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The Impact of Mobility on Early Career Earnings:
A Quantile Regression Approach for UK Graduates

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Abstract
This paper uses HESA data from the Destination of Leavers from Higher Education survey 2002/03 to examine whether more mobile students have an earnings advantage over those who are less mobile. We define mobility in terms of both choice of institution and location of employment. A clear finding that emerges is that mobility is associated with superior earnings outcomes, principally through students extending their job search horizon. Our analysis examines the entire earnings distribution rather than focussing solely upon the mean, as in common in much of the existing literature. This will provide a much clearer picture as to the true effect of mobility on earnings. We also confirm, via bivariate probit analysis, that there is a positive correlation between individual mobility decisions with regard to the location of university attended and location of employment. There are important policy implications resulting from these findings. If raising student fees or associated living costs reduces mobility, for example through choosing to live at home, this may affect future earnings with consequent impact on loan repayments. Alternatively, any subsidies provided by the Scottish and Welsh governments for local students may not help their own economies given the incentive for students to leave their country of origin post-study to increase their potential earnings.

Keywords
labour economics; graduates; earnings premium; mobility; quantile regression

JEL Codes
J24, J31

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1. Introduction

Graduate earnings and mobility are two topics of widespread interest. There is a diverse literature examining wage premia for university graduates, including analysis of differential returns for field of study as well as social versus private returns.[1] More broadly, education and human capital skills are seen as a major determinant of economic growth at the macro level. See for example Fougère et al. (1999) which examines the link between human capital and growth in an overlapping generations model with endogenous growth. At the micro level graduate placement and mobility are seen as key determinants of regional development (see Shindo, 2010 for an analysis of the impact of education subsidies on regional economic growth).

The current paper combines these two major themes by examining the impact of graduate mobility on the individual wage premium. Although the literature examining the two themes separately is well developed, that linking the two is far less so. We utilise the notion of mobility similar to that adopted by DaVanzo (1976, 1983). Thus, we consider two distinct individual decisions; mobility from location of initial domicile to university, followed by mobility between university and place of post-graduate employment. Subsequently, we estimate rates of return conditional on type of mobility.

From a theoretical perspective one might anticipate that the same set of observed and unobserved factors such as risk aversion, psychological and emotional factors influence both types of mobility. We therefore adopt a bivariate probit specification that allows for the correlation between the two types of mobility. A priori, a positive correlation is expected, i.e. unobserved factors that decrease the likelihood of moving to university (e.g. importance of family ties) also make it less likely individuals will move to find employment.

Our analysis employs data from the UK Higher Education (DLHE) Longitudinal Survey 2003/04 cohort. The survey identifies mobility patterns of individual graduates, i.e. both mobility to university and to subsequent employment, as well as labor market outcomes defined at 3.5 years after graduation. Thus, the data shed light on whether the more mobile earn a premium compared to those who do not move. We restrict analysis to first degree graduates born in or resident in the UK.[2] We then follow the student cohort into the labour market and establish the extent to which earnings differ by mobility history. The implicit assumption is that salary after 3.5 years is a good predictor of lifetime earnings. Available evidence suggests that this is indeed the case as the vast majority of workers tend to remain in the same UK region and in the the same broad occupational grouping for very long periods. Thus, in general individuals post-graduation tend to select an occupation and region of employment with a lifetime view (Naylor et al., 1998). Given the evidence presented by de Grip et al. (2008) on the persistence of graduate disadvantage after early career mismatch, we are confident that the early career opportunities analysed here are reflective of lifetime opportunities and that early career disadvantage is likely to translate into inferior long-term outcomes. In a similar vein, Oreopoulos et al. (2012) report that 70 per cent of overall graduate wage growth occurs in the first ten years of an individual's work experience.

We adopt a framework that considers the inter-relationship between area of domicile, location of study and place of employment in a comprehensive examination of graduate mobility. In addition, we examine the sensitivity of results to the definition of mobility with respect to a variety of distance measures. Finally, we use quantile regression analysis to examine the graduate earnings distribution (conditional on mobility) rather than the more traditional (and limited) focus on the mean. This echoes the sentiments of Courtioux et al. (2014) who model the distribution of higher education returns using a microsimulation approach and conclude that it is important to examine the distribution and variance of returns.

In what follows, we initially provide some background information on the UK higher education sector which will place some of the results discussed later into context. A review of the relevant literature, encompassing two disparate but related strands follows, before we describe the data source and the methodology adopted in the empirical analysis. A discussion of the results and conclusions then complete the paper. A clear finding to emerge is that students who are more mobile earn more than those who are less mobile. There is also a crucial distinction between those who constrain their location of job search and those who do not. Furthermore, the earnings advantage is shown to vary along the earnings distribution, with the implication that concentrating upon only mean outcomes mis-represents the effect of mobility upon earnings.

2. Some Background

First we outline some salient points of the UK higher education system to provide context for the empirical analysis that follows. From the 1960s there has been substantial growth in the number of degree awarding institutions and those endowed with the title of university. In order to distinguish the old and established from the new, a number of institutions formed coalitions. Perhaps the most prestigious is the Russell Group of 24 large research intensive universities including Oxford, Cambridge and the University of London. The 94 Group consisted of smaller research intensive universities which did not gain admission to the Russell Group on account of their size, though this group disbanded in 2013. The pre-1992 group were those longstanding institutions that had university status prior to the polytechnics being awarded equivalent status in 1992. The remainder consist of former polytechnics and teacher training, art and design, agriculture music and drama colleges together with other specialist institutions.

Degree classifications in the UK rely on the appointment of external examiners with the aim of ensuring comparability across institutions. Students are classified on the basis of their performance, ranging from a pass degree to an honours degree, split into third, lower second, upper second and first class honours in increasing order of merit. Traditionally, those wishing to proceed to a higher degree require at least an upper second.

The quality of institutions is judged primarily on their performance in research as opposed to teaching. The main purpose of the Research Assessment Exercise (RAE), now Research Excellence Framework (REF), is to enable the higher education funding bodies in England, Wales, Scotland and Northern Ireland to distribute public funds selectively on the basis of assessed research quality. These exercises take place every 4, 5 or 6 years. Panels use a standard scale for each assessed discipline ranging in 2001 from 1 (national) to 5* (international) levels of excellence with the modal grade being split into 3a/3b and 5 having a starred grade as well as a standard grade, thus providing a seven point scale.

3. Literature Review

The existing literature has two major strands; the graduate earnings premium and graduate mobility. The current analysis unifies these separate strands by examining the extent to which graduate mobility affects the earnings premium over similarly qualified contemporaries. We begin by providing an overview of the literature pertaining to the graduate earnings premium followed by graduate mobility.

3.1 Graduate earnings premium

A number of papers have examined the financial returns to UK graduates. Walker and Zhu (2011) and O'Leary and Sloane (2005) use the Labour Force Survey (LFS) and Chevalier (2011) the HESA longitudinal data to explore various aspects of rates of return to education. The findings are broadly similar; while degrees as a whole lead to substantial increases in lifetime earnings there is substantial heterogeneity in returns across discipline. Degree class is also shown to have a large effect independent of discipline. Further, the returns are greater for women than for men. O'Leary and Sloane (2008) show that there are substantial regional variations in the returns to higher education. However, adjusting for regional differences in the cost of living (including housing costs) substantially reduces the variance. More recently, O'Leary and Sloane (2016) show that over the decade 2001-2010, a period associated with a rapid expansion of the UK higher education sector, the graduate wage premium declined marginally (but statistically significantly). They also identify an upward shift in the likelihood of young British university graduates being employed in non-graduate jobs over the course of the decade.

3.2 Graduate mobility

Interest in graduate mobility has spawned a vast multi-disciplinary literature. There are a number of distinct themes. We identify four below. Most of the literature examines only a single dimension of mobility, i.e. either mobility from domicile to university or from university to employment, whereas our analysis examines both types of mobility simultaneously. The first theme revolves around identifying the key determinants and constraints underlying the different types of mobility. The following two themes relate to regional outcomes and field of study. These are somewhat tangential to the main focus of the current paper but help place our analysis in a broader context. The final theme builds on the first and is closest to the current analysis in that it looks at both dimensions of graduate mobility, i.e. mobility to university and from university to subsequent employment.

3.2.1 Determinants and type of mobility

A number of studies focus on the first stage of mobility and consider various constraints including distance from place of residence to the nearest university. See, for example, Denzler and Wolter (2011) for Switzerland. Other studies focus on the second stage of mobility, i.e. university to first employment, see Winters (2012). This US study points to size of university and regional location as key determinants of mobility. The results suggest that both earnings and occupational level are lower for those who remain in the region of their university vis-a-vis those who move. Mellander et al. (2011), also using US data, suggest that satisfaction with the local community plays the dominant role in the decision to stay. Venhorst et al. (2011) demonstrate that local labour market conditions play a key role in retaining graduates in regions of the Netherlands and Biagi et al. (2011) report that economic, social and environmental characteristics perform a similar role in Italy.

In a related literature, the nature of job search and its impact have been shown to play an important role in labour markets in general (see, for example, Sloane et al., 2013), but there is limited work on the role of job search in the context of graduate mobility and earnings. A recent paper by Pirog

(2016) suggests that type of search activity plays a significant role in predicting the success of Polish geography graduates in finding employment.

3.2.2 Regional outcomes

Rural/urban considerations are the focus of studies by Corcoran et al. (2010) for Australia and Ahlin et al. (2014) for Sweden. Large urban regions provide a broader market for skills which translate into a higher probability of employment, higher initial wages and greater wage growth. Regional impact studies include Osborne et al. (1987) for Northern Ireland and Bristow et al. (2011) for Wales. In both cases a net loss of high quality graduates to other regions is of concern. In the case of Italy, Dotti et al. (2013) report that the ability to attract high quality students from other regions depends crucially on local labour market conditions in both origin and destination locations. Iammorino and Marinelli (2013) suggest that greater regional migration of graduates in Italy would contribute significantly to reducing labour market mismatch.

A number of studies examine knowledge spillovers between universities and high technology firms. Faggian and McCann (2008) conclude that universities serve first and foremost to draw individuals with high quality human capital into regions, contributing to regional innovation. Similarly, Faggian and McCann (2009b) examine the relationship between inter-regional flows of graduates and regional innovation performance in Britain.[3] Faggian and McCann (2009b) suggest that Britain is characterised by distinct periphery-centre flows.

3.2.3 Graduate disciplines

The pattern of mobility differentiated by type, and in particular field of study is the focus of a number of studies. Faggian et al. (2007a) report that graduates with arts degrees demonstrate less post-graduation mobility than those with a degree in science or social science. Mosca and Wright (2010) note that male graduates, those with better degrees, from more highly ranked institutions and those who have already changed region to study are more likely to migrate for employment. Interestingly, this contrasts with Faggian et al. (2007a) who find that British female graduates are more mobile than their male counterparts. Similar results are reported for Italy by Coniglio and Prota (2008) and for the Netherlands by Venhorst et al. (2011). Wright (2011) notes that public sector employment is particularly important for UK graduates, especially outside of London.

3.2.4 Sequential studies

Faggian et al. (2007a) examine dual sequential mobility incorporating movement from domicile to university and from university to first employment. Their analysis adopts a multinomial logit specification to examine employment-migration behaviour of the 1997-2000 cohort of graduates. They use HESA data across 54 counties in England and Wales and 9 regional councils in Scotland. A companion paper by the same authors (2007b) models the sequential mobility behaviour of Scottish and Welsh students. Their focus is on estimating supply elasticities rather than returns to human capital. They also incorporate the special circumstances which apply to Scottish and Welsh students in terms of tuition fees that do not apply to the majority of UK students from England.

The literature linking these two strands of graduate outcomes and mobility is far less well-developed. Jewell and Faggian (2014) compare the salary markups for creative and STEM (science, technology, engineering and mathematics) graduates and show that dual migration (i.e. to and from university) is associated with the highest wage premium. However, while creative graduates do not derive much benefit from any other form of migration behaviour, STEM graduates benefit from a range of migration patterns. Finally, Abreu et al. (2015) examine the impact of industrial mobility on earnings and job satisfaction for UK graduates. The authors find that those who alter both location and industry face an earnings disadvantage in the short run compared to non-movers, while those who change location but not industry out-perform non-movers.

Our own study clearly falls into this sequential mobility category, but is wider-ranging in its investigation compared to existing studies. Faggian et al. (2007a) is central and closest in spirit to the current analysis. The value added of our study is as follows. We consider a more complete regional classification, as in Hoare and Corver (2010), and we examine the sensitivity of our results to a variety of definitions of mobility differentiated by distance. We use bivariate probit to highlight the inter-relationship between the two stages of mobility. We relate individual characteristics to individual outcomes, rather than taking the average characteristics of regions, and we use quantile regression to highlight the effects on earnings at different points in the overall distribution.

We adopt a framework that considers the inter-relationship between place of residence, place of study and place of employment in an analysis of graduate mobility and distribution of graduate earnings. This allows a more comprehensive picture to be painted of the effect of mobility across the entire spectrum of graduate earners in the UK labour market.

4. Data

The empirical analysis employs the Destinations of Leavers from Higher Education (DLHE) survey, conducted by the UK Higher Education Statistics Agency (HESA). The survey is organised in two stages, the first a census of individuals who have completed higher education courses in the UK carried out approximately six months after graduation (referred to as the Early Survey). The second stage (the Longitudinal Survey), looks at the destination of leavers up to 3.5 years after graduation and is based on a sub-sample drawn from the Early Survey.

The DLHE provides the key information required for our analysis, i.e. individual level mobility together with earnings. The data includes details of a range of personal characteristics (such as age, gender and ethnicity), the university attended and the degree course studied, employment circumstances (whether employed, self-employed etc.) after completion of study and job details including salary. Crucially for the mobility analysis, the data also contain an indication of location at three points in time: the home domicile is recorded before entry to university; we know the location of the university attended; and the location of employment 3.5 years after graduation. While the DLHE survey includes those completing undergraduate and postgraduate degrees, we restrict the focus to undergraduates. This enables a cleaner comparison for analysis of labour market outcomes. After removing observations with missing data, 7,901 undergraduate degree holders with complete migration history are identified. Of these, 3,717 also provide earnings data.

In its current form, the DLHE survey has run since 2002/03, with the most recent data available for 2008/09. In an attempt to avoid conflating recessionary effects with graduate premium and mobility effects our analysis utilises the 2002/03 cohort.[4, 5] Recent North American studies demonstrate that aggregate labour market conditions have strong and persistent effects on individual careers via the choice of initial jobs. Oreopoulos et al. (2012) analyse a large sample of Canadian college graduates from 1982 to 1999, a period which straddles two recessions. They conclude that graduating in a recession leads to large initial earnings losses of around 9 per cent of annual earnings. This loss is estimated to halve within 5 years, but does not disappear until ten years after graduation. Similar studies in the UK are limited. However, Britton et al. (2015) report that though graduates suffer proportionately less during recession than non-graduates, losses in earnings growth are still substantial and especially so for females.

5. Methodology

Consider the situation facing a student (labelled j) deciding where to attend university.[6] If she moves from her domicile location to a university in an alternative location then she is identified as a mover and we define an indicator variable I_{1j} that takes a value of 1. Alternatively, if she attends a university in the same location as her domicile, I_{1j} takes a value of 0. Second, we define an indicator variable I_{2j} that takes the value of 1 if she works in a different location to that of the university from which she graduated and zero otherwise. Thus, we can model the propensity of student j to migrate, both from domicile to university, and from university to employment, as follows:

$$I_{1j}^{*} = w_j\delta + \epsilon_{1j} \quad [1]$$

$$I_{2j}^{*} = v_j\gamma + \epsilon_{2j} \quad [2]$$

where for student j I_{1j}^{*} and I_{2j}^{*} are unobserved latent variables. It is assumed that the relationship between observed and unobserved mobility status is I_{ij}=1 if I_{ij}^{*} >0 and I_{ij}=0 otherwise (for i=1,2). The vectors w and v contain variables known to influence the decision of student j to migrate, δ and γ are conformable vectors of returns to these characteristics and ε_1 and ε_2 are normally distributed random error terms. Under the assumption that the error terms in equations [1] and [2] are potentially correlated, there are efficiency gains in simultaneously estimating the model via bivariate probit with Cov $(\epsilon_1, \epsilon_2) = \rho$.

Given the distinction between first stage mobility i.e. domicile to university and the second stage from university to employment, we mirror the classification adopted by DaVanzo (1983):

A. *Non-Movers*: those who attend university and work in the same location as their home domicile (I_1=0, I_2=0);

B. *Move-Returners*: those who move from their domicile location to attend university but subsequently return to work (I_1=1, I_2=1);

C. *Stay-Leavers*: those who remain in their domicile location to attend university but subsequently leave for employment in another location (I_1=0, I_2=1);

D. *Leave-Stayers*: those who move from their domicile location to attend university and subsequently remain in this same location for employment (I_1=1, I_2=0);

E. *Non-Returning Double-Movers*: those who move from their domicile location to attend university and subsequently move again to another location (which is not their home domicile) for employment. While this involves a double move in the same way as for move-returners (B), this second stage movement involves any location other than the original domicile (I_1=1, I_2=1).

Mobility from one location to another is defined by reference to the distance between them. Data available within the DLHE allow us to calculate the straight line distance in kilometres from the three key locations of domicile, university and employment. We can set a threshold at any defined distance level distinguishing between movers and non-movers.[7] We systematically increase the distance threshold, starting at 5km through to 100km, although in what follows we concentrate upon three key points at 25, 50 and 100km. This enables the sensitivity of the results to the chosen distance measure to be gauged. This approach has not been previously utilised in the literature.

Given this classification, we subsequently label groups B through E as movers (M), where each classification is a distinctly identifiable group of movers, and group A as non-movers (N). The earnings of each variety of mover category and non-movers can then be estimated. Standard linear regression techniques estimate the average relationship between the outcome variable and regressors based upon the conditional mean. This provides only a partial view and fails to describe the relationship at different points in the conditional earnings distribution. In contrast, quantile regression methods (see Koenker and Bassett, 1978) provide the capability to infer outcomes across the entire conditional distribution.[8] As such, the estimated conditional quantile (θth) earnings may be written as:

$$Q^{\theta}(\tilde{y}^k|z^k) = z^k\beta^{\theta,k} \qquad [3]$$

where $\tilde{y}^k$ is log earnings for mobility status group k, where k runs from A through E as defined above, z is a vector of characteristics known to influence earnings (with common structure across mobility status categories assumed, but with the distribution varying across k), $\beta^{\theta,k}$ is an estimated conformable vector of coefficient returns to these characteristics varying with quantile θ and across mobility status k. To simplify in places we refer to the suffixes N and M to denote non-movers and the aggregated category of all movers respectively. The quantile regression approach allows earnings for movers and non-movers of each variety to be estimated along the entire length of the distribution.

Equation [3] involves simulating the conditional wage distribution for each variety of mobility status A through E across quantiles and conditional on the vector z^k. The decomposition suggested by

Machado and Mata (2005) outlined below involves the quantiles of the marginal rather than conditional wage distribution. To illustrate, let us focus on the non-mover status group. In order to derive the marginal wage distribution we use estimates from equation [3] defined over the specific group (A) and then randomly select a row vector from *z* representing the characteristics of a given individual *j* among group A together with a randomly selected quantile θ. Multiplying the chosen *z* vector by the particular estimated coefficient vector $\beta^{\theta,k}$ where θ is a random draw and *k* refers to status group A, gives a single predicted marginal wage for a non-mover. This process is then repeated to generate an estimate of the entire marginal wage distribution, which is equivalent to integrating out the conditional wage distribution over *z* and θ.

$$f(\tilde{y}^N) = \iint_{z,\theta} Q^{\theta}(\tilde{y}^N | z^{kN}) dz d\theta \qquad [4]$$

This marginal wage distribution for non-movers can then be divided into quantiles and labelled $Q^{\theta}(\tilde{y}^N)$ as in the decomposition below. This represents the first term on the right handside of the Machado and Mata (2005) decomposition:

$$Q^{\theta}(y^N) - Q^{\theta}(y^M) = \left[Q^{\theta}(\tilde{y}^N) - Q^{\theta}(\tilde{y}^*)\right] + \left[Q^{\theta}(\tilde{y}^*) - Q^{\theta}(\tilde{y}^M)\right] + residual \qquad [5]$$

where $Q^{\theta}(y^N)$ and $Q^{\theta}(y^M)$ are observed earnings at quantile θ for non-movers and movers respectively and $Q^{\theta}(\tilde{y}^N)$ and $Q^{\theta}(\tilde{y}^M)$ are linear predictions at each θ estimated from equation [3]. Finally, the counterfactual term $Q^{\theta}(\tilde{y}^*)$ is based on the distribution of earnings that would exist if the characteristics of non-movers were rewarded in the same way as those of a given variety of movers. In essence we follow exactly the same steps as above, but combine rows of the *z* matrix for non-movers with quantile regression coeficients for a given variety of mover.

At any comparison point θ the difference in earnings between non-movers and movers may then be decomposed into the components represented by equation [5]. The first bracketed term on the right hand side (a 'coefficient effect') measures the extent to which the earnings-determining characteristics contained within vector z are rewarded differentially between non-movers and a given status of movers. The second term, a 'composition effect', is the contribution of the covariates included in the earnings specification, i.e. the extent to which vector z differs between non-movers and movers.[9] In the decomposition set up by Machado and Mata there will also be a residual component related to simulation and sampling errors which would disappear asymptotically (see Melly, 2007).[10]

6. Results

6.1 Descriptive statistics

Table 1 provides an overview of the distribution of graduates across the standard government office regions of the UK. While our focus is not based upon a regional analysis, such figures provide an interesting backdrop. Consistent with population density patterns, column 1 demonstrates a clustering of prospective students domiciled in London (13.3%) and the South East (14.4%) prior to attending university and much lower proportions originating from the North East (3.8%) and Northern Ireland (4.0%). The pattern of students attending university (column 2) is not in general that dissimilar to the breakdown based on region of domicile, although it is apparent that Yorkshire and Humberside is a net importer of students while the South East is a net exporter. In terms of graduate employment (column 3), the most striking pattern is the dominance of London in the graduate labour market. Of all graduates in employment, 17.7% are to be found in this region, the largest of any individual area and a third greater than its initial share by domicile.

Table 1
Distribution of UK Students and Working Graduates by Government Office Region (%s)

	Domicile	Institution	Employment
North East	3.8	4.3	3.6
North West	11.8	12.6	11.6
Yorkshire & Humberside	7.1	12.5	8.3
East Midlands	6.8	6.8	5.8
West Midlands	8.1	7.7	6.5
Eastern	9.1	5.9	6.5
London	13.3	13.2	17.7
South East	14.4	11.1	12.4
South West	8.7	8.2	7.0
Wales	4.6	5.4	4.7
Scotland	8.2	9.1	8.2
Northern Ireland	4.0	3.2	3.4
Outside UK	0.0	0.0	4.4
Sample size	14,153	14,534	10,213

Note: all figures are weighted using *finalwt* to be nationally representative.

While such patterns are well-known, we are also able to quantify the average distance that students move (by above-defined region), both prior and subsequent to attending university (see Table 2). With regard to the initial movement to university, those domiciled in London move on average the least distance (57.7km) and those in the South West the greatest (133.0km). Noticeably, there is also a greater tendency to move in the south east corner of England more generally, with the South East (129.9km) and Eastern region (128.7km) having the next two highest average distances. At the other extreme is Scotland (77.5km), which in spite of its regional remoteness has the second lowest figure after London.[11] The average distance for the second stage movement from university to gain employment is lower in the aggregate (74.1km) than the average distance moved from domicile to university (91.2km). While there are a number of ways in which distances may be calculated, there are interesting patterns along the lines of region of domicile, institution and employment. With regard to region of domicile, the three regions with the highest average distances moved to university (South West, South East and Eastern) also have the three highest average distances moved from university to employment (i.e. 99.1, 97.1 and 108.3km respectively), and London still has the lowest average distance at 48.0km. Indeed, as noted earlier in Table 1, London is a hub of graduate employment and evidently many of those who study in London also subsequently find employment there.[12] This is supported by the low average distance (29.3km) that students who studied in London subsequently move to take up a job. Also of note is the fact that average travel distances are lowest for those employed in Scotland (46.6km) and appreciably lower than the average distance travelled by those who study in Scotland (101.7km). This supports the view seen in Table 1 that while Scotland is a net importer of students (9.1% of students study there from a student base of 8.2% of the UK population), it is a net exporter of graduates (with only 8.2% of graduates employed there).

Table 2
Average Distances Moved (Km) by Government Office Region

	To University	From University		
		Domicile	**Institution**	**Employment**
North East	110.0	93.3	103.0	84.2
North West	78.7	61.4	74.9	55.4
Yorkshire & Humberside	82.7	71.6	92.7	61.2
East Midlands	94.6	71.5	86.6	72.3
West Midlands	78.7	76.0	72.1	74.4
Eastern	128.7	108.3	79.5	117.3
London	57.7	48.0	29.3	71.9
South East	129.9	97.1	82.9	106.9
South West	133.0	99.1	118.0	104.3
Wales	97.6	68.2	74.8	59.7
Scotland	77.5	69.2	101.7	46.6
Northern Ireland	98.7	85.9	50.2	77.4
Aggregate UK	**91.2**		**74.1**	

Note: all average distances moved to university are based upon the region of domicile.

Table 3 switches from a regional focus to demonstrate how the proportion of students across the defined mobility categories varies as the distance threshold increases. As anticipated, the proportion in each of the five categories is sensitive to the definition of distance. The proportion of non-movers rises as the distance threshold rises, and correspondingly the proportion in the non-returning double-mover category declines. Adopting three representative distances at 25, 50 and 100km, approximately one third of the sample are in each of these categories at the 25km threshold, whereas nearly two thirds (64.6%) are classified as non-movers at the 100km threshold.[13] At this level, only about one in five (17.8%) are non-returning double movers. Meanwhile, move-returners and stay-leavers are consistently the smallest movement categories and across the three representative distances there is little change in their proportions: at 25km they collectively account for 12.3% of graduates; at 100km they account for 6.9%. Similarly, the remaining leave-stayer category is consistent across distance measures, accounting for over one in ten at all thresholds.

Table 3
Graduate Mobility Patterns by Movement Thresholds (%s)

	Non-Movers	Move-Returners	Stay-Leavers	Leave-Stayers	Non-Returning Double-Movers
5km	4.2	10.8	3.5	15.4	66.2
10km	12.3	9.7	5.6	17.8	54.6
15km	21.3	8.8	5.6	17.4	46.9
20km	28.6	8.0	5.2	16.2	42.1
25km	33.6	7.4	4.9	15.2	39.0
30km	37.0	7.0	5.0	14.7	36.4
35km	39.7	6.5	4.8	14.4	34.5
40km	42.7	6.2	4.8	14.2	32.2
45km	45.0	5.9	4.7	13.9	30.6
50km	47.4	5.5	4.6	13.6	28.9
55km	49.8	5.1	4.5	13.4	27.3
60km	51.6	4.8	4.4	13.2	26.0
65km	53.6	4.5	4.3	12.6	24.9
70km	55.3	4.3	4.3	12.3	23.8
100km	64.6	2.9	4.0	10.8	17.8

6.2 Bivariate probit

Table 4 illustrates the results for the bivariate probit analysis, modelling the joint decision to move to university and from university to work.[14] The marginal effects, or influence on the probability of observing a given movement, are reported across the chosen three representative distance thresholds for a number of the key variables within the specification (complete results available in Appendix Table 1). While there is some variation across the three distance thresholds in terms of significance of estimates, the direction of influence remains unchanged and there is a remarkably consistent story at 50 and 100km. Dealing initially with the likelihood of moving to university (see equation [1]), this increases with age, having a reported learning difficulty (such as dyslexia), and being male. Similarly, university reputation and research quality both tend to increase the tendency to relocate from domicile to university. Students attending the research intensive universities of the Russell Group and universities more highly ranked in the 2001 RAE have an increased propensity to move.[15] In contrast, being of an ethnic minority background decreases the likelihood as does the number of institutions in the home region.[16] Furthermore, although not presented in the table, substantial effects are also apparent across degree subject studied and domicile region, with those in Scotland and London in particular significantly less likely to move to university.

Table 4
Marginal Effects of Joint Decision to Move from Home Domicile to University (I_1) and from University to Work (I_2) by Movement Threshold

	25km		50km		100km	
	Univ - I_1	Work - I_2	Univ - I_1	Work - I_2	Univ - I_1	Work - I_2
Age at entry	0.030		0.100^{++}		0.168^{+++}	
Age at entry squared	-0.001		-0.003^{+++}		-0.005^{+++}	
Age		-0.074		-0.013		0.069
Age squared		0.001		-0.000		-0.002
Male	0.007	0.000	0.025^{+}	0.011	0.025^{+}	0.012
Non-white	-0.174^{+++}	-0.074^{+++}	-0.199^{+++}	-0.088^{+++}	-0.146^{+++}	-0.082^{+++}
Learning problem	0.059^{++}	0.002	0.091^{+++}	0.044	0.043	0.032
University choices	-0.164^{+++}		-0.125^{+++}		-0.078^{+++}	
University choices squared	0.000		-0.000		-0.001^{+++}	
University research quality	0.012	-0.007	0.049^{+++}	0.011	0.060^{+++}	0.030^{+++}
Institution type						
Russell Group	(E)	(E)	(E)	(E)	(E)	(E)
1994 Group	0.056^{++}	0.092^{+++}	0.052^{+}	0.064^{++}	0.015	0.047^{++}
Pre-1992	-0.088^{+++}	-0.002	-0.122^{+++}	-0.043^{++}	-0.139^{+++}	-0.056^{+++}
Other	-0.104^{+++}	-0.089^{+++}	-0.085^{+++}	-0.109^{+++}	-0.041	-0.042^{+}
Labour market characteristics						
Distance from London x10^3		-0.296^{+++}		0.119		0.311^{+++}
Population density (work)x10^3		-0.018		0.000		0.037^{++}
Economic activity (work)		0.036		0.032^{+++}		0.023^{+++}
Professional earnings (work)		0.001		0.001^{++}		0.000
Population density (university) x10^3		-0.024		0.044^{++}		0.041^{+++}
Economic activity (university)		0.004		0.009^{++}		0.005^{+}
Professional earnings (university)		-0.001		-0.002^{+++}		-0.002^{+++}
Part-time worker		-0.046^{+++}		-0.042^{+++}		-0.020
Cov(ε_1, ε_2) - ρ	0.733^{+++}		0.780^{+++}		0.809^{+++}	
Sample size	7,303		7,303		7,303	

Notes: (E) denotes and excluded reference category; $^{+}/^{++}/^{+++}$ denotes statistical significance at the 90%/95%/99% level respectively; in the likelihood function covariance (ρ) is not estimated directly but rather atanhρ (=½ln((1+ρ)/(1-ρ))) is and this has a coefficient value of 0.936/1.045/1.125 for the three distance thresholds respectively; likelihood ratio test that atanhρ=0 ($\chi^2_{(1)}$=1365.97/1808.62/1910.49) is easily rejected; additional controls also included for degree subject (17) and region of domicile (12) that are not reported.

With regard the decision to move from university to find employment (see equation [2]), there is once again regularity across distance thresholds. Those from an ethnic minority background in particular are less likely to move away from university. This is also true for those attending less-prestigious institutions outside of the Russell Group/1994 Group and those who are employed on a part-time basis. A number of indicators of economic buoyancy and labour market opportunities that have been included to capture differing prospects between regions of study and work also play an important role. While population densities, economic activity rates and average professional earnings at the regional level and distance from central London are invariably insignificant at the 25km threshold, they are significant at both the 50/100km thresholds. The economic activity rate and the level of professional earnings (which may be thought of as indicative of the level of graduate salaries in the region of work) both act as pull factors and positively affect the decision to move away from university. In contrast, higher professional earnings in the university region reduce the likelihood of graduates moving.

Finally, the estimate of ρ in the bivariate specification, the term capturing the correlation between the unobservables in the move-to-university and the move-to-work equations, is highly significant and positive across all three distance measures, suggesting that unobserved individual traits such as drive, ambition, personality etc. influence the decision to move both pre- and post-university in the same direction.[17,18] Modelling these as separate phenomena, or failure to account for the cross determination of these events, will therefore potentially lead to incorrect inferences being drawn. The fact that such observed and unobserved characteristics influence mobility is important at the level of the individual as mobility affects the level of graduate earnings. We turn to this issue in the next section.

6.3 Quantile regression

We estimate quantile regressions with annual salary (logarithm) as the dependent variable and a host of income determining characteristics as explanatory variables. It would be impractical to present results and give a detailed account of individual estimates across the entire earnings distribution and for all mover/stayer categories, so we present an aggregate set of results in Table 5 for representative quantiles at the median and upper/lower quartiles. These estimates are invariably well-defined and conform to a familiar pattern as predicted by human capital theory (see Mincer, 1974): earnings are higher for males and for those on a permanent contract as opposed to those employed on a fixed term/temporary basis; earnings are lower for those who work part-time, who are non-white and for those with more months spent unemployed since graduation; there are large regional variations in earnings, with the highest returns being found in the South East of England and London; large earnings differentials are evident across degree subjects, with Creative Arts and Design and Linguistics, Languages and Literature conferring some of the lowest returns; and finally, a lower degree classification substantially reduces earnings. These are general findings that tend to be evident over all quantile ranges, although the influence of age is only statistically significant at the lower quartile. Given the lack of variation in age for the specific cohort studied this is largely unsurprising, although what evidence there is points to earnings increasing with age.

Table 5
Wage Equation Estimates by Quartile

	0.25	**0.5**	**0.75**
	Coef	**Coef**	**Coef**
Age	0.118^{++}	0.046	0.058
Age squared	-0.002	0.000	-0.001
Male	0.017	0.038^{+++}	0.041^{+++}
Non-white	-0.035^{+}	-0.030^{++}	-0.010
Learning problem	-0.009	0.002	-0.008
Months unemployed	-0.014^{+++}	-0.014^{+++}	0.017^{+++}
Months unemployed squared	0.000	0.000	0.001^{+++}
Part-time employment	-0.935^{+++}	-0.604^{+++}	-0.386^{+++}
Permanent contract	0.102^{+++}	0.064^{+++}	0.043^{+++}
University quality	-0.012	-0.006	0.000
Institution type			
Russell Group	(E)	(E)	(E)
1994 Group	0.031	0.021	0.010
Pre-1992	-0.002	0.030	-0.005
Other	-0.019	-0.006	-0.028
Degree class			
First	(E)	(E)	(E)
Upper second	-0.033	-0.042^{++}	-0.032^{+}
Lower second	-0.078^{+++}	-0.098^{+++}	-0.073^{+++}
Third	-0.101^{++}	-0.144^{+++}	-0.089^{+++}
Unclassified	0.088	0.043	0.042
Other	0.003	-0.029	-0.018
Degree subject			
Medicine & dentistry	0.705^{+++}	0.699^{+++}	0.565^{+++}
Subjects allied to medicine	0.116^{+++}	0.126^{+++}	0.068^{+++}

Biological, veterinary & agricultural	-0.075^{+++}	-0.053^{++}	-0.056^{++}
Physical sciences	-0.040	-0.011	-0.056^{+}
Mathematics & computer science	0.040	0.072^{++}	0.073^{++}
Engineering & technology	0.223^{+++}	0.208^{+++}	0.126^{+++}
Architecture, building & planning	0.098^{+}	0.086^{+}	0.039
Social studies	0.021	0.026	0.029
Law	-0.010	0.019	-0.082^{+}
Business & administrative studies	(E)	(E)	(E)
Communication & documentation	-0.028	-0.066	-0.108^{+++}
Linguistics, languages & literature	-0.025	-0.079^{+++}	-0.038
History & philosophy	0.016	-0.003	-0.065
Creative arts & design	-0.077^{+}	-0.123^{+++}	-0.145^{+++}
Education	0.290^{+++}	0.223^{+++}	0.111^{+++}
Combined	0.047^{+}	0.063^{+++}	0.036^{++}
Region of employment			
North East	-0.053	0.004	0.017
North West	-0.035	-0.045	-0.031
Yorkshire & Humberside	-0.040	-0.036	-0.019
East Midlands	(E)	(E)	(E)
West Midlands	-0.074^{+}	-0.040	-0.010
Eastern	0.011	0.018	0.027
London	0.128^{+++}	0.127^{+++}	0.153^{+++}
South East	0.022	0.070^{++}	0.065^{++}
South West	-0.049	-0.058^{+}	-0.054
Wales/Other	-0.145^{+++}	-0.151^{+++}	-0.075^{+}
Scotland	-0.089^{++}	-0.067^{+++}	-0.022
Northern Ireland	-0.135^{+++}	-0.117^{+++}	-0.054^{+}
Constant	7.838^{+++}	8.853^{+++}	8.831^{+++}
Sample size	3,708		

Notes: (E) denotes and excluded reference category; $^{+}$/$^{++}$/$^{+++}$ denotes statistical significance at the 90%/95%/99% level respectively.

Interestingly, controlling for quality of university attended, via institution type and a measure of university research pedigree, shows no significant effect upon individual earnings *ceteris paribus*. Furthermore, it is also apparent that the earnings advantage experienced by males only occurs at the median and above and that the earnings disadvantage of non-whites is not found at the lower quartile. This again reinforces the notion that analysis of the mean provides only a partial view of the economic impact upon graduate outcomes.

Based upon the underlying quantile regressions for each of the five categories of graduate mobility, Figure 1 graphically displays the earnings premium (i.e. the coefficient effect) from the decomposition described in equation [5]. The figures illustrate results for each of the four mover-categories of graduates relative to those who neither move to university nor subsequently move to work. Given that the analysis is restricted to graduates in the workforce, one might anticipate a fairly homogeneous group, implying we would not expect to observe systematic differences in earnings determination across mover categories, particularly once we have controlled for degree outcomes and region of employment. Homogeneity would in turn imply a negligible coefficient effect in the decomposition framework with differences in observed earnings attributable to compositional differences related to individual, job and regional characteristics. Alternatively, instances where different mobility groups receive a systematic earnings advantage, i.e. an earnings premium, would be characterised by an identifiable coefficient effect. Under such a scenario, heterogeneity would exist across groups, but not heterogeneity in observed characteristics but rather in unobserved characteristics such as motivation and innate ability. This hypothesis is examined in Figure 1, with the various panels plotting earnings premia for each of the mobility categories across the distribution against a common baseline of those who do not move.

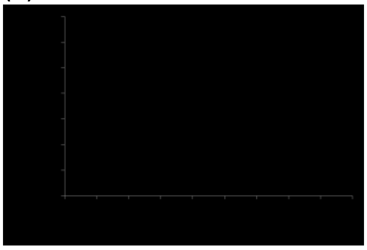
We replicate figures based on the three distinct distance measures of 25, 50 and 100km. However, given the special nature of London as a centre of both graduate education and employment, we distinguish those who remain in London from non-movers more generally. For this reason, the results in Figure 1 exclude those who report their domicile, institution and employment region as all being within London (defined as a government office region). However, it should be noted that this exclusion in no way drives any of the results or conclusions. We concentrate initially on the results at 100km given the similarity with the 50km threshold. While full decomposition results are relegated to Appendix Table 2, the focus of Figure 1 and its accompanying discussion relates exclusively to the (unexplained) coefficient component.[19]

Panel (a) illustrates the coefficient effect for move-returners vis-a-vis non-movers. Interestingly, the return is negative and significant across the entire distribution, despite the upward trajectory over the second half of the earnings distribution. Even at the ninth decile (0.9 quantile), the premium is still a statistically significant -0.05 log points. Thus, rather than mobility conferring any sort of earnings advantage those who initially move to university but subsequently return to their home domicile fare less well than the baseline non-mover category. The implication here, as we will see in the following discussion, is that job search constraint is the crucial factor in influencing graduate earnings.

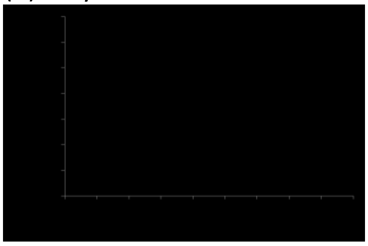
Figure 1
Earnings Premiums and 95% Confidence Intervals Relative to Non-Movers by Mobility History, Quantile and Movement Threshold

25km

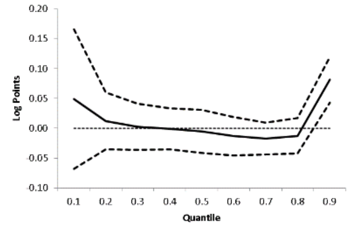
(a) Move-Returners



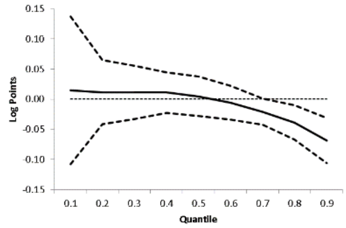
(b) Stay-Leavers



(c) Leave-Stayers

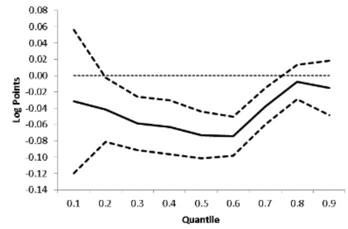


(d) Non-Returning Double-Movers

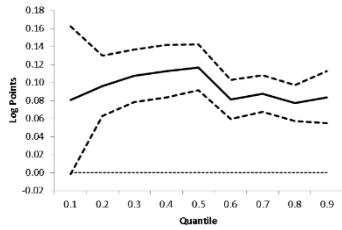


50km

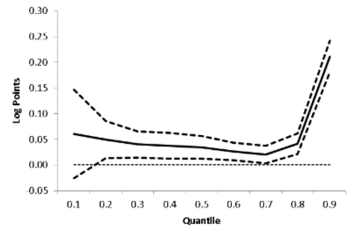
(a) Move-Returners



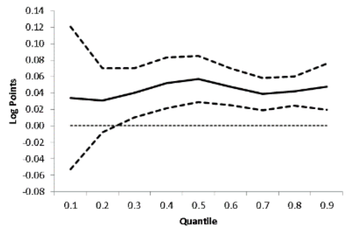
(b) Stay-Leavers



(c) Leave-Stayers

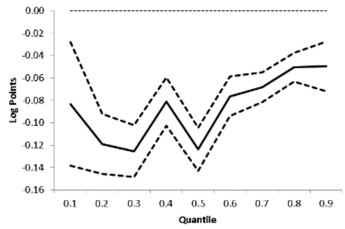


(d) Non-Returning Double-Movers

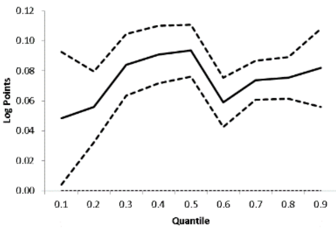


100km

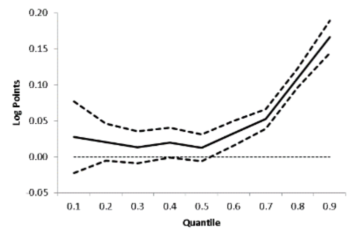
(a) Move-Returners



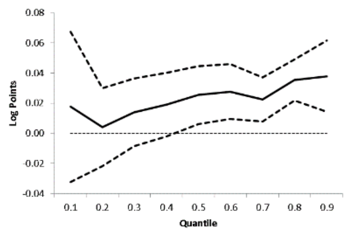
(b) Stay-Leavers



(c) Leave-Stayers



(d) Non-Returning Double-Movers



Notes: — point estimates; - - - 95% confidence interval.

Panel (b) represents the coefficient effect of the stay-leaver group. Premiums are significantly positive over all deciles and increase in magnitude over the earnings distribution (albeit with a slight dip after the median). Starting at 0.048 log points at the first decile (0.1 quantile), the returns reach a maximum of 0.094 log points at the median and remain substantial at 0.082 for the ninth decile (0.9 quantile). Unlike the results described previously, there is a substantial reward to mobility defined as a movement away from the domicile area to take up employment.

Panel (c) compares those who leave their domicile to go to university and then gain employment within the same location, i.e. leave-stayers, vis-a-vis the baseline non-movers. The pattern of the coefficient effect is flat and invariably insignificantly different from non-movers over the first half of the distribution. In contrast, over the second half the trend is upward, rising from a significant 0.033 at the sixth decile to a peak of 0.167 log points at the ninth. Once again, mobility is associated with superior earnings outcomes, but for the leave-stayer group this is restricted only to those in the top half of the earnings distribution. Indeed, the rewards received here are the highest across all of the defined movement categories.

Finally, panel (d) examines non-returning double movers and this is an evidently different group to the move-returners discussed above. The crucial distinction for this group is that they do not return to the home domicile after graduation and this markedly affects the conclusions. While the pattern over lower earnings levels reflects insignificant premiums to mobility, at all points from the median onwards returns are significant and positive, rising from 0.025 log points at the median through to 0.038 log points at the ninth decile.

Comparing results across alternative definitions of mobility, the patterns at the defined 50km radius are remarkably similar to those already identified. While there are some subtle differences, for example the negative premiums observed for move-returners at the 100km threshold across the entire earnings distribution are now only observed over the third to sixth decile at the 50km threshold, the underlying story of how mobility affects earnings is unchanged. However, when we move to the 25km threshold many of the observed premiums are now insignificant.[20] In itself this is reassuring, in that defining a movement threshold at 25km will designate as mobile those who have in reality moved only a short distance and as such the distinction between genuine movers and stayers is blurred. Under such a scenario we would not expect to see clear-cut returns to mobility. Noticeably, though, those in the stay-leaver group still receive a significant premium even at the

25km threshold, averaging in excess of 0.1 log points over the first four deciles and remaining significantly positive (although smaller) over the next three.[21]

7. Conclusions

Adopting a bivariate probit specification to model the dual mobility decision of moving to and from university acknowledges the potential importance of the inter-relationship between the two decisions. Unobservable traits encapsulate attributes such as motivation, drive and ambition, which positively affect both the decision to leave the home domicile to attend university and also the decision to move from university or home region when entering the labour market.

Limited mobility is important at the individual level for students as the more mobile enjoy an earnings premium over those who are less so. Students who remain in their domicile location fare the least well and do not experience an earnings advantage over their more mobile counterparts at any point of the earnings distribution. While premiums are evident over the various classifications of mobility, the crucial distinction is with those who constrain their location of job search: individuals who move to university but subsequently return to the home domicile fail to earn a premium over most parts of the earnings distribution; individuals who exhibit mobility over university choice but remain in the same location for employment earn modest premiums; individuals who are immobile in the choice of university but who subsequently move for employment earn substantial premiums for all but the very highest and very lowest quantiles. Furthermore, the fact that mobility premiums vary along the earnings distribution implies that concentrating solely upon the mean of the distribution provides a misleading picture as to the true effects of mobility on earnings.

Such findings lead to important considerations from a policy perspective. There is an inevitable tension between prosperity for regions from which students originate (but potentially leave) and the individual financial returns available for students. Regions have vested interests in retaining, or perhaps even recruiting, highly qualified workers. In Scotland and Wales, where tuition fees of domiciled students are subsidised, there are obvious financial implications for regions that find themselves net exporters of student talent. While our analysis encompasses a period prior to an increase in fees of up to £9000 in England, the implications for current cohorts is nonetheless clear. If graduates are to recoup their investment, mobility in terms of employment is crucial. The results suggest this is more important than the initial decision of whether or not to move to study.

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Appendix Table 1
Marginal Effects on Earnings of Joint Decision to Move from Home Domicile to University (I_1) and from University to Work (I_2) by Movement Threshold

	25km		**50km**		**100km**	
	Univ - I_1	**Work - I_2**	**Univ - I_1**	**Work - I_2**	**Univ - I_1**	**Work - I_2**
Age at entry	0.030		0.100^{++}		0.168^{+++}	
Age at entry squared	-0.001		-0.003^{+++}		-0.005^{+++}	
Age		-0.074		-0.013		0.069
Age squared		0.001		-0.000		-0.002
Male	0.007	0.000	0.025^{+}	0.011	0.025^{+}	0.012
Non-white	-0.174^{+++}	-0.074^{+++}	-0.199^{+++}	-0.088^{+++}	-0.146^{+++}	-0.082^{+++}
Learning problem	0.059^{++}	0.002	0.091^{+++}	0.044	0.043	0.032
University choices	-0.164^{+++}		-0.125^{+++}		-0.078^{+++}	
University choices squared	0.000		-0.000		-0.001^{+++}	
University research quality	0.012	-0.007	0.049^{+++}	0.011	0.060^{+++}	0.030^{+++}
Institution type						
Russell Group	(E)	(E)	(E)	(E)	(E)	(E)
1994 Group	0.056^{++}	0.092^{+++}	0.052^{+}	0.064^{++}	0.015	0.047^{++}
Pre-1992	-0.088^{+++}	-0.002	-0.122^{+++}	-0.043^{++}	-0.139^{+++}	-0.056^{+++}
Other	-0.104^{+++}	-0.089^{+++}	-0.085^{+++}	-0.109^{+++}	-0.041	-0.042^{+}
Degree subject						
Medicine & dentistry	-0.023	-0.065	0.033	-0.096^{++}	0.056^{+}	-0.076^{++}
Subjects allied to medicine	0.024	0.045^{+}	0.029	0.002	0.033	0.018
Biological, veterinary & agricultural	0.073^{+++}	0.068^{++}	0.099^{+++}	0.077^{+++}	0.081^{+++}	0.102^{+++}
Physical sciences	0.026	0.064^{+}	0.084^{++}	0.080^{++}	0.062^{+}	0.062^{+}
Mathematics & computer science	-0.053	0.016	-0.018	0.009	-0.010	-0.001
Engineering & technology	-0.009	0.094^{+++}	0.014	0.063+	-0.007	0.040
Architecture, building & planning	0.075^{+}	0.129^{+++}	0.056	0.121^{++}	0.094^{+}	0.106^{++}
Social studies	0.020	-0.018	0.041	-0.005	0.023	-0.005
Law	-0.011	0.025	-0.024	0.035	-0.018	0.012
Business & administrative studies	(E)	(E)	(E)	(E)	(E)	(E)
Communication & documentation	0.081^{+++}	0.036	0.121^{+++}	0.076^{+}	0.135^{+++}	0.080^{++}
Linguistics, languages & literature	0.035	0.052	0.066^{++}	0.071^{++}	0.061^{+}	0.052^{+}
History & philosophy	-0.010	-0.050	-0.011	-0.019	0.028	0.036
Creative arts & design	0.069	0.037	0.112^{+++}	0.004	0.162^{+++}	0.031
Education	-0.003	0.065^{++}	-0.010	0.008	-0.085^{+++}	-0.048^{++}
Combined	0.016	0.013	0.044^{++}	0.013	0.039^{+}	0.011
Degree class						
First		(E)		(E)		(E)
Upper second		0.013		0.015		0.008
Lower second		-0.001		0.005		-0.002
Third		-0.048		-0.013		-0.015
Unclassified		-0.056		-0.033		-0.030
Other		0.064^{+}		0.058^{+}		0.017
Number of unemployment spells						
0		(E)		(E)		(E)
1		0.007		0.016		0.008
2		0.015		0.025		0.022
3		0.069		0.081^{++}		0.038
4		0.058		0.105		0.065

5+		0.076		-0.000		-0.013
Importance of degree						
Formal requirement		(E)		(E)		(E)
Important		0.009		-0.001		-0.003
Not very important but helped		-0.023		-0.034^{++}		-0.022^{+}
Not important		-0.028		-0.032		-0.033^{++}
Don't know/not stated		-0.021		-0.044^{++}		-0.018
Labour market characteristics						
Distance from London x10^{3}		-0.296^{+++}		0.119		0.311^{+++}
Population density (work)x10^{3}		-0.018		0.000		0.037^{++}
Economic activity (work)		0.036		0.032^{+++}		0.023^{+++}
Professional earnings (work)		0.001		0.001^{++}		0.000
Population density (university) x10^{3}		-0.024		0.044^{++}		0.041^{+++}
Economic activity (university)		0.004		0.009^{++}		0.005^{+}
Professional earnings (university)		-0.001		-0.002^{+++}		-0.002^{+++}
Region of domicile						
North East	-0.180^{+++}	0.118^{++}	-0.116^{++}	0.105^{++}	0.118^{++}	0.199^{+++}
North West	-0.193^{+++}	-0.033	-0.211^{+++}	-0.058^{+}	-0.097^{+++}	-0.040
Yorkshire & Humberside	-0.151^{+++}	-0.027	-0.168^{+++}	-0.012	-0.067^{++}	-0.020
East Midlands	(E)	(E)	(E)	0.008	(E)	(E)
West Midlands	-0.054	0.006	-0.067^{+}	0.081^{++}	0.016	0.058^{+}
Eastern	0.044	0.057	0.036	-0.163^{+++}	0.087^{++}	0.120^{+++}
London	-0.443^{+++}	-0.137^{+++}	-0.327^{+++}	-0.010	-0.112^{+++}	-0.063^{++}
South East	0.026	-0.011	-0.039	0.011	0.053^{+}	0.035
South West	-0.002	0.005	-0.004	-0.069^{++}	0.053	0.069^{++}
Wales	-0.123^{+++}	-0.076^{++}	-0.148^{+++}	-0.261^{+++}	-0.000	0.010
Scotland	-0.366^{+++}	-0.250^{+++}	-0.374^{+++}	0.027	-0.196^{+++}	-0.155^{+++}
Northern Ireland	-0.060	0.079^{+}	-0.089^{++}		-0.057^{+}	-0.018
Part-time worker		-0.046^{+++}		-0.042^{+++}		-0.020
Self-employed		-0.035		-0.025		0.022
Cov(ε_1, ε_2) - ρ		0.733^{+++}		0.780^{+++}		0.809^{+++}
Sample size		7,433		7,433		7,433

Notes: (E) denotes and excluded reference category; $^{+}$/$^{++}$/$^{+++}$ denotes statistical significance at the 90%/95%/99% level respectively; in the likelihood function ρ is not estimated directly but rather atanhρ (=½ln((1+ρ)/(1-ρ))) is and this has a coefficient value of 0.936/1.045/1.125 for the three distance thresholds respectively; likelihood ratio test that atanhρ=0 ($\chi^2_{(1)}$=1365.97/1808.62/1910.49) is easily rejected.

Appendix Table 2
Earnings Decompositions Relative to Non-Movers by Quantile and Movement Threshold

(a) 25km		**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
MR	Earnings differential	-0.082	-0.040	-0.074^{+}	-0.085^{+++}	-0.075^{+}	-0.066^{+}	-0.049	-0.034^{+++}	-0.071^{+++}
	Characteristics	-0.005	-0.010	-0.016	-0.017	-0.012	-0.007	-0.006	-0.003	-0.003
	Coefficients	-0.076	-0.031	-0.058^{+++}	-0.068^{+++}	-0.063^{+++}	-0.059^{+++}	-0.043^{+++}	-0.031^{++}	-0.067^{+++}
SL	Earnings differential	0.353^{+++}	0.243^{+++}	0.236^{+++}	0.227^{+++}	0.204^{+++}	0.157^{+++}	0.159^{+++}	0.165^{+++}	0.190^{+++}
	Characteristics	0.250^{+++}	0.137^{+++}	0.116^{+++}	0.123^{+++}	0.122^{+++}	0.125^{+++}	0.131^{+++}	0.149^{+++}	0.185^{+++}
	Coefficients	0.103^{+}	0.106^{+++}	0.120^{+++}	0.104^{+++}	0.082^{+++}	0.032^{++}	0.027^{+}	0.017	0.005
LS	Earnings differential	0.266^{+++}	0.123^{+++}	0.081^{+++}	0.069^{+++}	0.061^{+++}	0.056^{+++}	0.053^{+++}	0.072^{+++}	0.204^{+++}
	Characteristics	0.217^{+++}	0.111^{+++}	0.078^{+++}	0.070^{+++}	0.066^{++}	0.069^{+++}	0.071^{+++}	0.084^{+++}	0.123^{+++}
	Coefficients	0.049	0.012	0.003	-0.001	-0.005	-0.013	-0.017	-0.013	0.081^{+++}
NRDM	Earnings differential	0.245^{+++}	0.145^{+++}	0.117^{+++}	0.115^{+++}	0.105^{+++}	0.090^{+++}	0.073^{+++}	0.067^{+++}	0.059^{+++}
	Characteristics	0.231^{+++}	0.134^{+++}	0.106^{+++}	0.103^{+++}	0.100^{+++}	0.095^{+++}	0.094^{+++}	0.106^{+++}	0.128^{++}
	Coefficients	0.015	0.012	0.011	0.011	0.005	-0.006	-0.021^{+}	-0.039^{+++}	-0.069^{+++}
(b) 50km		**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
MR	Earnings differential	-0.127	-0.106^{++}	-0.105^{++}	-0.116^{+++}	-0.129^{+++}	-0.126^{+++}	-0.083^{++}	-0.050^{+++}	-0.076^{++}
	Characteristics	-0.096	-0.064	-0.047	-0.053^{++}	-0.056^{++}	-0.051^{++}	-0.045^{++}	-0.042^{++}	-0.061^{+++}
	Coefficients	-0.032	-0.042^{++}	-0.059^{+++}	-0.063^{+++}	-0.073^{+++}	-0.074^{+++}	-0.037^{+++}	-0.008	-0.015
SL	Earnings differential	0.277^{+++}	0.209^{+++}	0.200^{+++}	0.194^{+++}	0.184^{+++}	0.145^{+++}	0.140^{+++}	0.141^{+++}	0.170^{+++}
	Characteristics	0.197^{+++}	0.113^{+++}	0.093^{+++}	0.081^{+++}	0.067^{+++}	0.064^{+++}	0.053^{+++}	0.064^{+++}	0.086^{+++}
	Coefficients	0.081^{+}	0.096^{+++}	0.107^{+++}	0.113^{+++}	0.117^{+++}	0.081^{+++}	0.088^{+++}	0.077^{+++}	0.084^{+++}
LS	Earnings differential	0.182^{+++}	0.101^{+++}	0.078^{+++}	0.071^{+++}	0.063^{+++}	0.058^{+++}	0.052^{+++}	0.078^{++}	0.272^{+++}
	Characteristics	0.121^{+++}	0.051^{+++}	0.037^{++}	0.033^{++}	0.028	0.031^{+}	0.032^{++}	0.036^{+}	0.061^{+}
	Coefficients	0.061	0.050^{+++}	0.040^{+++}	0.038^{+++}	0.035^{+++}	0.027^{+++}	0.020^{++}	0.042^{+++}	0.211^{+++}
NRDM	Earnings differential	0.174^{+}	0.091^{++}	0.080^{+++}	0.078^{+++}	0.070^{+++}	0.063^{+++}	0.055^{+++}	0.063^{++}	0.071
	Characteristics	0.140^{+++}	0.060^{+++}	0.040^{+++}	0.025	0.013	0.015	0.017	0.021	0.024
	Coefficients	0.034	0.031	0.040^{+++}	0.052^{+++}	0.057^{+++}	0.048^{+++}	0.039^{+++}	0.042^{+++}	0.047^{+++}
(c) 100km		**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
MR	Earnings differential	-0.289	-0.219^{+++}	-0.213^{+++}	-0.161^{+++}	-0.207^{+++}	-0.159^{+++}	-0.142^{+++}	-0.107^{+++}	-0.105^{++}
	Characteristics	-0.205^{++}	-0.100^{++}	-0.088^{+++}	-0.080^{+++}	-0.083^{+++}	-0.083^{+++}	-0.073^{+++}	-0.057^{++}	-0.056^{++}
	Coefficients	-0.083^{+++}	-0.119^{+++}	-0.125^{+++}	-0.081^{+++}	-0.124^{+++}	-0.076^{+++}	-0.068^{+++}	-0.050^{+++}	-0.050^{+++}
SL	Earnings differential	0.203^{+++}	0.160^{+++}	0.178^{+++}	0.175^{+++}	0.164^{+++}	0.114^{+++}	0.122^{+++}	0.130^{+++}	0.154^{+++}
	Characteristics	0.154^{+++}	0.104^{+++}	0.094^{+++}	0.084^{+++}	0.071^{+++}	0.055^{+++}	0.048^{+++}	0.055^{+++}	0.072^{++}
	Coefficients	0.048^{++}	0.056^{+++}	0.084^{+++}	0.091^{+++}	0.094^{+++}	0.059^{+++}	0.074^{+++}	0.075^{+++}	0.082^{+++}
LS	Earnings differential	0.100^{+++}	0.069^{+++}	0.063^{++}	0.069^{+++}	0.064^{+++}	0.079^{+++}	0.100^{+++}	0.173^{+++}	0.302^{+++}
	Characteristics	0.073^{++}	0.048^{++}	0.050^{+++}	0.050^{++}	0.052^{+++}	0.047^{+++}	0.048^{+++}	0.063^{+++}	0.136^{+++}
	Coefficients	0.027	0.020	0.013	0.020^{+}	0.013	0.033^{+++}	0.053^{+++}	0.109^{+++}	0.167^{+++}
NRDM	Earnings differential	0.086^{+++}	0.038^{++}	0.035^{++}	0.034^{++}	0.031^{++}	0.030^{++}	0.032^{+++}	0.051^{+++}	0.058^{+++}
	Characteristics	0.068^{++}	0.033^{+}	0.021	0.015	0.006	0.002	0.009	0.016	0.020
	Coefficients	0.018	0.004	0.014	0.019^{+}	0.025^{+++}	0.028^{+++}	0.022^{+++}	0.036^{+++}	0.038^{+++}

Notes: MR = Move-Returners; SL = Stay-Leavers; LS = Leave-Stayers; NRDM = Non-Returning Double-Movers; statistical significance based upon bootstrapped standard errors (using x-y pair bootstrapping with replacement) derived from 100 repetitions; $^{+}/^{++}/^{+++}$ denotes statistical significance at the 90%/95%/99% level respectively.

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[1] Good examples within this literature are O'Leary and Sloane (2005, 2008), Walker and Zhu (2011) and Chevalier (2011), which identify substantial heterogeneity in lifetime returns to degree education across disciplines, gender and across regions of the UK.

[2] We ignore those who do not proceed straight into the labour market after graduation and also delete the small number of graduates who take up employment abroad.

[3] Interestingly, the results are sensitive to whether or not London is included and Scotland excluded in the analysis.

[4] The survey response rate is 44%. See Kitchen et al. (2008) for further details.

[5] While the data avoid the issue of recession, they predate the 2012 introduction of top-up fees of up to £9,000 that universities can charge. It may be conjectured that the implications of mobility analysed here will not be representative of the situation facing the most recent cohorts if mobility patterns have been affected by the new fee regime. However, official HESA data does not support such a view, in that the proportion of all full-time undergraduates whose term-time accommodation is recorded as the parental home has remained remarkably stable since 2007/08 (the earliest year a consistent series is available) and has fluctuated only minimally between 23-24%.

[6] For grammatical simplicity we will assume that student *j* is female, but the empirical estimation that follows is conducted for both males and females.

[7] Specifically, postcode data can be translated to ordinance survey northing and easting values and triangulating these with a simple implementation of Pythagoras's Theorem allows for a straight line distance to be derived between any two points.

[8] Additionally, quantile regression is more robust to outliers than mean-based least squares regression and is semiparametric in that it avoids assumptions about the parametric distribution of the error process.

[9] While the detailed decomposition of the component effect is path dependent, the aggregate decomposition is not and the results are invariable to the order in which we decompose equation [5].

[10] Specifically, we implement the Stata module rqdeco.ado (see Melly, 2007) and while the procedure simplies the decomposition it makes no difference to results and conclusions drawn later. When the decomposition is simulated on a finite distribution the residual element is consistently only a minor component across all estimated quantiles.

[11] Although not reported, this is driven by the fact that the majority of students (91.7%) domiciled in Scotland chose to study at a Scottish university. This is higher than any other region and can be reconciled with the fee regime in place, under which Scottish students do not pay university tuition fees if they study at a Scottish institution.

[12] While there is obvious stickiness evident within the data with students having a tendency to gain employment in the same region as their university is located, the proportion (77.5%) is higher in London than in any of the other regions.

[13] While arbitrary, such thresholds are sensible in light of the distances described in Table 2 and provide an informative span for the vast majority of regions.

[14] Specifically, we fitted a seemingly unrelated bivariate probit model via maximum-likelihood estimation. See Greene (2003, 710-714) for an overview of the bivariate probit model.

[15] These are university-wide grade point averages over a 7-point scale from the 2001 RAE.

[16] More specifically, this is the number of institutions of the type (Russell Group etc.) attended by the respondent in his/her home region.

[17] Moreover, the significance of the correlation term ρ is not restricted to the three distance measures reported and is evident when we designate any distance threshold between 5km and 100km.

[18] This is consistent with the idea of mobility capital, or how "wandering potentialities are etched in a life story and feed on family experience … and personality" (Murphy-Lejeune, 2002, p9).

[19] There is a complicated pattern that needs to be described for the composition component but this in itself is not central to the story told here. In general, it is substantial for both stay-leaver and leave-stayer groups and declines in magnitude as we move along the earnings distribution and such effects are most pronounced at the 25km threshold. For move-returners, the composition effect is largely negligible at the 25km threshold but is much more important at higher thresholds. At 100km in particular it is the dominant component in the

decomposition away from the more central parts of the earnings distribution. For the non-returning double-mover group, the composition effect dominates at the 25km threshold but is then only significant at 50/100km around the lower quartile and below.

[20] Although a similarity in the profile shapes is maintained.

[21] As a robustness check, we also calculated results by defining mobility as a movement between two standard geographical regions, a definition adopted by the vast majority of the existing empirical literature. While a critique of such a definition of mobility is that it is a rather vague notion, in that movement from one region to another may potentially represent either a small (in the case of contiguous regions) or large distance, the pattern of results reported above does not change. In particular, the consistently highest premiums for the stay-leaver group and premiums associated with mobility in the move from university to employment are still apparent.