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Where they go, what they do and why it matters: The importance of geographic accessibility and social class for decisions relating to higher education institution type, degree level and field of study

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Abstract:
The factors influencing the decision of school leavers to participate in higher education has been extensively investigated previously. This has mainly focused on the influence of characteristics such as parental education level, social class and spatial factors on the decision to participate in higher education at a broad level. However, given the influence the type of tertiary education pursued may have on future labour market outcomes, an understanding of the factors behind more specific higher education outcomes decisions is important. Within this context, this paper focuses on the influence of geographic accessibility and social class on young people when making decisions relating to higher education institution type, degree level and field of study pursued using a rich Irish dataset. We estimate this relationship using a bivariate probit framework and controlling for a range of other variables we find evidence of significant spatial and socio-economic effects on these higher education outcomes.

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1. Introduction

The factors influencing the decision of school leavers to participate in higher education has been extensively investigated. In general, this research has tended to focus on the influence of characteristics such as the gender and ability of students, their parents' level of education and social class, household income, school-level variables and travel distance on the decision to participate in higher education (Dubois, 2002; Lauer, 2002; Frenette, 2006; Flannery & O'Donoghue, 2009; McCoy & Smyth, 2011). While an understanding of the factors behind the transition from upper secondary to tertiary education is important from a policy viewpoint, there has been comparatively little consideration of how these factors influence the type of tertiary education pursued.

Where school leavers choose to go for higher education, what level of degree they pursue, and what field of study they enrol in matters, particularly for subsequent labour market outcomes. This is because, as previous research has shown, variations in the level of higher education completed and field of study are associated with differences in both employment prospects and earnings (Grubb, 1993; Kelly *et al*. 2010; McGuinness 2003; Blundell *et al*. 2000). In general these studies suggest that those who obtain higher level qualifications have a significant labour market advantage over those with lower level qualifications. In addition, obtaining a qualification in certain fields of study, such as medicine and engineering, tends to provide improved labour market returns when compared to qualifications in other areas, such as the humanities. Moreover, higher education institution (HEI) type also matters in this regard. For example, both Brewer, Eide & Ehrenberg (1999) and Long (2008) show that attending a selective 4-year college in the United States can impact relative lifetime earnings. Kelly *et al*. (2010) show that for Ireland, controlling for level of degree and subject choice, the type of institution attended (university or not) can have significant future earnings implications. Furthermore, evidence from the Higher Education Authority (HEA) in Ireland (2010, 2007) suggests that those with higher levels of undergraduate qualifications are more likely to earn more as a graduate.

Within this context this paper focuses on the role of, and interaction between, two key variables likely to impact school leavers when making decisions relating to HEI type, degree level and field of study. Specifically, it aims to examine the role of geographic accessibility

and social class in determining the outcomes of these decisions, controlling for a wide range of other determinants. We focus on these spatial and social variables because previous research has demonstrated their importance for observed inequalities in relation to higher education participation. We build on this research by examining their interplay in shaping outcomes for Irish school leavers relating to more specific higher education participation decisions, namely those relating to HEI type, degree level and field of study. This is undertaken by presenting a comprehensive higher education choice model that estimates the impact of various individual, parental, school level, regional and accessibility factors on these outcomes for those that participate in higher education.

The research question addressed and modelling approach used in this paper extends previous research which has examined the influence of variables such as social class and geographic accessibility on higher education participation decisions. For example, Nguyen and Taylor (2003) estimated the relationship between the decision of US high school graduates to pursue a two or four year college education and a range of individual and socioeconomic factors. They found that parental education level was particularly important in the transition to the latter. Hilmer (1998) undertook a similar study investigating the choice between a community college and a university education in the US and found that variation in tuition fees between HEI types can influence the type of higher education young people pursue.

A more recent literature has focussed on the important role of travel distance, and geographic accessibility more generally, in higher education decisions. For example, Frenette (2006) estimated the influence of distance from a young person's home to their nearest university on participation in Canada and found that potential students that live further away had a lower probability of enrolment. More specifically, students from lower-income families were found to be particularly disadvantaged by distance. Spiess and Wrohlich (2010) used German data to also explore the relationship between travel distance and the decision of young people to attend university. They too found a significant distance effect and showed how this was driven mainly by so-called 'transaction costs' rather than by

'neighbourhood effects'. XXXX[1] *et al*. (2013), examining data for Ireland, found that travel distance had a significantly negative impact on participation for those from lower social classes and that this impact grew stronger as distance increased. It also found that the distance effects were most pronounced for lower ability students from these social backgrounds.

While these studies focussed mainly on the decision to proceed to higher education or not, other studies have considered the role of travel distance on choices relating to HEI type or degree type. For example, Sa *et al*. (2006) utilised a system-wide higher education accessibility measure to show that geographic proximity significantly increases the probability of high school leavers continuing their education at a university or professional college in the Netherlands, while Sa *et al*. (2011) investigated the importance of geographic accessibility for joint decisions on HEI type and leaving home in Portugal. For the UK, Gibbons and Vignoles (2012) concluded that travel distance had little or no impact on the decision to participate in higher education in England, but did have a strong influence on institutional choice. Ordonvensky (1995) modelled the decision by US high school graduates to undertake a four year college/university, two year academic or two year vocational education as a function of various individual and household characteristics such as high school grade average and parental education. Distance to nearest institute was also included in the model and found to play a significant role in determining the higher education outcomes of the sample.

While a small number of studies have separately examined the role of geographic accessibility and social class for higher education decisions relating to participation, HEI type or degree choices, no study to date has comprehensively considered their importance for joint decisions relating to (i) HEI type and degree level; or (ii) HEI type and subject choice. As discussed, the outcomes of these decisions can have very important implications for future labour market outcomes. In this context, this paper adds to the current literature using a unique and comprehensive Irish dataset and provides a more realistic and extensive empirical analysis of the various higher education related choices faced by school leavers. In

[1] Author-identifying references removed throughout and replaced by XXXX.

particular we model, for the first time, the importance of a range of factors in the joint decisions relating to where and what to study. To do so, we employ a range of bivariate choice models which allows us to control for correlations in these decisions and to better account for the role of geographic accessibility and social class in these choices.

The paper is structured as follows: in the next section we present a brief overview of higher education in Ireland, followed by sections describing the data that is used and the empirical strategy that is followed to address our objectives. The next section presents a summary of our key results, followed by a discussion of the implications of our findings.

2. Higher Education in Ireland

Higher education institutions in Ireland include universities and institutes of technology (IoTs), as well as a small number of other public and private colleges, with a competitive entry system based mainly on grades achieved in the Leaving Certificate examinations at the end of secondary school[2]. These grades are converted into a points score generally referred to as Central Applications Office (CAO) points, with the number of points an individual receives helping to determine the type of course they can pursue. Higher education qualifications in Ireland follow the *Bologna Process and European Qualifications Framework*, with students able to pursue degrees in both universities and IoTs. However, there are differences with regard to degree type, with individuals having the choice to undertake an 'honours' degree or 'ordinary' degree. The former is typically a three or four year degree while an ordinary degree is specifically three years.

However, the main difference between the two degree levels lies in the difficulty of the course, with an honours degree deemed to be of a more rigorous nature as judged by the National Framework of Qualifications of Ireland[3]. Furthermore, ordinary degree programmes tend to be in more 'applied' fields of study such as manufacturing, construction and service based programmes, while honours degree programmes tend to be

[2] A full list of HEIs in Ireland is available at www.educationireland.ie/.
[3] This is the national body established in Ireland to oversee standards within higher education in Ireland. The standards set by this body are guided by the Bologna Process and European Qualifications Framework. See www.nfq.ie/nfq/en/ for more details.

in more 'academic' or 'professional' fields of study, such as arts, commerce, law and medicine. Evidence from the HEA (2010, 2007) suggests that graduates of the latter programme types are likely to earn more than graduates with an ordinary degree qualification. They also show significant differences in other employment outcomes with those graduating with an honours degree more likely to find employment in areas such as financial services and medicine, while ordinary degree graduates are more likely to work in sectors such as construction. Ordinary degree programmes are most common in IoTs where they constitute 40% of all undergraduate enrolments, compared to only 2% of all undergraduate enrolments in universities.

There is also entry to higher education in Ireland at a 'sub-degree' level e.g. diploma and certificate courses. Again, this is more common in IoTs, comprising 10% of all undergraduate enrolments compared to just 3% in universities. While some private colleges also offer degree level programmes, the norm is to pursue sub-degree programmes at these institutions. There is also variation with regard to field of study across HEI type, with courses in the areas of health and humanities more common in the university sector and engineering courses more common in IoTs. Of the 150,000 full time undergraduate students in higher education in Ireland in 2010, 53% were in the university sector, 40% in IoTs, with the remaining 7% in other colleges (Higher Education Authority, 2012). According to O'Connell *et al*. (2006), there is considerable variation in both county and regional admission rates to the different HEI types in Ireland.

From a policy perspective, the Irish State provides financial aid and assistance to higher education students who meet certain criteria based on parental income levels and geographic distance from their chosen HEI to help reduce potential inequalities in accessing higher education related to income or geographical factors. The spatial component of these grants is that students who satisfy the income related means test either receive a full or partial grant[4], depending on whether they live more than or less than 28 miles (45kms) from the HEI they wish to attend. The proportion of students in receipt of a grant fell from 63% in 1992 to 32% in 2007, although there is some evidence of progressivity within the system

[4] These are also known as non-adjacent and adjacent grants respectively.

with those from lower social classes representing a higher proportion of those in receipt (McCoy *et al*. 2010). Higher education fees were abolished in Ireland in 1996, though so-called 'registration fees' have been rising steadily since their inception. For example, the registration fee for the academic year 2005/06 (the year in which the students in our dataset were making their decision on whether to participate in higher education) was €775, compared to a registration fee of €2500 for the academic year 2012/2013. There is little to no variation in this fee across institution type (University or IoT), field of study and level of third level education pursued.

Finally, a number of access programmes which explicitly target socioeconomically disadvantaged individuals also exist in Ireland. For instance, the Higher Education Access Route (HEAR) programme is a third level admissions scheme for school leavers from socio-economically disadvantaged backgrounds where eligible students compete for a quota of reduced points places in third level institutions, mainly in universities. The Delivery of Equality of Opportunity In Schools (DEIS) system also exists where certain second level schools that are deemed to be disadvantaged may access additional resources such as extra learning support for teachers and a home-to- community liaison programme (Department of Education and Science, 2005).

3. Data

The data used is from the 2007 wave of the School Leavers' Survey (SLS) from Ireland, with school leavers who exited the second-level system in the 2004/05 academic year providing the reference cohort for the survey. The survey is based on a stratified random sample of those leaving the official second-level system, with a total sample size of 2,025 respondents and a response rate of 54 per cent[5]. It collects a wide range of individual, demographic, income, social, school, education and labour market related information and it is possible to identify those who made the transition to higher education, as well as the secondary school that they attended. Furthermore, it is also possible to classify those who proceeded to higher education on the basis of which HEI they chose and on which course they enrolled.

[5] Further details of the survey are available in Byrne *et al*. (2008).

Thus, the dataset provides the necessary information in relation to HEI type, degree level and field of study. Summary statistics for these variables are presented in Table 1.

[Insert Table 1 about here]

In our analysis we wish to consider only those school leavers who progressed to higher education and who thus faced joint decisions in relation to a.) study at a university or non-university HEI and b.) what type of course to pursue (i.e. degree/non-degree, field of study)[6]. This leaves us with a sample of 761 individuals. For each of these individuals, the SLS dataset contains the Leaving Certificate examination grades of the student which is used to calculate the CAO points they achieved. This provides us with an excellent proxy for the scholarly ability of the student and also helps us to account for some supply-side effects in higher education participation. The dataset also provides useful information for considering intergenerational dimensions in the decision-making process as it provides data on the social class, occupation and education level of school leavers' parents. Furthermore, information on whether or not an individual has undertaken any extra private tuition (grinds) outside of regular school hours while in upper secondary education is available, as are data on a range of school level variables, including the gender enrolment mix and the religious sponsorship type of the school the student attended. Summary statistics and a more detailed description of these variables are presented in Table 2.

[Insert Table 2 about here]

In order to model the impact of geographic accessibility on participation decisions, the postal addresses of every secondary school contained within the SLS dataset were 'geocoded' to provide precise spatial (x,y) coordinates for each student's school[7]. This facilitates the calculation of a range of geographic accessibility measures, including simple nearest distance measures (see Figure 1) as well as system-wide access measures based on

[6] XXXX *et al*. (2013) considered the decision of school leavers to participate in higher education using the same dataset.

[7] Unfortunately, the postal addresses of each respondent's residential location were not available and thus school locations are used in the subsequent modelling. This is a similar approach to that undertaken in Sa *et al*. (2006) and XXXX *et al*. (2013).

distances to a number of institutions (see Sa *et al*. (2006) for a discussion). Since road network densities tends to differ significantly across Ireland, and in particular across urban and rural areas, road network travel distances are utilised. This provides a more accurate estimate of travel distance than standard Euclidean measures of distance (XXXX *et al*., 2008; XXXX, 2010). These distance and accessibility measures were calculated for both university and non-university HEIs.

[Insert Figure 1 about here]

Figure 1 presents the distance to (a) nearest HEI and (b) nearest university in the Republic of Ireland. Overall, Figure 1(a) suggests that while there is a good geographic spread of HEIs across the country and that most areas have relatively good accessibility in terms of travel distance, there are large areas from which an individual would have to travel 50-100 kilometres (kms). Figure 1(b) shows the corresponding nearest distances for universities, suggesting the geographic accessibility inequalities are much more pronounced for this type of HEI, particularly in the South East, South West, and North West[8]. Of course with a finite number of HEIs, some inequality in terms of geographic access is inevitable. The important issue relates to whether these inequalities impact on the decisions made by those who proceed to higher education in relation to HEI type, degree level and field of study.

4. Empirical Strategy

Our empirical strategy employs a bivariate probit model to consider the joint decision of school leavers who proceed to higher education in terms of what type of HEI they attend (e.g. university or non-university) and what type of course they choose (e.g. honours or lower degree/sub-degree course). These outcomes are potentially related after conditioning on regressors and this relatedness occurs *via* correlation of the error terms in the separate decision models. The bivariate probit model is similar to seemingly unrelated regression (SUR) models, but instead estimates separate binary probit models with correlated disturbances. This approach is applicable when it is assumed that an individual is

[8] Recently announced changes to the structure and composition of higher education in Ireland will change this picture, though the North West will remain relatively worse off (Higher Education Authority, 2013).

undertaking two interrelated binary decisions at the same time. It involves taking two independent binary probit models and estimating them together, allowing for a correlation between the error terms in the two equations.

The general specification for a binary probit model is presented in Equations [1] and [2]. There are two latent variables Y_{1i}^{*} and Y_{2i}^{*} each of which is assumed to be a linear function of a set of explanatory variables (which may or may not be the same for each decision) and an error term – see Equation [1]. In our estimations, the binary choice variables Y_{1i} and Y_{2i} relate to HEI type and course type respectively and the outcome of each decision is equal to one if the latent variable is greater than zero (e.g. the school leaver studies at a university/chooses an honours level degree) and equal to zero otherwise (e.g. the school leaver studies at a non-university HEI/chooses a non-honours level course). Thus, we have:

$$Y_{1i}^{*} = X_{1i}\beta_1 + u_{1i}, \text{ where } Y_{1i} = 1 \text{ if } Y_{1i}^{*} > 0 \text{ and } Y_{1i} = 0 \text{ otherwise}$$

And [1]

$$Y_{2i}^{*} = X_{2i}\beta_2 + u_{2i}, \text{ where } Y_{2i} = 1 \text{ if } Y_{2i}^{*} > 0 \text{ and } Y_{2i} = 0 \text{ otherwise}$$

The error terms in the model are assumed to have a joint or bivariate normal distribution which allows for a non-zero correlation (ρ) between the errors – see Equation [2]. In other words, it is assumed that the two error terms are not independent of each other. This implies:

$$E(u_{1i}) = E(u_{2i}) = 0, Var(u_{1i}) = Var(u_{2i}) = 1 \text{ and } Cov(u_{1i}, u_{1i}) = \rho$$

such that [2]

$$(u_{1i}, u_{1i}) \sim N_2(0,0,1,1,\rho)$$

where N_2 represents the bivariate normal distribution. Thus, under the assumption of joint normality, it is possible to write down the probability of each of the different outcomes as a function of the explanatory variables and the unknown model parameters (β_1 and β_2) and to estimate the latter using maximum likelihood methods. This also provides an estimate of the coefficient of correlation between the two error terms to help assess the appropriateness of the model specification and the model collapses to two separate probit models if $\rho = 0$.

Allowing for correlation between the error terms of the two equations recognises that there may be unobservable characteristics of individuals that influence both decisions. For example, it may be the case that unobserved preferences towards more 'academic'-based study may make one school leaver (call her *SL1*) more likely to choose both a university education and an honours degree. In this case we would have $u_{1,SL1} > 0$ and $u_{2,SL1} > 0$. On the other hand, an otherwise similar school leaver (call her *SL2*) with unobserved tastes for more 'applied' skills may be more inclined towards shorter term study on a 'practical' course, which are typically provided in IoTs. In this instance, it would be the case that $u_{1,SL2} < 0$ and $u_{2,SL2} < 0$.

Accounting for these unobserved heterogeneities is important since a model which fails to do so would predict the same probability of, for example, proceeding to study at a university for both individuals. However, our modelling approach controls for this unobserved heterogeneity in preferences by allowing for correlation between the error terms in both decisions. In other words, it allows the probability of one outcome to be dependent on the value or probability of the other. In the illustrative cases set out above we would therefore expect $\rho > 0$ since there is a positive correlation between the error terms for each of the two individuals.

We estimate a number of different models using this approach. We begin by considering the joint decision of school leavers in terms of whether they study at a university or non-university HEI and whether they choose an honours or non-honours level course. We also then estimate a series of bivariate probit models where the dependent variables are whether they study at a university or non-university HEI (once again) and if they choose one particular field of study over all the others. Since we disaggregate field of study into 6 separate categories (see Table 1), this implies 6 additional bivariate probit models. In all instances our primary interest is the impact of travel distance and social class on the decisions made, as well as how these regressors interact with each other.

Once estimated the usual approach to calculating marginal and average effects can be followed in order to predict, for example, the impact of a change in one explanatory variable on the marginal probability of an outcome e.g. the effect of social class on the likelihood of attending a university. It is also possible to calculate the marginal effect of a change in an explanatory variable on the joint probability of the various outcome combinations e.g. the effect of greater travel distance to a university on the probability that a school leaver undertakes a non-honours level course at a non-university HEI. Furthermore, the approach also allows for the estimation of the impact of changes in explanatory variables on conditional probabilities, such as the impact of greater travel distance on the likelihood that an individual who studies an honours degree chooses to do so at a university.

5. Results

5.1 Institution Type and Degree Level

Table 3 presents results from the bivariate probit model considering the joint decision to proceed to a university or non-university HEI and whether to study an honours or non-honours level course[9]. As discussed, this implies two (separate) binary dependent variables. First, *University* takes a value of 1 if the individual chooses to study at a university and a value of 0 if (s)he chooses to study at a non-university HEI. Second, *Honours Degree* takes a value of 1 if the individual pursues an honours degree level qualification and a value of 0 if (s)he pursues a lower level qualification. Given the structure of higher education in Ireland, we believe it is likely that these two decisions are correlated. This is confirmed in Table 3 by the estimated correlation between the error terms of $\hat{\rho} = 0.52$ (.57) which is both positive and statistically significant at the 1% level. This suggests that there are unobserved factors which imply that an individual who is more (less) likely to pursue a course at a university is also more (less) likely to choose to undertake an honours level degree. Thus, it provides justification for the use of a bivariate probit model over two separate probit models.

[9] Alternative specifications of this model including a nested logit and recursive bivariate probit model were also considered before this particular specification was chosen. The former was rejected due to a desire to comprehensively explore the importance of variables that do not vary with the choice outcome, such as social class, while the latter proved to be an inferior model based upon diagnostic and goodness of fit measures such the AIC and BIC criteria.

[Insert Table 3 about here]

The main results in Table 3 are presented as mean marginal effects for our sample[10]. For example, a student's exam performance in upper secondary education as measured by CAO points is found to have a strong and statistically significant association with both *University* and *Honours Degree*. We also find significant gender effects with females found to be more likely to progress to university and to undertake an honours degree. We do not find any significant impact from attending paid tuition grinds during an individual's last year of upper secondary school on either of our choice outcomes. However, we do find that, even after controlling for ability and other factors, there is a strong social gradient in terms of university participation and pursuing an honours degree. For example, our results suggest that a school leaver whose parental social class is categorised as 'semi-skilled or unskilled manual' is 26% less likely to enter university on average when compared to an otherwise similar student whose parental social class is 'higher or lower professional'. Moreover, these students are also 29% less likely to pursue an honours degree. Table 3 also presents some evidence of the influence of school level variables on these higher education outcomes. For example, while attending a second level school designated with DEIS status does not significantly influence either outcome, an individual that has taken extra tuition (grinds) outside of normal class hours is more likely to undertake an Honours Degree.

The results presented in Table 3 suggest that geographic accessibility to certain HEI types, measured in terms of minimum distance to nearest university and non-university HEI, does not impact on either the choice of a university education nor on the decision to pursue an honours level degree. While the estimated average marginal effect is negative for both choices, implying that the likelihood of choosing these higher education outcomes decreases as travel distance increases, it is not statistically significantly different from zero at the usual levels of significance. However, this model also included non-linear (squared) terms for both distance measures, with some evidence of nonlinear effects present with

[10] The robustness of the estimates in our chosen model was tested by undertaking a stepwise inclusion of our explanatory variables. Also, we estimated our models with variations around parental education level included as a covariate, however this did not prove significant in any specification. As a result of this, along with potential issues of multicollinearity, this variable was not included in the final model.

respect to distance to university and the decision to attend university. This is not evident in the estimated average marginal effects in Table 3, since only the total marginal effect of distance is included as is best practice – see Ai and Norton (2003) for a detailed discussion.

In order to explore these non-linear effects, we present the estimated difference in higher education participation probabilities for individuals that live at various distances from their nearest university relative to a student that lives 20kms from their nearest university. The statistical significance of these estimates suggests that those that live 160kms from a university have statistically the same likelihood of attending a university (as opposed to a non-university HEI) as an individual that lives 20kms from a university, controlling for all other factors included in our model. This is consistent with the average marginal effect of the distance variable in Table 3. However, Table 4 also suggests that for those living more than 140kms away there is a practically and statistically significant effect of distance on university choice. For example, an individual living 180kms from a university is 17% less likely to choose a university compared to an otherwise similar individual living 20kms away. Furthermore, this differential increases with distance, such that the estimated difference is 27% at 220kms and 31% at 240kms.

[Insert Table 4 about here]

To further investigate and illustrate these distance effects, Figure 2 presents the predicted probabilities from our model of each of the four possible higher education choice outcomes under two different scenarios, holding all of the other explanatory variables constant at their sample means. The first scenario shows these probabilities for a school leaver living in County Donegal, a county in the northwest of the country with relatively poor accessibility to universities in the Republic of Ireland, while the second shows the same probabilities for a school leaver from outside of this county[11]. We see from these relative predicted probabilities that those from this area are far less likely to choose any higher education outcome within a university relative to those not living in this area. We also find that they

[11] Our sample excludes those that enter a third level institute in the United Kingdom. However, our findings are robust to including these individuals in our sample with a significant bias against those living greater than 160 kms from a HEI in Ireland.

are more likely to undertake a higher education course below honours level. The presence of an IoT within the county combined with very low accessibility to a university helps to explain these specific findings.

[Insert Figure 2 about here]

Since previous research using the same dataset found evidence of important differences in the effect of travel distance on students from different social classes in terms of their relative likelihood of participating in higher education (XXXX *et al*., 2013), we also considered this possibility in terms of the joint decision modelled in Table 3. Specifically, we estimated additional models which also included interaction terms between our distance and social class variables in order to test whether distance might matter more for certain groups of school leavers in terms of either what type of HEI they chose to study at and the level of degree they chose to pursue. In contrast to XXXX *et al*. (2013), no differential impacts of distance by social class were observed (results available on request). This suggests that while distance matters more for school leavers from poorer households in terms of their decision to participate in higher education, it does not have a differential impact for them in terms of where they choose to study and what level of degree they pursue. In other words, once these poorer school leavers decide to participate in higher education, distance does not have a relatively adverse effect on the subsequent higher-education related decisions modelled here.

5.2 Institution Type and Field of Study

Table 5 presents results for 6 separate bivariate probit models which consider the joint decision of HEI type and field of study[12]. The university choice equation is specified as before. The dependent variable in the field of study equation is also a binary variable taking a value of 1 if the individual chooses a particular field of study (e.g. humanities/arts) and a value of 0 if (s)he participates in an alternative field of study. The dependent variable in this

[12] A multinomial logit model was also considered for this estimation. However, given the restrictive IIA assumption and plausible correlation between these choices and university participation, the bivariate probit approach was considered more appropriate.

second equation is then altered in the other models to reflect the different fields of study[13]. As before, the underlying assumption in these models is that the decision to choose a particular field of study is correlated with the chosen HEI type. Indeed, the statistical significance of the correlation parameter ρ in five of the six estimated models in Table 5 justifies this assumption. For reasons of space, Table 5 presents only the estimated marginal effects from the 6 different fields of study equations, though the results of each university choice model within the 6 different bivariate probits were very similar to those presented in Table 3[14]. Thus, we focus on the impact of our explanatory variables on an individual's chosen field of study in the discussion below.

[Insert Table 5 about here]

Table 5 suggests there is some evidence of geographic accessibility having an impact on the field of study an individual decides to pursue in higher education. Specifically, the results indicate that young people that live closer to a university are more likely to pursue a humanities/arts qualification and less likely to pursue a science related course. We find no evidence for geographic accessibility impacting on the probability of pursuing a commerce/law, engineering, or medical related programme of study. However, we do find that those that live further from a university are more likely to pursue a field of study other than the 5 main programme areas defined in our model. These 'other' fields of study are defined in Table 1 and include courses relating to administration, childcare, construction and catering. These types of programmes are typically offered in non-university HEIs in Ireland. Overall the results support the contention that spatial factors may not only prevent certain individuals from entering a university, but may also have the added effect of influencing the field of study an individual pursues.

In terms of the results in Table 5, we also find significant gender, school sponsorship and social class effects with regard to the probability of studying certain subject areas in higher

[13] The six fields of study chosen as the dependent variables in these models are broadly in line with the delineation made by the Higher Education Authority in Ireland in investigating enrolments by field of study.
[14] These results are available from the authors on request. We also ran these 6 separate bivariate probits with degree type as the first equation (as opposed to university/non university). The results were very similar to those presented here.

education. The first effect is expected due to differences in male/female preferences for particular areas of study as borne out by male/female enrolment numbers in certain fields of study e.g. more males in engineering and science courses, more females in humanities/arts courses. Our dummy variable indicating whether an individual completed his/her second level education in a Catholic denominated school also presents as significant in the 'other' field of study. Indeed we find that attending a Catholic school decreases the probability of an individual pursuing a programme of study outside the main 5 categories by 39%. We also find that those from lower social classes are significantly less likely to pursue medical related (nursing or general doctor) studies. The size of the estimated marginal effect indicates that this effect is relatively strong with the probability of an individual from the lowest social class pursing a medical based course 87% lower than an equivalent individual in the highest social class.

Finally, we also estimated all of the bivariate probit models with a system-wide measure of accessibility to university as specified in Sa *et al*. (2006) as an explanatory variable in place of our travel distance measures. The goal here was to investigate the consistency of our main results with regard to the impact of travel distance on higher education outcomes. The results of these estimations are presented in Appendix A1/A2 and are not explained in detail within this paper. Overall they indicate that our main results in Tables 3 and 5 seem robust to changes in the type of spatial accessibility measure used, with system-wide accessibility to university having a positive and significant effect on university participation but not on the honours degree choice. Within our field of study models, the impact of this spatial accessibility measure is broadly in line with the estimations using travel distance, with the evidence suggesting that those that have lower geographic accessibility to a university are more likely to pursue a field of study other than the 5 main programme areas defined in our model.

6. Discussion

Higher education choices such as the type of institute an individual attends, the level of qualification pursued and the field of study chosen can have significance impacts on future labor market outcomes, especially early in the working lifecycle. Social or spatial inequalities that may bias these higher education choices may therefore have implications for issues

such as social immobility and persistent income inequality. While previous empirical research has mainly focused upon higher education participation at a broad level, this study adds to the literature by focusing on the factors that may influence these specific higher education outcomes in an Irish context.

From a spatial viewpoint, while travel distance does not emerge as significant in influencing institution type or level of study on average, the results show that such accessibility is significant in deciding whether a higher education participant goes to university for those living in particularly inaccessible areas of the country, namely those from the North West.
As this particular area of Ireland is close to Northern Ireland it may be suggested that these individuals do not suffer any bias, as they have greater geographical accessibility to HEI's in Northern Ireland. Our model does not include these distances in the estimations, however, the findings are robust enough to suggest these individuals face a bias in their own country with regard to the type of third level institute they attend, as a result of where they reside. This bias may be accentuated by the fact that there is a significant cost differential between both nations (€4,000 per year of undergraduate studies in Northern Ireland and €2,500 in the Republic of Ireland).

This would seem to be a somewhat uncommon finding, given the fact that previous studies in other countries such as Sa et al (2011), Speiss and Wrochlich (2011) and Gibbons and Vignoles (2012) do find average distance effects on higher education institution type for Portugal, Germany and the UK respectively. From a policy viewpoint, this result, allied to the fact that we find no differential impacts of distance by social class, may imply that the higher education maintenance grant system in Ireland does help reduce much of the potential spatial bias relating to equality of access for those that enter higher education. However, given that our results do suggest that one particular area of the country does experience this bias, there may be scope for a better targeted grant policy with those living more than 160 KM from a university that that wish to attend this particular institution type provided greater financial support to do so. In this context, the recent proposal to amalgamate 7 Institutes of Technology and create three new technical universities in the South East, South West and Dublin regions of Ireland (HEA, 2013), will not help alleviate the spatial bias we find in relation to university participation. Our findings suggest that in the interest of spatial

accessibility to a university education, greater consideration may be given to encouraging such an amalgamation closer to the North West of the country.

Our results also indicate that geographical proximity may influence the field of study an individual pursues, with those further away from a university less likely to pursue studies in the 5 'main' fields of study, namely Humanities, Commerce/Law, Engineering, Science or Medical related studies. Given the fact that the vast majority of these 'other' courses are delivered in non-university institutions this result may seem somewhat contradictory to our earlier assertion that travel distance has little impact on university participation on average. However, it may suggest that impact of distance on the university participation of this particular cohort is not fully captured by the broader university/non-university sample split. This result may be explained by these individuals simply wishing to pursue courses that are not on offer in university setting, however it is also plausible that they are drawn to these fields of study (as opposed to other fields) because they live further away from a university. While beyond the scope of this paper, this may warrant further investigation in to the exact nature of this spatial bias for those pursing studies outside the 5 main fields we have identified.

With a strong policy focus on addressing social inequality in higher education access in Ireland our finding that, all else equal those from lower social classes that participate in higher education are less likely to do so at the university and honours degree level, compared to those from higher social classes is important. Such a relationship may help perpetuate income inequalities and raises questions about government policy relating to access to different types of higher education for those from lower social classes, specifically programmes such as HEAR. As with field of study choice, it may be reasonable to think that individuals from these social groups may be self-selecting into these higher education outcomes, however, the strength of the relationship found in our estimations suggest that this variation may not be explained by simple demand alone.

We also see a strong social gradient with regard to participation in certain fields of study as those from the lowest social class have a significantly lower probability of undertaking a medical based course in higher education relative to their counterparts in the highest social

class. This field of study brings particularly high returns in the labour market (Kelly et al, 2010), therefore social inequalities in participation may also help preserve income inequalities throughout the lifecycle. To address this, quota systems could be introduced, to guarantee a certain number of places within this specific field of study for those from disadvantaged backgrounds.

Finally in terms of our findings, the most recent National Plan for Equity of Access to Higher Education in Ireland (HEA, 2008) is due to finish in 2013, with a new plan currently under review for 2014-2016. The results presented here suggest that significant biases stemming from spatial and social factors may still exist in higher education outcomes in Ireland. While our data is somewhat dated, it is the first robust analysis of these issues in an Irish context and so may help inform any future policy formed relating to access to higher education.

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Tables and Figures

Table 1: Summary Statistics for Course Level and Field of Study by HEI Type

Variable	Description	Attended university		Attended non-university HEI	
Course Level		Number	%	Number	%
Honours Level Degree	Enrolled on an honours degree level course	349	93.06	194	50.2
Non-Honours Level Degree	Enrolled on either an ordinary degree level or sub-degree level course	26	6.94	192	49.8
	Total	375	100	386	100
		Attended university		**Attended non-university HEI**	
Field of Study		Number	Per cent	Number	Per cent
Humanities/Arts	Enrolled on humanities/arts course	156	41.6	82	21.24
Commerce/Law	Enrolled on a commerce/law course	75	20.00	116	30.05
Engineering	Enrolled on an engineering course	31	8.02	62	16.06
Science	Enrolled on a science course	76	20.2	54	13.99
Medical	Enrolled on a medical/nursing	32	8.53	11	2.85
Other	Enrolled on a secretarial, construction, catering or other (non 5 'main' field related) course	5	1.03	61	15.8
	Total	375	100	386	100

Source: Analysis of SLS data for 2007.

Table 2: Variable Descriptions and Summary Statistics for Explanatory Variables

Variable	Description	Mean	SD	Min	Max
Spatial Variables					
Minimum Distance to University	Distance to nearest university (kms)	50.63	62.96	1	248.0
Minimum Distance to Non-University	Distance to nearest non-university (kms)	17.36	19.00	1	77.0
System-Wide Accessibility to University	Measure of system-wide accessibility to universities in Republic of Ireland – see Sa *et al*. (2006)	-1.99	1.12	-3.7	.34
Border	1= Border region; 0 = Not Border region	0.13	0.33	0	1
Midlands	1= Midlands region; 0 = Not Midlands region	0.05	0.21	0	1
West	1= West region; 0 = Not West region	0.11	0.31	0	1
Dublin	1= Dublin region; 0 = Not Dublin region	0.25	0.43	0	1
Mid-East	1= Mid-East region; 0 = Not Mid-East region	0.07	0.25	0	1
Mid-West	1= Mid-West region; 0 = Not Mid-West region	0.13	0.33	0	1
South-East	1= South-East region; 0 = Not South-East region	0.09	0.29	0	1
South-West	1= South-West region; 0 = Not South-West region	0.17	0.38	0	1
Student Variables					
Gender	Gender of respondent (Female = 1; Male = 0)	0.55	0.49	0	1
CAO Points	Total CAO points achieved by student	388.26	105.72	45	600
Grinds	1= individual attended paid tuition grinds during last year of upper secondary study; 0 = individual did not attend paid tuition grinds during last year of upper secondary study	0.55	0.49	0	1
Socioeconomic Variables					
Social Class I	Fathers' social class is higher or lower professional = 1; Else = 0	0.49	0.50	0	1
Social Class II	Fathers' social class is non-manual or skilled manual = 1; Else = 0	0.35	0.47	0	1
Social Class III	Fathers' social class is semi-skilled or unskilled manual = 1; Else = 0	0.16	0.36	0	1
School Variables					
Sponsorship	Catholic sponsored school = 1; Else = 0	0.50	0.50	0	1
Deis	DEIS designated school	0.10	0.30	0	1

Source: Analysis of SLS data for 2007.

Table 3: Estimated Marginal Effects: Bivariate Probit Model of University Participation and Degree Type

	University		***Honours Degree***	
Variable	**dy/dx**	**z**	**dy/dx**	**z**
Minimum Distance to University	-0.001	(0.41)	-0.0005	(0.18)
Minimum Distance to Non-University	-0.006	(1.14)	-0.004	(0.72)
Midlands	0.53*	(2.27)	0.41	(1.35)
West	0.04	(0.16)	0.09	(0.33)
Dublin	-0.15	(0.51)	-0.08	(0.3)
Mid-East	-0.41	(1.4)	0.28	(0.83)
Mid-West	-0.15	(0.51)	0.24	(0.74)
South-East	-0.19	(0.76)	0.26	(1.08)
South-West	-0.01	(0.07)	0.12	(0.44)
Gender	0.29***	(2.68)	0.11	(0.98)
CAO Points	0.009***	(10.83)	0.007***	(12.5)
Grinds	0.05	(0.56)	0.2*	(1.70)
Social Class II	-0.24**	(1.96)	-0.22**	(2.07)
Social Class III	-0.26*	(1.64)	-0.29*	(1.69)
Deis	-.024	(0.11)	-0.13	(.79)
Sponsorship	0.19	(1.56)	-0.05	(0.43)
Statistics				
Wald χ^2	452.11			
$\hat{\rho}$	0.57*** (47.2)			
Number of Observations	761			

Notes: The model is a bivariate probit model with clustered standard errors and sample weights and the table reports the average marginal effects. The base category for the regional dummies is the Border region of Ireland. Absolute values of z statistics are presented in parentheses. *** denotes significant at 1%, ** denotes significant at 5%, and * denotes significant at 10%.

Table 4: Estimated Difference in University Participation Probabilities Between Living 20kms from University and Other Distances

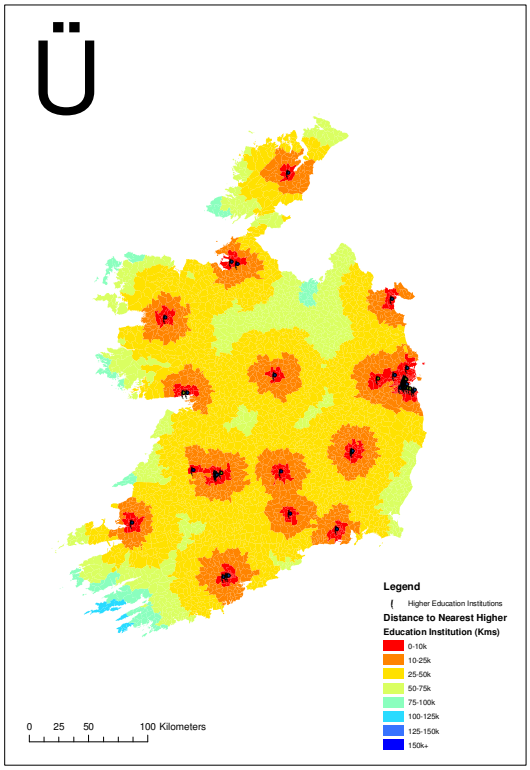
Distance to Nearest University (Kms)	Coefficient	z
40	0.001	(0.13)
60	0.01	(0.03)
80	0.01	(0.22)
100	0.03	(0.46)
120	0.06	(0.74)
140	0.09	(1.08)
160	0.13	(1.45)
180	0.17**	(1.86)
200	0.22***	(2.29)
220	0.27***	(2.77)
240	0.31***	(3.37)

Table 5: Estimated Marginal Effects: Bivariate Probit Models of University Participation and Subject Choice

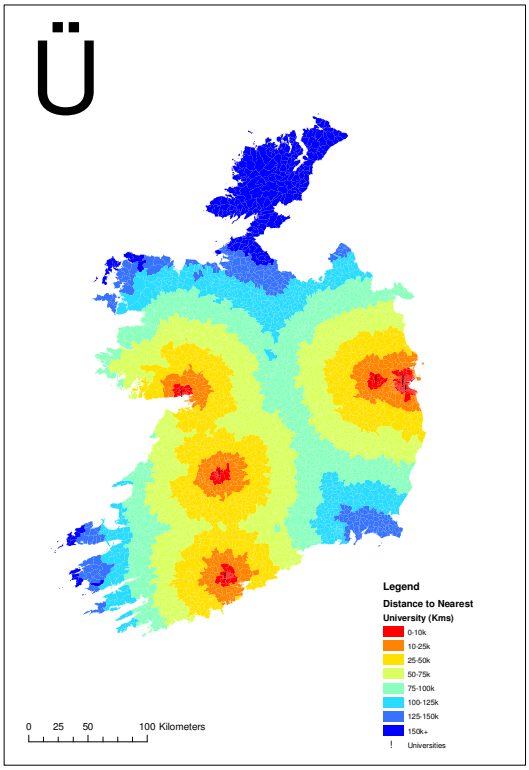
	Humanities/Art		Commerce/Law		Engineering		Science		Medical		Other	
Variable	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**
Minimum Distance to University	-0.004*	(1.82)	-0.002	(1.31)	.001	(0.25)	0.004*	(1.88)	-0.002	(0.56)	0.006**	(2.36)
Minimum Distance to Non-University	0.002	(0.59)	-0.001	(0.23)	0.008	(1.38)	-0.002	(0.56)	-0.008	(1.06)	-0.002	(0.47)
Midlands	0.26	(0.99)	0.28	(0.91)	0.01	(0.03)	-0.69***	(2.66)	-0.34	(0.69)	0.42	(0.97)
West	-0.16	(0.74)	0.11	(0.48)	0.03	(0.11)	-.06	(0.29)	-0.29	(0.77)	0.52	(1.42)
Dublin	-.06	(0.25)	-0.05	(0.22)	-0.06	(0.18)	0.25	(0.94)	-0.9**	(2.11)	0.6	(1.55)
Mid-East	-0.33	(1.26)	0.3	(1.06)	0.57*	(1.72)	-0.13	(0.39)	-0.87	(1.46)	0.46	(1.05)
Mid-West	-.24	(1.32)	0.11	(0.49)	0.53*	(1.77)	-0.26	(1.20)	-0.07	(0.2)	0.23	(0.63)
South-East	0.43**	(2.15)	0.29	(1.26)	0.09	(0.33)	-0.40**	(2.13)	-0.67*	(1.66)	-0.55	(1.3)
South-West	-0.38	(1.72)	-0.04	(0.20)	0.52*	(1.69)	0.19	(0.80)	-0.51	(1.44)	0.52	(1.46)
Gender	0.64***	(6.13)	-0.06	(0.59)	-1.02***	(7.54)	-0.39***	(3.40)	0.96***	(4.5)	0.12	(0.82)
CAO Points	0.002***	(3.87)	-0.001*	(1.64)	0.0003	(0.44)	0.0009	(1.55)	0.002*	(1.93)	-.004***	(5.44)
Grinds	0.27**	(2.27)	-0.04	(0.4)	-0.21	(1.61)	0.0003	(0.00)	-0.05	(0.33)	-0.1	(0.51)
Social Class II	0.26**	(2.36)	-.15	(1.36)	-0.09	(0.59)	-0.03	(0.24)	-0.05	(0.32)	0.004	(0.03)
Social Class III	0.22	(1.34)	-.08	(0.49)	-0.05	(0.26)	-0.004	(0.03)	-0.87***	(3.17)	0.16	(0.81)
Deis	-0.33*	(1.76)	0.09	(0.48)	0.03	(0.15)	0.22	(1.05)	-0.28	(0.9)	0.004	(0.02)
Sponsorship	-.03	(0.29)	0.15	(1.5)	0.12	(0.95)	0.17	(1.43)	-0.34*	(1.82)	-0.39***	(2.61)
Statistics												
Wald χ^2	359.08		240.38		313.68		271.06		293.7		298.84	
Rho	0.37*** (22.63)		-0.7*** (12.2)		-0.35*** (8.95)		0.14 (2.2)		0.34*** (7.26)		-0.69*** (29.05)	
Number of Observations	761		761		761		761		761		761	

Notes: The model is a bivariate probit model with clustered standard errors and sample weights and the table reports the average marginal effects. The results from the university participation equations are not presented - see Section 5.2 in the text for more details. The field of study labelled 'other' relates to a variety of different study areas such as administration, childcare, construction and catering - see Table 1 for more details.

Figure 1: Distance to Nearest HEI and University

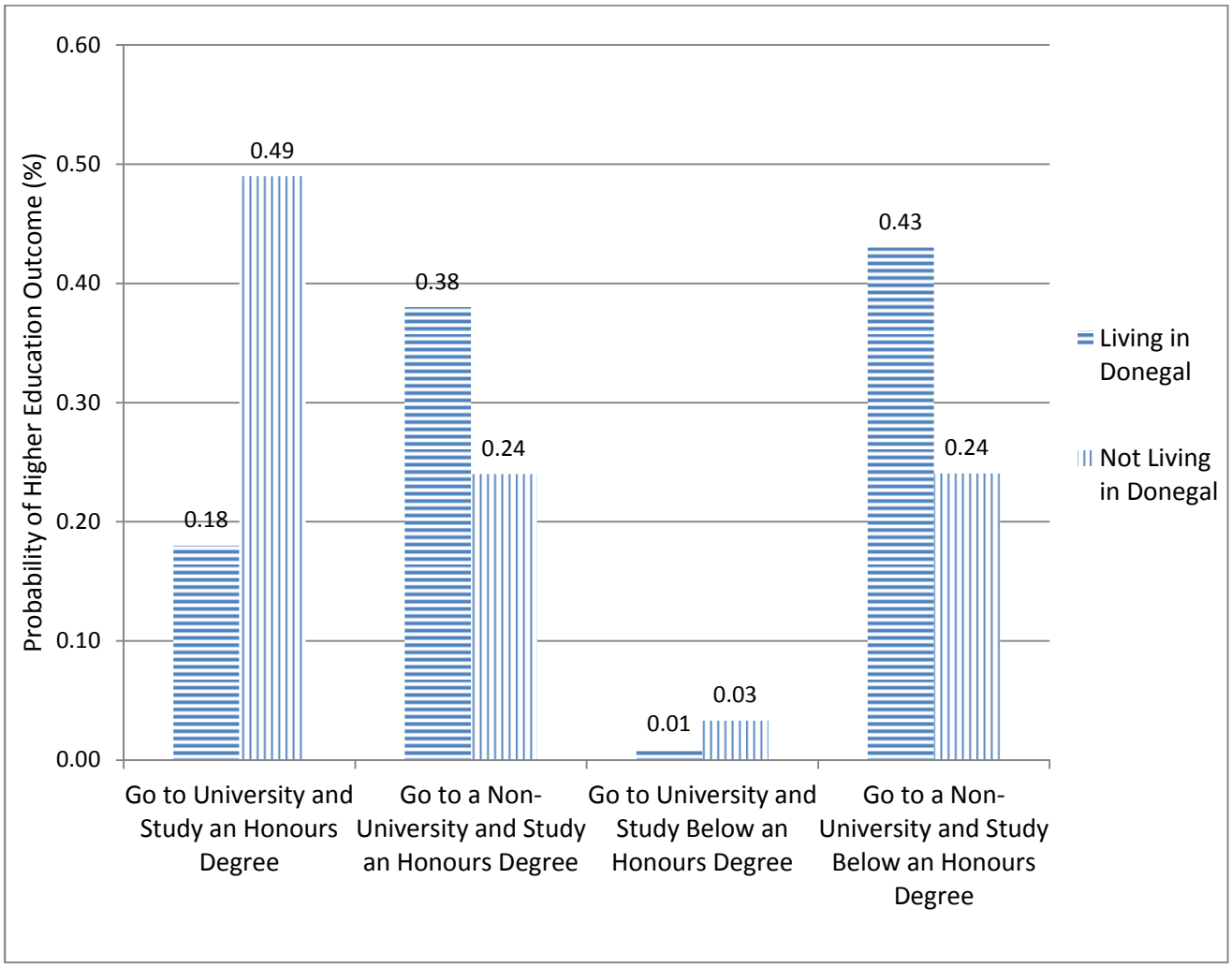


(a) Distance to nearest HEI



(b) Distance to nearest university

Figure 2: Predicted Probabilities by County of Origin (%)



Appendix A1: Estimated Marginal Effects: Bivariate Probit Model of University Participation and Degree Type with System-Wide Accessibility Measure

	University		***Higher Degree***	
Variable	**dy/dx**	**z**	**dy/dx**	**z**
System-Wide Accessibility to University	0.121*	(1.64)	0.07	(1.17)
Midlands	0.77***	(3.26)	0.32	(1.16)
West	0.33	(1.24)	-0.02	(0.11)
Dublin	0.03	(0.12)	-0.25	(1.13)
Mid-East	-0.22	(0.87)	0.09	(0.38)
Mid-West	0.15	(0.55)	0.14	(0.52)
South-East	0.09	(0.38)	0.21	(1.09)
South-West	0.26	(1.17)	-0.01	(0.06)
Gender	0.25***	(2.36)	0.12	(1.07)
CAO Points	0.009***	(11.13)	0.007***	(12.57)
Grinds	0.08	(0.79)	0.21*	(1.75)
Social Class II	-0.23**	(1.98)	-0.24**	(2.17)
Social Class III	-0.23	(1.43)	-0.29*	(1.66)
Deis	-0.21	(0.87)	-0.10	(0.68)
Sponsorship	0.18	(1.44)	-0.03	(0.26)
Statistics				
Wald χ^2	420.7			
$\hat{\rho}$	0.51*** (49.51)			
Number of Observations	761			

Notes: The model is a bivariate probit model with clustered standard errors and sample weights and the table reports the average marginal effects. The base category for the regional dummies is the border region of Ireland. Absolute values of z statistics are presented in parentheses. *** denotes significant at 1%, ** denotes significant at 5%, and * denotes significant at 10%.

Appendix A2: Estimated Marginal Effects: Bivariate Probit Models of University Participation and Subject Choice with System-Wide Accessibility Measure

	Humanities/Art		Commerce/Law		Engineering		Science		Medical		Other	
Variable	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**	**dy/dx**	**z**
System-Wide Accessibility to University	0.12**	(1.99)	.06	(1.09)	-.11	(1.4)	-.12*	(1.7)	.13	(1.4)	-.14*	(1.82)
Midlands	0.08	(0.31)	0.15	(0.54)	0.06	(0.21)	-0.62**	(2.36)	-0.33	(0.72)	0.53	(1.3)
West	-0.25	(1.25)	0.05	(0.29)	0.07	(0.31)	-0.11	(0.47)	-0.2	(0.66)	0.48	(1.4)
Dublin	-0.21	(1.00)	-0.07	(0.39)	-0.025	(0.09)	0.25	(0.98)	-0.81**	(2.07)	0.52	(1.45)
Mid-East	-0.39*	(1.7)	0.27	(1.04)	0.7***	(2.65)	-0.19	(0.6)	-0.87*	(152)	0.35	(0.9)
Mid-West	-0.32**	(2.11)	0.06	(0.34)	0.51**	(2.08)	-0.28	(1.25)	0.03	(0.13)	0.16	(0.51)
South-East	0.23	(1.16)	0.16	(0.88)	0.11	(0.44)	-0.40*	(1.79)	-0.59	(1.48)	-0.38	(1.0)
South-West	-0.47***	(2.66)	-0.06	(0.38)	0.53*	(1.95)	0.09	(.42)	-0.39	(1.33)	.43	(1.2 5)
Gender	0.6***	(6.47)	-0.05	(0.55)	-1.02***	(7.59)	-0.39***	(3.4)	0.9***	(4.69)	.12	(0.84)
CAO Points	0.002***	(3.96)	-0.001*	(1.73)	0.0003	(0.53)	0.0006	(1.17)	0.001**	(1.96)	-.004***	(5.55)
Grinds	0.25**	(2.27)	-0.04	(0.38)	-0.23*	(1.77)	-0.02	(0.2)	-0.03	(0.22)	-0.08	(0.52)
Social Class II	0.24**	(2.36)	-.15	(1.45)	-0.08	(0.52)	-0.03	(0.24)	-0.06	(0.36)	0.01	(0.01)
Social Class III	0.19	(1.16)	-.09	(0.6)	-0.03	(0.17)	0.07	(0.4)	-0.87***	(3.24)	0.18	(0.95)
Deis	-0.2	(1.09)	0.16	(0.94)	0.01	(0.08)	0.07	(0.31)	-0.28	(0.88)	-0.07	(0.32)
Sponsorship	-.05	(0.43)	0.14	(1.52)	0.09	(0.72)	0.15	(1.28)	-0.32*	(1.86)	-0.35**	(2.46)
Statistics												
Wald χ^2	295.31		225.37		298.62		245.68		278.99		261.14	
Rho	0.37*** (20.85)		-0.26*** (12.25)		-0.36** (9.9)		0.16* (3.5)		0.34*** (7.47)		-0.59*** (24.9)	
Number of Observations	761		761		761		761		761		761	

Notes: The results from the university participation equations are not presented – see section 5.2 in the text for more details. The field of study labelled 'other' relates to a variety of different study areas such as administration, childcare, construction and catering. See Table 1 for more details.