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## UNIVERSITY CHOICE AND THE INFLUENCE UPON INFREQUENT AND ROUTINE MOBILITY

Dr Lisa Davison  
Rees Jeffreys Lecturer in Transport Studies  
University of Ulster

Dr Aoife Ahern  
Senior Lecturer  
University College Dublin

Professor Julian Hine  
Professor of Transport  
University of Ulster

### Abstract

Student mobility is often considered with respect to where students choose to go to university and how this relates to their current or familial home. Their routine mobilities, with a few notable exceptions, have received limited attention and how their semi-permanent migration influences their infrequent and routine mobilities has received even less consideration. Yet many students are at an age where travel patterns are formed, influenced by the opportunities provided by the choice to live independently and the opportunity to attain a driving licence and less traditional students will have other influences upon travel behaviour.

This paper starts the process of redressing this balance. It is based on a survey response from 1,049 students from 17 universities across the United Kingdom and the Republic of Ireland. Firstly, it examines the attitudinal influences upon university choice through principal component analysis; secondly, it explores the geographical spread of the universities which the students considered to understand the extent to which student attitudes influenced the potential and actual mobility; thirdly, the actual university and travel choices made will be summarised considering both routine and infrequent journeys from a student's term time or permanent address and, where applicable journeys to their familial or another address, finally regression analysis will be applied to examine the attitudinal and other influences upon university choice and the energy implications of the mode and travel choices will be estimated. This paper will conclude by highlighting the potential for future research to better understand the administrative, university, and individual influences upon student infrequent and routine mobility.

### Introduction

Research suggests that whilst the introduction of and increases in tuition fees in the UK have had limited impact upon applications to university [1] but there have been reductions in mobility across the UK and between Northern Ireland and the Republic of Ireland [2]. Such trends are also apparent other parts of Europe [3] despite structural changes to increase mobility. One premise of this research is that differentiated tuition fees can increase student mobility by encouraging applicants to consider other countries and therefore have an impact upon related transport and travel. Yet, tuition fees are not the only influence upon choice; elements such as geographical location [4] and family circumstance [5] also have an impact. Hence all these influences impact upon a student's routine mobility, trips taken every day or every week, and their infrequent mobility, for instance the trip between a term time and permanent address. There has been a developing research interest into student transport and travel implications of university are developing, often focussing on elements such as transport access [6], or alternatively the daily travel choices [7], with students often being recognised as more likely to rely upon more active modes or collective modes when compared with the population as a whole [8], though exceptions exist [9]. The research bringing these two elements together is more limited and this paper is part of process to reduce this. It is an extension of work presented at the 2013 ITRN conference [10] and the focus of two journal papers in preparation, the first explores influences upon university choice and the second how student choices influence travel and transport behaviour considering routine and infrequent university-related mobility. The purpose of this conference paper is to summarise the main findings of each of these papers.

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## Methodology

The target population for this research was undergraduate students studying at universities in the Republic of Ireland and the United Kingdom. Individual universities acted as a conduit for targeting the wider student population with all universities with undergraduate courses being targeted. University registrars were contacted in order to determine their interest in the research and their willingness to participate. At each university an appropriate 'gatekeeper' was identified. Their role was to make students aware of the online questionnaire and to encourage completion. The gatekeepers used electronic means, either email or the Internet, to make students aware of the survey. Most participating universities communicated details of the survey on two occasions. The student-focused questionnaire considered the student's educational choices, living arrangements, travel behaviour, tuition fees and socio-demographic characteristics. Overall the survey received 1,049 useable responses. Students from 17 universities are represented, this accounts for 9% of the 189 eligible universities. The primary reason for not participating was concern about survey fatigue amongst students and related to this the need to prioritise internal survey and national student surveys. Response from universities agreeing to circulate the survey details ranges from 8 to 222 responses. In addition there were also a small number of students responding to the survey having received the link through other means. Whilst this was not part of sampling approach these are maintained as the focus is on differences by geographical and administrative area / country rather than institution. The potential implications of are considered in the analysis and discussion of these.

The analysis of results focuses upon the influences upon university choice based on revealed behaviour and stated preferences, followed by student mode choice plus the distance travelled considering living arrangements and then finally the emissions produced from, the journey to university from a term-time address and also a 'permanent' address where the respondent lives away from a family or personal home to attend university. Analysis differentiates by the country of the higher education institute throughout. Chi-squared, T-tests, ANOVAs and regression analysis are applied appropriate to better understand the geographical variations and the significance of relationships between socio-demographics and other factors with respect to respondent university and travel choices and the impacts of these. With regards to student preferences, principal component analysis, a form of factor analysis assuming all variance can be accounted for, is used to identify the 'underlying constructs or dimensions that provide a condensed statement of the relationship between a set of variables' [11]. Using a similar approach to that discussed in [12]. To calculate emissions the main source of information for carbon dioxide emissions according the mode choice was the 2013 Government GHG Conversion Factors for Company Reporting [13]. Assumption were made regarding the emission levels and some mode given that, for instance emissions from domestic flights differ from short haul and differ again from long. This value was then multiplied by twice the distance from the term time or permanent address to university to get an estimate of the emissions from a return journey. For regular journeys to and from university students responded to a question regarding how often they made the journey into university per week. Assuming a 12 week semester this was used to calculate the annual emissions. For less regular journeys students summarised the number of time they made the journey between their university or term time address and a separate term time address each semester. A similar approach was used totalling up the number of return journeys per year and calculating the annual emissions on this basis.

## Influences of country of domicile on university choice

Influences upon university choice considered include the geographical spread including response to differential tuition fees and broader influences, in response to attitudinal and open questions. As expected there is a significant relationship between the country of study against the country of domicile, here between 87% (Scotland) and 95% (Republic of Ireland) of respondents are studying in the same country as their permanent address, this reflects the national trends (HESA, 2014; HEA 2012/13). Of the remainder universities in Scotland and the Republic of Ireland are most popular with international students from outside the UK and Ireland, whereas universities in Northern Ireland are attracting student from the Republic of Ireland. Of the respondents domiciled in Wales the majority are at universities in England, again reflecting trends in the UK (HESA, 2014), and there are also limited suggestion of

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wider mobility but based on a small sample of respondents. Respondents also provided details of the universities they applied to and these are considered according to the country. The majority of students (79%) only applied to universities in their country of domicile, therefore respondents across the sample applied to 1.25 countries on average, however, of the students that applied to universities in a number of countries (21%) the average increased to 2.17. The summary table highlights that for the countries of domicile included in the case study mobility is highest for students domiciled in Northern Ireland and lowest in Scotland, with universities in England and then Scotland being most popular for students from Northern Ireland. This suggests that tuition fees and course availability have influenced applications. The Republic of Ireland is interesting in that whilst the majority of students applied in their country of domicile (99% for England, Scotland and Northern Ireland) only 92% of students domiciled in the Republic of Ireland applied to universities there, with relatively high proportions applying to universities in Northern Ireland, perhaps relating to proximity of the institutes involved in the research to the administrative border.

### **Influences of tuition fees and other costs on university choice**

The reported cost of tuition by the country of institute and year of study is broadly aligned with policy in each administrative area, though on occasions this is based on student perceptions of what they pay rather than actual costs. This difference in reporting was included students where a governmental or public body such as the Scottish Government or the National Health Service paid the fees directly to the university. Whilst, some students reported the costs to themselves (usually 0) others were aware of the amount covered and included details of this. This summary also includes tuition fees for students from other domiciles, which may inflate the values, however the number of responses does not allow for further interrogation of this data. It highlights that, with the exception of England where the recent increase is reported, there has been limited fluctuation across the different year groups and that on balance tuition fees are lowest in Scotland. Students also responded to questions about whether they investigated the cost of living across a range of countries. A two way ANOVA demonstrates a significant difference in main effects and the interaction. Regarding main effects this is in particular for the country ( $F=18.968$ ,  $p=.000$ ) with post-hoc tests, demonstrating that England is significantly different from all other administrations and that Scotland and the Republic of Ireland are significantly different, but also year of study ( $F=7.905$ ,  $p=.000$ ), with first years being significantly different from all other years. The interaction between the country and year of study is also significant ( $F=11.459$ ,  $p=.000$ ) with the plot demonstrating the impact of the recent increase from institutions in England.

There are also significant differences between country of domicile and the extent to which they investigated the cost of studying in that country ( $p=.000$ ), with respondents being most likely to investigate the cost of study locally. Students domiciled in England are least likely to explore the cost of studying in other administrations, whereas students domiciled in Northern Ireland are most likely to examine the costs of study within the UK and Ireland and those in the Republic of Ireland more likely to explore options in Northern Ireland and the rest of Europe and the world. Similar trends exist when focussing on the country where the higher educational institute is situated ( $p=.000$ ). One aspect which is of interest is that not all students investigated the cost of going to university in the selected country, suggesting other non-financial influences upon choice as explored below. Also of interest is the level of impact the research into costs had, the response to a qualitative follow up question included: costs did not have an impact (66 respondents); the cost of tuition fees (67 respondents) prohibited study in other countries, this, comprised mainly of students domiciled in Scotland who were eligible to have their fees paid by the Scottish government and were therefore not willing to study elsewhere; the cost of living (40 respondents) linked to access to grants (26 respondents) and travel costs (18 respondents); and a preference for a geographical area, sometimes influenced by family (31 respondents), including children and, to a lesser extent, an existing job (2 respondents) and the decision to stay close to established friendship groups (2 respondents).

### **Influences of personal preferences upon on university choice**

As outlined in Table 1 three latent factors with were identified using principal component analysis. Component 1 measures the university and course, 2 family and friends and 3 the cost of the living and qualifications required, factors load positively on components 1 and 2

but negatively on component 3. These components account for 58% of the variance. Each component demonstrates acceptable internal consistency.

**Table 1 Factor loadings upon constructs influencing university choice**

How important were the following considerations when applying for University?	Descriptive statistics		Components		
	M	S.D.	1 $\alpha=.71$	2 $\alpha=.85$	3 $\alpha=.65$
The facilities at the university	2.09	0.83	0.77		
The approach to teaching	2.07	0.84	0.77		
The reputation of the university	1.85	0.79	0.75		
The research carried out by the university	3.02	1.00	0.66		
The course	1.17	0.40	0.40		
The proximity to friends	2.82	1.14		0.93	
The proximity to family	2.66	1.20		0.92	
The cost of the course	2.46	1.18			-0.87
The cost of living	2.32	1.07			-0.86
The qualifications required	1.71	0.77			-0.51

The influence of a range of socio-demographic and study choice characteristics influence response to each of these factors. Gender significantly influences the component factor scores, males recognise each of these factors as more important than females once adjustments are made for component 3 Respondents aged over 25 have a lower factor score for components 1 and 3, suggesting that younger respondents are more concerned about these elements and older entrants have other priorities not measured by these component factors. Similar results are found for dependent students and independent students. Distinct from this is the association between whether a student opts to live away from their permanent address to attend university, where the component relating to friends and family is conversely more important for respondents who opt have separate term time and home addresses Assuming that education-based factors influence priorities when selecting a university the year of study has a significant influence upon component 1, though post hoc tests do not demonstrate any clear significant difference between the different years of study. Interestingly, given the changes in tuition fees in some of the countries there is no significant difference between the year of study and component 3 which incorporates the cost of going to university, though looking at these collectively may obscure the impact of this. The differences between countries suggest this may be the case with significant differences between the country and each of the factors. This is particularly the case for component 3 costs and qualifications, with post hoc tests demonstrating a significant difference between Northern Ireland and other administrations. Once results are adjusted for the negative factor loadings respondents in Northern Ireland are least likely to agree with these statements, whereas respondents from other areas are more likely to. There are also significant differences between administrations and the remaining components. For each of these the post hoc tests demonstrate a significant difference between Northern Ireland and England with respondents at university in Northern Ireland valuing the university and course more and the proximity to family and friends less. A further trend which may confound this is that there are significant differences between each institute and the three components so the impact may relate more to the specific institute as opposed to the country. The variable response from each institute prevents the application of post hoc tests to examine this in more detail.

### **Routine and infrequent mobility**

For 477 (46%) respondents their term time address is also their permanent address; all respondents are considered within this section irrespective of whether they are living in university-related accommodation, or a personal or family home. Here the emphasis is routine mobility between this 'term-time' address and the place of study. Distance travelled

between these two points varies by mode and country noting that the maximum journey length is 291 kilometres. In Northern Ireland the distance travelled by car as a driver exceeds other modes and is greater both on average and regarding range than the other countries. In Scotland the range of distances travelled by car as a driver is greater in comparison to other modes, though the mean for public transport modes exceed that of car as a driver. In the other countries modes such as car as a passenger (Republic of Ireland) and train (England) compete over a greater range of distances. Comparing bus and train the distances travelled are similar for Scotland and Northern Ireland, whereas students travelling by bus travel shorter distances in comparison to rail in England but longer distances in the Republic of Ireland.

There are significant differences between mode choice and country ( $\chi^2(42, N= 1045) = 590.896, p= .000$ ). Analysis highlights that students travelling to university in Northern Ireland from their own or a parental address and to a lesser extent from a separate term time address are particularly car dependent. This is also true of students in studying in England travelling from their own or a parental address only, linked to this there is a prevalence of travelling as a passenger demonstrating a culture of car sharing from a term time address in each of these two administrations. Travelling as a passenger is also a popular mode choice from a student's own or parental address in the Republic of Ireland. Public transport is a more popular choice in Scotland where the urban and interurban rail network allows for a comparatively high proportion of students to travel by train from a term-time address whether it's their own a parental or a university-related address. Bus or coach is also a popular choice for students in Scotland when travelling from their own or a parental address but is relatively more popular for students in the Republic of Ireland who rely more heavily on bus and coach provision irrespective of their living arrangements. Considering non-motorised modes there is a greater cycling culture in the Republic of Ireland when travelling from a separate term time address and walking is most popular in Scotland followed by England. Of the students travelling as a car driver 62% had a parking permit, varying from 6% in the Republic of Ireland to 82% in England. Additionally 17% of those travelling as a car passenger and smaller proportion with other mode choices also opted to have a permit. Of the students travelling by public transport 64% opting to travel by bus and 48% travelling by train are travelling on a season ticket, though the choice to do this varies by country. For bus / coach this ranges from 26% in Northern Ireland to 79% in the Republic of Ireland and for train from 17% in the Republic of Ireland to 66% in Scotland, suggesting different offers are available to students across the administrations, varying by public transport option. Some students not travelling by public transport also have access to a season ticket though the proportionally this is much lower. In addition, for each of the administrative areas, students travelling from university-related accommodation travel lower distances to get to university, though for Northern Ireland this is marginally higher in comparison to the other countries. On average the distance travelled to university is similar across the administrations for students travelling from their own home and or their parental home, with students in the Republic of Ireland travelling a slightly lower distance on average and students in Northern Ireland travelling further, particularly to a parental home. However, there are larger differences in the variability and range of distances with a lower range of distances being travelled to parental homes and a student's own home England and in particular to a parental home in the Republic of Ireland. This is in comparison to the other countries of Scotland and Northern Ireland and travel to a student's own home in the Republic of Ireland. One influence upon this could relate to university choice and the number of universities available in the vicinity of a personal or parental home. Each mode choice and distance travelled could in turn influence trip frequency, which has an influence on overall emissions. In the case of distance for this more 'local' journey, there is a significant negative relationship between these two variables with journey frequency over the academic year reducing with distance ( $\beta= -.183, t(946) = -5.724 p= .000$ ), though the r-squared value suggest that distance only accounts for 3% of the variance in trip frequency. Mode choice also has a significant impact upon trip frequency (Welch's  $F(7, 286.136) = 35.822, p = .000$ ) with a Games-Howell post hoc test demonstrating significant differences between the lower frequency at which car drivers access the university when compared to people travelling by bus or coach, cycling or walking.

Examining the relationship between socio-demographic characteristics and students' educational choices and mode choice and distance travelled, gender ( $\chi^2(5, N= 879) =$

14.160,  $p = .015$ ) and age ( $\chi^2(5, N = 874) = 73.980, p = .000$ ), as well as student status (dependent or independent of parents) ( $\chi^2(5, N = 831) = 47.934, p = .000$ ). Additionally year of study ( $\chi^2(15, N = 942) = 60.782, p = .000$ ), and mode of study (full or part time) ( $\chi^2(5, N = 942) = 28.591, p = .000$ ) all demonstrate significant differences in mode choice. Specifically male respondents are more likely to use active modes whereas females are more likely to travel as a car passenger, otherwise observed values are similar to expected values; older students are more likely to travel by car as a driver whereas younger students are more likely to use other modes; with identical trends apparent amongst independent students and those studying part-time, linked to the widening participation agenda. Considering how many years into a degree a respondent is suggests that students in the first and second year of university are more likely to select public transport and walking and in the later years, in particular 4<sup>th</sup> year, are more likely to drive a car. When examining the impact on distance gender and year of study do not have significant impacts but age, ( $t(151.336) = 5.182, p = .000$ ) student status ( $t(299.599) = 4.466, p = .000$ ) and mode of study ( $t(57.980) = 3.371, p = .001$ ) do. On average younger student travel shorter distances to university, as do dependent and full time students. Extending this to trip frequency males travel to university more frequently than females ( $t(491.728) = 5.258, p = .000$ ), perhaps relating to subject choice, as do younger students ( $t(185.403) = 4.940, p = .000$ ) as well as dependent students ( $t(413.847) = 3.135, p = .002$ ) and those studying full-time rather than part-time ( $t(913) = 10.345, p = .000$ ), the latter being somewhat intuitive.

Of the 564 (54%) respondent with a separate term time and permanent address 462 (44% of the total sample) provided details of their permanent address. Students at universities in the Republic of Ireland are flying furthest between university and their permanent address, emphasising the attractiveness of the university to international students domiciled in Europe and further afield. Air travel features for students studying at universities in England also, but over shorter distances, in some cases for domestic travel. Ferry journeys feature for England and Scotland also, though these are over considerably shorter distances in comparison to air travel. The distances involved exceed that of other surface modes on average and for Scotland also cover a greater range. The average distance by car as a driver is highest across all modes in England and also covers the greatest range of distances, whereas in Scotland train covers the greatest range but average distance is marginally higher for bus / coach travel. In the Republic of Ireland bus / coach travel covers the greatest range and the greater average distance, with car as a driver covering a much lower proportion of the distances travelled. With the exception of the Republic of Ireland the average distance travelled by car as a passenger is lower than all other surface modes. Northern Ireland is interesting in that there is much lower variability in the distances travelled for each of the mode, reflecting the geography of the country and the transport provision within it. Given that a relatively high proportion of respondents studying in Northern Ireland live in the Republic of Ireland this suggests they live near to the administrative border.

Similar to the mode choice for the routine journey to university for this more infrequent journey students from Northern Ireland and England are most likely to travel by car, in particular as the driver though travelling as a passenger is also a popular choice in Northern Ireland. Respondents in the Republic of Ireland are particularly likely to travel by bus or coach, whereas in Scotland use of all forms of surface public transport is slightly elevated and opting to travel by air is proportionately much higher for students in Scotland. Use of the ferry is low or non-existent across each country and flights the second least popular mode choice. This reflects the dominance of home domiciled students, though domestic flights also feature. Again there is an overall difference in mode choice according to year of study ( $\chi^2 = 60.114, p = .000$ ). [distance] Trip frequency is significantly influenced by the distance travelled ( $\beta = -.157, t = -3.170, p = .002$ ) but the r-squared value is again low (.025). Mode choice is also influential (Welch's  $F = 41.092, p = .000$ ), with post hoc tests demonstrating significant differences between trips by aeroplane and ferry and all other modes, with the mean number of trips for these modes being significantly lower than all other modes once distances has been considered.

There are again similarities between the mode chosen for regular and less frequent journeys with age ( $\chi^2 = 28.474, p = .000$ ), student status ( $\chi^2 = 17.152, p = .002$ ) and mode of study ( $\chi^2 = 14.626, p = .012$ ) influencing the mode chosen for the journey to a student's permanent

address. Specifically, older students are proportionately more likely to drive and younger students are more likely to travel by public transport or as a car passenger, with independent and part-time students following a similar trend. In terms of the distance between university and a permanent address there is no significant relationship between gender, age, student status or mode of study but there is a small significant relationship between gender and the frequency of trips home ( $t=2.530$ ,  $p = .012$ ), with males making on average 2.66 fewer trips per year and also year of study ( $F=3.506$ ,  $p = .015$ ), where the post hoc tests suggests a small difference between students in their 3<sup>rd</sup> and 4<sup>th</sup> year of study

### **The energy implications of student choice**

Emissions values have been calculated for the each journey based on distance and mode choice and then, based on the frequency of the journey across the year, annual values are calculated. Multiple regression analysis is applied to understand the impact mode choice, distance travelled and journey frequency on the emissions from university-related travel. From this it is clear that these variables account for a greater proportion of the variance for the journey to and from university from the term time address than the journey between university and term-time address,  $r$ -squared values being .650 and .248 respectively. As expected, each of the variables have a significant interest but for the journey between term-time address and university distance is most influential, and focusing on the standardised coefficient also for the journey between permanent address and university / term time address. In terms of the latter the number of journeys can also be demonstrated as influential.

Then this paper explores the relative transport impact of university-related travel according to the country and the decision as to whether to have a separate term-time and permanent address. This demonstrates significant differences between living arrangements (whether a student has a term time address and permanent address or just one 'term time' address) and countries for emissions from the journey between the term-time address and university (Welch's  $F = 35.822$ ,  $p = .000$ ) and overall emissions (Welch's  $F = 5.716$ ,  $p = .000$ ) and, where students have a separate permanent address, each country (Welch's  $F = 3.421$ ,  $p = .019$ ). From this it is clear that annual emissions are highest for regular travel to and from university when a student has a permanent address rather than a separate term time and permanent address, though this largely balances out once the less frequent journeys to a home address are accounted for. Another interesting trend is the administrative differences university-related emissions being highest in Northern Ireland and lowest in Scotland across journey types.

Considering first the journey between the term time address and university in each of the countries with the exception of Northern Ireland the emissions are significantly between respondents with a separate term time and home address when compared to those with only a permanent address, with students with term time addresses typically generated lower levels of carbon dioxide when making this journey. In addition, there is a significant difference between students with separate addresses studying in England the in the Republic of Ireland, with higher emissions on average in the latter. Respondents in Northern Ireland are more unusual in that there is only a significant difference between students in Northern Ireland with and without separate term time addresses. When reviewing differences between students with a permanent address only Northern Ireland is again an unusual case being significantly different from all other sample segments demonstrating particularly high emissions. Other countries demonstrate that the emissions profile of students with permanent addresses for this journey are significantly higher than for separate addresses with the exception of Northern Ireland where results for emissions are less markedly different. Whilst the emissions profile between the permanent address and the university or term time address is significantly different, the Games Howell post hoc test doesn't reveal any core differences though the descriptive statistics suggests that emissions are highest for students in Northern Ireland and lowest for those studying in Scotland. The impact of this is more apparent when examining overall emissions, where post hoc tests highlight one key significant difference: the higher emission levels of students in Northern Ireland with only a permanent address, in comparison to all other countries irrespective of whether the student has a separate address or not. The only non-significant difference is between students in Northern Ireland with and without a separate university address. Aside from this results

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suggest a balance between the frequent and irregular mobility of respondents in each of the other administrative areas / countries.

### **Conclusion**

This research demonstrates that tuition fees do influence university choices for some students, particularly when availability of financial support is considered, for instance for Scottish domiciled students when considering whether to study outside of Scotland. However, other influences also exist including factors identified from principal component analysis (the university and course; the costs including living costs; proximity to friends and family). These differ by country and also socio-demographic characteristics and can be explored further by examining in more depth response to open questions regarding influence. Living arrangements also differ significantly and this coupled with the university selection process has an influence upon the transport mode and travel distance relating to the routine, day to day or week to week university-related journeys and the more infrequent journeys to a permanent address for some students. Such differences are apparent when the environmental implications of these are considered across the year, where often the infrequent journeys balance to a separate term address reduce but do not eliminate the increased emissions from longer routine journeys. What is most clear from these calculations are that emission levels are higher in Northern Ireland in particular when compared to other countries, with emissions being lowest in Scotland, owing to a combination of distance travelled and mode-choice. It is interesting that the sample of students studying in Northern Ireland also includes a higher proportion of students who are part time or stress the importance of the university and course when selecting where to study. In order to consider these results more holistically further analysis is required to examine the links between university choice and transport implications in more detail and to make comparisons between countries as to the relative effects. It is anticipated that structural equation models or regression will be used to achieve this.

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