held view that a university education is a good investment and a guarantee of economic success. This paper using data from one large civic university in the UK to consider the determinants and consequences of over-education. Approximately one in five graduates genuinely have more education than their jobs require. This study tests and rejects the hypothesis of non-random selection into over-education among graduates who have been in the labour market for sometime. In addition, the evidence strongly suggests that ordinary least squares systematically underestimate the magnitude of the negative effect of over-education on earnings.

JEL Classification Numbers: I21, J31.

Keywords: educational economics, wage differentials.

1. Introduction

Rising higher education is one of the most important socio-economic changes in modern economic history. Alongside the rapid educational upgrading of the labour force, several studies have shown that a significant number of university graduates are taking jobs for which a university education is not required (Dolton and Vignoles, 2000; Sloane et al., 1999). Furthermore, a related literature has demonstrated widespread and significant skill shortages especially at the intermediate level of skill (Prais, 2001; McIntosh and Steedman, 2000). As education continues to expand, these findings have led many to question the widely held view that a university education is a good investment and a guarantee of economic success.

While the phenomenon of over-education is not new, so far there has been no complete theory on over-education in the literature (see for an early discussion, Berg, 1970; Freeman, 1976). Most simply defined, over-education is a discrepancy between workers' actual and required levels of schooling. It may result in downward occupational mobility and accordingly in reducing the rate of return to investment in education. Few studies for the UK have examined the incidence and implications of over-education in the graduate labour market.

Most previous work for the UK have suggested that the incidence of over-education is as high as 30 or 40 percent of the graduate population (Sloane et al. (1999; Dolton and Vignoles, 2000). This analysis is based comes from the Newcastle Alumni

Survey, especially commissioned to permit new research in this field¹. Using this data and more precise measures of over-education, our results indicate that 22 percent of graduates are over-educated, suggesting that previous studies had largely over-stated the extent of over-education in the labour market.

Furthermore, previous studies have the UK and other countries have estimated the effect of over-education on earnings under the assumption that it is a random phenomenon (Sloane et al., 1999; Dolton and Vignoles, 2000; Green et al., 2000). The main methodology question that rising in relation to these estimates is whether the observed negative association between over-education and earnings represents a causal relationship. This question partly originated from the fact that over-educated individuals appear to have characteristics, such as lower ability or personal commitments, which are also associated with lower wages. In this paper, we test and reject the hypothesis of non-random selection into over-education. In addition, the corrected estimates strongly suggest that OLS largely understate the true effect of over-education on labour market earnings.

The remainder of this paper is set out as follows. The next section outlines the econometric framework. Section 3 briefly describes the Newcastle Alumni Survey and presents some descriptive statistics. In section 4 we estimate the impact of over-education on earnings. Finally, section 5 summaries and concludes the paper.

¹ This survey was funded by the Economics Department and the Alumni Office at the University of Newcastle upon Tyne, and the Government Office North East.

2. Estimation Methods

The over-education literature to date has assumed that mismatch in the labour market is essentially a random phenomenon and has relied on the following wage function to measure the relationship between over-education and wages:

$$\ln y_i = \mathbf{b}_0 + \mathbf{b}_{1k} X_{ki} + \mathbf{b}_2 S_i + \mathbf{m}_i \quad (1)$$

where S is an indicator variable taking the value 1 if the person is in a job for which they are over-educated, X is a vector of other characteristics and μ is the error term. More recently, Sloane et al. (1999) modelled over-education at an initial labour market state ($j=1$) and at some time afterwards ($j=2$). These authors however continued to assume that the over-education process is exogenously determined. Following Sloane et al. (1999) our first wage specification is estimated as follows:

$$\ln y_{ji} = \mathbf{b}_{0j} + \mathbf{b}_{1kj} X_{kji} + \mathbf{b}_{2j} S_i^j + \mathbf{m}_{ji}, \quad j = 1, 2 \quad (2)$$

where S^j for $j=1,2$ is a measure of skill under-utilization in first and later employment. Henceforth, we will drop the individual i subscript notation.

However, the over-educated are likely to be a non-random sample from the population and therefore may receive lower wages even if they had found jobs commensurate with their qualifications. A standard solution to the problem of causal

inferences is the Treatment Effects technique where we posit the existence of an observed covariate that is a determinant of over-education but is uncorrelated with wages. Hence, our alternative model structure involves estimating the following over-education probit equation:

$$S^j = \mathbf{d}_j \mathbf{Z}_j + \mathbf{e}_j, \quad j = 1, 2 \quad (3)$$

where S^j is a measure of skill under-utilisation and \mathbf{Z} is a vector of characteristics that are thought to determine over-education. Predicted values of S^j are then used to compute the Heckman (1979, 1990) selection adjustment term, λ , as follows:

$$\hat{I}_j = \frac{\mathbf{f}(\hat{\mathbf{d}}\mathbf{Z})}{\Phi(\hat{\mathbf{d}}\mathbf{Z})}$$

where $S=1$

$$\hat{I}_j = \frac{-\mathbf{f}(\hat{\mathbf{d}}\mathbf{Z})}{1 - \Phi(\hat{\mathbf{d}}\mathbf{Z})}$$

and where $S=0$. \mathbf{f} is the normal probability distribution function, and Φ is the normal cumulative distribution function. It is crucial that \mathbf{Z} includes variables that can be legitimately excluded from \mathbf{X} .

Along with the actual values for over-education, λ is entered into the following wage equation, which is our second earnings specification:

$$\ln y_j = \mathbf{b}_{0j} + \mathbf{b}_{1kj} X_{kj} + \mathbf{b}_{2j} S^j + \mathbf{q}_j \mathbf{l}_j + \mathbf{m}_j, j = 1,2 \quad (4)$$

The probit specification assumes independence between over-education in both periods. However, several reasons may be advanced for a high degree of complementarity between over-education in both stages including the effects of unobserved characteristics, such as ability, as well as observed attributes, such as faculty of degree. For this reason, over-education is also modelled using a bivariate probit as follows:

$$S^j = 1 \text{ if } S^{j*} > 0, S^j = 0 \text{ otherwise.}$$

$$S^{j*} = \mathbf{a}_j Z_j + \mathbf{e}_j, j = 1,2$$

$$[\mathbf{e}_1, \mathbf{e}_2] \sim \text{bivariate normal}[0,0,1,1,\mathbf{r}]$$

$$E[S^{1*} | S^2, Z_2] = \mathbf{a}_1 Z_1 + \mathbf{r} \mathbf{l}_2$$

S^{j*} is the latent variable corresponding to S^j . The rho term measures the correlation between the unobservables in the over-education equations.

Following an extension of the Heckman procedure outlined in Ham (1982), using the above bivariate model, we can correct for sample selectivity in the form of a second Treatment Effects model, which is our third wage specification, as follows:

$$\ln y_2 = \mathbf{b}_0 + \mathbf{b}_1 X + \mathbf{b}_2 S^1 + \mathbf{b}_3 S^2 + \mathbf{q}_1 \mathbf{I}_1 + \mathbf{q}_2 \mathbf{I}_2 + \mathbf{m} \quad (5)$$

where y_2 is wages in current employment, λ_1 and λ_2 are generated from the bivariate probit model above. The λ variables in the regression are computed from:

$$\mathbf{I}_1 = \mathbf{f}(w_1) \Phi \left[(w_2 - \mathbf{r}_{12} w_1) / (1 - \mathbf{r}_{12}^2)^{1/2} \right] / \Phi_2$$

$$\mathbf{I}_2 = \mathbf{f}(w_2) \Phi \left[(w_1 - \mathbf{r}_{12} w_2) / (1 - \mathbf{r}_{12}^2)^{1/2} \right] / \Phi_2$$

For the case where $S^1=S^2=1$

$$w_1 = -\mathbf{a}_1 Z_1 \quad w_2 = -\mathbf{a}_2 Z_2$$

The bivariate normal CDF is:

$$\Phi_2 = \Phi(w_1, w_2, \mathbf{r}_{12})$$

\mathbf{f} denotes the normal probability distribution function and Φ is the normal cumulative distribution function as before. To derive the other cases, we change the sign of w_1 when $S^1=0$, w_2 when $S^2=0$, and ρ when $S^1 \neq S^2$. In the Treatment Effects models, the standard errors are corrected for heteroscedasticity and the appropriate asymptotic covariance matrices computed as in Pagan (1984).

3. Newcastle Alumni Survey

This study uses data from the Newcastle Alumni Survey, which was collected at the University of Newcastle-upon-Tyne in 1998. The sample for this survey was selected using the Newcastle University Alumni Database of graduates and postgraduates. At the time the survey was carried out, 43,099 alumni were in this database. However, only 3,187 indicated their interest in participating in “careers research” and were posted the questionnaire. Overall, 2,434 members returned the questionnaire most of whom had graduated in the 1990s. Although a generally satisfactory response rate (76.37 percent) had been achieved, anything less than a perfect response raises the question of whether those who replied were representative of the university alumni population. The main causes of non-response are unknown as the survey was posted and no other contact was made.

Since we are only interested in the UK labour market our sample excludes all individuals living abroad during either their first or current job (i.e., 343 persons). In addition, we drop graduates from the faculty of medicine (i.e., 232 persons) and those who graduated before 1970 (i.e., 220 persons) since these individuals are unlikely to be over-educated. Finally, we only focus on individuals who are currently in employment at the time of the survey. This leaves us with a final sample of 1,389 graduates, of which our estimation samples are 852 and 731. We lose a significant number of observations due to missing data. In take account of the uneven distribution of responses across years, we generated sample weights based on our samples of 852 and 731 persons. All

Table 1
Summary Statistics

	N=852		N=731	
	Mean	Std. Dev.	Mean	Std. Dev.
Log of wage variable				
First job	9.646	0.754	9.64	0.753
Current job, mid-points	9.497	0.618	9.503	0.616
Over-education				
First job	0.462	0.499	0.459	0.499
Current job	0.194	0.395	0.196	0.397
Gender				
Female	0.347	0.476	0.345	0.476
Faculty				
Engineering & technology	0.182	0.386	0.189	0.392
Agric. science	0.314	0.464	0.303	0.46
Admin, bus, soc sc, prof'al, voc'al subjects	0.284	0.451	0.286	0.452
Languages	0.035	0.184	0.032	0.175
Arts & Humanities	0.155	0.362	0.161	0.368
Education	0.030	0.170	0.029	0.168
Class of degree				
First class	0.080	0.272	0.082	0.274
Second upper	0.386	0.487	0.386	0.487
Second lower	0.409	0.492	0.411	0.492
Third	0.057	0.232	0.06	0.238
Pass	0.067	0.250	0.06	0.238
Qualifications				
Professional qualification	0.426	0.495	0.437	0.496
Postgraduate degree	0.420	0.494	0.405	0.491
Employment characteristics				
Part-time	0.122	0.327	0.103	0.304
Self-employed	0.036	0.187	0.11	0.313
Sector				
Public admin	0.202	0.401	0.183	0.387
Education	0.147	0.354	0.176	0.381
Industry incl public utilities	0.220	0.415	0.222	0.416
Commerce	0.146	0.353	0.154	0.362
Self-regulating professions	0.087	0.282	0.085	0.279
Other	0.198	0.399	0.181	0.385
Firm size				
<25 employees	0.238	0.426	0.234	0.424
25-99 employees	0.225	0.418	0.209	0.407
100-499 employees	0.189	0.392	0.251	0.434
>500 employees	0.294	0.456	0.282	0.45
Occupation				
Manager	0.060	0.237	0.178	0.383
Professional	0.350	0.477	0.393	0.489
Associate professions	0.267	0.442	0.292	0.455
Other occupation	0.323	0.468	0.137	0.344
Labour market mobility				
Relocate for job	0.291	0.454	0.268	0.443
Relocate for job* female	0.059	0.235	0.062	0.241
Family commitments				
Partner prior to first job	0.084	0.278	0.089	0.284
Child prior to first job	0.315	0.465	0.304	0.46
Partner	0.728	0.445	0.719	0.45
Child	0.487	0.500	0.479	0.5
Debt commitments				
Debts>1000	0.236	0.425	0.231	0.421
On-the-job experience - current job only				
Training			0.659	0.474
Age (years)			36.85	7.99
Experience (years)			14.78	7.85
Unemployment (years)	0.357	1.077	0.379	1.139

descriptive statistics and regression analysis was performed using these weights.

Table 1 provides the summary statistics of the variables used in this study for our samples.

The most distinguishing feature of the Newcastle Alumni Survey is that it is the only British data set that contains two direct questions measuring the extent of education under-utilisation. The first question is: “What is/was the minimum formal qualification level required for *entering* this job?” and the second question is: “What do you believe to be the education level required to *actually do* this job?” Answers to both questions are on a four-point scale as follows: postgraduate qualification, degree, sub-degree qualification, and no qualifications required. The first question provides a match between acquired and required qualifications to get the job, whereas the second question provides a direct measure of over-education in terms of job content.

The criticism most widely levelled at subjective measure of over-education is that of credentialism i.e., where the educational requirements to get a job exceed those to do the job. As all previous studies for the UK that we are aware of have relied on questions framed as in the first question, the incidence of over-education may have been over-estimated by past researchers for this reason. In this paper using the second question, over-education is a dummy variable coded 1 if a graduate requires a postgraduate qualification or a degree and 0 otherwise. Table 2 demonstrates that between first and current employment, the percentage of workers who are over-educated fell from 52 percent to 22 percent. This suggests a considerably lower number of over-educated

Table 2
Percent of Over-educated Workers

	First Job N=852	Current Job N=731
Total over-educated	52	22
Gender		
Male	51.92	24.41
Female	52.66	20.00

workers than previous studies. We find that similar shares of men and women are over-educated in both first and current employment, which is in line with earlier studies such as Dolton and Vignoles (2000).

4. The Impact of Over-Education on Wages

One of the key questions of this literature is whether over-educated workers earn less than otherwise similarly educated workers whose jobs are commensurate with their educational qualifications. It could be the case that many graduates in non-graduate positions may transform these jobs and earn the same as other workers in graduate level positions (Mason, 1996). Therefore, if over-education is really the result of skill under-utilisation, a lower quality of education, or a lower level of ability it should be reflected in a lower level of wages. This section investigates the relationship between over-education and wages. The wage data in the Newcastle data is in twenty annual wage intervals ranging from less than £2,000 to £70,000. Our wage measured is the log of mid-point value of the earnings interval deflated at 1995 prices.

Table 3 displays the effect of over-education and other determinants on wages in first employment. The first column of the table reports the simple OLS estimate of the effect of over-education on wages. The second column presents the results of the Treatment Effects models. Under OLS estimation the estimated pay penalty associated with over-education is 18 percent in first employment. These results can be compared to those of Dolton and Vignoles (2000) and Sloane et al. (1999). The former study estimated a pay penalty within the range of 13 and 18 percent whereas the latter estimated a pay differential of 10 percent for men and 20 percent for women².

When we correct for endogeneity using the Treatment Effects method, the selectivity term is statistically insignificant as is the over-education term, which suggests that over-education in first employment is a random phenomenon³. Furthermore, the Hausman test indicates that there is no statistical difference between IV and OLS. The instrumental set to identify the system comprised the relocation and debt commitment variables was validated by the Sargan test and Bound et al. (1995) criteria.

Briefly reviewing the other determinants of earnings in first employment we observe that graduates of the faculty of arts and humanities earn less than those of other faculties. Class of degree and postgraduate qualifications are not statistically significant. Graduates in the educational sector earn more than those in other sectors. Also, graduates in small firms earn less than those in large firms. Self-employment status as well as

² Dolton and Vignoles' (2000) results depend on the extent of over-education, whereas the estimates provided by Sloane et al. (1999) were those of a binary over-education variable.

³ The corresponding selection models are presented in table 2A.

Table 3
The Effect of Over-Education on Wages in First Employment

	1		2	
Wage Estimation Method	OLS		Treatment Effects	
Selection Model	None		Probit	
Instrumental Variables	None		Relocation/Debt	
	Coef.	Std. Err.	Coef.	Std. Err.
Gender				
Female	-0.140**	0.066	-0.140**	0.054
Faculty - Engineering & technology				
Agric, science	-0.114	0.111	-0.123	0.080
Admin, bus, soc sc, prof'al, voc'al subjects	-0.014	0.112	-0.011	0.082
Languages	-0.216	0.157	-0.210	0.149
Arts & Humanities	-0.255**	0.13	-0.263**	0.099
Education	-0.057	0.216	-0.036	0.167
Class of degree - default Pass/Third				
First class	-0.044	0.173	-0.027	0.116
Second upper	-0.092	0.111	-0.091	0.080
Second lower	-0.108	0.11	-0.110	0.079
Qualifications				
Professional qualification	0.026	0.071	0.029	0.051
Postgraduate degree	0.071	0.072	0.076	0.053
Employment characteristics				
Self-employed	0.038	0.221	0.049	0.131
Part-time	-0.234	0.143	-0.231**	0.077
Occupation - default (all the others)				
Manager	0.061	0.108	0.083	0.120
Professional	0.147	0.097	0.197*	0.115
Associate prof	0.046	0.083	0.082	0.096
Sector - default education				
Public admin	-0.360**	0.156	-0.385**	0.101
Industry incl public utilities	-0.476**	0.156	-0.503**	0.108
Commerce	-0.340**	0.166	-0.388**	0.133
Self-regulating prof	-0.551**	0.181	-0.555**	0.114
Other	-0.355*	0.192	-0.390**	0.117
Firm size- default <25				
25-99 employees	0.251**	0.107	0.268**	0.076
100-499 employees	0.200*	0.103	0.214**	0.078
>500 employees	0.208**	0.084	0.228**	0.078
Over-education variable				
Over-education (0,1)	-0.176**	0.061	-0.057	0.220
Selectivity term				
Lambda			-0.074	0.132
Constant				
Constant	10.056**	0.232	9.983**	0.203
N		852		852
R squared		0.175		0.175
F-test on the excluded instruments			F(2, 825) = 14.36	
Partial R-squared			0.060	
Sargan test			0.170	
Hausman t-test			0.020	

occupation have no discernible impact on earnings. Part-time status substantially lowers earnings. As is standard in combined wage equations, female graduates earn significantly less than their male counterparts.

Table 4 presents the effects of over-education and other variables on wages in current employment where the selection terms are derived from either probit or bivariate probit estimation models⁴. Column one displays the simple model where an over-education dummy is included in the wage regression. Column two reports the Treatment Effects model where the selectivity term is derived from the probit model in which no account is taken of over-education in first employment. Column three is identical to column 2 except that the instrumental variable that enters the selection equation is now over-education in the first job. Finally, column four presents an alternative Treatment Effects model in which both first and current employment over-education terms are included and two associated selection terms calculated from the bivariate probit model are used to correct for sample selection. In current employment, the effect of over-education is much more serious than in first employment. According to our OLS estimate, the pay penalty associated with over-education stands at 27 percent. These results are in contrast to those provided by Dolton and Vignoles (2000) and Sloane et al. (1999). These authors report that the effect of over-education on earnings actually fell over the first six years after graduation.

⁴ In specifications 2 and 3, the corresponding selection models are presented in table 3A, and for specification 4 the bivariate model is illustrated in table 4A.

Table 4
The Effect of Over-Education on Wages in Current Employment

	1		2		3		4	
Estimation Technique	Mid-points		Mid-points		Mid-points		Mid-points	
Selection Technique	None		Probit		Probit		Bivariate Probit	
Instruments	None		Relocation		Over-ed. First job		Relocation/Debt	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Gender								
Female	-0.192**	0.040	-0.206**	0.043	-0.211**	0.045	-0.206**	0.084
Occupational Default (all others)								
Manager	0.497**	0.113	0.410**	0.082	0.378**	0.079	0.392**	0.156
Professional	0.318**	0.128	0.184**	0.091	0.134*	0.078	0.145	0.165
Associate prof	0.237**	0.113	0.154**	0.074	0.124*	0.070	0.132	0.138
Faculty - Engineering & technology								
Agric, science	0.059	0.063	0.089	0.060	0.100	0.061	0.105	0.116
Admin, bus, soc sc, prof'al, voc'a	-0.056	0.081	-0.067	0.058	-0.071	0.061	-0.665	0.113
Languages	-0.154	0.103	-0.097	0.116	-0.076	0.120	-0.706	0.225
Arts & Humanities	-0.154**	0.077	-0.095	0.074	-0.074	0.075	-0.740	0.142
Education	-0.423*	0.219	-0.433**	0.122	-0.436**	0.128	-0.459*	0.240
Class of degree - default Pass/Third								
First class	0.241**	0.093	0.175*	0.090	0.150*	0.091	0.149	0.173
Second upper	0.148**	0.065	0.109*	0.063	0.094	0.065	0.102	0.121
Second lower	0.094	0.062	0.043	0.064	0.024	0.064	0.363	0.122
Qualifications								
Professional qualification	-0.007	0.045	-0.017	0.039	-0.020	0.040	-0.248	0.076
Postgraduate degree	0.176*	0.102	0.133**	0.054	0.117**	0.054	0.119	0.103
Sector - default education								
Public admin	-0.030	0.065	-0.031	0.067	-0.031	0.070	-0.190	0.131
Industry incl public utilities	0.040	0.071	0.043	0.069	0.043	0.072	0.560	0.135
Commerce	0.387**	0.071	0.434**	0.078	0.452**	0.079	0.463**	0.157
Self-regulating prof	0.114	0.082	0.096	0.085	0.089	0.089	0.942	0.165
Other	-0.001	0.093	0.026	0.070	0.036	0.073	0.484	0.138
Firm size- default <25								
25-99 employees	0.185**	0.055	0.152**	0.059	0.140**	0.060	0.144	0.113
100-499 employees	0.219**	0.061	0.199**	0.056	0.192**	0.058	0.192*	0.109
>500 employees	0.247**	0.053	0.257**	0.054	0.260**	0.057	0.255**	0.106
Employment characteristics								
Self-employed	0.227*	0.124	0.223**	0.069	0.222**	0.072	0.222*	0.134
Part-time	-0.228**	0.088	-0.191**	0.063	-0.176**	0.064	-0.195	0.124
On-the-job experience (Years)								
Training	0.065*	0.039	0.056	0.039	0.052	0.041	0.553	0.076
Age	-0.145*	0.077	-0.146**	0.025	-0.147**	0.027	-0.149**	0.049
Experience	0.202**	0.076	0.208**	0.028	0.210**	0.030	0.209**	0.055
Experience squared	-0.001**	0.000	-0.001**	0.000	-0.002**	0.000	-0.150**	0.001
Unemployment	0.111	0.079	0.116**	0.030	0.118**	0.031	0.120**	0.058
Over-education variables (0,1)								
Current job	-0.268**	0.066	-0.713**	0.217	-0.879**	0.137	-0.802**	0.350
First job							-0.966	0.140
Selectivity term								
Lambda-current job			0.264**	0.125	0.399**	0.081	0.339*	0.207
Lambda-first job							0.465	0.116
Constant								
Constant	11.598**	1.559	11.838**	0.570	11.927**	0.589	11.991**	1.105
N		731		731		731		731
R-squared		0.492		0.495		0.510		0.514
F-test on the excluded instruments				F(2, 699) = 5.55				
Partial R-squared				0.008				
Sargan test				0.731				
Hausman t-test				2.077				

Using the Heckman Selection estimation approach, the effect of over-education on earnings rises almost threefold to 71 percent and 88 percent in specifications two and three, respectively. Moreover, the selection terms with respect to over-education in current employment are positive and statistically significant across specifications. Though the estimates in specification three are more sharply defined, there is no statistical difference between the estimates in specifications two and three. A Hausman test shows that the difference between IV and OLS is statistically significant. These results indicate that the OLS estimate of the impact of over-education is biased downwards. Moreover, the results in specification four reveal that over-education in first employment does not determine earnings at a future date, except indirectly through its effect on future over-education. In this specification where selection is modelled by a bivariate probit the estimate on over-education is 80 percent, which is not substantially different from that produced in specifications two and three.

Before turning to the question of instrumental validity, we briefly review the other determinants of wages in current employment. In the simple specification, graduates of the faculty of arts and humanities earn less than those of the faculty of engineering and technology. However, this differential is statistically insignificant once account is taken of sample selection into over-education. Across all specifications, graduates of the faculty of education earn less in comparison with those of other disciplines, perhaps due to the fact that salaries for teachers are relatively low. Degree class and postgraduate qualifications are statistically significant except in the fourth specifications. Also graduates in managerial, professional and associate professional occupations earn more

than in other occupations except in the final specification where once we control for sample selection into over-education in both periods, the coefficients on professional and associate professional occupations dissolve. Across all specifications, part-time status significantly lowers annual earnings but surprisingly training is not statistically significant. However, experience is important and follows the usual U-shape pattern. As is standard, women earn significantly less than their male counterparts in every specification.

The validity of our relocation instruments (including the relocation interacted with gender) in current employment was checked using the standard tests. Despite the fact that our mobility instruments empirically clear these tests, these variables are weak instruments. There were no strong instrumental variables available in our data to control for sample selection bias in current employment. Instead, what we found was that there was a strong unobservable dependence between over-education in current and first employment. Furthermore, over-education in first employment was not a good predictor of current earnings except indirectly through its effect on over-education in current employment. Accordingly, we checked the sensitivity of our results as reported above using over-education in first employment and also re-modelled the first stage equation using a bivariate probit. However, it is an open-end question whether or not over-education in first employment can be used to legitimately instrument over-education in subsequent employment. If it can be argued that it is valid, our results suggest that OLS estimates significantly understate the true effect of over-education on earnings.

5. Conclusion

In this paper using data from one large civic university we investigated the incidence and estimated the effects of over-education on earnings among university graduates. We found that approximately 52 percent of early graduates and 22 percent of those who have been in the labour market for some time genuinely have jobs for which a degree is not required to do the work. This evidence suggests that earlier studies have over-stated the extent of over-education in the graduate labour market.

Our OLS estimates indicate a significant pay differential in the returns to education associated with an educational discrepancy among early labour market entrants but no selection effects were uncovered. There are a wide variety of reasons for this result. One that is in line with our previous findings on the determinants of over-education is that there is initially a significant amount that is unknown about the work ability of new graduates. However, work ability emerges more clearly later in the labour market in the form of productivity differentials between graduates and earnings differentials begin to arise. In line with this hypothesis, the empirical evidence revealed considerable selection into over-education among those who had been in the labour market for some time. In addition, our results demonstrated that OLS estimates significantly understated the pay disadvantage associated with over-education for those upon whom our instruments impacted.

Appendix

Table 1A

The Determinants of Over-Education in First Employment

	Coef.	Std. Err.
Gender		
Female	-0.018	0.129
Faculty - Engineering & technology		
Agric, science	0.163	0.196
Admin, bus, soc sc, prof'al, voc'al subjects	-0.269	0.202
Languages	-0.484	0.350
Arts & Humanities	0.094	0.254
Education	-1.531**	0.395
Class of degree - default Pass/Third		
First class	-0.508*	0.297
Second upper	0.002	0.224
Second lower	0.063	0.223
Qualifications		
Professional qualification	-0.109	0.125
Postgraduate degree	-0.139	0.128
Employment characteristics		
Part-time	-0.118	0.168
Self-employed	-0.358	0.283
Occupation - default (all the others)		
Manager	-0.361	0.289
Professional	-1.209**	0.162
Associate prof	-0.811**	0.164
Sector - default education		
Public admin	0.989**	0.253
Industry incl public utilities	0.987**	0.257
Commerce	1.547**	0.274
Self-regulating prof	0.318	0.308
Other	1.257**	0.261
Firm size- default <25		
25-99 employees	-0.440**	0.170
100-499 employees	-0.355*	0.189
>500 employees	-0.572**	0.167
Mobility		
Relocate for this job	-0.696**	0.139
Debt commitments		
Debts>1000	0.364**	0.143
Constant		
Constant	0.255	0.398
N	852	
R-squared		
log-likelihood	-395.276	

Table 2A
The Determinants of Over-Education in Current Employment

Estimation Technique Instruments	1		2	
	Probit Relocation Coef.	Std. Err.	Probit Over-ed. first job Coef.	Std. Err.
Gender				
Female	0.091	0.164	-0.171	0.140
Faculty - Engineering & technology				
Agric, science	0.380*	0.213	0.384*	0.219
Admin, bus, soc sc, prof'al, voc'al subjects	0.041	0.220	0.086	0.244
Languages	0.629*	0.368	0.651*	0.363
Arts & Humanities	0.609**	0.240	0.675**	0.259
Education	-0.506	0.458	0.114	0.511
Class of degree - default Pass/Third				
First class	-0.623*	0.357	-0.506	0.334
Second upper	-0.389*	0.215	-0.419*	0.225
Second lower	-0.511**	0.217	-0.573**	0.222
Qualifications				
Professional qualification	-0.062	0.140	-0.115	0.151
Postgraduate degree	-0.484**	0.204	-0.477**	0.210
Employment characteristics				
Part-time	0.343*	0.203	0.699**	0.198
Self-employed	0.022	0.246	-0.191	0.271
Occupation - default (all the others)				
Manager	-0.544**	0.220	-0.622**	0.233
Professional	-1.070**	0.202	-1.043**	0.215
Associate prof	-0.439**	0.175	-0.407**	0.190
Sector - default education				
Public admin	0.152	0.289	0.129	0.293
Industry incl public utilities	0.234	0.263	0.091	0.266
Commerce	0.592**	0.275	0.498*	0.273
Self-regulating prof	-0.118	0.366	-0.081	0.366
Other	0.406	0.278	0.239	0.278
Firm size- default <25				
25-99 employees	-0.274	0.208	-0.444**	0.226
100-499 employees	-0.210	0.185	-0.372*	0.196
>500 employees	0.127	0.197	-0.038	0.207
On-the-job experience (Years)				
Training	-0.114	0.141	-0.053	0.146
Age	0.036	0.126	0.050	0.137
Experience	0.023	0.133	0.054	0.145
Experience squared	-0.003**	0.001	-0.004**	0.001
Unemployment	-0.005	0.143	-0.040	0.157
Mobility				
Relocate for this job	0.306*	0.176		
Relocate for this job* female	-1.175**	0.341		
Over-education first job				
Over-education first job			1.096**	0.158
Constant				
Constant	-1.123	2.752	-2.151	2.971
N		731		731
R-squared				
Log-likelihood		-279.94		-253.85

Table 3A
The Determinants of Over-Education – Bivariate Probit

	First job Coef.	Std. Err.	Current job Coef.	Std. Err.
Gender				
Female	0.073	0.138	0.060	0.177
Occupation - default (all the others)				
Manager	-0.195	0.237	-0.57**5	0.221
Professional	-1.107**	0.172	-1.044**	0.196
Associate prof	-0.759**	0.158	-0.425**	0.177
Faculty - Engineering & technology				
Agric, science	0.053	0.181	0.485**	0.223
Admin, bus, soc sc, prof'al, voc'al subjects	-0.432**	0.207	0.121	0.244
Languages	-0.531	0.394	0.746*	0.397
Arts & Humanities	-0.166	0.232	0.709**	0.267
Education	-1.729**	0.802	-0.368	1.053
Class of degree - default Pass/Third				
First class	-0.326	0.313	-0.598*	0.331
Second upper	0.204	0.213	-0.380*	0.217
Second lower	0.267	0.203	-0.482**	0.215
Qualifications				
Professional qualification	-0.256**	0.129	-0.167	0.147
Postgraduate degree	-0.111	0.135	-0.522**	0.204
Sector - default education				
Public admin	1.068**	0.280	0.279	0.289
Industry incl public utilities	0.938**	0.290	0.244	0.295
Commerce	1.509**	0.298	0.712**	0.301
Self-regulating prof	0.225	0.346	0.030	0.394
Other	1.187**	0.285	0.406	0.277
Firm size- default <25				
25-99 employees	-0.405**	0.178	-0.331*	0.205
100-499 employees	-0.354**	0.181	-0.279	0.208
>500 employees	-0.695**	0.165	-0.013	0.175
Employment characteristics				
Self-employed	-0.262	0.468	-0.062	0.265
Part-time	-0.155	0.197	0.464*	0.240
Mobility				
Relocate for first job	-0.684**	0.135		
Relocate for current job			0.210	0.160
Relocate for current job *female			-1.074**	0.464
Debt commitments				
Debts>1000	0.372**	0.130		
On-the-job experience (Years)				
Training			-0.026	0.143
Age			0.046	0.099
Experience			0.022	0.105
Experience squared			-0.003**	0.001
Unemployment			-0.051	0.110
Constant				
Constant	0.190	0.411	-1.453	2.132
Disturbance correlation				
RHO(1,2)	0.660**	0.068		
N			731	
Log likelihood			-584.5868	

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