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Analysis of the Factors Influencing Higher Education Participation

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Declaration of Authenticity

This thesis is the result of the author's original research. It has been composed by the author and not been previously submitted for examination which has led to the award of a degree.

Signed:

Date:

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Abstract

This thesis contributes to the theory of the demand for higher education through an empirical analysis of higher education participation in Great Britain (with particular reference to Scotland). Three dimensions of higher education participation are empirically assessed using Higher Education Statistics Agency data: the effects of tuition fees, differences in participation by gender and student mobility. These research themes are pertinent to policy in the provision of higher education.

The chapter "Tuition Fees and Higher Education Participation" examines the impact of the abolition of tuition fees on higher education enrolment in Scotland. Employing a difference-in-differences methodology, this study shows the effects of abolishing tuition fees on Age Participation Indices in higher education in Scotland. From a policy perspective, the results show that participation rates in higher education are price sensitive and participation is increased by the abolition of tuition fees.

The chapter "Higher Education Enrolment by Gender" analyses female and male enrolments in higher education in Scotland. Female participation in higher education has become significantly higher than male participation in Scotland. This study analyses factors contributing to differences in participation by gender. The graduate employment rate and the population positively influence female enrolments in higher education. Female price response models are developed to analyse the introduction of the Graduate Endowment Fee on female participation. For the majority of institutions, the Fee did not impact the female share of participation.

The chapter "Geographical Mobility in Higher Education" explores factors influencing cross country migration in Great Britain for higher education. Using logistic regressions for British micro data from 1998/99 to 2015/16, this study finds age, socio-economic background, institution classification, subject area and regional location contribute to the probability of individuals moving country for higher education. The largest mobility differences across males and females occur by subject area.

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Chapter 1 Introduction and Overview

1.1 Background

The provision of higher education has been subject to significant changes in recent decades, not only from a funding perspective, but also in terms of the growing number of students as well as changing student demographic. Policies on financing higher education have attracted much focus, where reforms have been necessary to meet growing challenges in increasing expansion and burgeoning budgetary constraints of governments. This has in turn stimulated fervent debates emerging from governments and scholars in the field of the economics of education. Over the last few decades the demographic of the student population has experienced significant changes. Historically, male participation significantly outperformed female participation. It is now the case that females dominate entry to higher education in many countries, with 67 of 120 countries worldwide reporting higher female than male participation in higher education (Becker, Hubbard and Murphy, 2010). The geographical mobility of students has been a key topic of interest for policymakers in the provision of higher education, as well as to governments from the perspective of labour markets, innovation and economic growth (Faggian, McCann and Sheppard, 2006).

Understanding how students respond to the price of higher education is fundamental to governments in addressing widening participation in higher education, skills shortages and, ultimately, the future of the labour market. This is particularly prevalent in current times when governments are faced with fiscal crises. It is widely recognised that students are price sensitive to increases in tuition fees (for example, see Leslie and Brinkman, 1987; Heller, 1997 and Shin and Milton, 2006). A number of empirical studies have found enrolments in higher education are negatively impacted by increases in tuition fees. It is therefore rational to think that a reduction, or the abolition of tuition fees, will have the reverse effect on enrolments. This creates the demand for further examination on the topic of the price sensitivity of tuition fees in participation in higher education, particularly from the perspective of governments.

Over the past half century, females in the UK have experienced increased economic agency, including increased representation in the workforce (particularly in skilled and white collared professional roles) and a decrease in non-economic activity such as unpaid housework. Separately, legislative changes to certain female dominated professions, such as nursing and

primary school teaching, have imposed a new minimum qualification requirement of having a university degree. Consequently, there has been an increase in females participating in higher education. The process has advanced to a state where there are more females than males participating in higher education in the UK. This trend has been reflected across many parts of the developed world. Understanding the factors underlying the position where female participation in higher education not only matches that of males, but in fact surpasses, is key to policy formulation in respect of higher education funding and administration in a political environment, where female economic participation is still a dynamic factor.

Similarly, understanding the reasons behind the geographical mobility of students is crucial in the future provision of higher education. The decision of which higher education institution to attend and in which field to study, are at the forefront of the decision making process of an individual's decision to enrol in higher education. Understanding the push and pull factors from an individual's perspective is important in the regional provision of higher education institutions as well as the provision of subject areas.

1.2 Objectives

The objective of this research is to determine factors influencing participation in higher education. This thesis will address the following questions from both a theoretical and empirical perspective using Higher Education Statistics Agency (HESA) and Higher Education Information Database for Institutions (heidi) for Great Britain.

1) What is the impact of tuition fees on higher education participation?
2) Why differences are apparent among gender participation rates
3) What causes geographical mobility in higher education?

Focus will be placed on gaps and limitations arising within existing literature in order to provide new contributions to the field of participation in higher education. Based on the findings from the studies, the objective of the research is to stimulate policy relevant discussions and recommendations for public administrators in higher education in Scotland and, to a lesser extent, in Great Britain.

1.3 Expected contribution

This thesis draws on a substantial body of existing literature in addressing the reasons for participating in higher education. The expected contribution of each empirical study from the thesis will be discussed in turn.

This first empirical chapter of this study addresses the impact of abolishing tuition fees in higher education on enrolment. This chapter is dedicated to investigating student price responsiveness to higher education. Many countries have introduced or increased tuition fees as a result of financial constraints faced by government, coupled with the belief that the private benefits obtained from higher education outweigh the public benefits. Scotland provides a unique case where tuition fees were abolished. Chapter 2 employs empirical analysis to focus on higher education participation at Scottish higher education institutions for Scottish undergraduates. The results obtained from this analysis have implications for policies relating to tuition fees across countries. Typically, previous studies have highlighted the negative impact of increasing tuition fees on higher education participation. This analysis highlights the effects of removing tuition fees and controls for tuition fees imposed in neighbouring countries within Great Britain.

The second empirical chapter addresses gender participation gaps in higher education in Scotland. A puzzle has emerged in the participation rates by gender with females overtaking male participation rates in a large proportion of countries globally (Becker et al, 2010). Scotland provides an interesting case study to address this puzzle as there are disproportionately lower rates of participation in higher education in Scotland among males compared to females, a situation that emerged in 1993-1994. This study analyses factors relating to previous empirical literature and anecdotal evidence.

The empirical analysis presented in Chapter 4 is anticipated to be the first empirical study to analyse student mobility patterns across England, Scotland and Wales. Previous empirical studies have focussed on Scotland and Wales. It is interesting to compare the results across all countries in Great Britain to better understand factors affecting mobility. This is particularly true in comparing Scotland and Wales with England, which has a significantly higher number of students and higher education institutions.

An additional benefit of this thesis is that it has constructed unique datasets which have been derived from HESA and heidi. These datasets have been developed for the sole purpose of the three empirical studies.

1.4 Outline of the study

The chapters outlined below are used in order to discern factors affecting participation in higher education; specifically analysing tuition fees, gender and geographical mobility.

Chapter 2: Tuition Fees and Higher Education Participation

This chapter examines the impact of the abolition of tuition fees on higher education enrolment within the context of Scotland. Tuition fees were abolished in Scotland in 2000, following their introduction in 1998. This chapter first presents an extensive overview of the literature relating to tuition fees and higher education participation. Following this, an overview of tuition fees in Great Britain is presented. Summary statistics are presented to outline Scotland's participation rates in higher education within the context of Great Britain. The chapter then reveals the empirical model developed for the impact of the abolition of tuition fees in Scotland, controlling for biases unrelated to tuition fees. The empirical analysis focuses on higher education participation for the period 1994-2013. The study is extended to analyse the impact of the abolition of tuition fees on subject area participation. Limitations are discussed followed by a conclusions at the end of the chapter.

Chapter 3: Higher Education Enrolment by Gender

This chapter contributes to existing literature on the differences between male and female higher education participation. The chapter begins by reviewing previous literature to derive key variables to be analysed within the empirical study before moving on to the case of Scotland where female participation exceeds male participation. The chapter then provides descriptive statistics for Scotland to contextualise the differences that have emerged in higher education by gender. The methodology and model specification are then outlined followed by a discussion of the empirical results and diagnostic testing. This chapter also analyses female price response to higher education and provides analysis across institutions in Scotland. Limitation and conclusions of the study are addressed at the end of Chapter 3.

Chapter 4: Geographical Mobility in Higher Education

The final empirical chapter explores the factors influencing individuals to move from their domicile country for higher education. Beginning by reviewing the existing literature related to geographical mobility of students for higher education, this chapter proceeds by reviewing the administrative and funding processes in higher education in Great Britain. The chapter subsequently looks at the compositions of institutions and student demographic in higher education in Great Britain before stating the expected contribution of the thesis chapter. An overview of the methodology and data are presented followed by summary statistics. The empirical models are then presented for each of the three countries, followed by a discussion on the output from the models. This chapter concludes by addressing limitations of the study and conclusions that can be drawn from the results.

Chapter 5 provides a discussion of the empirical results obtained from the three empirical chapters in addition to providing policy implications. Additionally, the final chapter identifies the limitations to the research presented in the empirical chapter and offers ideas for future research.

Chapter 2 Tuition Fees and Higher Education Participation

2.1 Introduction

Those tasked with making decisions about funding allocation for higher education are faced with a trade-off between increased demand for skills and knowledge and increasing financial constraints of governments. This is coupled with the trend towards increased privatisation in higher education since the 1980s (McMahon, 2009). Given that student participation in higher education is believed to be sensitive to price, as the price of higher education increases, it is anticipated that the level of participation will decrease. The policy treatment of higher education funding has changed to a private from a public good in some countries. Consequently, education in some countries is purchased by individuals as opposed to being provided by the state (Altbach, 2006; Wilkins, Shams and Huisman, 2013). The switch from public to private good has come as a result of the notion that individuals, rather than society, receive a higher benefit from participating in higher education. This is coupled with the fact that governments have come under increased financial pressure. Indeed, the share of the public contribution towards higher education funding has significantly decreased in recent years in a number of OECD countries[1] (OECD, 2017).

A vast literature exists examining the effect of university costs on enrolment in higher education (Leslie and Brinkman, 1987). A substantial proportion of these studies focus on how the imposition of tuition fees affects enrolment in higher education. This paper expands on previous literature by examining the impact of the abolition of tuition fees on higher education enrolment. Scotland provides an interesting case where tuition fees were abolished in 2000. A difference-in-differences methodology is employed to study the effect of the abolition of tuition fees in higher education in Scotland. The study measures the effect of tuition fees through a comparison in enrolment rates in universities in Scotland (where tuition fees were abolished), against enrolment in England and Wales, where fees remained in place. The analysis suggests that abolishing tuition fees increases participation in higher education. From a policy perspective, the results show that participation rates in higher

[1] Between 1995 and 2009 the OECD average percentage share of public expenditure on tertiary education decreased from 78.9% to 70%.

education are price sensitive and can be manipulated by either the abolition or the imposition of tuition fees.

This chapter is organised as follows: Section 2.2 provides a literature review on the demand for participation in higher education, with particular focus on student price responsiveness to education, Section 2.3 provides history of tuition fees, Section 2.4 provides the motivation for the current study, Section 2.5 presents the data analysis and model and Section 2.6 provides discussion of the results and conclusions.

2.2 Literature review

2.2.1 Human Capital Theory

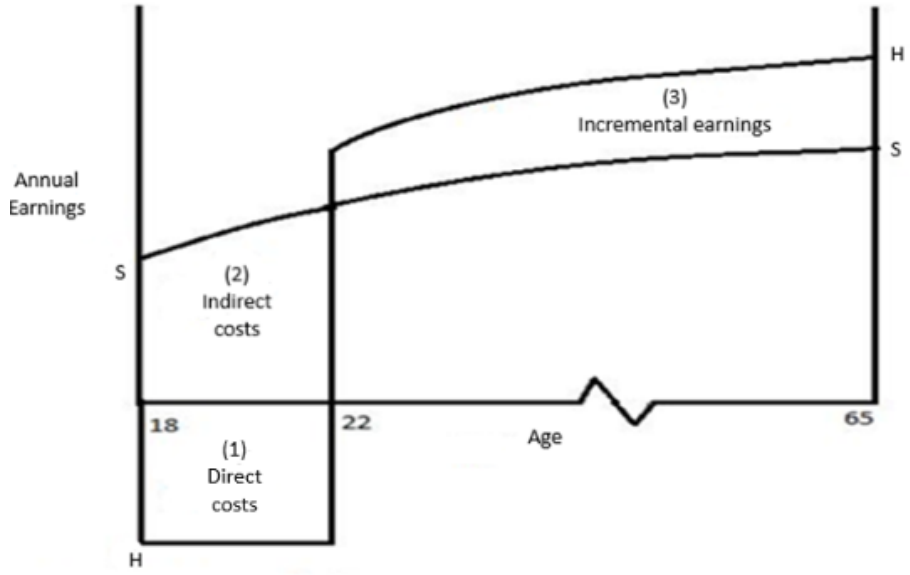
One of the most fundamental concepts in labour economics concerns human capital theory. Human capital can be defined as knowledge and skills obtained by individuals. The knowledge and skills contribute to the productivity of the individuals. This in turn is believed to generate higher wages and ultimately increase an individual's earning potential (Becker, 1964). Investment in human capital has also been related to increased participation in the labour force and, additionally, it positively influences the length and frequency of employment (Mincer, 1975).

An individual is expected to complete secondary education at a young age, 16-18 years old, typically entering higher education directly from schooling and completing undergraduate education around the age of twenty-two. Investment in human capital may, however, continue throughout an individual's lifetime but at a falling rate.

Costs are a crucial element when considering human capital investment. There are opportunity costs associated with investment in human capital. The opportunity costs of attending higher education are typically associated with the earnings foregone by entering education rather than entering the labour market, where the individual would receive some form of income. Schultz (1961) states that over half the costs associated with participating in higher education are related to income foregone by individuals (the opportunity costs). The costs can be split into two categories; direct and indirect. Direct costs are predominantly associated with tuition fees. Tuition fees can be defined as the price levied on student in return for educational services. Tuition fees are paid to the higher education institution

directly. Indirect costs are related to the foregone earnings of an individual, as well as the costs of books, accommodation and transportation. This concept is represented in Figure 2.1.

Figure 2.1: Age-Earnings Profiles with and without Higher Education



Source: McConnell and Brue (1995, p.80)

Figure 2.1 represents the earnings potentials of two individuals. Curve SS illustrates earnings for an individual entering the labour market at the age of 18 after completing high school (S), without higher education. Curve HH shows the earnings profile of an individual entering higher education at the age of 18, followed by labour market entry at age 22. The individual entering higher education is faced with direct costs and indirect costs, denoted by (1) and (2) in Figure 2.1. The Incremental earnings component of the diagram represents the earnings differential between the two individuals, where the individual who has completed higher education is anticipated to benefit from higher wage for the duration of their time in the labour force, albeit entering the labour market at age 22, compared to those entering directly from high school at the age of 18.

As outlined above, individuals enter higher education with the expectation of future benefits. Participating in higher education incurs both direct and indirect costs. Given that the benefits and costs occur over time, it is necessary to adjust them to derive their expected present value. Paulsen (2001, p.59) illustrates an individual's investment decision process by incorporating the present discounted values of the benefits and costs, using a discount rate.

The below equations are provided to illustrate the present discounted value of the costs and benefits associated with higher education where:

PDV^{DC} denotes the present discounted value of the direct costs

PDV^{IC} denotes the present discounted value of the indirect costs

C_t denotes the direct costs (tuition, books, transportation)

S_t denotes subsidies (grants, loans, scholarships), subtracted from C_t

E_{it}^{F} denotes the indirect costs (earnings forgone in attending higher education)

E_{it}^{PT} denotes any part-time employment earnings accrued in higher education, subtracted from E_{it}^{F}

i denotes the discount rate, obtained from the market rate of interest. Given that the costs and benefits accumulate over time, adjustments should be made using i to ascertain the present values

Equation (2.1) below denotes the present discount value (PDV) of the direct costs (DC) and equation (2.2) denotes the PDV of the indirect costs (IC), assuming an individual spends four years in higher education:

$$PDV^{DC} = \sum_{t=1}^{4} \frac{C_t - S_t}{(1+i)^t} = \frac{C_1 - S_1}{(1+i)^1} + \frac{C_2 - S_2}{(1+i)^2} + \frac{C_3 - S_3}{(1+i)^3} + \frac{C_4 - S_4}{(1+i)^4}$$

(2.1)

$$PDV^{IC} = \sum_{t=1}^{4} \frac{E_{it}^{F} - E_{it}^{PT}}{(1+i)^t} = \frac{E_{i1}^{F} - E_{i1}^{PT}}{(1+i)^1} + \frac{E_{i2}^{F} - E_{i2}^{PT}}{(1+i)^2} + \frac{E_{i3}^{F} - E_{i3}^{PT}}{(1+i)^3} + \frac{E_{i4}^{F} - E_{i4}^{PT}}{(1+i)^4}$$

(2.2)

The above equations outline the PDV of the costs associated with participating in higher education. One must also consider the PDV of the earnings differential associated with the accumulation of human capital. Having completed higher education, it is anticipated the earnings differential will occur in year five (after four years of studying) when the individual

enters the labour market. One can then derive the PDV of the earnings differential between an individual who has obtained higher education (H) and an individual who enters the labour market (S), $(E_{it}^{H} - E_{it}^{S})$, for period five (*i5*) in addition to all subsequent years in the labour market (*iT*) derived in equation (2.3) below:

$$PDV^{H-S} = \sum_{t=5}^{T} \frac{E_{it}^{H} - E_{it}^{S}}{(1+i)^{t}} = \frac{E_{i5}^{H} - E_{i5}^{S}}{(1+i)^{5}} \dots + \frac{E_{iT}^{H} - E_{iT}^{S}}{(1+i)^{T}}$$

(2.3)

Having derived the PDV of the costs and benefits associated with participation in higher education, one can compare the present discounted value of the earning differential to the costs. When the discounted present value of the earnings differential exceeds the discounted present value of the costs, enrolment in higher education would be viable. This is denoted in equation (2.4) below:

$$\sum_{t=5}^{T} \frac{E_{it}^{H} - E_{it}^{S}}{(1+i)^{t}} > \sum_{t=1}^{4} \frac{C_t - S_t}{(1+i)^{t}} + \sum_{t=1}^{4} \frac{E_{it}^{F} - E_{it}^{PT}}{(1+i)^{t}}$$

(2.4)

One can therefore assume the internal rate of return is derived by equating the earnings differential equation (2.3) and the costs (direct and indirect minus scholarships and part-time employment earnings) equations (2.1) and (2.2) using the discount rate (r).

$$\sum_{t=5}^{T} \frac{E_{it}^{H} - E_{it}^{S}}{(1+r)^{t}} = \sum_{t=1}^{4} \frac{C_t - S_t}{(1+r)^{t}} + \sum_{t=1}^{4} \frac{E_{it}^{F} - E_{it}^{PT}}{(1+r)^{t}}$$

(2.5)

Individuals will thus invest in higher education when the present discounted value of the benefits exceed the present discounted value of the cost, that is when the internal rate of return exceeds the market rate of interest.

2.2.2 Benefits of higher education

Benefits from investing in higher education are undoubtedly witnessed, to some extent, on both an individual and social level. The below sections will provide an overview of the private and public benefits of higher education that are discussed within previous literature.

Private benefits

Having completed compulsory education, an economically active individual ordinarily has two options; to enter the labour market or continue in education. An individual considers potential private benefits when deciding whether to enrol in higher education. This notion is concerned with the fact that future earnings are anticipated to be higher than if they had entered the labour market directly from school. Indeed, an individual must also consider the earnings they will forgo during the time in which they will be in higher education.

The private benefits are not only confined to higher future lifetime earnings. An array of private benefits have been linked to higher education. These include a greater probability of employment and higher labour market entry level wages. A lower probability of unemployment has also been associated with participating in higher education. Mincer (1991) notes individuals with a higher level of education have a lower risk of losing their job, thus benefitting from better job security. This could be linked to the types of employment graduates enter when compared to those who have not obtained higher education. According to Reimer, Noelke and Kucel (2008), studying subjects from "soft fields" lead to less favourable labour market outcomes than those from "hard fields" such as STEM (science, technology, engineering and mathematics) subjects. The rationale for this does not stem from the notion that more individuals participate in the "soft fields", thus creating excess supply, but rather from the fact that those studying subjects in the "soft field", overall, have lower academic ability as demonstrated in their secondary school attainment records.

Private non-market benefits have also been linked to the accumulation of human capital. These non-market benefits include benefits to the health not only of the individual, but also that of their spouse and their children, in that they have a lower likelihood of developing diabetes and other illnesses (Hartog and Oosterbeek, 1992). The apparent health benefits have been associated with better behaviours and a reduced probability of developing habits such as smoking, excessive drinking, becoming overweight and the consumption of illegal

drugs (Cutler and Lleras-Muney, 2006). The health-related benefits of obtaining higher education anticipate a longer life expectancy for those individuals (Leigh, 1990).

Preventive care measures are also more apparent in those who have more years of education. These include using seatbelts, fitting smoke detectors in the home and obtaining vaccines. Leigh (1990) argues that higher educational attainment is associated with an individual's likelihood to read news articles, thus, making them aware of the risks in not wearing seat belts. Moreover, Leigh (1990) states that these individuals are less dependent on beliefs, and tend to rely on facts when making decisions thus making them risk averse. Indeed, there could be a cause-and-effect problem here, in that we are unable to establish whether individuals who have a degree are more likely to wear seatbelts or individuals who wear seatbelts are more likely to have a degree.

Public benefits

An individual is likely to consider only the private benefits of higher education that can be internalised, but their investment is also likely to generate public benefits. Public benefits, also known as external benefits, include those which are valuable to society.

Many studies have explored the public benefits obtained from higher education. These can be separated into the quantifiable (economic) and non-quantifiable (non-economic) benefits. In terms of the quantifiable benefits, studies have revealed three fundamental channels through which the private benefits can be quantified. These involve calculating expected social rates of return, analysing the impact higher education has on economic growth and assessing the benefits received by communities surrounding higher education establishments (Paulsen, 2001).

Studies evaluating the public benefits produced by higher education have found several benefits. The increased productivity of individuals not only generates higher wages for the individual. Greater productivity is regarded as a public benefit as it leads to increased output, and income in terms of tax contributions due to higher earnings. This is among the most cited monetary benefits to society (Paulsen, 2001 and Sianesi and Reenan, 2002). Hanushek (2016), however, argues that the assumption of higher education stimulating productivity, and ultimately growth should be treated with caution, and attributes growth rates of countries to variances in cognitive skills rather than additional years of schooling. Thus, there appears to be conflicting opinions in terms of the correlation between higher education and

productivity. Johnston (2004) distinguishes between the private and public benefits in terms of income; stating that while the private benefits to education involve higher private earnings, the social benefits, in terms of earnings, are associated with higher national income.

Other studies (such as Leslie and Brinkman, 1988; cited in Paulsen and Smart, 2001) analysing the impact of higher education institutions find the presence of a university in a local area stimulates local economic growth and promotes job creation, thus creating external economies of scale. There are also non-monetary social benefits that are more difficult to quantify, but nonetheless still important. These include increased social cohesion, particularly in terms of racial tolerance and the ability to question one's attitudes (Preston and Green (2003). As discussed above, those who have obtained higher education are also believed to have the ability to make better choices in terms of consumption goods, pertaining to a healthier lifestyle in terms of diet, alcohol and smoking (Johnston, 2004) which contributes to a decreased reliance on government support (Bloom, Hartley and Rosovsky (2007). Increased voter participation is also cited, particularly in terms of political attitude favouring public programs, (Bowen, 1977) and a reduced probability of anti-social behaviour and incarceration (Moretti, 2003; Johnston, 2004). Moretti (2003) states that education reduces crime as it influences individuals to be risk averse which in turn deters individuals from engaging in crime.

Indeed, there are an array of public benefits and externalities associated with participation in higher education. Few studies go beyond simply mentioning these public benefits, given the difficulties associated with quantifying the external benefits. McMahon (2009) notes that the scale of the impact of the external benefits may be underplayed in the sense that some studies control for occupation. Given certain careers require a degree, controlling for occupation reduces the overall impacts on public benefits. McMahon (2009) states that market failures can arise because of the poor evidence to support the public benefits of higher education. When little is known about these benefits, public expenditures on higher education will not be at an optimal level, leading ultimately to market inefficiencies and failures.

2.2.3 Demand for higher education

Economic motivation has been widely cited as a key incentive to enter higher education. Individuals are assumed to base their decision to enter higher education predominantly on the expected future private benefits. As discussed above, however, costs are incurred in entering higher education. The costs and benefits form an implied, immeasurable, rate of return to the investment in education and thus it is anticipated the individual will assign monetary values to non-monetary benefits and costs in order to make a rational decision (Campbell and Siegel, 1967).

Campbell and Siegel (1967) note that, like other investments, the investment in higher education may not generate the future benefits that were expected. This can occur for many reasons, such as the student not completing the years at university, or because opportunities may not exist in the labour market.

A pertinent question in the economics of education concerns who should pay the costs of higher education. Scholars have long debated this question and are conflicted as to whether they believe the private benefits outweigh the public benefits or vice-versa. For those who believe the private benefits are greater than the social benefits, high tuition fees are recommended given students are believed to receive greater benefits than society would receive from their higher education (Stampen, 1980). Those who believe the social benefits are greater argue that low or no tuition fees be imposed on individuals. Advocates of low/no tuition believe society should bear the burden of a sizeable proportion of the fees generated through taxes.

According to Paulsen and St John (2002), literature relating to the decision to participate in higher education has been predominantly focussed on individuals at the age of secondary school completion and has not reflected the age diversity associated with higher education participants, particularly over the last few decades. Traditionally, studies have also omitted ethnicity and socio-economic background. Thus, traditional models in the decision to participate in higher education have limitations, particularly with regard to financial restrictions.

The growing diversity in age among the higher education population has created a gap in traditional models relating to the decision to participate, according to Paulsen and St John (2002). Financial nexus theory, according to Paulsen and St John is believed to encapsulate

higher education choice and persistence. This theory points to the fact that potential students consider their options when deciding to attend higher education in the form of costs and aid, and this is believed to continue during their studies and thus affect their persistence decision to continue within the higher education institution. Students thus reconsider financial costs a number of times throughout their academic studies.

The financial nexus model enables the diverse nature of the higher education population to be studied by categorising choice contexts from both traditional and non-traditional higher education participants. While traditional participants choose their higher education establishment based on subsidies, studentships or lower tuition fees, non-traditional students, such as those who are over twenty-five years old, are more inclined to base their decision on a higher education institution that capitalises on their cost of living or that enables them to continue working. Thus the financial nexus model predominantly focusses on an individual's circumstances by grouping, based on traditional and non-traditional students.

The demand for higher education has been rapidly increasing over the last few decades. The demand has come not only from individuals wishing to pursue further study, but also from society and governments due to the expected future benefits to both parties. The product markets in China and South East Asia have priced Western manufacturing out of many markets. Therefore a knowledge based economy is perceived as being the most valuable alternative for the UK. The next section provides a history of tuition fees.

2.3 A history of tuition fees

The burgeoning demand for higher education, coupled with decreasing shares of government expenditure due to increased budgetary constraints, has led to increased interest on tuition fees from policymakers. Considerable attention has been directed to the accessibility and restrictions imposed through tuition fees, which are becoming increasingly salient in many countries. This section will provide an overview of tuition fee policy types and their implications.

Historically, higher education in Central, Western and Eastern Europe, and Russia emerged on the offering of free education for able individuals who had obtained the necessary entry qualifications. The motivations for free higher education stemmed from several angles. Many

deem higher education as a right for individuals and highlight the vast social benefits generated from higher education. Moreover, advocates of no tuition believe the imposition of tuition fees may deter individuals entering higher education as the indirect costs associated with attending higher education are already infeasible for some households (Marcucci and Johnstone, 2007).

One of the primary reasons cited for the imposition of tuition fees, in additional to the previously mentioned increased government budgetary constraints, is associated with the fact that there is a disproportionate distribution across socio-economic classes in higher education, particularly in participation among those from lower classes. This has in turn led policy makers to believe that those from middle and higher income families reap the benefits of free tuition. This is coupled with the notion that those from higher socio-economic backgrounds have higher probabilities of enrolling in higher education and thus benefit from the taxes collected to subsidise tuition fees (Marcucci and Johnstone, 2007). Indeed, those from high socio-economic backgrounds will have their tuition fees subsidised at the expense of all taxpayers. Policies relating to tuition fees are paramount from both an individual and social perspective in terms of the accessibility to higher education for individuals and the revenue stream for society. Some scholars have argued that tuition fees levied upon the individual will lead to more efficiencies in higher education as they will hold the institution more accountable if they are paying consumers of the education it provides (Huisman and Currie, 2004). These reasons have in turn led to many governments imposing tuition fees. The introduction of tuition fees is now common in several countries globally and, as such, there are only a small number of countries which offer free tuition for students[2].

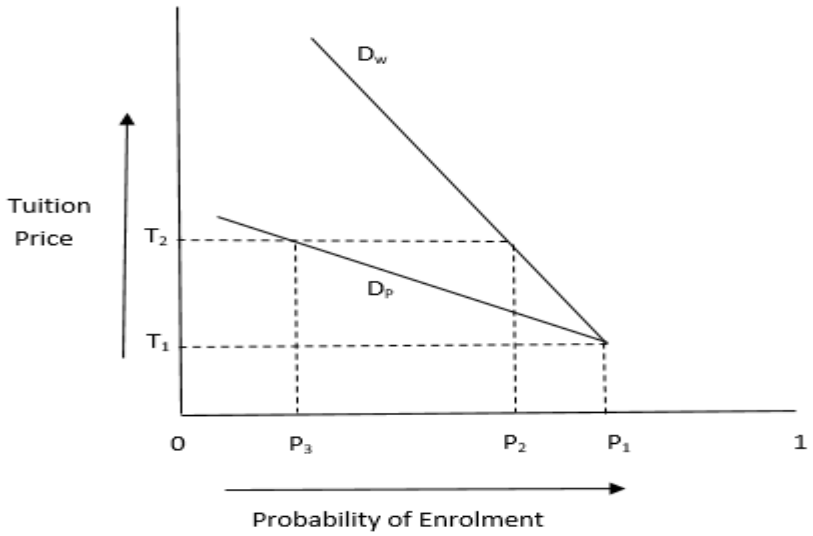
The introduction of tuition fees could have a detrimental impact for countries where tuition fees have previously been waived for the student, whereby participation in higher education may decline, particularly from lower socio-economic backgrounds (Wilkins et al, 2013). Paulsen (2001) argues that individuals from lower socio-economic background are more responsive to changes in tuition fees than those from middle and higher socio-economic backgrounds[3]. In terms of existing literature, it is the consensus that the elasticity of demand for education is higher for those from lower socio-economic backgrounds, than those from

[2] Countries offering free tuition tend to lie in Eastern and Central Europe, Russia and former Soviet Union countries (Marcucci and Johnstone, 2007).

[3] It is also the case the students from low socio-economic backgrounds have lower academic performance and lower preferences to enrol in higher education (Declercq and Verboven, 2015).

higher socio-economic backgrounds. This can be illustrated using the diagram below in Figure 2.2.

Figure 2.2: Higher education demand of low and high socio-economic background



Source: Heller (1997, p.639)

The diagram shows the demand curve for low socio-economic background individuals represented by D_p and those from high socio-economic backgrounds are represented by D_W. The point P_1 illustrates the probability of enrolling in university which corresponds to a low level of tuition fees (T_1). At this point, both the low and high-income individuals have an identical probability of attending, which is close to one. When the price of tuition rises to T_2, the probability of the low income individual enrolling in higher education reduces, corresponding to P_3 in the diagram while the individual from the higher socio-economic background would observe a smaller reduction in the probability of enrolment, corresponding to P_2 (Heller, 1997). Given individuals from low socio-economic backgrounds are more sensitive to the price of higher education, it is anticipated that financial aid, in the form of subsidies or grants, could assist individuals from lower socio-economic backgrounds. This will subsequently increase their probability of enrolling in higher education and ultimately shift their demand curve to the right to correspond to the increased probability of enrolment.

2.3.1 Tuition fee policy types

As discussed in the previous section, it is apparent tuition fees in higher education are now prevalent in a number of countries. Nevertheless, the way in which tuition fees are paid significantly differs by country. In a broad sense there are two methods in which tuition fees are paid. Institutions in some countries have adopted an upfront approach, where fees are demanded prior to the service of higher education being delivered. The price of tuition fees may be set by institution, or alternatively, it may be regulated by statute, this is country dependent. In other countries, governments and institutions have adopted a deferred payment approach, where tuition fees are expected after an individual has completed higher education. In this case, governments pay the institutions on behalf of the student and the students repay the government at a specified point after graduation (this could be income contingent). These two very contrasting methods of collection vary depending on the country in which the higher education is obtained and is subject to the home country's opinion regarding the responsible party for payment.

The countries that have adopted upfront tuition fees will ordinarily result in the cost burden and responsibility being placed upon the student's parents. It is the case in some countries that subsidies are offered based on ability to pay whereby the government has adopted means tested fees. In this respect, ability to pay is assessed and the cost applicable to parents is dependent on family income (Marcucci and Johnstone, 2007). The rationale for the deferred approach is based primarily on the idea that parents should not be responsible for their child's education and children may not be in a financial position to meet the costs for their tuition. Thus, tuition is paid for retrospectively. Other countries provide higher education without charge to the individuals and therefore free tuition is similar to the deferred payment, in that parents are not assumed to be financially responsible for their children's education. Moreover, free tuition is believed to have been implemented where government's either are of the belief that positive externalities are generated from higher education participation or they deem it necessary to offer university places at no cost given the notion that tuition fees exclude those from lower socio-economic backgrounds who may not be in the financial position to pay tuition.

Biffl and Isaac (2002) state that while free tuition fees encourage students from lower socio-economic backgrounds to participate in higher education, barriers remain, and as individuals

from higher socio-economic backgrounds are more prominent, the inequality present in higher education participation is justification for imposing tuition fees. The basis of their argument is that subsidies may be put in place for those from less advantaged backgrounds which in turn would stimulate participation among lower socio-economic backgrounds; those from higher socio-economic backgrounds will be undeterred by the introduction of tuition fees and their participation rates will remain relatively constant. Demand from higher socio-economic background is therefore considered inelastic. Biffl et al further argue that the supply of places at university would increase if tuition fees were introduced.

Controversially, Biffl et al argue that the fees, and subsidies offered, for higher education should be sensitive to the positive externalities generated from specific courses. The rationale for this is to charge lower fees, or implement subsidies, for courses that offer greater spill-over effects to society. These are related to the labour force planning and identifying future shortages within specific industries.

2.3.2 Empirical evidence on tuition fees and demand for higher education

The introduction of tuition fees is regarded as a principal factor considered in the decision to participate in higher education (Paulsen and St John, 2002). This is particularly prevalent in those from low-income backgrounds as the cost may create barriers to access higher education. The majority of studies have focussed on identifying the elasticity of demand for higher education following increases in tuition fees. This section will summarise studies relating to the effects of tuition fees and provide an overview of country specific tuition fees policies that have been implemented, and provide an overview of empirical studies assessing the implications of the tuition fees.

The case of the U.S.

Several econometric studies have demonstrated tuition fees have a negative impact on enrolment in higher education. The majority of these studies emanate from the U.S. Heller (1997), for example, studied the effects of a $100 increase in tuition fees in four year colleges and community colleges in the U.S. for the period 1970 to the 1980s. The study found that the tuition fee increase had a negative effect on enrolment, by an approximate decrease of 0.5 to 1 percentage points across the institutions. Heller (1997) notes the findings from the study are similar to a previous study conducted by Leslie and Brinkman (1987).

A similar study for the U.S. was conducted by Kane (1994). Kane (1994) studied the effects of a $1,000 dollar increase in the net direct costs of higher education using pooled cross-sectional data for the period 1973 to 1988. The author found a significant decrease of five percentage points in the probability of individuals enrolling in higher education, findings that were similar to a study by Leslie and Brinkman (1987) (cited in Kane, 1994). These results differ considerably by ethnicity, with African Americans being significantly more deterred by the increase.

Shin and Milton (2006) use data for 1998, 2000 and 2002 to employ hierarchical linear modelling growth models to assess the effects of tuition fee changes on enrolment. The analysis shows that a $100 increase in tuition fees decreases enrolments by 1.13 students per year, per institution. The effects from the model are, however, not statistically significant. Undoubtedly, these results are different from the previous studies conducted by Heller (1997) and Kane (1994) from the 1970s and 80s data. Shin and Milton (2006) argue that students were more responsive to tuition fees during the time period studied by Heller (1997) and Kane (1994) due to different economic conditions being present during those years when compared to their 1998-2002 study.

Shin and Milton (2006) provide some justification for the conflicting results between their study and Heller's 1997 study through a number of channels. First, they emphasise the fact that their study focusses on a shorter time period, where tuition fees increased by 12.8% and note that this is a small increase, while greater increases may lead to a decrease in enrolment. Second, the authors report that, unlike previous studies, their study included wage premia which are important in explaining enrolment patterns in institutions, noting that students are more responsive to the benefits of a university education, rather than the costs. Third, they note that although an increase in tuition fees overall is not significant in enrolment, competition in tuition fees among higher education providers is significant. This implies that students 'shop around' and institutions should therefore assess their competitor's fees when setting their own fees. Thus, results across earlier studies from Heller and Kane and not directly comparable with Shin and Milton's more recent study.

Hemelt and Marcotte (2011) exploit more recent data and consider a longer time period, between 1991 and 2006. The study focusses on 4 year public universities (universities that offer Batchelor's degrees and are funded by local and state governments, offering lower tuition fees than private universities). The study uses institution and year fixed effects panel

regressions to establish within institution variations over time in tuition fees and the subsequent effects on enrolment. The authors report an increase in tuition fees of $100 (in 2006 prices) would decrease enrolment by approximately 0.25%. The elasticities found in this study are in line with previous studies (Kane, 1995 and Heller, 1997). It is interesting to note that although Hemelt and Marcotte's study has some overlap with the paper by Shin and Milton with regard to the time period used, the studies produce significantly different results. This can be attributed to the fact that Shin and Milton's empirical analysis is restricted to three years of data. Moreover, Hemelt and Marcotte (2011) state that Shin and Milton's analysis used tuition fee data for years where fluctuations were significantly small and this is reflected in their insignificant results for the three years used in their analysis.

Although the findings in the U.S. studies vary in the magnitude of the effect, the consensus (with the exception of Shin and Milton's study) is that increasing tuition fees has a significantly negative effect on enrolments in higher education, particularly when there are sharp increases in tuition fees.

The case of Australia

It has been the case that tuition fees have existed in the U.S. for several decades and the studies emerging from there have focussed on the effects of an increase in tuition fees. However, it is widely known that tuition fees are not unanimous across the world. The preceding analysis focusses on the case of the introduction of tuition fees and its implication.

Australia provides an example of a country where tuition fees were reintroduced after a period of no fee. Australia had initially abolished tuition fees in 1974. However increased demand for higher education, along with the fact that higher education funding was financed through tax, led to their reintroduction in 1989. Two options of repayment were available to students in Australia from 1989. The first incurred an upfront charge with a 25% discount. The second option offered an income contingent loan form of repayment. An income contingent loan is one where the instalments are postponed, and only become repayable when the borrower is receiving income above a certain level. Deductions are made directly from salary in the same way as income tax. Such loans are incentivised with low interest which lowers the real cost of tuition over the repayment period compared to bank loans.

The justification for the income contingent tuition fees stemmed from the belief that introducing fees, without the offer of a loan, would create barriers to entry for those who

were academically able, but without the means to pay for their degree upfront (Chapman, 1997). Individuals from lower socio-economic backgrounds with the desire to enter higher education may be forced to seek a bank loan to pay their tuition upfront had the income contingent loan not been offered. Banks may however be reluctant to lend for higher education purposes as there is no way to secure the loan if the individuals do not have collateral. Moreover, given the evidence of positive externalities arising from higher education, albeit difficult to quantify, Chapman (1997) argued that the rationale for charging some form of tuition fees was justified. Implementing income contingent fees would help to reduce barriers faced by those from lower socio-economic backgrounds. Thus, income contingent repayments may incentivise higher education study when compared to bank loans.

The financial risk assumed by individuals participating in higher education is diminished by income contingent repayments. Chapman (1997) argues that income contingency repayments are favourable for students not only due to the aforementioned reasons relating to socio-economic background but also because a student is protected from repaying should they fail to complete their course, encounter unemployment or not earn above the repayment threshold. Repayments vary considerably between students for these reasons, particularly the latter, as repayments are dependent upon income thresholds therefore an individual who earns more will repay more subject to income contingency repayment thresholds.

Despite the incentive of the 25% discount, however, the popular student's choice was to defer payment (Chapman, 1997). Chapman's study revealed that in Australia the introduction of income contingent repayments did not deter entry to higher education. Indeed, higher education enrolment has increased since the introduction, despite the fact that tuition was free prior to the introduction. It is interesting to note that Chapman's 2016 study reveals there were no changes to the composition of the student population in terms of socio-economic background 25 years after the introduction of income contingent fees (Chapman, 2016). Chapman (1997) therefore argues the decision to participate in higher education in Australia was not affected by the introduction of income contingent repayments. Moreover, Chapman (2016) states that income contingent tuition fees did not deter entry for those from lower socio-economic backgrounds. Chapman (2016) argues that this is a more favourable

approach to higher education fees than imposing upfront tuition fees which would incur bank loans.

Johnstone (2004) agrees to an extent with Chapman (1997) in respect of the success of income contingent repayments in Australia. Johnstone (2004) states that, while the case of Australia demonstrates successful implementation of income contingent repayments, income contingent loans are confounded with repercussions which were not intended. This was particularly with regard to the dynamics of the repayments that create a cost sharing between a government and a student.

From a government's perspective, Johnstone (2004) argues "…this machinery, including the power to mandate employers to collect such sums at the point of wage and salary payments, as well as the government's power to verify compliance and punish transgressors, could in theory be applied as well to the collection of conventional loans—or, for that matter, to the collection of any payment owed by citizens the effective collection of which is deemed to be of overriding public importance (e.g. local taxes, child support, alimony, traffic fines, philanthropic contributions, or tort judgments)" (Johnstone, 2004, p.48).

Additionally, Johnstone (2004) argues that the amount of income declared by individuals is capable of manipulation. Some income is not declared and earnings can be transferred to others who are not part of the income contingent repayment scheme, thus averting repayments from students. While Johnstone states that a large proportion of countries have controls to monitor earnings, some countries are faced with difficulties surrounding income and thus problems are anticipated in regards to recuperating the repayment.

Johnstone (2004) also argues that the higher education cost to the public purse as a result of some individuals not being required to repay their income contingent loan, imposes an encumbrance on society, given some students who accept the income contingent repayment scheme will not repay and therefore a loss to society is incurred. Moreover, income contingent loans are financial assets owned by governments; the rate of interest payable on the loan is less than the rate of inflation, the assets will decline in real value. This in turn has political ramifications. Moreover, Johnstone (2004) notes that costs of higher education have moved from the traditional method, whereby the cost is levied on parents, to students who incur a cost when they have earned above a set threshold.

The case of the UK

A UK survey conducted by Davies and Elias (2003) analysed student "dropout" from higher education institutions. Questionnaires were posted to approximately 15,200 individuals who had potentially withdrawn from higher education between 1996 and 1998. Approximately 10% of the individuals responded to the survey. The study identified that, of those who completed the questionnaire, financial difficulties accounted for 18% of total "drop outs". The study also points to the notion that socio-economic background impacts higher education participation, as those students who received parental support for their studies were less inclined to dropout while those subsidised by government support reported experiencing financial hardship throughout their studies. Additionally, students who received grants, as opposed to those who had taken a student loan, were less likely to drop out.

A study by Sá (2014) analyses two fundamental changes to the funding of higher education. The first change concerned the removal of tuition fees in Scotland in 2001 and the second was the increase in tuition fees in England in 2012. Using university applications data, Sá (2014) finds the abolition of tuition fees in Scotland increased applications by 21 log points and the increase in tuition fees in England decreased applications by 25 log points. Thus, the study finds applications to higher education increase when tuition fees are abolished while the opposite is true when tuition fees increase.

According to Dearden, Fitzsimons and Wyness (2011), the imposition of up-front tuition fees in England, Wales and Northern Ireland has a negative impact on participation. Thus, participation in higher education in these countries in the UK has been adversely affected by the introduction of tuition fees. Similar to the results presented in the aforementioned U.S. studies, the study by Dearden et al (2011) finds a £1,000 increase in tuition fees reduces higher education participation by 3.9 percentage points. Moreover, the study finds that maintenance grants increases participation. The study reveals a £1,000 increase in maintenance grants to be associated with an increase in participation of 2.6 percentage points. A maintenance grant is a non-repayable form of support offered to students to assist with living costs. The amount of money received is based on household income, with students from lower income households receiving higher amounts than those from higher income households. Indeed, the UK currently has two states in terms of tuition fees. On the one hand, tuition fees are applicable in England, Wales and Northern Ireland while, on the

other hand, tuition is free for Scottish domiciled students who study in Scotland. These will be discussed in more detail in Section 2.4.

Fervent debates have emerged in light of the introduction of tuition fees in many countries. While government backed student loans are offered with very low or no interest, this can lead to inefficient behaviours being adopted by a student. The non-market interest rate acts as a signal to the student and subsequently incentivises them "to borrow as much as possible and to repay as slow as possible" (Barr, 1999, p.20). Additionally, individuals from higher socio-economic backgrounds who do not require financial support would be encouraged to take the offered student loan if no interest rates were imposed and invest it directly in an asset with a higher yield, thus enriching the already-wealthy at the expense of the public purse. Arguably, the interest generated from tuition fees could be recycled to aid individuals from lower socio-economic backgrounds (Barr, 1999).

2.3.3 Supply of places in higher education

The justification for free higher education comes under pressure when there are fewer places available than are demanded, creating a paradox in the funding of higher education. This is due to the notion that a finite number of free places will be made available and thus demand for the free places may exceed supply. The restricted capacity/ number of free places has the potential to lead to selectivity, and ultimately to students being refused places or being placed on waiting lists. One argument proposed to counteract this is for the prestigious institutions, which are typically faced with high demand, to charge a supplement for courses where there may be excess demand (Biffl and Isaac, 2002).

Some scholars have proposed charging top-up fees which are payable by students. This would help to relax supply side constraints in higher education institutions. King (2001) notes that increased funding for some courses, such as engineering and business, would subsequently generate increased demand for these subjects, given their "marketable" status. King (2001) notes that these subjects are known to provide increased wages for the individual upon graduation, and states that they are "unlikely to provide significant public benefits that are not captured by the student" (King, 2001, p.192). King (2001) recommends governments should reduce or remove subsidies in fields where there are fewer social benefits, and in turn reallocate funding to fields that provide great social benefits. Contrary to King's (2001)

assertions, it can be argued that subjects, such as engineering, can create several public benefits. Engineers develop and enhance technologies which in turn creates public benefits that should not be undermined (Smith, 2011).

2.3.4 Summary of the literature

The literature reviewed presents a number of considerations in assessing student demand for higher education. The decision to invest in human capital is heavily influenced by costs arising as a result of direct and indirect costs. An individual will typically invest in higher education when the expected benefits exceed the expected costs. A number of private and public benefits are obtained through participating in higher education.

Individuals, when making the decision to enter higher education, will consider the costs associated with tuition fees. The costs associated with participating in higher education are believed to significantly impact an individual's decision to enter higher education. Previous empirical literature find students are price responsive to participating in higher education. The studies find that increasing tuition fees has a significant negative impact on participation (see, for example, Heller, 1997 and Hemelt and Marcotte, 2011). The next section of this essay will provide an overview of tuition fees and higher education enrolment in Great Britain, followed by an empirical model which investigates the impact of the abolition of tuition fees on higher education enrolment in Scotland.

2.4 Higher education and tuition fees in Great Britain

Historically, participation in higher education in Great Britain was significantly lower than many other OECD countries and subsequently policies were implemented by the government to increase participation. According to Chevalier and Lindley (2007) there was a surge in the number of individuals participating in higher education, where student numbers doubled between 1988 and 1992. This increase has been attributed to a number of factors which will be discussed.

In the late 1980s and early 1990s, many reforms were implemented in the higher education market. First, higher education institutions were able to expand due to rigorous reforms from the implementation of the Education Reform Act of 1988. Second, polytechnic institutions were granted university status in 1992, ending the binary divide between tertiary education

institutions in Great Britain. Additionally, reforms to the General Certificate of Secondary Education (GCSE) were implemented and subsequently led to more individuals achieving the necessary qualification to enrol in university (Chevalier and Lindley, 2007). The increase in student numbers can also be attributed to increases in demand, as students reacted to changes in the labour market where there was a move towards service sector employment (Blanden and Machin, 2004). Participation is also believed to have been propelled by lower costs per student (Chevalier, 2000).

With regard to tuition fees in Great Britain, there have been some radical changes throughout history. Higher education institutions in Great Britain date back to the 1830s when universities, as we know them today, were established (prior to this there were two universities in England, Oxford and Cambridge, and four in Scotland, the Universities of St Andrews, Glasgow, Aberdeen, Edinburgh). Scottish higher education institutions offered places at very low tuition, and grants to assist individuals in entering higher education, while English institutions (including Oxford and Cambridge) did not offer assistance by way of low or subsidised tuition (Anderson, 2016).

Until the 1880s there were various reforms implemented in Scotland to further assist individuals entering higher education, while English institutions and students did not receive any government grants or funding. The English higher education funding system was reformed in the late 1880s whereby a contribution to institutions was received from the state.

By the early 1900s the UK higher education system was very much subsidised and managed by the state (Anderson, 2016). Between 1962 and the late 1990s, entry to higher education was generally free for individuals. Fees in terms of tuition were paid to institutions by the UK government and many entrants benefitted from grants to compensate if they were from low-income families. The UK became the first European country to implement considerable tuition fees (Johnstone, 2004). Up front tuition fees of £1,000 per year of study were implemented in 1998, these were linked to inflation and were means tested.

In 2004, tuition fees were increased to a maximum of £3,000 per year and changed to income contingent tuition fees as opposed to up-front fees, which were introduced in 1998. During this time, tuition fees were removed in Scotland in the year 2000 and replaced with a Graduate Endowment fee. The Graduate Endowment Fee was introduced in the Education (Graduate Endowment and Student Support) (Scotland) Act 2001. The purpose of the

Graduate Endowment Fee was to remove barriers in accessing higher education for individuals in Scotland. As such, a graduate who was awarded a degree or had met the academic requirements for the award of a degree from a higher education institution in Scotland was obliged to make a one-off payment of approximately £2,000.

The most noticeable change to tuition fees in the rest of the UK came in the way tuition fees were collected. Tuition fee collection was changed to income contingent fees in 2004. The changing political environment influenced the funding of higher education in the UK in 2010 when tuition fees in England were increased to a maximum of £9,000 per year. Indeed, this is believed to have been the turning point in higher education in Britain where higher education shifted from being treated as a public to a private good (Anderson, 2016).

Between 1945 and 2010, it had very much been the consensus that the state was responsible for managing higher education (Shattock, 2012), despite the introduction of tuition fees in 1998. Shattock (2012) states that since 2011, the administration of higher education has been passed from the state to the market, implying that higher education has moved from being a public (social) good to a private good within the context of Great Britain. As discussed above, financial constraints are known to impact on the degree completion rate.

2.4.1 Tuition fees and higher education participation in Scotland

Current literature provides an understanding of higher education participation in relation to an introduction or change in tuition fees. With the exception of a study by Sá (2014) which uses applications to higher education data, studies do not analyse the impact of the abolition of tuition fees on participation rates. According to the literature, many countries have introduced tuition fees as a government response to increased budgetary constraints and increased demand for places at higher education institutions. While this is true for a number of countries, limitations exist within the current literature in relation to the impact of the abolition of tuition fees on higher education participation.

Scotland provides a unique case whereby tuition fees for first degrees were introduced in the academic year 1998/99. The tuition fees were abolished in 2000 and replaced with a Graduate Endowment fee in 2001. The Graduate Endowment fee was abolished in 2007 and since then, Scottish and EU domiciled students do not pay for tuition or a fee to study first degrees at higher education institutions in Scotland.

In this study we employ empirical analysis to focus on higher education participation at Scottish higher education institutions for Scottish undergraduates for the period 1994 – 2013. While this study analyses the same policy change as Sá (2014), many differences exist in the analyses. This study uses enrolment data while the study by Sá (2014) uses applications data. Distinct differences are thus apparent between the present study and the previous study by Sá as applications may not translate to enrolments in higher education. Thus, a contribution of the present study is the analysis presented in regards to enrolments in higher education. Data were obtained from the Higher Education Statistics Agency (HESA) using Higher Education Information Database for Institutions (heidi) for the number of individuals entering full-time undergraduate study by age and subject area studied.

The number of entrants by age will then be used to determine the Age Participation Index (API) whereby the proportion of young people aged 17-20 in Scotland entering full-time higher education will be calculated using enrolment data from HESA and population data from the National Records of Scotland. API data will be used as a proxy for participation in higher education. API data will identify whether the proportion of those aged 17-20 in Scotland entering higher education has increased or decreased. Participation and population data will also be collected for England/Wales from HESA and the Office for National Statistics and grouped together in order to make a comparison.

A difference-in-differences methodology is adopted to identify the impact of tuition fees on higher education participation while controlling for the impact that other variables may have on participation. This will isolate the effect of tuition fees on higher education participation by determining whether the abolition of tuition fees in Scotland has had an impact on the API and whether the API in England/Wales has been affected by the introduction of tuition fees. The identifying assumption of the difference-in-differences is that the trends in the API would have been the same in both England/Wales and Scotland had the abolition of tuition fees not occurred in Scotland.

The study will be conducted by subject area to identify trends, to show whether demand for specific subject areas has changed with respect to tuition fees. This approach was selected as Scotland, England/Wales form part of the United Kingdom and therefore are within the same country, it is thus plausible that other factors are identical/similar across regions.

Moreover, other aspects that have the potential to influence participation in higher education across the regions are likely to be different. Difference-in-differences estimations will thus be used to fit regression models that are based on equations.

The difference-in-differences method will therefore be used to compare the changes in participation over the time period between Scotland and England/Wales, where Scotland will be used as the treatment group and England/Wales will be the comparison group (Gertler, Martinez, Premand, Rawlings and Vermeersch, 2011). The justification for such a method is due to the notion that analysing the participation rates across Scotland and England/Wales for the impact of tuition fees will not identify the causal impact of tuition fees as there are many factors which are similar across the UK other than tuition fees that are believed to influence participation. Thus, the difference in the before and after outcomes of tuition fees in Scotland will be analysed to establish the first difference. In order to control for factors that are constant over time, it is necessary to ascertain the before and after outcomes for England/Wales since they did not experience abolition of tuition fees. This study will be based under the assumption that environmental factors are the same across Scotland and England/Wales and thus can be established as the second difference.

The results obtained from this analysis have implications for policies relating to tuition fees across countries. Typically, previous studies have highlighted the negative impact of increasing tuition fees on higher education participation. This analysis highlights the effects of removing tuition fees and controls for tuition fees imposed in neighbouring countries within Great Britain.

2.4.2 Higher education in Scotland

There are currently 19 higher education institutions in Scotland, a large proportion of which are situated in main cities for accessible learning. Scotland's population is concentrated in the Central Belt (Glasgow, Ayrshire, Falkirk, Edinburgh, Lothian and Fife, with over 50% of the population residing in these areas (House of Commons Scottish Affairs Committee, 2016). The wider Glasgow area is home to seven higher education institutions. The Scottish higher education market has more leading universities per head of the population than the rest of the world, with the exception of Luxembourg (Audit Scotland, 2016, calculations are based on The Times Higher Education World University Rankings 2015-16 and population statistics obtained from the Office for National Statistics).

All higher education institutions are currently funded by the Scottish Government through the Scottish Funding Council (SFC) (Scottish Government, 2015). The Scottish education system is distinct from that of the rest of the UK. There are two main differences: the first is that a university degree takes four years to complete in Scotland and only three years in England (ordinarily, English students spend one year more at secondary school before entering higher education); the second is that Scottish domiciled and EU students do not currently pay tuition fees when studying in Scotland, as mentioned above.

Prior to the 1990s, higher education tuition fees in the UK, including Scotland, were not levied on individuals who participated in higher education. In 1998, however, the Teacher and Higher Education Act 1998 introduced up-front tuition fees for higher education degrees and introduced maintenance loans to replace maintenance grants. Tuition fees in England and Wales stood at £1,000 per year when they were introduced in 1998, and as previously mentioned, increased to a maximum of £3,000 per year in 2004. Upfront tuition fees were abolished in Scotland in 2000.

In 2001, a Graduate Endowment Fee was introduced in Scotland whereby Scottish and EU domiciled students studying at Scottish higher education institutions who had completed three or more years of higher education were required to pay around £2,000 approximately 10 months after completion of their degree (Scottish Government, 2007)[4]. The rationale for this stemmed from the notion that individuals would gain from participation in higher education and should thus pay the fee in acknowledgement of the benefits they received. Table 2.1 shows the Graduate Endowment Fee from when it was first introduced in 2001, to when it was abolished in 2007.

Table 2.1: Graduate Endowment Fee

Academic year student enters higher education	Amount payable (£)
2001/02	2,000
2002/03	2,030
2003/04	2,092
2004/05	2,154
2005/06	2,216
2006/07	2,289

Source: Scottish Government (2007). *Notes*: Table shows the Graduate Endowment Fee and amount payable by year of entry. The Graduate Endowment Fee was introduced in 2001 and abolished in 2007. The fee was payable upon graduation.

[4] Some students were exempt from payment of the Graduate Endowment fee, including lone parents, mature students and those receiving disability allowance (Scottish Parliament, 2000).

In 2004, the UK government introduced the Higher Education Act 2004 whereby the upfront tuition fees imposed in England, Wales and Northern Ireland were replaced with deferrable tuition fees (income contingent fees) from the academic year 2006/07. The tuition fee amount increased to up to £3,000 for students in the UK excluding Scotland (Briggs, 2006).

In 2007 the Graduate Endowment Fee was abolished and Scottish and EU domiciled students were no longer required to pay any fee for participating in higher education in Scotland. The rationale for abolishing the Fee was due to the fact that a financial burden was experienced when graduates entered the labour market as they were required to pay the Fee. Students wishing to enrol in higher education institutions in Scotland who were Scottish or EU-domiciled were able to apply to the Student Awards Agency for Scotland (SAAS), an agency of the Scottish Government, for their tuition to be paid. They would therefore incur no direct costs in the form of tuition fees. Tuition fees paid by the Scottish Government for Scottish and EU domiciled undergraduate degrees are approximately £1,820 per year. Tuition fees were levied on students from other parts of the UK studying in Scotland.

Meanwhile in England and Wales, fees were increased to up to £9,000 per year effective from 2012. This subsequently led to universities in Scotland being able to increase tuition fees for students coming from England, Wales and Northern Ireland to study in Scotland. Students from the rest of the United Kingdom can pay up to £9,000 per year in tuition for an undergraduate degree while those not from the EU can pay between £8,880 and £47,200 (Audit Scotland, 2016).

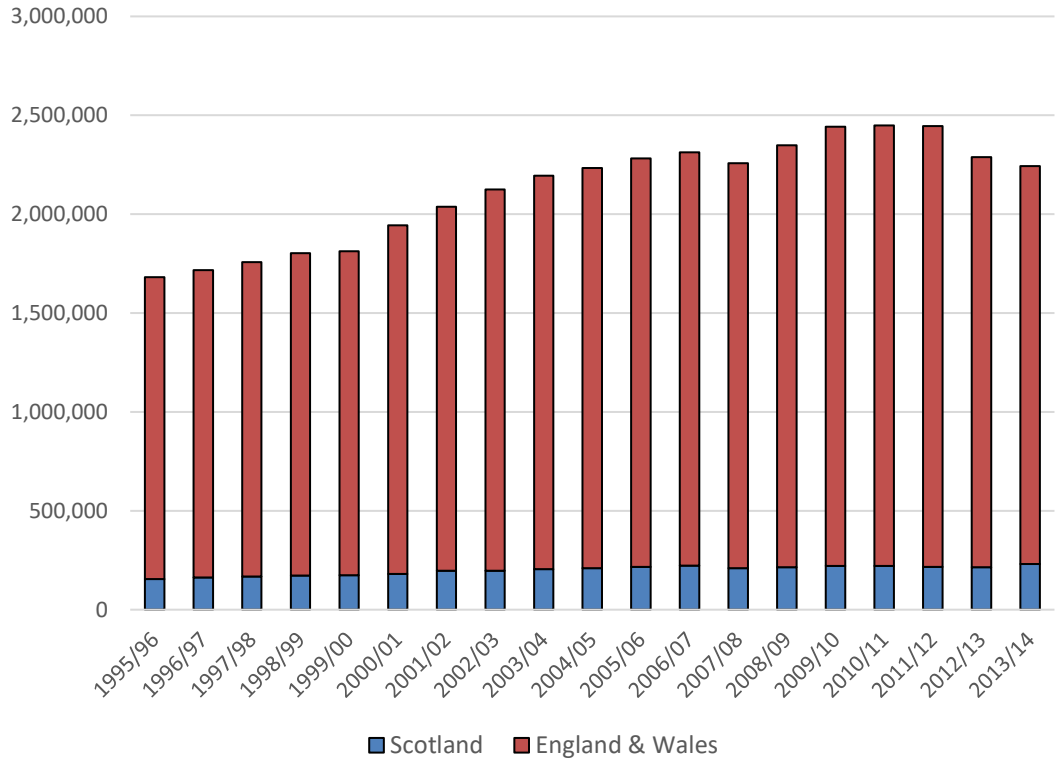
2.4.3 Summary statistics

Figure 2.3 shows the number of individuals in higher education in Scotland and England/Wales (combined) from academic years 1995/96 to 2013/14. Between 1995/96 and 2013/14, the number of individuals participating in higher education has increased by 33%. Whereas Scotland had the largest increase of 49%, England/Wales witnessed an increase of 32% in the number of students in higher education.

The total number of individuals in higher education (between undergraduate and postgraduate degrees) has decreased by 10% between 2011/12 and 2013/14 in

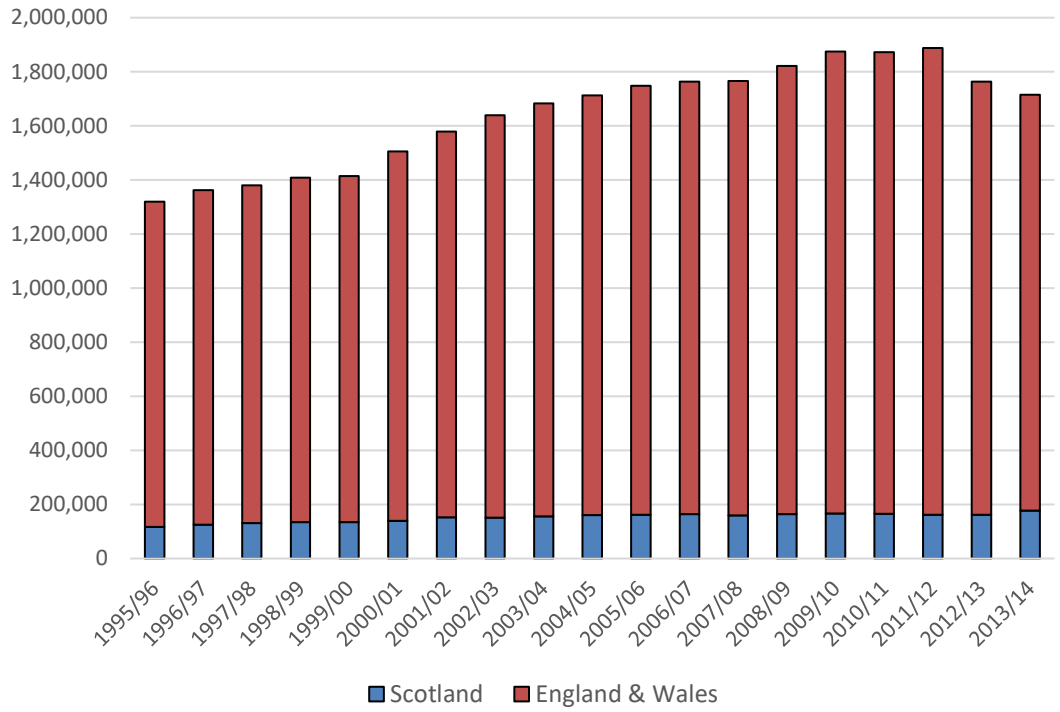
England/Wales; while it increasing by 7% in Scotland over the same period. Notably, however, some differences are apparent when students are separated into undergraduates and postgraduates. The decrease in England/Wales can be attributed to the number of undergraduate students, rather than postgraduate students. Since 2011/12, the number of undergraduate students in England/Wale has decreased by over 10% (Figure 2.4 below). Scotland's undergraduate population has increased by 9% over the same period. It is plausible that the decrease in England/Wales from 2012/13 can be attributed to the increase in tuition fees which took effect in 2012/13. The justification from this stems from the notion that a number of students, who potentially may have deferred entry to higher education, decided to enter one year earlier, in 2011/12, to offset the increase in tuition.

Figure 2.3: Number of Students in Higher Education (Postgraduate and Undergraduate), 1995/96 - 2013/14



Source: HESA (2015). *Notes*: Figure reports number of students in higher education (postgraduate and undergraduate) for the period 1995/96 to 2013/14.

Figure 2.4: Number of Undergraduate Students, 1995/96 – 2013/14



Source: HESA (2015). *Notes*: Figure reports number of undergraduate students in higher education for the period 1995/96 to 2013/14.

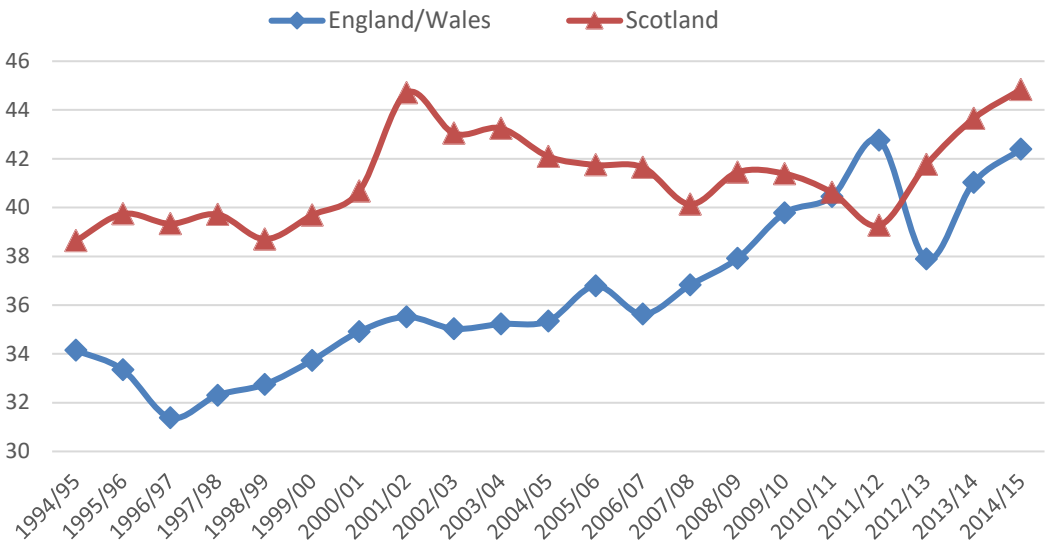
In 1995/96, UK domiciled students accounted for 92% of all undergraduate students in England/Wales and Scotland. In 2013/14, this decreased to 87% in England and Wales and 85% in Scotland. Scotland has a higher proportion of EU-domiciled students than England and Wales. Conversely, the proportion of non-EU domiciled students is greater in England and Wales than Scotland.

An Age Participation Index (API) has been developed in order to establish the proportion of individuals entering higher education. The number of individuals within their first year of undergraduate study aged 20 years and under is expressed as a proportion of the population of 17 year olds. This allows for comparisons in participation across countries. The sample is restricted to individuals who enrol in university to take a Bachelor's undergraduate degree.

Figure 2.5 below shows the API for Scotland and England/Wales between 1994/95 and 2013/14. An examination of the API shows Scotland has consistently had a higher proportion of individuals entering higher education than England/Wales since 1994 with the exception of 2011 (the year prior to fees significantly increasing, as discussed above).

The API for Scotland increased by 10% in the year following the abolition of tuition, consistent with the notion that tuition fees are related to participation rates. Prior to 2000, the API followed a similar time trend across Scotland and England/Wales, particularly between 1998/99 and 1999/2000.

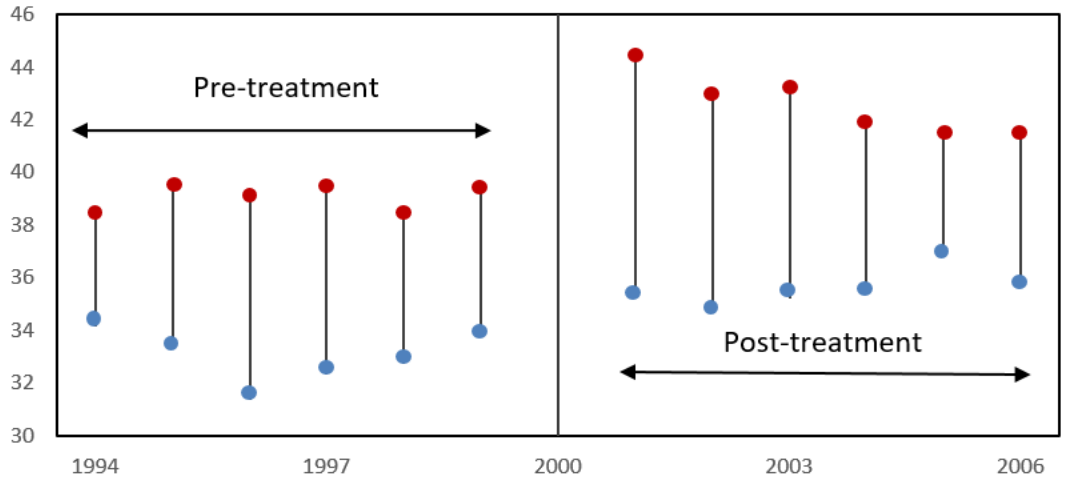
Figure 2.5: Age Participation Index aged 20 and under



Source: HESA and ONS (2016). *Notes:* Figure reports the Age Participation indices for England/Wales (shown in blue) and Scotland (shown in red) for those aged 20 and under. The Age Participation Index is calculated using the number of entrants aged 20 and under to higher education institutions divided by the population aged 17 in a given year.

Isolating the years either side of the policy intervention is shown graphically in Figure 2.6 below. Each line in the chart represents the range of the API whereby the top illustrates the API in Scotland (represented in red) and the bottom of the line shows the API in England/Wales (represented in blue). From this chart, it is apparent the API increased in Scotland and England/Wales following the abolition of tuition in Scotland. The magnitude of the increase was more pronounced in Scotland, particularly between the years immediately prior to and following the abolition (1999/00 and 2001/02 respectively).

Figure 2.6: API Pre-and Post-Tuition Fees in Scotland (Scotland vs England/Wales)



Notes: Figure reports the Age Participation indices for England/Wales (shown in blue) and Scotland (shown in red) for those aged 20 and under. The Age Participation Index is calculated using the number of entrants aged 20 and under to higher education institutions and is divided by the population aged 17 in a given year. This figure isolates the pre-treatment and post-treatment periods.

2.5 Empirical model

This paper aims to establish the effect of the abolition of tuition fees on higher education enrolment in Scotland. The relationship between a policy change and its subsequent effect can be evaluated by assessing the pre and post outcomes. This method involves comparing the outcomes post policy to the situation before the policy was implemented. Given that enrolment in higher education may be affected by factors not relating to tuition fees, it is necessary to control for secular trends not relating to tuition fees to isolate the effects of abolishing tuition fees. This is particularly important given the policy implications that can emerge in light of such a study.

Given the foregoing, a difference-in-differences method is adopted as the empirical approach. The difference-in-differences method addresses the requirements outlined above. The causal effect of the policy can be addressed by using a control group who did not experience the abolition of tuition fees, thus eliminating differences in the outcome which are not attributed to the abolition of tuition fees. The difference-in-differences estimator takes the average change in the outcome for a treatment group and subtracts the average change in the outcome for the control group over the same time (Stock and Watson, 2007). This approach eliminates potential biases in comparisons over time that are caused by trends

in factors unrelated to tuition fees and controls for secular trends not relating to tuition fees (Imbens and Wooldridge, 2009).

Applying the difference-in-differences method to the study of concern, the abolition of tuition fees in Scotland will be assessed using Scotland as the treatment group and England/Wales as the control group. England/Wales serves as an appropriate control group given that tuition fees were still in place when tuition fees were abolished in Scotland. Moreover, tuition fee policies were similar across Scotland and England/Wales prior to the abolition of tuition fees in Scotland. Many similarities also exists between these countries in terms of the economic environment.

Given that tuition fees were abolished only in Scotland, two time periods have been established; 1998-99 (pre-abolition) and 2001-02 (post-abolition). Within the first period, i.e. when Scotland did not differ in terms of tuition with respect to England/Wales, no treatment is required. During the second period, Scotland's tuition fees differs from England/Wales, thus the data are exposed to treatment during this period. The average gain within the second period is subtracted from the average gain in the first period in order to omit biases in the second period and can be written in the form:

$$\widehat{\delta_{DD}} = \widehat{Y_1^T} - \widehat{Y_0^T} - (\widehat{Y_1^C} - \widehat{Y_0^C}) \qquad (2.6)$$

Equation (2.6) denotes the difference-in-differences methodology approach ($\widehat{\delta_{DD}}$) where T denotes the treatment variable (Scotland) and C is the control variable (England/Wales). $\widehat{Y_1^T}$ and $\widehat{Y_0^T}$ denote the outcomes for Scotland's API at periods 1 and 0 respectively, where time period 1 is exposed to the policy change in the abolition of tuition fees and time period 0 is prior to the abolition of tuition fees. $\widehat{Y_1^C}$ and $\widehat{Y_0^C}$ denote the API for England and Wales at period 1 (no tuition fees in Scotland) and period 0 (tuition fees in Scotland) respectively. The difference between period 1 and 0 for the control group for England/Wales ($\widehat{Y_1^C} - \widehat{Y_0^C}$) is subtracted from the difference between the treatment group for Scotland ($\widehat{Y_1^T} - \widehat{Y_0^T}$) to establish the estimated effect of the abolition of tuition fees on the API in Scotland. A summary of descriptive statistics is contained within Table 2.2 below.

2.5.1 Estimation results and discussion

Table 2.2 shows the differences in the average enrolment rates for Scotland and England/Wales between the pre-abolition of tuition fees in Scotland in 1998-1999 and the post-abolition in 2001-2002. The third column presents the two differences that have been differenced to provide the difference-in-differences analysis. The results shows the implied effect of the abolition of tuition in Scotland which is estimated to be an increase in the API of 2.64 in Scotland (when other differences have been netted out). This equals an increase of approximately 6.7% when compared to the 1999 API in Scotland.

Table 2.2: Descriptive Statistics Difference-in-Differences estimates of Age Participation Index in Scotland and England/Wales

Scotland	Δ API
Mean	4.675
Median	4.675
Minimum	4.339
Maximum	5.012
Std. Dev.	0.47643
C.V.	0.009054

England/ Wales	Δ API
Mean	2.033
Median	2.033
Minimum	2.28
Maximum	1.784
Std. Dev.	-0.35075
C.V.	-0.01115

	Δ Δ API
Mean	2.642
Median	2.642
Minimum	2.059
Maximum	3.228
Std. Dev.	0.82718
C.V.	0.020201

Notes: Table reports the descriptive statistics for the difference-in-differences estimator for the Age Participation Index for those aged 20 and under. The first column shows the difference in the API between the pre-and post-treatment period for Scotland, the second column shows the difference for England/Wales and the third column reports the difference-in-differences descriptive statistics.

In order to test the robustness of the results, it is necessary to establish whether the findings hold for longer periods of time. Similar tests were conducted whereby periods greater than two years were used. Appendix A shows descriptive statistics for difference-in-differences of the API for periods ranging from three to six years. In all cases, the difference-in-differences had positive results.

To test the significance and robustness, OLS regressions were run to provide standard errors for the analysis. To allow for heteroskedasticity, robust standard errors were obtained. Given the fact that the model uses aggregate data for the pre and post periods, and the policy occurs only once, robust standard errors are sufficient for the models (thus we do not need to use clustered standard errors as stated by Bertrand, Duflo and Mullainathan (2004).

The following equation (2.7) was used to run the OLS regression:

$$API_{it} = \beta_o + \beta_1 Scotland_{it} + \beta_2 NoFees_{it} + \beta_3 (ScotlandNoFees)_{it} + \varepsilon_{it} \quad (2.7)$$

where API_{it} is the Age Participation Index in country i at time t, $Scotland_{it}$ denotes if the observation is in the treatment group (represented by a dummy variable), and $NoFees_{it}$ is used as a post treatment dummy. Differencing the API across both countries and time gives $\beta_3 (Scotland * NoFees)_{it}$. ε_{it} denotes the idiosyncratic error to represent unobserved factors that vary over time and affect API_{it}. β_3 is the average treatment effect on Scotland's API and can be formally represented by:

$$(E[API_{it}|Scotland_{it} = 1, NoFees_{it} = 1] - E[API_{it}|Scotland_{it} = 1, NoFees_{it} = 0]) -$$

$$(E[API_{it}|Scotland_{it} = 0, NoFees_{it} = 1] - E[API_{it}|Scotland_{it} = 0, NoFees_{it} = 0] = \beta_3$$

The interpretation of $\beta_3$is based on the assumption that factors unrelated to the abolition of tuition fees do not affect the API in the control and treatment groups differently. Figure 2.6 showed trends in the API across Scotland and England/Wales were similar prior to the abolition of tuition fees in 2000. This therefore warrants the belief that the API in Scotland and England/Wales would have followed a similar pattern had tuition fees not be abolished in Scotland.

The results from the models are shown in Table 2.3 below. The regression results show the coefficients and significance for the parameter of interest, ScotlandNoFees, which is the difference-in-differences estimator. Model (1) shows the results for the effects immediately surrounding the policy change (1998-99 as the pre-treatment period and 2001-02 as the post-treatment period). From the results, it is evident that abolishing tuition fees in Scotland had an impact on the API in the years immediately after the abolition. The estimated treatment effect is 2.64, and is significant, revealing the API increased following the abolition of tuition in Scotland.

Further models were estimated, to complement and test the robustness of the descriptive statistics of the difference-in-differences models. Model 1 and 2 show significance for the difference-in-differences estimator, while the results from model 3, 4 and 5 are not significant. This shows the effects of the policy were more pronounced until approximately three years after the removal of tuition fees and subsequently the effect diminished as time

passed. This implies there was no long-run impact in abolishing tuition fees. It is also interesting to note the size of the coefficient reduces from 2.64 in model 1 to 1.96 in model 2. This implies the effect of abolition of tuition fees was greatest in the years immediately after tuition fees were abolished.

Table 2.3: Effects of tuition fee abolition on higher education enrolment, OLS regression estimates

	(1)	(2)	(3)	(4)	(5)
	1998-99 - 2001-02	1997-99- 2001-03	1996-99 - 2001-04	1995-99 - 2001-05	1994-99 - 2001-06
Intercept	33.239***	32.54***	32.927***	32.7***	32.942***
	(0.491)	(0.488)	(0.422)	(0.411)	(0.485)
NoFees	2.033***	2.738***	2.329***	2.879***	2.646***
	(0.547)	(0.499)	(0.491)	(0.515)	(0.485)
Scotland	5.955***	6.442***	6.819***	6.735***	6.36***
	(0.694)	(0.536)	(0.542)	(0.456)	(0.463)
ScotlandNoFees	2.643**	1.964**	1.171	0.649	0.797
	(1.106)	(0.761)	(0.771)	(0.756)	(0.711)

Notes: Table reports the regression output for the difference-in differences estimates for those aged 20 and under. Robust standard errors in parentheses. The coefficients for the variable ScotlandNoFees shows the difference-in-differences estimate. Column 1 reports the coefficient estimates for the immediate pre-and post-treatment period (1998-99 - 2001-02) and column 5 presents the longest pre-and post-treatment period (1994-99 - 2001-06). Robust standard errors in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Model diagnostics, in the form of F Tests were calculated for each regression above. The below table shows the F Test results for each of the models. According to the F Tests, we can reject the null hypothesis that the coefficients in the models are equal to zero in favour of the alternative hypothesis that the variables hold some explanatory power for each of the time periods tested.

It is interesting to note however that the regression output (above) shows significant explanatory power for the variable ScotlandNoFees, which is the variable of interest for models (1) and (2) for time periods 1998-1999 to 2001-2002 and 1997-1999 to 2001-2003. The variable's significance, however, stops in model (3), with the longer period of time at either side of the policy change on tuition. The variable ScotlandNoFees becomes

insignificant from models (3) to (5), demonstrating the abolition of fees had the largest implications for participation up to three years after tuition was abolished.

Table 2.4: F Test Results

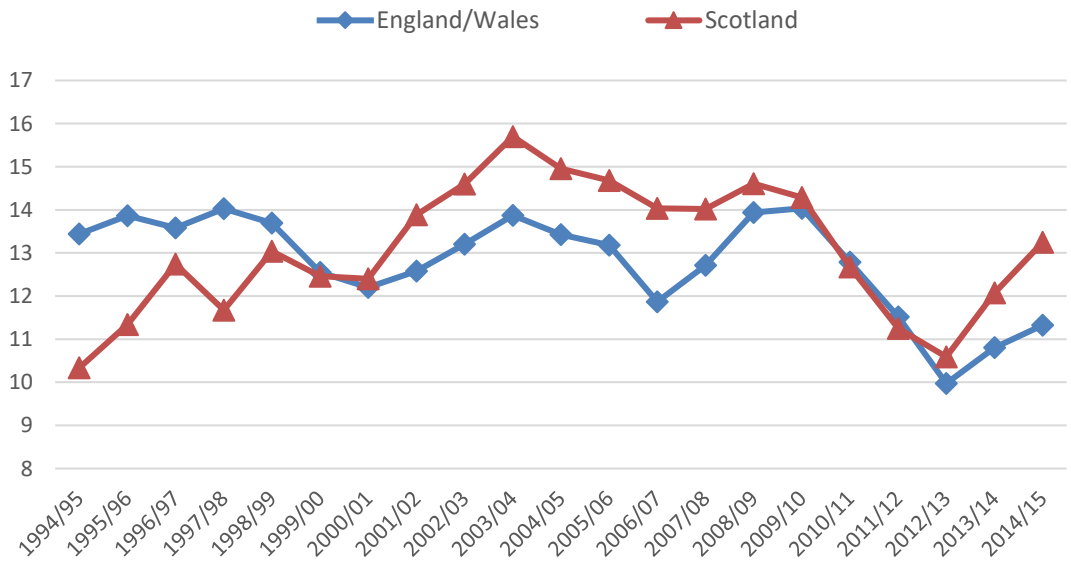
	(1)	(2)	(3)	(4)	(5)
	1998-99 - 2001-02	1997-99 - 2001-03	1996-99 - 2001-04	1995-99 - 2001-05	1994-99 - 2001-06
F Test	57.88	133.3	162.12	124.06	124.18
Prob>F	0.0009	0.0000	0.0000	0.0000	0.0000

Notes: Table reports the F Test results for the difference-in-differences models presented in Table 2.3.

Aged 21 and over analysis

Similar tests were conducted for those aged 21 and above. The rationale for this is to establish whether tuition fees impact participation only for those classified within the API for those aged 17 to 20, or whether the effects are apparent across all ages. An API was calculated for those aged 21 and over, using the population of those aged 21 as the denominator, the justification for this came from the fact that the largest proportion of participants fell into the age group 21-24. Figure 2.7 shows the API for those aged 21 and over.

Figure 2.7: Age Participation Index aged 21 and over



Source: HESA and ONS (2016). *Notes:* Figure reports the Age Participation indices for England/Wales (shown in blue) and Scotland (shown in red) for those 21 and over. The Age Participation Index is calculated using the

number of entrants aged 21 and over to higher education institutions divided by the population aged 21 in a given year.

It is apparent that the trends relevant to those aged 20 and under do not hold for those aged 21 and above. The chart shows the API in Scotland was lower than the England/Wales API until the abolition of tuition fees in 2000/01. The API in Scotland then outperformed that in England/Wales from 2001/02 until 2009/10 and was moderately lower in 2010/11 and 2011/12. The API in Scotland has since increased beyond the England/Wales API from 2012/13. It is also interesting to note the sharp decrease in the aged 21 and over API between 2009/10 and 2012/13 across Scotland and England/Wales which occurred during the economic downturn.

Appendix B shows descriptive statistics for difference-in-differences in the API for those aged 21 and over for periods ranging from one to six years. In all cases, the difference-in-differences had positive results. The most pronounced difference-in-differences occurs within the last time period used in the study, 1994-1999 to 2001-2006, compared to the difference-in-differences for those aged under 21 whereby the largest difference occurs in the shortest time period 1998-1999 to 2001-2002. It is well documented mature students have different behaviours when compared to those entering higher education following secondary school (Osborne, Marks and Turner, 2004).

OLS regressions were run to assess the significance of the model. The results from the regressions are shown in Table 2.5. The results show positive results for the difference-in-differences estimator across all models, however the F test results for model 1 means we cannot reject the null hypothesis that the coefficients in the model are equal to zero. The other models produce F statistics where we can indeed reject the null. Models 2 to 5 demonstrate that the abolition of tuition fees in Scotland positively affected enrolment probabilities for those aged 21 and over.

The results are particularly insightful when we compare the results across models. Indeed, the models for those aged 17 to 20 showed decreasing magnitudes of the effect, the further away from the treatment period. The models for those aged 21 and over, however, show the magnitudes increasing, implying the abolition effect was most pronounced up to six years after the abolition took place. This points to the notion that mature students do have different behaviours with respect to enrolling in higher education.

Table 2.5: Effects of tuition fee abolition on higher education enrolment, aged 21 and over, OLS regression estimates

	(1)	(2)	(3)	(4)	(5)
	1998-99 - 2001-02	1997-99- 2001-03	1996-99 - 2001-04	1995-99 - 2001-05	1994-99 - 2001-06
Intercept	13.121***	13.422***	13.463***	13.542***	13.526***
	(0.573)	(0.447)	(0.318)	(0.259)	(0.213)
NoFees	-0.231	-0.206	-0.194	-0.292***	-0.506***
	(0.652)	(0.582)	(0.573)	(0.333)	(0.357)
Scotland	-0.369	-1.029**	-0.983***	-1.291***	-1.594***
	(0.641)	(0.597)	(0.318)	(0.414)	(0.465)
ScotlandNoFees	1.724*	2.543**	2.501***	2.806***	3.218***
	(0.797)	(0.879)	(0.634)	(0.548)	(0.609)

Notes: Table reports the regression output for the difference-in differences estimates for those aged 21 and over. Robust standard errors in parentheses. The coefficients for the variable ScotlandNoFees shows the difference-in-differences estimate. Column 1 reports the coefficient estimates for the immediate pre-and post-treatment period (1998-99 - 2001-02) and column 5 presents the longest pre-and post-treatment period (1994-99 - 2001-06). Robust standard errors in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 2.6: F Test results, aged 21 and over

	(1)	(2)	(3)	(4)	(5)
	1998-99 - 2001-02	1997-99 - 2001-03	1996-99 - 2001-04	1995-99 - 2001-05	1994-99 - 2001-06
F Test	4.000	4.24	7.86	11.7	11.77
Prob>F	0.1067	0.0450	0.0040	0.0003	0.0001

Notes: Table reports the F Test results for the difference-in-differences models presented in Table 2.5.

2.5.2 Tuition fees and participation by subject area

As mentioned within the literature review, labour market outcomes of individuals vary by subject studied. Reimer, Noelke and Kucel (2008) argue that individuals with higher ability will apply for courses in which they can receive the higher returns, in other words, avoiding humanities and other "soft field" subjects. "Soft fields", according to Reimer et al, generates a lower "signal value" to potential employers than, for example, STEM subjects. Thus, Reimer et al (2008) believe that as access has widened in higher education participation, so too has ability. Consequently, students who are at the lower end of the ability spectrum tend to fall into "soft fields".

According to Van de Werfhorst, Sullivan and Cheung (2003), family background has a notable impact on subject choice in both secondary and higher education in the UK. Their study finds that those who are from higher socio-economic backgrounds are more inclined to choose "prestigious subjects", such as medicine and law. This was the only prominent class and subject relation in their findings. Moreover, the study draws particular attention to that fact that they do not find a dominant social class in terms of those studying engineering, something they state would perhaps be expected in those from a working class background. The rationale for this speculation stems from the notion that skills obtained from studying such a field are particularly useful in the labour market. It can also perhaps be attributed to the fact that engineering has a large manual element to it, thus identifying it with blue rather than white collar employment, which also might increase the class perception of the subject. It is worth noting that the Van de Werfhorst et al (2003) study used data from the 1958 British birth cohort and thus more recent data may provide different results.

In order to study the above in relation to Scotland**,** similar difference-in-differences studies were employed for 18 subject areas. Data were obtained from HESA for the period 1998 to 2013. Given tuition fees were abolished in 2000 in Scotland, the two years prior to and following the change were analysed (1998-1999 and 2001-2002). Subject definitions were in line with HESA's official subject classifications, JACS 3.0 (HESA, 2012). An Age Participation Index was developed for those aged 17 to 20 years old. The aim of this model is to provide a deeper understanding of the impact of abolishing tuition fees. In other words, this study sets out to analyse whether demand for a specific subject area increased as a result of tuition becoming free in Scotland.

Results for the first study are found in Table 2.7. Robustness tests were estimated with respect to the data in the form of t-tests for the highlighted subjects which were positively impacted by the abolition of tuition fees in Scotland. Subject choices with significant and insignificant t-test results are shown in Table 2.7.

Table 2.7: Difference-in-Differences estimates of Age Participation Index in Scotland and England/Wales by JACS Subject Area (aged 20 and under)

	Mean	Standard Deviation	Critical Value	T-statistic	
Engineering & technology	0.71	0.02	-0.03	7.14	*
Social studies	0.66	0.04	-0.01	3.92	
Business & administrative studies	0.53	-0.02	-0.02	5.35	*
Biological sciences	0.50	0.12	-0.03	1.09	
Computer science	0.30	0.11	0.03	2.83	
Education	0.29	-0.24	0.03	1.57	
Mathematical sciences	0.20	0.00	0.00	19.95	**
Physical sciences	0.20	0.12	0.05	1.96	
Languages	0.17	0.04	0.05	0.56	
Medicine & dentistry	0.14	-0.01	-0.03	9.41	*
Architecture, building & planning	0.05	0.01	0.00	7.07	*
Historical & philosophical studies	0.05	-0.02	0.00	0.21	
Law	0.00	0.05	0.05	0.03	
Agriculture & related subjects	0.00	0.02	0.02	0.05	
Veterinary science	-0.02	-0.01	-0.03	-9.18	*
Mass communications & documentation	-0.15	-0.15	-0.08	-2.07	
Subjects allied to medicine	-0.24	-0.04	-0.01	-14.95	**
Creative arts & design	-0.27	0.09	0.06	-1.74	

Notes: Table reports difference-in-differences estimates of the Age Participation Index for those aged 20 and under by subject area studied. The column entitled 'Mean' shows the coefficient of the difference-in-differences estimate. * $p < .10$; ** $p < .05$; *** $p < .01$ (two-tail test)

It is apparent from the difference-in-differences analysis above that some subjects have seen a significant increase in participation following the abolition of tuition fees, these are highlighted in the table. The most notable variables with statistical significance in terms of the t-statistics are engineering and technology and business and administrative studies whereby the apparent difference-in-differences between Scotland and England and Wales in API following the abolition of tuition fees are 0.71 and 0.53 respectively.

It is interesting to note that abolishing tuition fees has not impacted law, a subject which is believed to attract those from higher socio-economic backgrounds, as stated in Van de Werfhorst et al's 2003 paper. Indeed, it is plausible that law is oversubscribed. Moreover, given the growing prominence and demand for degrees in STEM (science, technology, engineering and mathematics) subjects, the results in the above are welcomed in terms of

support against “useless degree” uptake (Beblavy, Lehouelleur and Maselli, 2013). Rather, the results show support in the uptake of “hard” subjects (Beblavy et al, 2013, p.2). This is consistent with the notion that abolishing tuition has an impact in addressing the shortages and requirements deemed necessary by the Scottish Government given the growing demand in STEM sectors of the Scottish economy. Indeed, from a policy perspective, the example of Scotland shows abolishing tuition fees has produced an efficient outcome, in terms of addressing specific subject area shortages, thus adhering to the policy recommendations from Biffl et al (2002).

Notwithstanding the notion that the majority of subjects have witnessed an increase in participation, some subject areas have seen a decrease in participation following the abolition of tuition fees. The most notable is creative arts and design which had a 0.27 reduction in the API according to the difference-in-differences analysis in the above table, however this result was statistically insignificant. This was followed by subjects allied to medicine and mass communication and documentation. With the exception of subjects allied to medicine, the subjects that have seen a reduction following the abolition of participation are perceived to be subjects which fall into the “useless degree” subjects (Beblavy, Lehouelleur and Maselli, 2013).

Although we do not have economic background information for the individuals in this study, we can assume that at least some of the increase in participation in higher education has come from those from lower socio-economic background given the notion that engineering and social sciences have increased (based on the notion that previous studies have linked these subject areas with particular socio-economic backgrounds). Moreover, subjects such as law have not received an increase in participation following the abolition of tuition fees which corresponds to the notion that those from lower socio-economic backgrounds have benefitted from the abolition of tuition fees in Scotland.

In line with Biffl and Isaac (2002), this study does not provide an impetus for free tuition, particularly to encourage those from lower socio-economic backgrounds to enter higher education. Instead, it can be argued that free tuition stimulates better access opportunities but it is by no means considered the best solution given increased government budgetary constraints.

2.5.3 Limitations

The model presented in this paper shows that the abolition of tuition fees has significantly increased enrolment in undergraduate higher education degrees in Scotland. One limitation of the study is that it does not incorporate the number of places available at higher education institutions and therefore assumes supply has remained relatively constant across the period of study. One explanation for the results presented in this study is that there has been an increase in supply of university places while demand has in fact remained constant. By assuming supply has remained constant we have eliminated that as a potential explanation for the increase in participation in higher education in Scotland. In consequence this model has attributed that increase solely to an increase in demand.

Data on the supply of places at higher education institutions are unavailable for Scotland. The Scottish Funding Council (SFC) is responsible for providing funding to the institutions. There are few restrictions [5] and, ultimately the institution is free to use this funding strategically given there are few constraints to the number of undergraduate places they offers, subject to capacity and teaching constraints. The number of places available is thus determined by the individual institutions.

One potential factor to consider here is that an Audit Scotland report (2016) states the accessibility to higher education in Scotland for Scottish and EU students is becoming increasingly more difficult as demand has outweighed supply. It is therefore plausible that, if anything, the results from this study are somewhat underestimating the impact of the abolition of tuition fees. Furthermore, it may be the case the more individuals would have enrolled at higher education institutions had the number of places available been increased. The number of students eligible for funding decreased by 2% between 2012 and 2016 (Audit Scotland, 2016).

Additionally, to some extent this paper does not account for the fact that governments are facing increased budgetary constraints. Therefore the amount of funding devoted to higher education from the budget, could be used to fund other needs specific to Scotland. Nor, does it concern the impact of widening participation, a policy which has been very much embedded in the rationale for abolishing tuition fees in Scotland. It has been the consensus

[5] For example, the number of places in initial teacher training is controlled by the Scottish Government (Scottish Funding Council, 2017)

in previous literature that imposing free tuition does not remove barriers to entry and can indeed accentuate the gap between those from high and low socio-economic backgrounds. Indeed, the study conducted by Chapman (1997) for Australia found no distinct effects on the structure of entry by socio-economic background.

2.6 Conclusions

In the last two decades many countries have introduced or increased tuition fees in higher education as a result of increased budgetary constraints. This paper contributes to the empirical literature on the relationship between tuition fees and enrolment behaviours by analysing the effects of the abolition of tuition fees.

The analysis presented in the paper presents evidence that the abolition of tuition fees increases participation in higher education. A comparison of Scotland and England/Wales using a difference-in-differences methodology suggests that differences in higher education participation are related to differences in tuition fees. From a policy perspective, this is consistent with the Scottish Government's objective of removing barriers to entry to higher education (Scottish Government, 2013), and justifies the notion that abolishing tuition fees will increase participation. One must, however, consider the fact that a degree in Scotland takes four years to complete, while studying in England or Wales would reduce the degree term by one year to three year. This has implications in terms of the opportunity costs and indirect costs associated with higher education participation, particularly from the points of foregone earnings.

Participation analysis by subject area was conducted within the study. The findings suggest that, of the 18 subject areas, entry to engineering and technology fields have witnessed the largest increase following the abolition of tuition fees in Scotland. Other subjects showing a significance in terms of an increase in participation are business and administrative studies, mathematical sciences, medicine and dentistry and architecture, building and planning. Additionally, some subject show a decrease in participation, these are veterinary science and subjects allied to medicine. Moreover, the analysis of subject area points to the notion that abolishing tuition fees, has indeed had a positive impact in terms of where the increases in subject areas lie and do not fall into the "soft fields" category.

The results of the empirical model are consistent with the literature: students are price sensitive to enrolment in higher education. Thus, we can conclude that entry to higher education is price sensitive and participation rates can be manipulated by either the abolition or the imposition of tuition fees.

Chapter 3 Higher Education Enrolment by Gender

3.1 Introduction

Higher education has expanded significantly worldwide since the post-war period (Jacobs, 1996). Historically, female participation in higher education has been significantly lower than male participation (Broecke and Hamed, 2008). Indeed, historically it was also the case that males benefitted from greater opportunities in higher education (Sewell, 1971). The last two decades have witnessed significant changes in the participation in higher education by gender, with significantly larger proportions of entrants to higher education being female. It is now the case that females dominate entry to higher education in many countries, with 67 of 120 countries worldwide reporting higher female than male participation in higher education (Becker, Hubbard and Murphy, 2010).

This paper has two objectives. The first objective seeks to explore gender differences in higher education participation. The second objective is to assess female price response to higher education. The first part of the analysis will examine the fundamental reasons for the differences that have emerged in relation to participation by gender. Although being one of the most pertinent questions in higher education participation, this topic has received limited attention in literature, including in the context of Great Britain (Jacobs, 1996; Perna, 2005). However this topic has emerged as a fundamental theme in recent years (Buchmann et al, 2007). Scotland provides an example where, historically, male participation has been significantly higher than female participation. In recent decades, however, a puzzle has emerged whereby female participation in higher education has been significantly higher than male participation. The first part of this paper aims to investigate the reasons for these changes by assessing previous empirical studies coupled with a study unique to Scotland which predominantly focusses on female and male enrolments in higher education.

A number of studies argue that the increase in female participation cannot be attributed to an increase in benefits of study obtained by women when compared to men, particularly given the fact that females on average have lower income than males at all levels of education; it is instead believed to be associated with attitudes and behaviours possessed by women (Perna, 2005), coupled with the notion that females are motivated by increasing

labour market opportunities (Diprete and Buchmann, 2006). This study will investigate these aspects within the case of Scotland.

The second part of the analysis presented in this chapter will consider female price response to higher education. A number of studies have identified that females are more responsive than males to the price of higher education (see for example Mansfield and Warwick, 2006). This study specifically analyses the effect of a policy implemented in Scotland which removed the Graduate Endowment Fee in 2007. This study uses the share of female participants at higher education institutions in Scotland to establish whether female participation increased as a results of the fee being removed.

This chapter is organised as follows: Section 3.2 provides a literature review on gender differences in participation in higher education, Section 3.3 provides the motivation and expected contribution of this study, Section 3.4 presents the data analysis and models and Section 3.5 provides discussion of the results and conclusions.

3.2 Review of empirical studies

The section analyses previous empirical studies relating to gender differences in higher education participation. Previous empirical studies identify a number of key factors affecting males and females in higher education participation. The prominent factors identified in previous empirical studies are early years attainment, school workforce, non-cognitive skills, subject choice, the labour market and returns to education and marriage and divorces. This section will summarise previous empirical studies for each of these factors.

3.2.1 Early years attainment

In order to assess potential reasons for the increase in female participation in higher education among females, it is interesting to analyse literature relating to early year educational attainment. A vast literature exists depicting differences in early year's attainment by gender.

Human capital theory holds that the decision to enter higher education is regarded as an investment choice. The incentive of potential higher future earnings is believed to unequivocally influence an individual's decision to participate in higher education. In order

to enter higher education, it is necessary for individuals to have completed schooling to secondary level. Thus, entry to higher education is linked to the attainment in secondary education, and it is necessary for individuals to have met stipulated entry requirements which vary by institution (Buchmann, Diprete and McDaniel, 2007).

According to Perkins, Kleiner, Roey and Brown (2004), females earn higher scores than males in tests overall throughout their life prior to higher education. This is apparent in grade point average scores where female scores exceeded those attained by males between 1990 and 2000 in the U.S. This is consistent with Buchmann, DiPrete and McDaniel (2007) who find that females have higher reading ability than males which is apparent from pre-school years to secondary school.

A number of studies have found significant differences in abilities between males and females which are prevalent from early on in primary school. Among the most cited differences is the notion that males are more likely to experience reading difficulties, this is believed to be linked to the fact that males are more inclined to show antisocial behaviour (Trzesniewski, Moffitt and Caspi, 2006). A study by Long, Carpenter and Hayden (1999) attributes the increase in female participation to an increase in retention rates at school in post compulsory years among females.

A study conducted by the Department for Education and Skills (2007) with focus on England, finds a significant skills gap between males and females in English, whereby, females outperform males although with smaller gaps in Maths. However, the study highlights that despite the apparent differences by gender, socio-economic background has the largest effect on attainment. Nevertheless, the study provides some key explanations for the gender gap in early years' attainment. On the whole, attitudes towards schooling and approaches to learning are cited as the key factors contributing to the gender gap in early years of schooling where females outperform males. These studies agree that there are apparent differences in the ability and attitudes possessed by females and males from very early on in life, and the studies highlight that these factors have a subsequent effect on the future of the individuals.

3.2.2 School workforce

A number of previous studies have examined the effects of teacher's gender influence on the outcomes of pupils. Indeed, U.S. studies, such as Nixon and Robinson (1999) find a female's

educational attainment in school to be positively related to the percentage of female teachers in the school and conclude that female pupils are positively influenced by female teachers and consider them to be role models. A study by the Department for Education and Skills (2007) for England found female teachers have a significant and increasing higher presence in nursery and primary schools at around 84% in 2005. The proportion of male teachers in nursery and primary has significantly decreased. In 1970, twenty five percent of teachers were male compared to sixteen percent in 2005. The gender balance in secondary schools in England was found to be much more gender balanced. It is interesting to note that males outnumbered female teachers in secondary schools in England until 1993; now, female teachers slightly outnumber male teachers.

Many studies argue that the prominence of female teachers has led to an increase in females entering higher education, or rather, under participation of males in higher education due to underachievement and the absence of male role models in schools (see Tinklin, Croxford, Ducklin and Frame, 2001). As a result of this, policies have been implemented to increase the number of male teachers in schools, for example in England, Wales and Australia, there has been a drive to recruit more male teachers in the hope of enforcing a positive role-model for males pupils (Carrington and Skelton, 2003).

The study by Carrington and Skelton (2003) notes policies to implement more male 'role models' for male pupils lacks evidence to support the notion that assigning male teachers to male pupils improves the relative performance of males in schools. A more recent study by Carrington, Tymms and Merrell (2008) find similar results whereby the gender of a teacher has no influence on the attainment of the pupil. The study also found that females were no more likely to be influenced by female teachers than males were to be influenced by male teachers. The study did find, however, that pupil's attitudes to school were positively associated with having a female teacher (regardless of whether the pupil was male or female) but this had no bearing on attainment. These results are similar to a study conducted in Finland by Lahelma (2000) which found the dearth of male teachers unproblematic.

3.2.3 Non-cognitive skills

A growing development within the economics of education literature has been the importance of non-cognitive skills in supporting educational attainment and consequently

labour market outcomes. Non-cognitive skills are deemed as skills encompassing behavioural and social skills; otherwise referred to as soft skills. The gender disparity in non-cognitive skills, according to Becker et al (2010), is the fundamental explanation as to why more females than males participate in higher education. By using this measurement, their study draws on non-traditional expenses associated with participating in higher education. Females are believed to have higher non-cognitive skills than males and are thus better performing with regards to test scores during their schooling years.

Becker et al (2010) state that inequality in respect of non-cognitive ability is lower among females than males. This leads to the notion that elasticities in supply in terms of higher education is greater for females due to lower heterogeneity in higher education costs for them. Some studies, however, have found females are more price responsive than males to costs associated with higher education (see, for example, Wilkins, Shams and Huisman, 2013). Moreover, Becker et al conclude that, because of the aforementioned reasons, the supply of females in higher education is larger than males. Moreover, the study finds no ostensible evidence to support claims that the benefits from higher education are greater for females. Jacob (2002) studied both non-cognitive abilities, similar to Becker et al, and returns to higher education. Jacob (2002) notes that while the number of females entering white collar jobs, such as managerial and administrative roles, has significantly increased, the opposite can be said for females within blue collar employment positions, such as construction. Thus, males are more inclined to enter these roles without the need to participate in higher education.

Jacob (2002) offers a number of potential factors that could explain the increased volume of female enrolments within higher education, including fertility rates, marriage and the composition of the workforce. The study encountered barriers when attempting to analyse each factor as explanatory variables when studying female participation in higher education. Despite this, Jacob states that behaviour and educational attainment are the primary factors for higher participation among females which are related to characteristics possessed. Jacob's study finds that males are less inclined to enjoy school, more eager to earn money in the current and near future (therefore less inclined to forgo earnings during higher education participation) and are of the belief that their chosen career path does not require higher education. Moreover, Jacob argues that non-cognitive skills have an impact on career choice and labour market behaviour which are related to higher education participation.

Goldin, Katz and Kuziemko (2006) offer some explanations for the emergence in female participation exceeding male participation. One suggestion stems from the notion that males mature at a slower pace than females. Thus, given both genders typically apply for higher education in their teenage years, the maturity rate can create significant differences in higher education results. They find this explanation significant in all males, regardless of socio-economic background. While these maturity differences have always existed, Goldin et al argue that the differences only truly emerged when female aspirations changed in regards to higher education. Another key factor they state in support of this argument is related to the notion that higher education was not always financially manageable to those from lower socio-economic backgrounds and thus a clearer picture of the gap is now apparent.

3.2.4 Subject choice

An individual's decision of subject choice can be an iterative process. Becker (1975) notes that individuals are rational agents therefore basing subject decisions on the relative rates of return. Brennan and McGeevor (1988) established distinct conclusions which are believed to attract individuals to specific courses within higher education; individuals wishing to study engineering or business are fundamentally interested in 'training for industry' while individuals wishing to study humanities intend to do so in order to enhance their 'personal growth'.

Many studies relating to the wage differentials between males and females regard subject area of study as fundamental in explaining the gender gap in higher education participation. It is apparent that males were found to be more likely to study subjects which typically provide higher wages such as engineering and physical and mathematical sciences. Females were found to be more inclined to study subjects which tend towards lower wages such as languages, education and creative arts (Machin and Puhani, 2003), these findings were true for Germany and the United Kingdom. Other studies have argued that the pronounced increase in female participation in higher education is due to the fact that careers traditionally associated with females have, until relatively recently, not required a degree. Indeed, this is true for fields such as nursing and education in the UK. During the 1990s, a nursing qualification became the responsibility of universities, whereas it had previously been offered by hospitals. A similar change was implemented in teacher training courses, which switched from being taught in teacher training colleges to higher education

institutions, for example Jordanhill College, which predominantly offered teacher training courses, merged with the University of Strathclyde in 1993. Is it worth stating that nursing and teaching are more vocational than physics, maths and engineering, in the sense that they lead directly to very specific careers whereas physics, maths and engineering are of a more general character and will require further professional specialisation while on the job.

Over the last few decades it has been the case that females have begun taking subjects historically associated with a dominant uptake from males. Goldin et al (2006) analysed the reversal of the gender gap in higher education. Their study finds that there has been an increasing proportion of females taking maths and science subjects in high school; this trend was observed in the U.S. between 1972 and 1992. Goldin et al. state that these trends account for at least 30% of the increase in female participation in higher education. According to this study, females were attracted to "female-intensive occupations" which included subjects in the fields of education and social work; and also for social purposes, which specifically included finding a husband. A fundamental turning point for females, according to Goldin et al., occurred in the 1970s when females began to realise their potential when it came to careers. This in turn led to higher female demand for maths and science subjects in high school and, moreover, they began to outperform males in these subjects.

3.2.5 Labour market by gender

The human capital model has been widely adopted in explaining factors influencing the demand for higher education. Two of the most prominent factors believed to influence demand are unemployment and expected future earnings (Pissarides, 1981), these factors have been widely studied in relation to the decision to continue with education to a higher level and differ by gender. Leslie and Drinkwater (1999) find that individuals with a higher likelihood of unemployment are more inclined to continue with education. This is consistent with Pissarides (1981) whereby factors relating to the labour market are found to have a positive effect on the rate at which individuals choose to continue with education in Britain. The findings incorporate a vast range of labour market aspects such as unemployment and starting wages for graduates during the period of study. Pissarides draws conclusions for males and females separately, stating females, during the 1970s were not as responsive as males to changes in the economy, but instead more responsive to alterations in the demand for women in the labour market who were more academically qualified (this is consistent

with the study by Goldin et al 2006). Moreover, the 1970s study found unemployment to be an insignificant factor for females and significant for males (see below). Additionally, the study found male demand for higher education slowed following an increase in the salaries for manual workers when compared with graduate wages.

A major factor believed to increase female participation in higher education can be attributed to the notion that females in their teenage years were able to witness increased female participation in the labour market (Goldin, Katz and Kuziemko, 2006). Female labour force participation has been increasing in the developed world, particularly over the last 40 years in the UK, where there has been an increase in female labour force participation and a decrease in male employment (Office for National Statistics, 2013). This increased participation was further enhanced by antidiscrimination legislation and jurisprudence from the institutions of the European Union; for example Commission of the European Communities v the United Kingdom ([1982] ICR 578).

Pissarides (1981) also notes that the decision to continue with education has a cyclical aspect whereby the rate of continuation increases when unemployment is higher. Albanesi and Sahin (2013) find that unemployment increases more for males than females when there is an economic downturn and state this can be attributed to the types of industries associated with male employment, thus males are more inclined to lose their jobs during a recession than females. It is interesting to note that Pissarides (1981) argues that cyclical factors should be of minimal importance to individuals given the notion that downturns in the business cycle may have recovered by the time it takes an individual to complete the additional education they choose to obtain because of the downturn. Thus Pissarides suggests that business-cycle related choices may be myopic. According to Tian (1996), economic changes affect males and females in different ways. The study finds that, while females are less inclined to enrol in higher education during an economic downturn, male enrolment increases.

Furthermore, Albanesi and Sahin (2013) study the effects of the modifications in the composition of the labour market, particularly the increase in female participation since 1985. Their study finds that the increase in female demand for education when compared with male demand explains only a small proportion of changes in unemployment rates among males and females. Notwithstanding, they conclude that the narrowing of the gender gap in terms of unemployment can be attributed to the "convergence in labor force attachment of men and women" (Albanesi and Sahin, 2013, p. 1). Moreover, they state that

the growing prominence of females in the labour force is connected to the idea that females experience more attachment to the labour force, in the sense of being less likely to leave jobs for non-participation in the labour market, when compared with their male counterparts. Additionally the study finds a strong correlation between labour force participation by gender and unemployment gaps; countries with smaller labour market participation gaps by gender are also more inclined to experience lower gaps in unemployment by gender.

3.2.6 Returns to education

The returns to education have attracted considerable debate in economics literature, particularly in terms of gender. It is the consensus that individuals receive a higher present value of wages over their lifetime on average if they have obtained higher education. Carnevale, Rose and Cheah (2013), for example, estimate that individuals who have obtained a higher education degree in the U.S. can expect a return of 84% more over a lifetime than those who completed education to high school level. Many studies have established underlying reasons which can be attributed to higher earning among graduates. Perna (2003) suggests that not only do graduates have increased levels of academic ability, but they are also more motivated to succeed than those who do not participate in higher education and are thus expected to seek employment with higher wages.

Earnings for those with a higher education degree are, however, dependent on a number of factors. Carnevale et al. (2013) state that gender is one of the fundamental factors influencing lifetime earnings. A plethora of studies have focused on the returns to education by gender. Studies relating to the returns to education are relatively consistent in terms of whether males or females are the dominant recipients of higher education benefits, finding females, in general, to have higher returns than males. Other studies such as Perna (2003) found no difference in terms of returns between males and females. A study by Harmon, Oosterbeek and Walker (2000) finds that countries with the highest female employment rates, irrespective of educational attainment, have the lowest wage differentials between males and females. Their study on Europe finds that Nordic countries show the highest levels of female employment and the smallest gap between males and females in terms of returns to education, while Ireland and the UK have the lowest employment rates for females and subsequently the largest gap in returns by gender.

Studies finding females receiving higher returns from participating in higher education include Murphy and Welch (1992), Psacharopoulos (1994), Cooper and Cohn (1997), Walker and Zhu (2001), Knowles, Lorgelly and Owen (2002), Dougherty (2003) and Diprete and Buchmann (2006). These studies find marginally higher returns for female than males and note that returns have been increasing more rapidly for females. For example the study by Walker and Zhu (2001) finds a degree contributes to an increase in hourly earnings of around 23% for males and 31% for females. Despite the returns to a degree being greater for females, it is apparent that females earn less than males. Walker and Zhu (2008) provide a more recent analysis of the returns to higher education by gender. The study firstly notes relatively similar findings in terms of returns found in previous analyses. Despite the significant increases in higher education participation in the last forty years, the study by Walker and Zhu (2008) finds the graduate wage premium within the context of the United Kingdom has experienced no fall for males for the period 1994 to 2006. Moreover, the study finds that the female graduate wage premium has increased by 10%, albeit weakly significant. A study by Walker and Zhu (2017) disaggregates graduate earnings by gender and the type of institution attended. The study finds the wage coefficient of graduates is significantly increased by 10% for males and 11% for females from Russell Group institutions relative to post-1992 institutions. The study also finds male graduate earnings from pre-1992 institutions are approximately 7% higher than those from post-1992 institutions while the female increase is 5%. Dougherty (2003) notes despite females having higher returns, their earnings still tend to be lower than male's earnings.

A study by Davies and Guppy (1997) found males to be recipients of greater returns to higher education than females. The study finds males are more inclined to obtain higher economic returns than females due to their chosen fields of study being more financially rewarding. The study argues that typical male dominated industries, such as engineering, provide higher incomes than typical female fields. Moreover, the study in consistent with previous literature which finds males typically earn higher wages than females in general, regardless of education background.

Perna (2005) suggests higher participation among females can be attributed to the notion that both economic and non-economic benefits from obtaining higher education are greater among females, this is consistent with a study by Goldin, Katz and Kuziemko (2006). The benefits include financial returns, an increased probability of health insurance and a distinct

expectation that higher education produces greater employment chances. Moreover, Perna suggests females follow the human capital theory more closely than males whereby they perceive the benefits of attending higher education to outweigh the costs. It is interesting to note that females obtain lower salaries than males at all levels of the educational attainment spectrum even when using controls for educational attainment, according to Perna. Goldin et al (2006) also state that males experience a higher effort cost of attending higher education in terms of time associated with preparation, given the notion females tend to perform better in secondary school.

3.2.7 Marriages and divorces

A potential factor contributing to the increase in female participation in higher education is given by Goldin (1995). Goldin states that females were attracted to higher education due to the notion that their educational attainment would increase the likelihood of marrying a male who was also educated to university level and had a greater earnings potential. While Goldin's study focussed on higher education participation in the 1950s to 1980s, the statistics are noteworthy. Goldin found that females were attracted to going into higher education in the 1950s in order to benefit from the "Mrs" degree. This was effectively an attitude whereby attending higher education increased a female's chance of marrying a male who had also obtained higher education, which in turn led to a higher earnings potential that females could benefit from.

Goldin's study highlighted some very stark findings. The study finds university attendance increased the chances of marrying a university-educated husband with high earnings potential. In 1960, 64% of females aged 30–39 with 16 or more years of schooling married university-educated husbands, compared with only 11% for females with a high school qualifications. Goldin estimates that 57% of female graduates married before or during their year of university graduation. Goldin concludes that the private rate of return to university approximately doubles if husband's earnings are added to what a university-educated female could bring home herself.

Other, more recent, suggested contributions to the marital factors influencing females to participate stems from the notion that the increase in divorce rates has in turn led to an increase in females' financial responsibility for themselves and their children; this

subsequently led to an “insurance-based motive for college investment” (Goldin, Katz and Kuziemko, 2006, p.22). These allegations are consistent with Tian (1996) who finds that divorce rates have a positive relationship with higher education enrolment. This is primarily due to the fact that individuals choose to participate in higher education to diminish the likelihood of financial uncertainty, should they be faced with divorce, and to ward off deprivation as a result of divorce. Tian (1996) relates these findings to Craig and Spear’s 1982 study on the impacts of social change on different groups of people. Tian argues that social change has predominantly led individual’s to increase their levels of education in order to mitigate some of the potential eventualities associated with social change, such as divorce, which has grown in recent decades. Tian thus uses divorce rates as a proxy for uncertainty and deprivation. Moreover, Tian finds a negative relationship between higher education enrolment and divorce. This is consistent with the notion that females who are married are worse-performing in higher education while married males are positively affected in terms of their performance.

Diprete and Buchmann (2006) state that the likelihood of a female experiencing poverty has risen relative to males over the last few decades, which could in turn have led to the increase in female participation in higher education as a means to create the insurance against poverty. This has stemmed from the notion that females are more likely to be single parents coupled with the idea that single parenting has become more common. Moreover, McLanahan (2004) finds that non-marital childbearing is strongly associated with the education of the mother, where fewer years of education are associated with single motherhood.

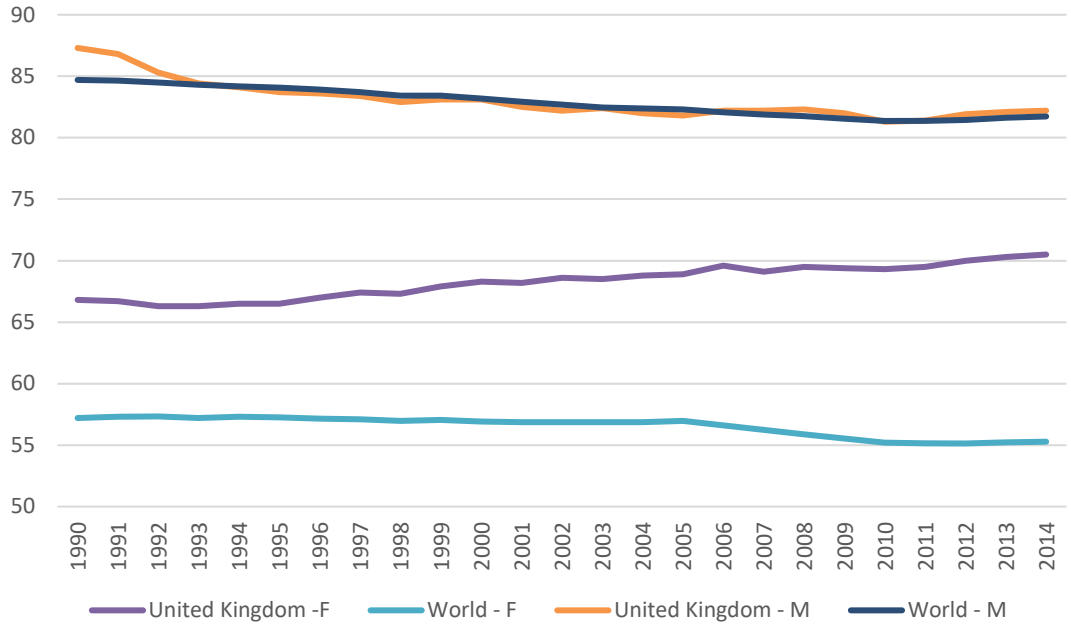
3.3 Contribution

Current literature provides an understanding of higher education participation by gender in terms of returns to higher education. However, a puzzle has emerged in the participation rates by gender with females overtaking male participation rates in a large proportion of countries globally (Becker et al, 2010). Scotland provides an interesting case study for a number of reasons. First, there have been disproportionately lower rates of participation in higher education in Scotland among males compared to females. Participation rates for those aged 20 and under were almost identical in both male and female until 1993-1994. Since

then, female rates have been up to 13 percentage points higher than male participation rates (Scottish Funding Council, 2014).

According to the literature, one fundamental reason given for the increase in female participation stems from the idea that more females are entering the labour market which has in turn led to increases in the number of females entering higher education. It is interesting to note that the composition of the labour market by gender in the UK. Figure 3.1 below shows the Labour Force Participation Rate by gender for the UK and the world (F denotes female and M denotes male). Indeed, it is evident male labour force participation has consistently exceeded female participation. This is true for both the UK and the World. Since 1990, it appears the gap between the male and female participation has narrowed in the UK, which has to a great extent been influenced by an increase in the female labour force participation, rather than a decrease in male participation. Indeed, the World rates have not changed considerably over the time period, and if anything the gap has widened between males and females. Moreover, the United Kingdom's female labour force participation rate was relatively consistent with the World in terms of trends but is now higher than the world rate by approximately 15 percentage points. Moreover, while UK female participation has increased, the male participation rate has subsequently decreased since 1990.

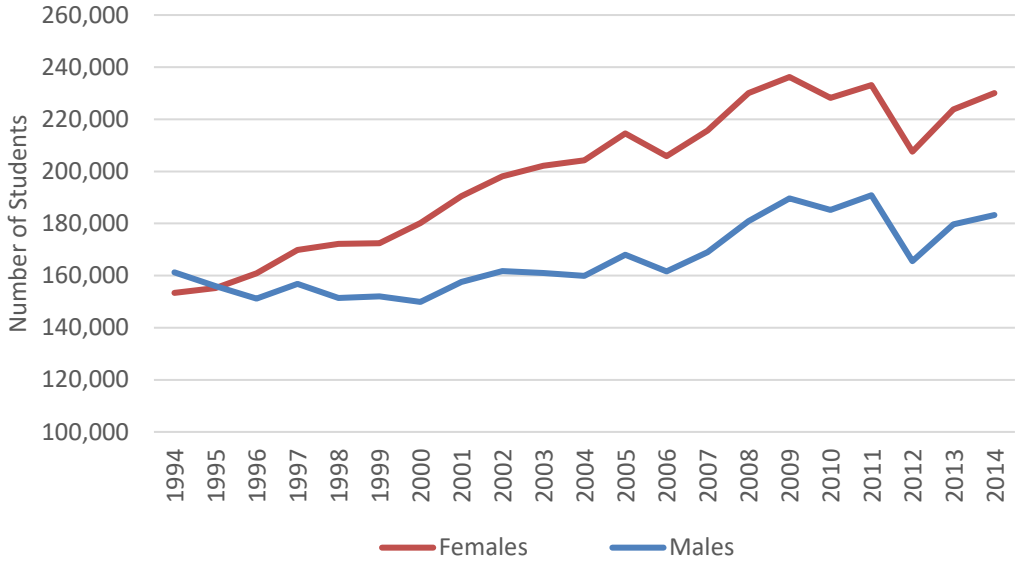
Figure 3.1: Labour Force Participation Rate by Gender (% of population aged 15 - 64, modelled ILO estimate



Source: World Bank, World Development Indicators (2016). *Notes:* Figure shows percentage of the working age population (aged 15-64) participating in the labour force. Figure shows comparison of the United Kingdom and the World (for females (F) and males (M)).

In terms of the participation in higher education across Great Britain, historically there was a relatively higher proportion of males in higher education than females. In 1994 51% of those entering higher education were male, in 2014, this figure significantly dropped to 44%, placing females at the top (HESA, 2016). Figure 3.2 shows the number of first year students entering higher education institutions in Great Britain by gender. It is clear that female participation exceeds male participation with the exception of 1994/95. While the trend has been consistent since 1995/96, it is interesting to note that both female and male participation rates have followed a similar trend, albeit with female participation exceeding male. The increase in female participation is apparent across all areas of Great Britain, with a marginally higher average increase of 1.8% per annum in Scotland compared to 1.7% increase in England and Wales.

Figure 3.2: Number of UK domiciled, first year, full-time undergraduates in higher education institutions in Great Britain

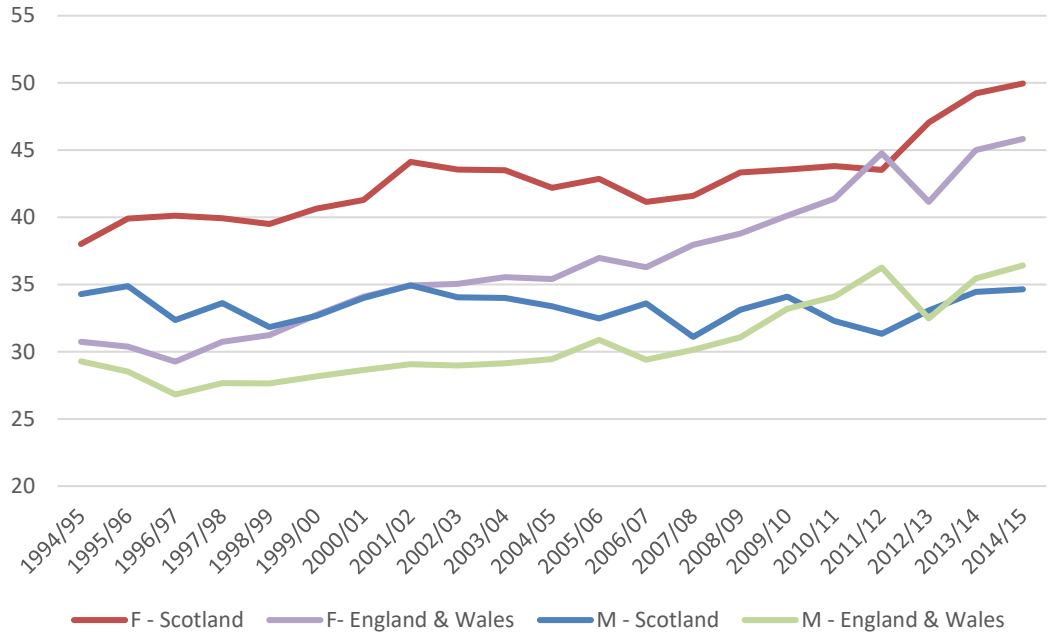


Source: HESA (2016). *Notes:* Figure shows number of UK domiciled first year full-time undergraduate students in higher education in Great Britain for females (red) and males (blue) for the period 1994 to 2014.

By contrast, male participation, despite increasing between 1994 and 2014, has had a smaller increase on average in Scotland when compared with England and Wales. Between 1994 and 2014, the average annual increase in Scotland was 0.63%, while in England and Wales, it was 0.83%. With this in mind, it is necessary to review the changes in participation with the aid of an age participation index in order to eliminate the possibilities of significant increases in population which could affect the overall increase in participation.

An Age Participation Index (API) was developed in order to eliminate potential effects of significant increases in population which could attribute to biases in participation. This is calculated by taking the number of first year full-time undergraduate students, under 21 years of age, entering higher education and dividing it by the population of those aged 17 years old. This methodology is consistent with the Scottish Government's calculation process (Scottish Government, 2005). Figure 3.3 shows the age participation indices by gender in England/Wales and Scotland.

Figure 3.3: API Scotland and England/Wales by Gender, 1994/95-2014/15



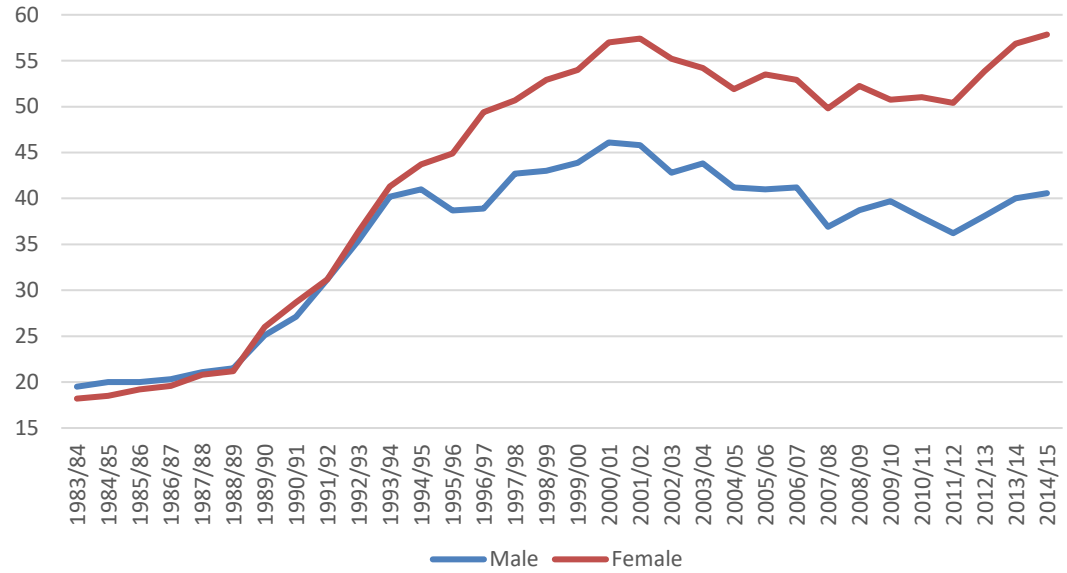
Source: HESA (2016). *Notes:* Figure shows the Age Participation Indices (API) for Scotland and England/Wales for females (F) and males (M). The API is calculated for those aged 20 and under entering full-time education divided by the population aged 17.

From the above chart, it is clear female participation in Scotland and England/Wales exceeded male participation across the years 1994 to 2014. The data used to calculate the APIs were obtained from HESA which has collected this information since 1994.

In terms of Scotland, it is clear from the time series 1994-2014 that females have had a higher API. This has not always been the case. Figure 3.4 shows a participation index developed by the Scottish Executive (2005) which extends further back to 1983/84. The data used for this chart differ slightly from the data contained in the previous charts as these data include those studying sub degrees [6] whereas the previous data only include first degrees. Female enrolment marginally exceeded male enrolment in 1989/90 and this trend continued until 1993/94. From 1994/95, the gap between the female and male API widened.

[6] Approximately 15% of the API in 1995/96 was comprised of those studying sub degrees. Sub degrees include qualifications that can be obtained through further education institutions such as HND and foundation courses in higher education.

Figure 3.4: API Scotland, alternative calculations, 1984-2014



Source: Scottish Executive (2005) and author's calculations based on HESA (2016). *Notes:* Figure shows the alternative calculation for the Age Participation Indices (API) for females and males in Scotland. The API is calculated for those aged 20 and under entering full-time education divided by the population aged 17. Figure 3.3 focuses on first degrees, whereas this chart contains not only first degrees, but additional data for those studying sub-degrees.

Subject choice by gender

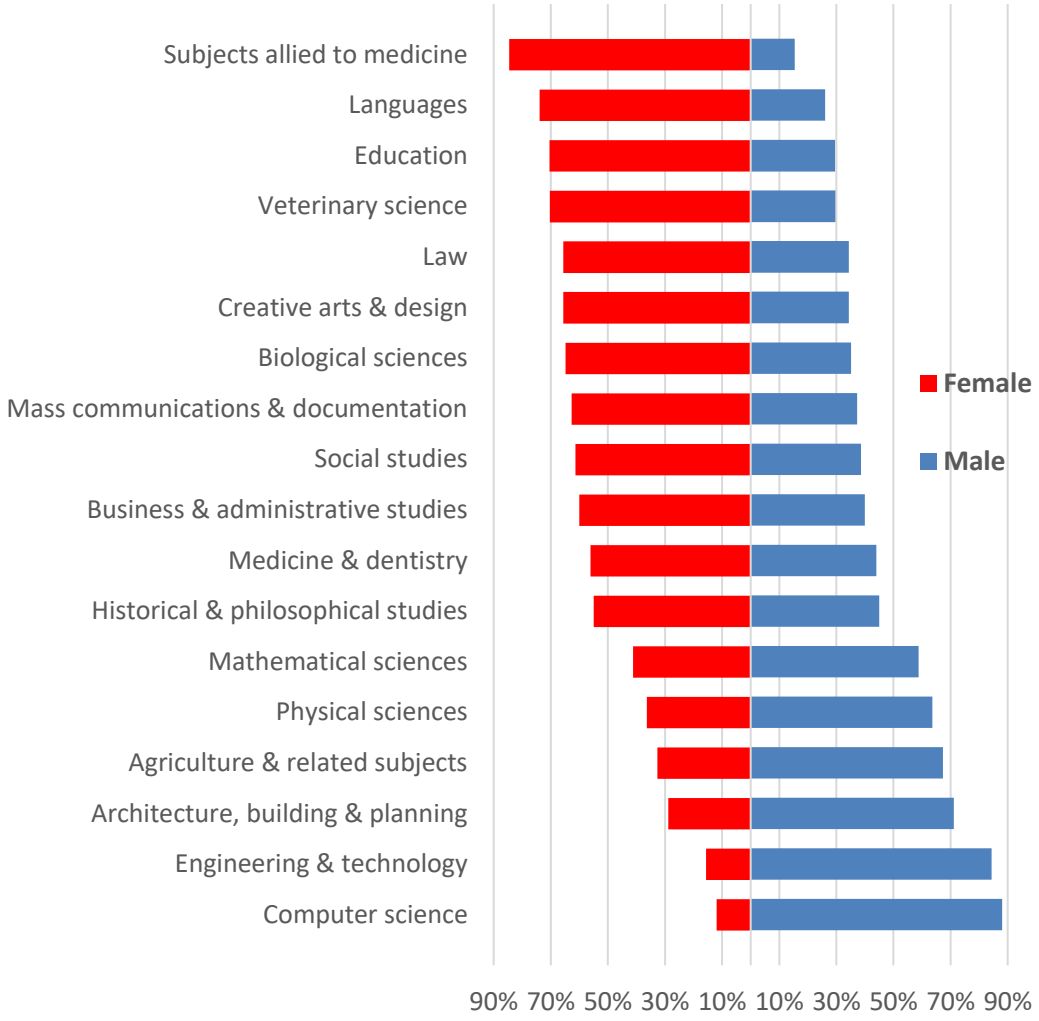
Data were obtained for a number of variables based on the literature review of higher education participation by gender. Participation data were obtained from the Higher Education Statistics Agency (HESA) to capture the number of first-year full-time undergraduate students aged 20 and under by gender, country of domicile, higher education institution and subject studied. Prior to conducting empirical analyses, we note some characteristics of the data.

Figure 3.5 presents the proportion of higher education entrants in Scotland in 1998/99 by gender and subject area. From the table it is evident some subjects attract larger concentrations of males or females. This is consistent with previous literature (see for example Machin and Puhani, 2003). For example, subjects allied to medicine, which includes nursing, witnessed an intake of 85% female and 15% male. Languages, education, veterinary science and law (74%, 70%, 70% and 66% respectively) also experienced strong participation by females in 1998/99. For males, the largest proportional intake was found to be in computer science with 88% males to 12% females. Other subjects popular among males

included engineering and technology, architecture, agriculture, and physical sciences (84%, 71% 67% and 64% respectively).

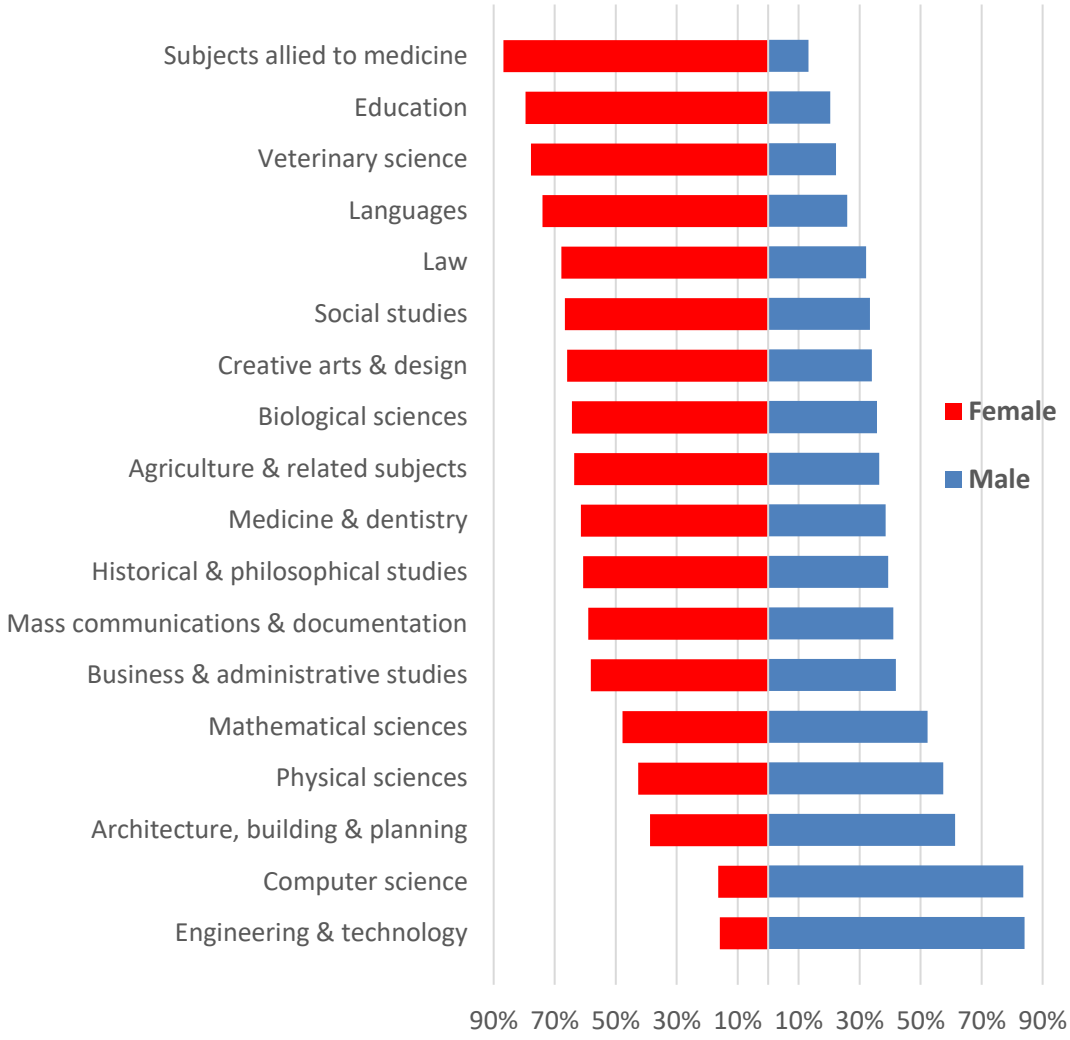
In light of the above, it is interesting to compare the findings from 1998/99 with more recent data in order to establish whether the differences continued. From the 2014/15 chart (see Figure 3.6), it is clear the female dominated subjects emulate those from 1998/99, with subjects allied to medicine experiencing an intake of 87% female, followed closely by those subjects from 1998/99 (namely education (80%), veterinary science (78%), languages (74%) and law (68%) whereby the percentage share of female students has increased. Male dominated subject choice in 2014/15 was also similar to that in 1998/99. In terms of science, technology, engineering and mathematics (STEM) subjects, males comprise the largest proportional uptake across both periods of the analysis.

Figure 3.5: Higher Education Entrants by Subject Area, Scotland, 1998/99



Source: HESA (2016). *Notes:* Figure shows the percentage composition of male and female entrants to higher education by subject area in 1998/99.

Figure 3.6: Higher Education Entrants by Subject Area, Scotland, 2014/15



Source: HESA (2016). *Notes:* Figure shows the percentage composition of male and female entrants to higher education by subject area in 2014/15.

The data comprise the number of entrants to 18 higher education institutions in Scotland. Table 3.1 below illustrates the percentage share of males and females entering each institution in 2014/15. The institution with the largest proportion of female entrants in Scotland is Queen Margaret University, with a 74% female intake in 2014/15. A potential reason for this stems from the fact that Queen Margaret typically offers courses in subjects allied to medicine, which has a predominantly female uptake[7]. Other institutions with a

[7] HESA data show that Queen Margaret University offers courses across six JACS subject areas, subjects allied to medicine, biological sciences, social studies, business and administrative studies, mass communication and documentation, and creative arts and design.

significantly larger share of females include Glasgow School of Art, The Robert Gordon University, The University of Dundee and The University of Stirling. It is apparent that 13 of the 18 institutions had more than 50% female entrants. Heriot-Watt University was the institution with the largest share of male entrants at 59%; this is not surprising given 26% of students enrolling at Heriot Watt entered the engineering and technology subject area.

Table 3.1: Female vs. Male Entrants at HEIs in Scotland, under 21 as at 2014/15

	Female	Male	Number
Queen Margaret University	74%	26%	569
Glasgow School of Art	70%	30%	205
The Robert Gordon University	65%	35%	1,515
The University of Dundee	64%	36%	1,691
The University of Stirling	63%	37%	1,625
Glasgow Caledonian University	61%	39%	2,394
The University of Glasgow	61%	39%	2,927
The University of Edinburgh	61%	39%	3,556
The University of St Andrews	59%	41%	1,299
The University of the West of Scotland	57%	43%	1,733
Edinburgh Napier University	54%	46%	1,842
The University of Aberdeen	52%	48%	1,581
SRUC	51%	49%	559
The University of Strathclyde	49%	51%	2,662
University of the Highlands and Islands	49%	51%	1,527
Royal Conservatoire of Scotland	49%	51%	175
University of Abertay Dundee	46%	54%	615
Heriot-Watt University	41%	59%	1,349

Source: HESA (2016). *Notes:* Table shows the percentage share of female and male entrants in addition to the total number of students to each of the higher education institutions in Scotland for those aged 20 and under in 2014/15.

From the table above, it is interesting to note that a large proportion of institutions with a greater percentage of females than males offer courses in subjects allied to medicine[8] which, to a great extent, covers nursing as a subject. From the 18 institutions above, 13 have entrants going into the subjects allied to medicine field. As discussed previously, nursing and teaching were historically not always offered as university degrees.

[8] Subjects Allied to Medicine is comprised of: Anatomy, Physiology, Pharmacology, Pharmacy, Nutrition, Ophthalmic, Audiology, Nursing, Medical Technology and other medical subjects (HESA, 2016).

The Scottish labour market

Data were obtained for the employment rates for those aged 16-24 using quarterly labour force survey data. The survey data were rescaled to account for the total population and the employment data were separated into those with a degree and those without. Employment rates were calculated in a method which is consistent with the Office for National Statistics' definition whereby the number of people employed was divided by the population (in this case aged 16-24).

There is a clear distinction between employment rates of graduates and non-graduates. In Scotland, the employment rate for graduates exceeds that for non-graduates for both males and females. It is interesting to note that the female employment rate for graduates is higher than the employment rate for male graduates. This trend has been apparent in England and Wales since 2000 and in Scotland since 2011. Moreover, in terms of the employment rate for non-graduates, the male rate is higher than the female in Scotland. This gap has stayed relatively consistent whereby male non graduate employment rates are around between 6 to 11 percentage points higher than female rates.

Demography

Data were obtained for the population of those who had their 17th birthday during the period 1998 to 2014. The rationale for including demography as an explanatory variable is due to the notion that level data are used as the dependent variable, as the number of first year full time undergraduates entering first year would not account for fluctuations in population. Including a demography variable will allow us to control for changes in the population, particularly larger increases or decreases, which could have an effect on the number of individuals within this age group who enter higher education. This will also ensure that population fluctuations are accounted for within the study to avoid biases in the results due to demographic changes.

3.4 Methodology and model specification

3.4.1 Overview of data

Panel data were obtained from HESA for 22 higher education institutions in Scotland for the number of UK domiciled first year full-time undergraduates by gender between 1998 and 2014. Some institutions have changed over the time period and thus it is necessary to remove these institutions to ensure consistency when analysing participation over time. Two institutions merged with current providers of higher education in Scotland, these were St Andrews College of Education (added to the University of Glasgow) and Northern College of Education (added to the University of Aberdeen). Additionally, The University of the Highlands and Islands, Edinburgh College of Art and Bell College were removed for the purpose of the analysis and as they had missing data due to either closing as an institution, or, in the case of the University of the Highlands and Islands, opening[9] after 1998. Figure 3.7 shows the number of males and females enrolling at each of the seventeen institutions in Scotland.

Three additional institutions were removed from the study due to the nature of the courses they offered. These were SRUC which specialises in agriculture, Glasgow School of Art, specialising in courses in architecture, fine art and design and the Royal Conservatoire which specialises in dance and drama. Moreover, these three institutions did not experience significant variation in their student annual admissions of students to undergraduate courses between 1998 and 2014, where student enrolments were consistently less than 300, which provides further impetus for exclusion of these institutions. The number of institutions used in the study was thereby reduced to 14.

3.4.2 Empirical model

The literature discussed in the chapter has been used to develop an empirical model to estimate the factors influencing participation in higher education by gender. A number of key

[9] http://www.gov.scot/Publications/2002/09/15499/11358

variables were collected for the purpose of the study. This section describes the key variables and subsequently the empirical model used.

The dependent variable $ParticipationShare_{it}$ denotes the percentage share of females and males respectively enrolling in higher education. This is calculated by taking the number of UK domiciled individuals enrolling in a given year in a higher education institution in Scotland. The number of enrolments was obtained from HESA for the period 1998 to 2014 and male and female shares were calculated to perform separate empirical models. Figure 3.8 shows the female shares by institution and year of entry.

A number of potential explanatory variables for the gender differences in higher education were identified in the literature review. These included $Marriage_t$ and $Divorce_t$ with the hypothesis that as marriages increase, the female share in higher education decreases. The hypothesis for divorces is that as they increase, participation in higher education, particularly from females, may increase given the relation between the financial uncertainties associated with divorces. These variables are included at the Scotland level, and are by no means a representation of an individual's marital situation, but instead included to represent the general marital state of Scotland, given the notion that the literature points to females being influenced by marriages and divorces.

$EmpD_t$ was included to denote the employment rate in a given year for those who had obtained a degree (calculated using Labour Force Survey data). The rationale for including this variable stemmed from the notion that the employment rate for those with a degree may affect those considering entering higher education whereby those individuals would be incentivised to enrol at higher education if the employment rate for those with a degree was favourable. $LogPop_t$ denotes the log of the population (male/ female specific) aged 17 in a given year for Scotland. $FTeachers_t$ was included to represent the percentage share of female teachers in secondary schools in Scotland. The justification for including this stems from the idea that the literature was mixed in terms of whether the presence of females teachers, or the lack of male teachers, influences (deters) females (males) in entering higher education. $Nursing_{it}$ was included given the significant proportion of females at Scottish higher education institutions studying subjects allied to medicine which encompasses nursing. This variable was included to establish whether a policy which mandated that nurses must be qualified to degree level was influential to the share of females at higher education institutions in Scotland.

The following equation was used to estimate the model:

$$ParticipationShare_{it} = \beta_0 + \beta_1 Marriages_t + \beta_2 Divorce_t + \beta_2 EmpD_t + \beta_3 logPop_t + \beta_4 FTeachers_t + \beta_5 Nursing_{it} + \mu_i + \varepsilon_{it} \quad (3.1)$$

Where *i* denotes institution and *t* denotes time.

3.4.3 Description of key variables

ParticipationShare$_{it}$ represents the share of the enrolment population who are male and female, whereby two separate models are run; one for female and one for male for *i* institution and *t* years[10];

Marriages$_t$ represents the proportion of the Scottish population getting married at time *t*. This variable is derived by taking the number of marriages in Scotland in a given year expressed per 1,000 of the population[11];

Divorce$_t$ represents the proportion of the Scottish population getting divorced at time *t*. This variable is derived by taking the number of divorces in Scotland in a given year expressed per 1,000 of the population[12];

EmpD$_t$ represents the proportion of the population in Scotland with a degree who are in employment in a given year *t*. Separate rates were calculated for males and females[13];

logPop$_t$ represents the population age 17 in a given year *t* in Scotland, expressed in log form. Separate variables were used for males and females[14];

FTeachers$_t$ represents the ratio of female teachers to male teachers in Scottish secondary schools the year prior to the individuals entering higher education[15];

Nursing$_{it}$ represents a policy announced in 2009 which affected nursing qualifications. The policy stated that individuals pursuing a career in nursing would be required to complete a

[10] Source: HESA (2016)
[11] Source: National Records of Scotland (2016)
[12] Source: National Records of Scotland (2016)
[13] Source: Labour Force Survey (2016)
[14] Source: National Records of Scotland (2016)
[15] Source: Scottish Government (2016)

degree at university. Prior to this, the majority of nurses completed a diploma when pursing nursing and were not required to obtain their qualification from a higher education institution.

μ_i represents the institution specific fixed effects; and ε_{it} represents the idiosyncratic error term.

The above model constitutes the final model used to estimate the results. All explanatory variables, with the exception of logPop, were lagged to represent the notion that the individuals typically apply to a higher education the year prior to entry and thus Marriages, Divorce, EmpD, FTeachers and Nursing were taken for the period *t-1* while logPop was taken in time period *t*.

To undertake this study, OLS and one-way fixed effects panel regression models were employed for the share of female entrants to universities for individuals aged 17 to 20 entering higher education, followed by models for the share of male participants. By including fixed effects, the model controls for average differences across institutions in the predictors, thus reducing the probability of omitted variable bias. The fixed effect model was estimated based on the notion that μ_i are assumed to be fixed parameters for the model and is appropriate given we are investigating N institutions. A one way model was chosen given that only one of the explanatory variables vary by institution. A fixed effects model is beneficial as it captures the omitted variables which do not vary over time, thus avoiding a misspecification error arising from unmodelled heterogeneity (Baltagi, 2005).

3.4.4 Summary statistics

This section provides summary statistics for the data used in modelling. Table 3.2 below presents the summary statistics for the variables used in each of the models. It is clear the female share is higher than the male share at Scottish higher education institutions, given the mean of 0.55. Moreover the maximum female share observed at any institution was 0.84 compared to the maximum male share of 0.73.

Table 3.2: Summary statistics model

Variable	Observations	Mean	Standard Deviation	Min	Max
$Sharefemale_1$	238	0.553	0.1	0.267	0.835
$Sharemale_2$	238	0.447	0.1	0.165	0.733
Divorce	238	2.159	0.217	1.801	2.535
Marriage	238	11.528	0.583	10.341	12.648
EmpD $Female_1$	238	0.778	0.037	0.694	0.842
EmpD $Male_2$	238	0.785	0.035	0.729	0.852
LogPop $Female_1$	238	10.352	0.032	10.299	10.436
LogPop $Male_2$	238	10.388	0.025	10.342	10.445
FTeachers	238	1.394	0.191	1.075	1.691
Nursing	238	0.189	0.392	0	1

Notes: Figure shows summary statistics for variables used within the regression analysis. For each of the variables the number of observations, mean value, standard deviation, minimum and maximum are provided. 1 (2) denotes that the variable has been used only in the female (male) model.

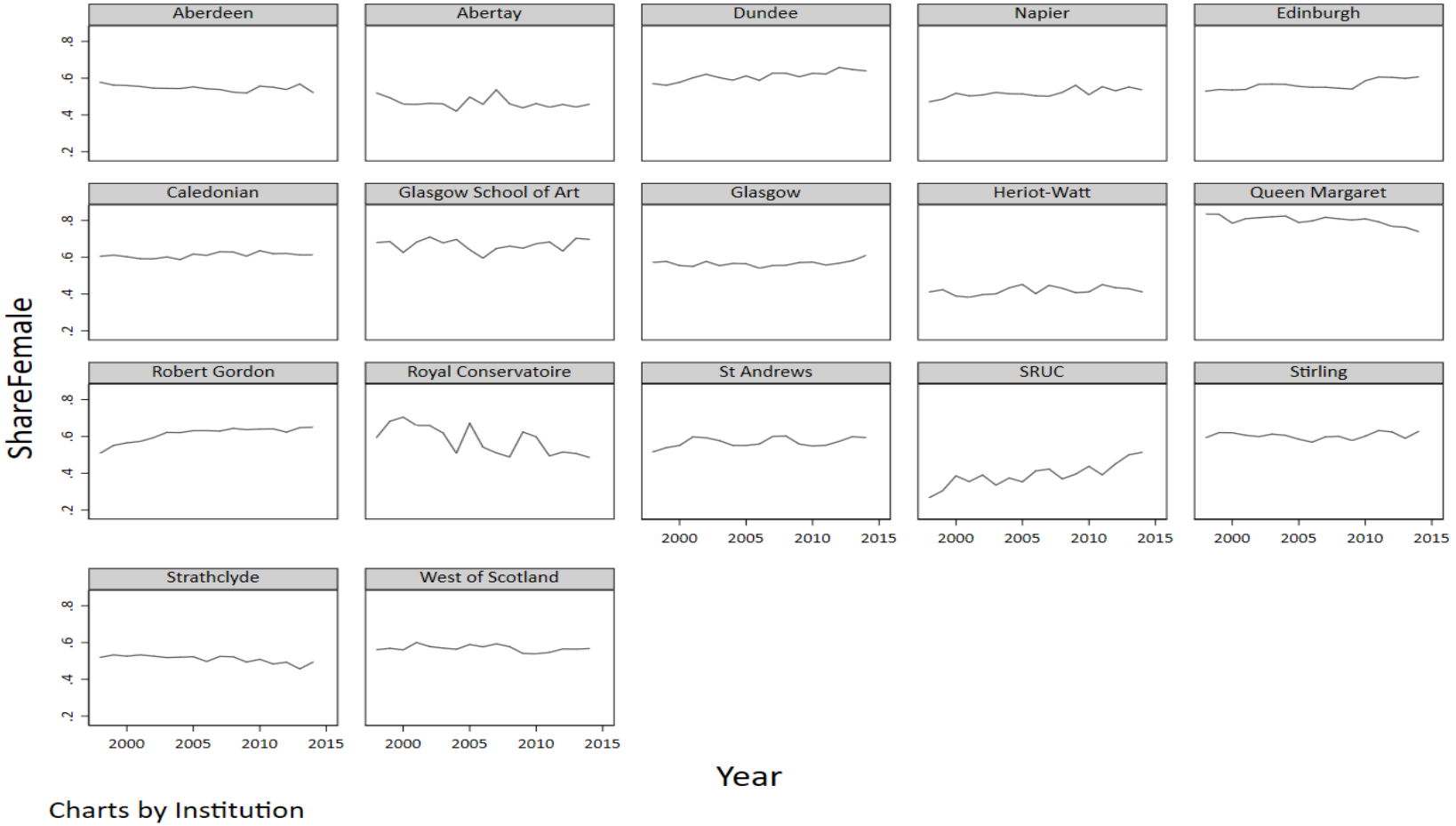
Figure 3.7 illustrates the number of female and male entrants to higher education institutions in Scotland between 1998 and 2014. It is clear some institutions did not experience significant changes in the number of entrants over the course of 1998-2014; these were Glasgow School of Art, Royal Conservatoire and SRUC (as discussed previously). The trends across males and females were relatively consistent across institutions. Figure 3.8 presents the female share of participants at each of the institutions.

The Universities of Edinburgh and Glasgow, the only Russell Group institutions in Scotland, have consistently had the highest number of entrants between 1998 and 2014. Females are well represented at these top institutions, with 56 percent average share of entrants at each institution over the course of the seventeen year period. This is something which is not apparent in U.S. higher education institutions (Jacobs, 1996)

Figure 3.7 Entrants to Higher Education in Scotland, by year of entry and gender

Notes: Figure shows the number of entrants aged 17-20 to higher education by institution, gender and year of entry.

Figure 3.8: Female Share of entrants to higher education institutions in Scotland



Notes: Figure shows the female share of entrants to each higher education institution in Scotland (of those aged 17-20) by year of entry.

3.4.5 Empirical results

This section provides the results from the empirical model from the OLS regressions and one way fixed effects panel regression models, interpretation of the models and discussion. Finally, this section will include robustness and diagnostics tests to ascertain the validity of the models.

Regression analysis

Table 3.3 provides the output from the OLS regressions for females in column 1 and male results are reported in column 2. In addition to the OLS regression models, one way fixed effect panel regression models were adopted to include institution fixed effects in columns 3 and 4 of the table. As previously mentioned, including fixed effects in the model controls for average differences across institutions in the predictors, thus reducing the probability of omitted variable bias. The purpose of the models is to identify why differences in participation exist between males and females. The extent to which the model captures gender differences in higher education participation is apparent in the coefficients and the statistical significance of the explanatory variables.

As discussed in the next section, cluster robust standard errors were used to account for intra-group correlation and heteroskedasticity in the fixed effects regression models (robust standard errors were clustered at the institution level).

Table 3.3: OLS and panel regressions (dependent variable share of female (male) entrants by institution (ParticipationShare))

	(1)	(2)	(3)	(4)
	Females	Males	Females	Males
MARRIAGES	**0.015**	**-0.009**	**-0.004**	**0.001**
	(0.02)	(0.019)	(0.005)	(0.004)
DIVORCES	**0.044**	**-0.039**	**0.0056**	**-0.002**
	(0.047)	(0.046)	(0.013)	(0.013)
EMPD	**0.417**	**-0.274**	**0.380 ****	**-0.092**
	(0.975)	(0.350)	(0.157)	(0.079)
LOGPOP	**0.027**	**0.027**	**0.188 ****	**0.125**
	(0.339)	(0.332)	(0.081)	(0.088)
FTEACHERS	**-0.001**	**0.039**	**0.037**	**-0.034**
	(0.059)	(0.081)	(0.032)	(0.039)
NURSING	**0.085*****	**-0.086 *****	**0.007**	**0.005**
	(0.023)	(0.023)	(0.021)	(0.021)
CONSTANT	**-0.208**	**0.552**	**2.309**	**-0.738**
	(3.335)	(3.406)	(0.876)	(0.934)
No. of observations	238	238	238	238
Institution fixed effects	No	No	Yes	Yes
R^2	0.062	0.063	0.266	0.266

Notes: Parameter estimates reported are from the OLS in columns 1 and 2 and fixed effects panel regression models in columns 3 and 4. The dependent variable in all models was the female share of participants at each of the higher education institutions in Scotland. Standard errors are reported in parentheses for models 1 and 2, cluster robust standard errors are reported in models 3 and 4. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

From the results presented above, it is interesting to note that both the OLS and fixed effects panel regressions have produced some significant explanatory variables. From the OLS models, the effect of all explanatory variables, with the exception of the log of population variable, have the opposite effects on males and females. The variable for the nursing qualification policy change (NURSING) is statistically significant across models (1) and (2). These effects show the policy mandating that nurses must be qualified to degree level has had a positive and significant effect on the share of females entering higher education institutions and subsequently had a negative effect on the male share of entrants. According

to the model output, the nursing qualification change in 2009 is estimated to have increased the female share of participation by between 8 and 9 percent while it has decreased the male share of participation by the same amount. The results from the OLS model should, however be treated with caution.

Given that the data include institution participation share, models were produced to include institution fixed effects. From the fixed effects models, the employment rate for those with a degree and the population variable hold some degree of significance in determining the differences in the share of female participation in higher education institutions in Scotland. From the male fixed effects panel regression, no explanatory variables were found to be statistically significant. Since the dependent variable and, indeed, some of the explanatory variables are expressed in terms of percentages, the coefficients in these cases can be interpreted as elasticities.

The results suggest that as the female employment rate for those with a degree increases, the percentage share of females entering higher education increases, thus representing a positive relationship. A one percent increase in the employment rate for females with a degree yields a 0.38 percentage points increase in the female share of participation in higher education. The coefficient for EMPD in the female model is 0.38 which suggests an inelastic relation. In other words, large changes in the employment rate for those with a degree lead to proportionally smaller changes in the share of female participants at higher education institutions in Scotland. These findings are consistent with the argument put forward by Bell and Blanchflower (2011) who state that labour market conditions have an effect on enrolment in higher education for young people. Pissarides (1981) argued that females are not necessarily responsive to changes in the economy, but more responsive to changes in the demand for woman in the labour market and thus the variable EMPD represents increasing demand for females with a degree in the labour market.

The population variable is significant and positively correlated with the participation share for females, signifying that as the female population aged 17 increases, the participation share of females in higher education increases. Therefore an increase in the female population aged 17 would result in an increase in the female share of entrants to higher education.

The female teachers variable is not statistically significant, indicating, at least for the case of Scotland, the percentage share of female teachers bears no influence on female entry to

higher education. This finding is consistent with studies conducted in England and Wales by Carrington et al (2003 and 2008). Additionally, the nursing variable is not significant in the fixed effect panel regression, implying the switch from nursing to a compulsory degree course did not influence the share of females at higher education institutions in Scotland. Although the marriage and divorce variables are insignificant in the female model for Scotland, the coefficients of the variables (in terms of whether they are positive or negative) are consistent with the literature whereby an increase in marriages decreases female participation while an increase in divorces increases participation.

It is apparent that females are underrepresented in institutions which hold a strong focus on Engineering, with the exception of the University of Strathclyde, whereby there is almost an even split between females and males (49% and 51% respectively). This is consistent with the literature from the U.S. (Jacobs, 1996) but perhaps not as marked.

Diagnostics testing

The models above were tested using a number of diagnostics tests to examine the validity of the models. First, the models were tested for heteroskedasticity. The test was used given the notion that the standard errors generated from fixed effect modelling assumes that there is homoskedastic disturbances whereby the variances in time and individuals is assumed to be the same (Baltagi, 2005).

To test the null hypothesis, of homoskedastic errors, against the alternative, heteroskedastic errors, we employ Breusch-Pagan tests for heteroskedasticity for the OLS models without fixed effects. In both the female and male models, we can accept the null hypothesis that the models have constant variance and therefore reporting standard errors is sufficient.

We employ a modified Wald test for group wise heteroskedasticity in the fixed effects regression. The modified Wald test reveals the presence of heteroskedasticity as we reject the null hypothesis due to a prob>chi-squared statistic of 0.0000 for both the female and male model. Thus, heteroskedasticity robust standard errors must be used to account for the presence of heteroskedasticity in the fixed effects models (the modified Wald test produced a chi-squared statistic of 300.12 for the female model and 269.51 for the male model)[16]. This

[16] Alternative functional forms were tested to establish whether the presence of heteroskedasticity was eliminated in other functional forms. From the other functional forms, no model was able to overcome the presence of heteroskedasticity (for example, using log-log models where both the

is consistent with the method used by Stock and Watson (2008, p.xxx to xxxi) who state "we allow for heteroskedasticity from the outset and simply use heteroskedasticity robust standard errors".

The results for the fixed effects model are based on cluster robust standard errors (Stock and Watson, 2008) in order to account for arbitrary intra-group correlation and heteroskedasticity that are prevalent within the panel fixed effects models. This allows the errors to be correlated within a higher education institution but assumes that errors not in the same institution are uncorrelated (Stock and Watson, 2008).

The joint significance of each model was tested by performing F-tests. This method tests the null hypothesis H_0 that the parameters are equal to zero against the alternative that the parameters in the model are different from zero.

This test yields an F value of 3.63 and 3.69 for the female and male OLS regressions without fixed effects respectively using $F(_{6,\ 231})$. Comparing these values to the critical value for the F distribution at the 5% significance level (2.10) establishes the null hypothesis can be rejected in the case of the OLS models without fixed effects and therefore the coefficients in the model are different from zero. The same tests can be applied to the fixed effects models for males and females. The F values within these models are 3.35 and 1.30 respectively for females and males. It should be noted that using cluster robust standard errors in the fixed effects model has significantly reduced the degrees of freedom which has subsequently impacted the male model. In the female fixed effect model, the F value exceed the critical value of 2.92 at the 5% significance level for $F(_{6,13})$. Thus, the null hypothesis can be unequivocally rejected in favour of the alternative for the female model, that the coefficients in the model are different from zero. The male fixed effects model, as outlined above does not explain the variance of the participation share of males in higher education institutions in Scotland.

Female response to price

A number of studies have found that females are more likely to be influenced by the cost of higher education than males (see, for example, Hossler, Hu and Schmit, 1999; Mansfield and

dependent variable and explanatory variables are expressed in log forms for the female model produced a modified Wald test chi-squared statistic of 719.96 with a prob>chi-squared statistic of 0.0000, implying the functional form specified in equation (3) provides the best functional form. Therefore, cluster robust standard errors were used to control for heteroskedasticity.

Warwick, 2006; Wilkins, Shams and Huisman, 2013). To complement the aforementioned study on factors that influenced gender participation in higher education, and to further investigate the reasons for increased participation among females, it is interesting to analyse whether females in Scotland have based their decision to enter higher education as a response to a policy intervention implemented in 2001 which changed the price individuals paid for education.

As previously mentioned in Chapter 2, the Graduate Endowment Fee (GE) was introduced in Scotland in 2001, the year after tuition fees were abolished. The 2001 cohort was the first to pay the fee following completion of their degree in 2004/05. Students studying at Scottish higher education institutions who had completed three or more years of higher education were required to pay around £2,000 approximately 10 months after they completed their degree[17] (Scottish Government, 2007). The rationale for introducing the GE stemmed from the notion that individuals would gain from participation in higher education and should thus pay the fee in acknowledgement of the benefits they received. The fees were collected to assist in the funding of bursaries and to support the future of Scottish higher education. Table 3.4 shows the GE from when it was first introduced in 2001/02, to when it was abolished in 2006/07.

Table 3.4: Graduate Endowment Fee

Academic year student enters Higher Education	Amount payable (£)
2001/02	2,000
2002/03	2,030
2003/04	2,092
2004/05	2,154
2005/06	2,216
2006/07	2,289

Source: Scottish Government (2007). *Notes*: Table shows the Graduate Endowment Fee and amount payable by year of entry. The Graduate Endowment Fee was introduced in 2001 and abolished in 2007. The fee was payable upon graduation.

The GE was removed for those completing higher education on or after 1 April 2007, thus an individual who entered higher education in 2004/05 would not be obliged to pay the fee if

[17] Exemptions from the graduate endowment included, mature students, lone parents, part-time students and those who did not study in Scotland (including those who were not Scottish domiciled), (Scottish Government, 2007).

they completed a three year course in June 2007. The rationale for the abolition of the GE stemmed from the notion that, despite the abolition of tuition fees in Scotland, the introduction of the GE imposed subsequent financial pressures on students and thus barriers to entry, particularly for those from lower socio-economic backgrounds. Moreover, despite the idea that graduates would pay the GE approximately 10 months after graduation, many did not pay during this time frame and instead deferred payment by adding it to their student loan (Scottish Government, 2007).

Data

The objective of this study is to ascertain whether females are influenced by the price of higher education. Data were obtained from HESA to calculate the percentage share of UK domiciled female students for each of the higher education institutions in Scotland and England/Wales for each academic years from 1998/99 to 2013/14. Given the aforementioned exceptions to the GE, this study focusses on those aged under 21 entering higher education on a full-time basis in order to eliminate potential individuals who were exempt from paying the GE, such as those who were classified as mature students.

Model specification

The policy reform chosen to estimate the effect of female response to price in higher education is the abolition of the GE in Scotland. In order to conduct this study, synthetic control methods[18] were used to assess whether females have been influenced by the abolition of GE in Scotland. This will enable us to establish whether the increase in the female share of participation in higher education has increased as a result of the abolition of fees. The hypothesis is that the female share would increase, given females are believed to be more price responsive to higher education than males. Thus this study aims to assess whether the removal of the GE has contributed to the increased participation levels of females in Scottish higher education institutions.

The synthetic control method will enable measurement of outcomes in both the population affected by the abolition of the GE (Scotland) and a comparator (England/Wales) which will be used as a control population, as individuals in England/Wales were not exposed to the policy intervention. Abadie, Diamond and Hainmueller (2015) note the control units should

[18] Developed in Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010).

be selected with care and should be selected based on the notion that they were not affected by the policy, or policies of a similar nature. Moreover, Abadie et al (2015) stress the importance of removing controls that experience idiosyncratic shocks which may bias the results. It is the belief that institutions in England and Wales do not suffer from the above and can thus be used in the analysis. It is worth noting that policies in regards to funding of higher education in England and Wales were changed in 2011, but this should bear no significance for the purpose of this study which focusses on a policy implemented in Scotland in 2007.

The model uses a synthetic control of 116 institutions across England and Wales covering the period 1998-2014 with the policy intervention occurring in Scotland in 2007. Within this study, a Russell Group[19] indicator was used. The rationale for using the synthetic control model stems from the notion that the outcome for the treatment period reflects the weighted combination of the control group's outcome to establish a treatment effect which shows the magnitude of the effect of the policy change. The synthetic cohort is constructed using the data for institutions in England/Wales to obtain the weighted average of the non-treated institutions that best represent characteristics of Scottish institutions prior to the abolition of the graduate endowment fee. The model is based on three fundamental assumptions. The first assumptions relates to the fact that only the treated country is affected by the policy change. The second corresponds to the fact that the policy change bears no effect prior to taking place and the third concerns the treated country's counterfactual which can be estimated using a fixed combination of donor institutions (the non-treated institutions).

The synthetic control method creates institution level weights to construct the synthetic control institution. The weights for all Scottish higher education institutions sum to one and are dependent on the other weights that have been assigned to the predictor variable, thus preventing the model from extrapolating the results. The weights are chosen from all possible combinations and selected based on the weights that minimise the mean squared prediction error for the years prior to the policy change (Abadie, Diamond and Hainmueller, 2010). The synthetic control method thus allows us to state the relative involvement of each of the control institutions to the counterfactual and additionally the extent to which the treated institution and its synthetic counterpart are similar in both the pre and post-

[19] A group of 24 UK universities perceived as leaders in research and teaching.

treatment periods. Details of the synthetic control cohort for each of the Scottish higher education institutions are contained within Appendix C.

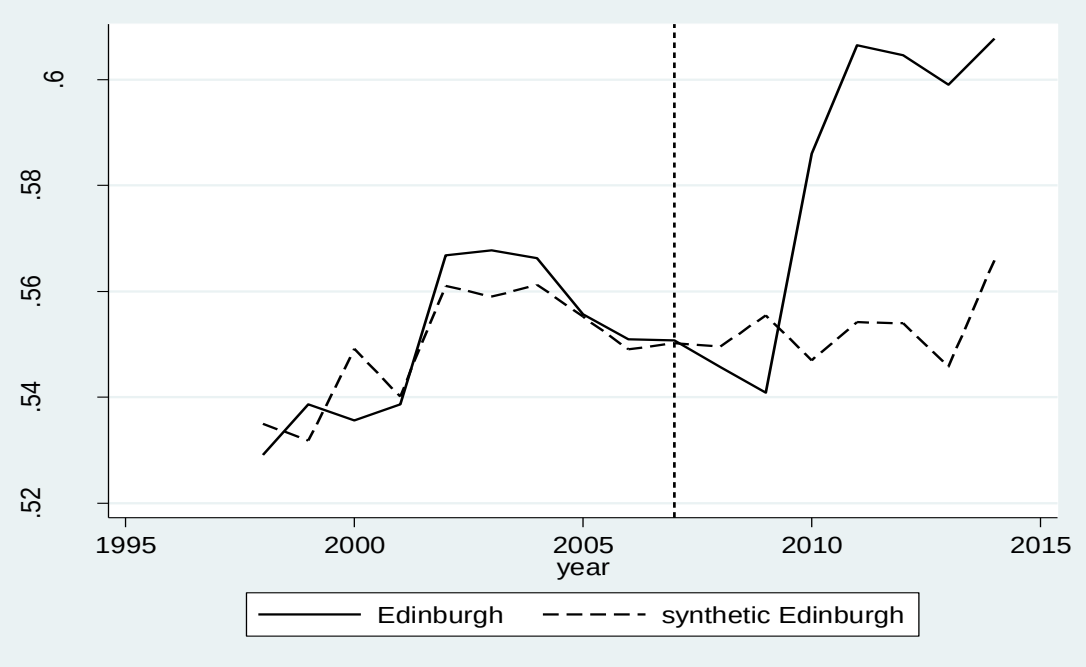
The study contains a total of 17 institutions in Scotland, the University of the Highlands and Islands was omitted from the study as it was established in 2001 and gained university status in 2011, thus insufficient data are available to apply the synthetic control method for this institution.

In order to conduct this study, the percentage share of female students was calculated for each of the higher education institutions in Scotland, England and Wales for each academic year using data from HESA. Scotland is considered to be the treatment group and England and Wales is the synthetic control whereby a weighted average of 116 higher education institutions are used.

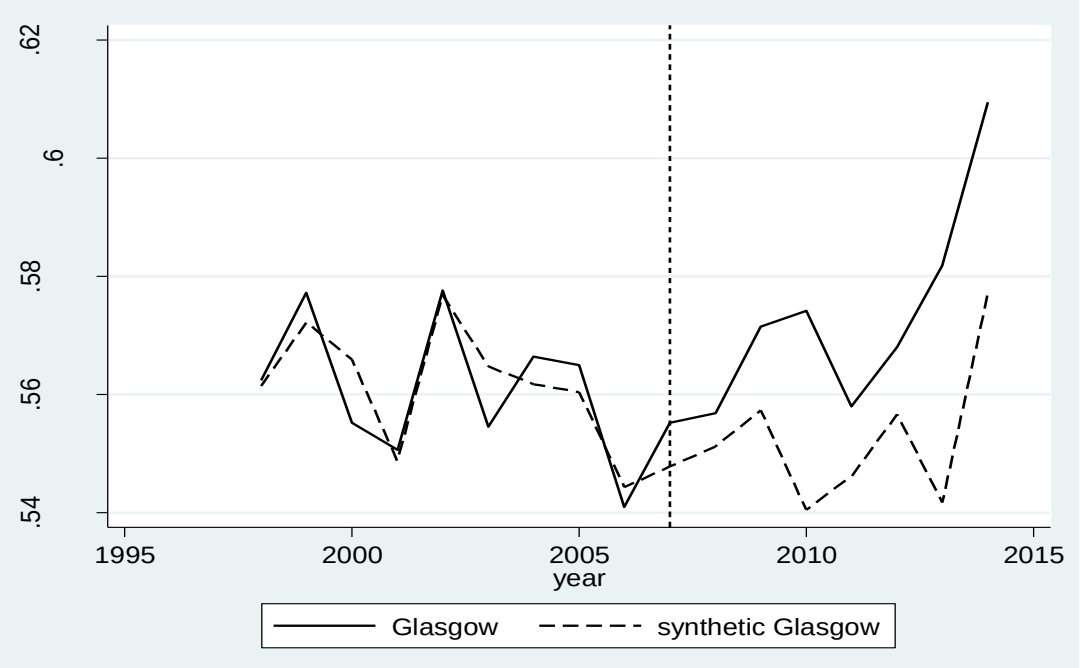
Figure 3.9: Synthetic Control results

Russell Group Institutions

University of Edinburgh

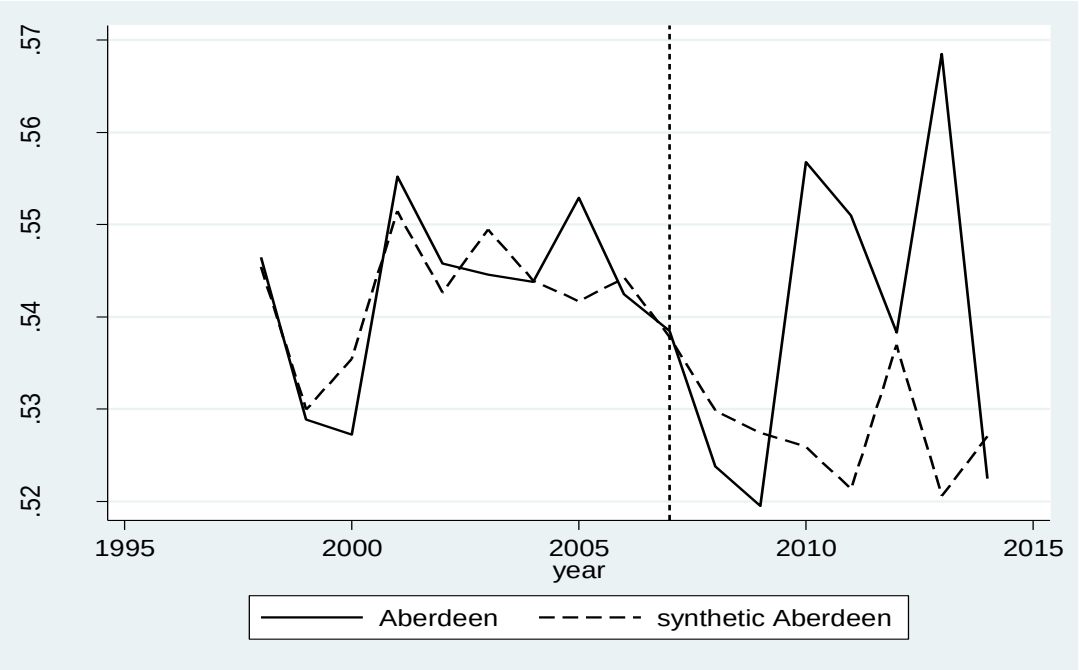


University of Glasgow

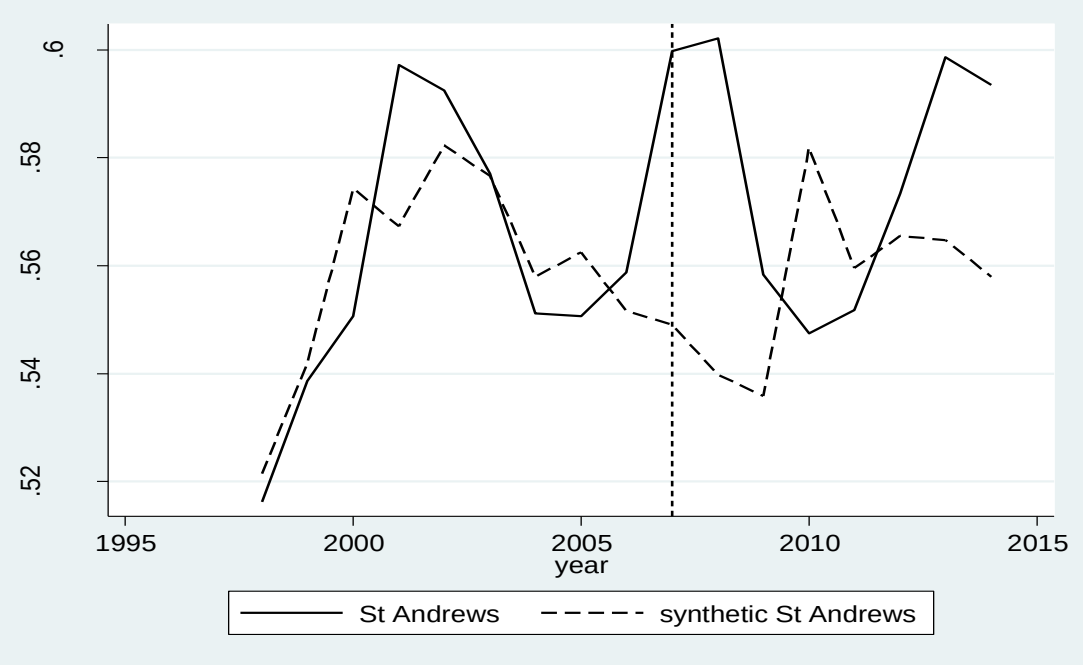


Pre-1992 institutions

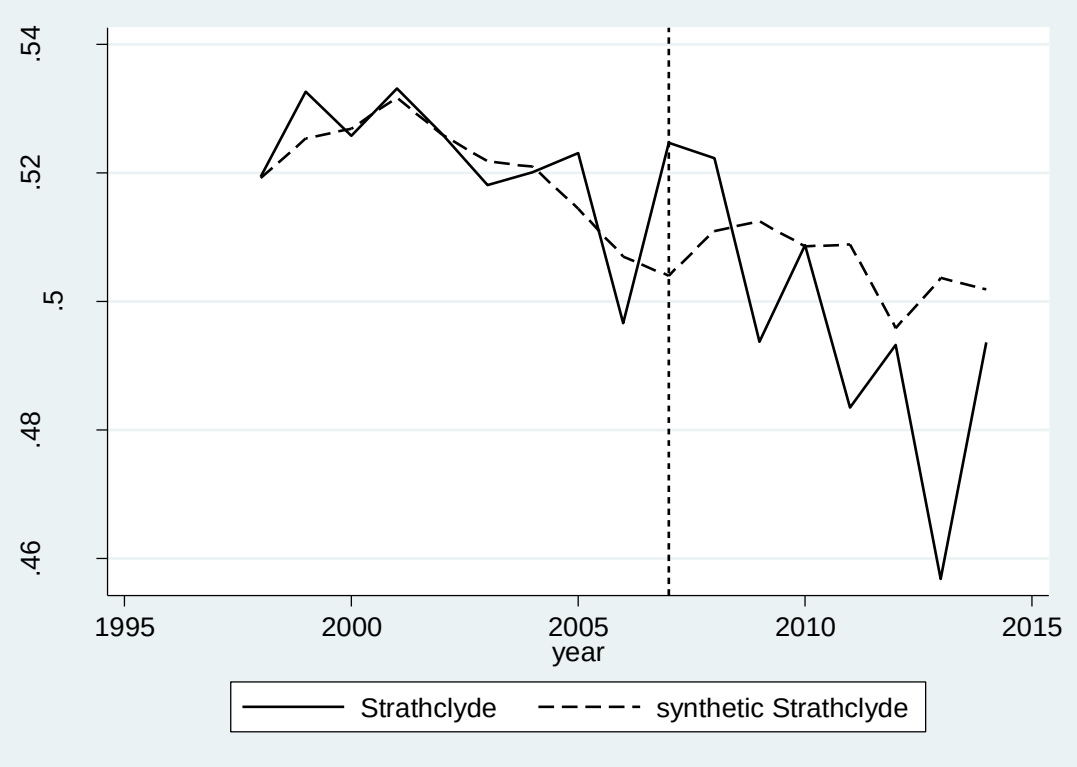
University of Aberdeen



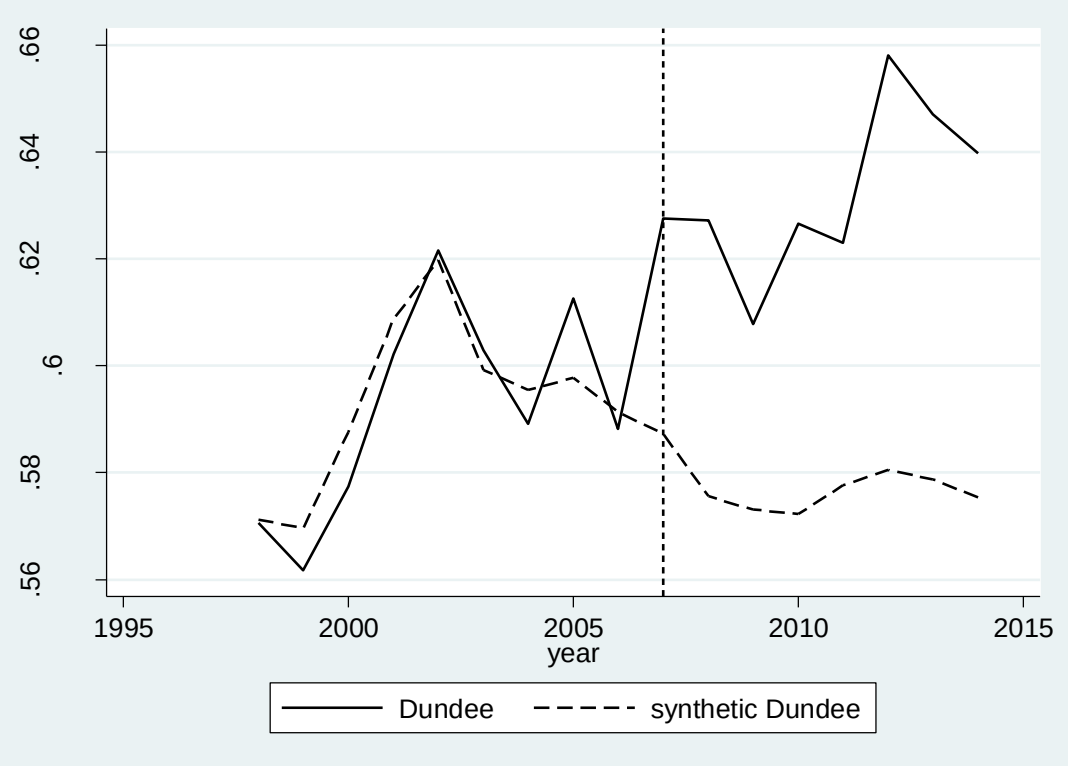
University of St Andrews



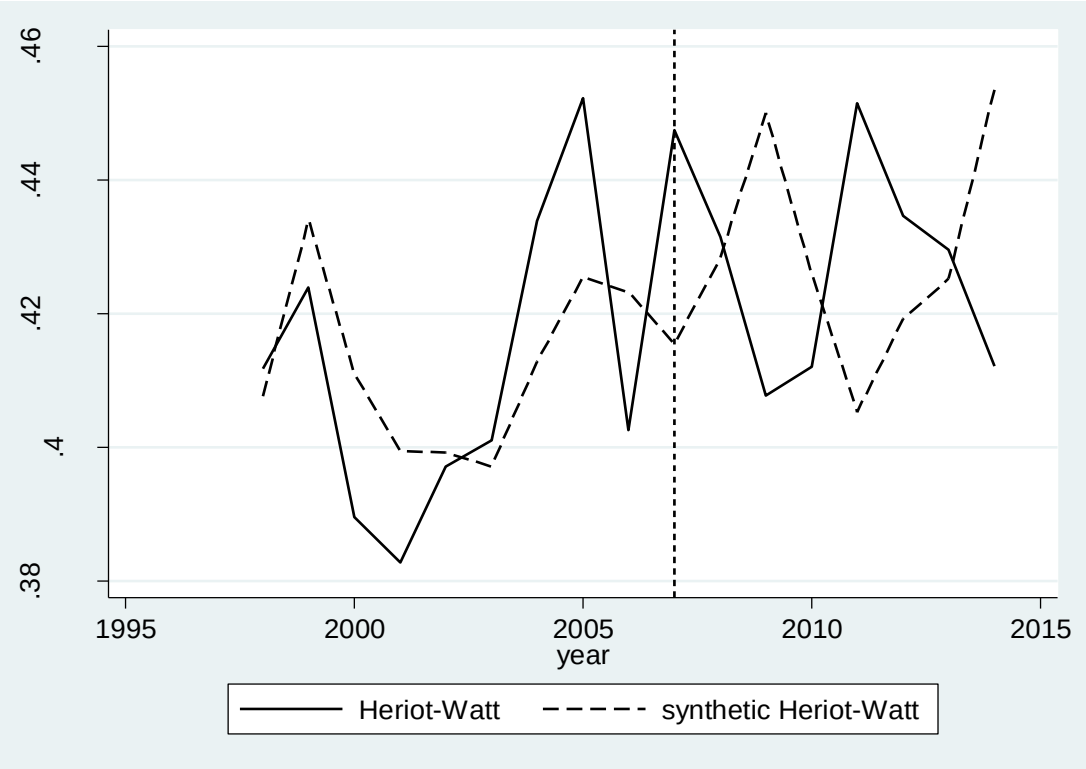
University of Strathclyde



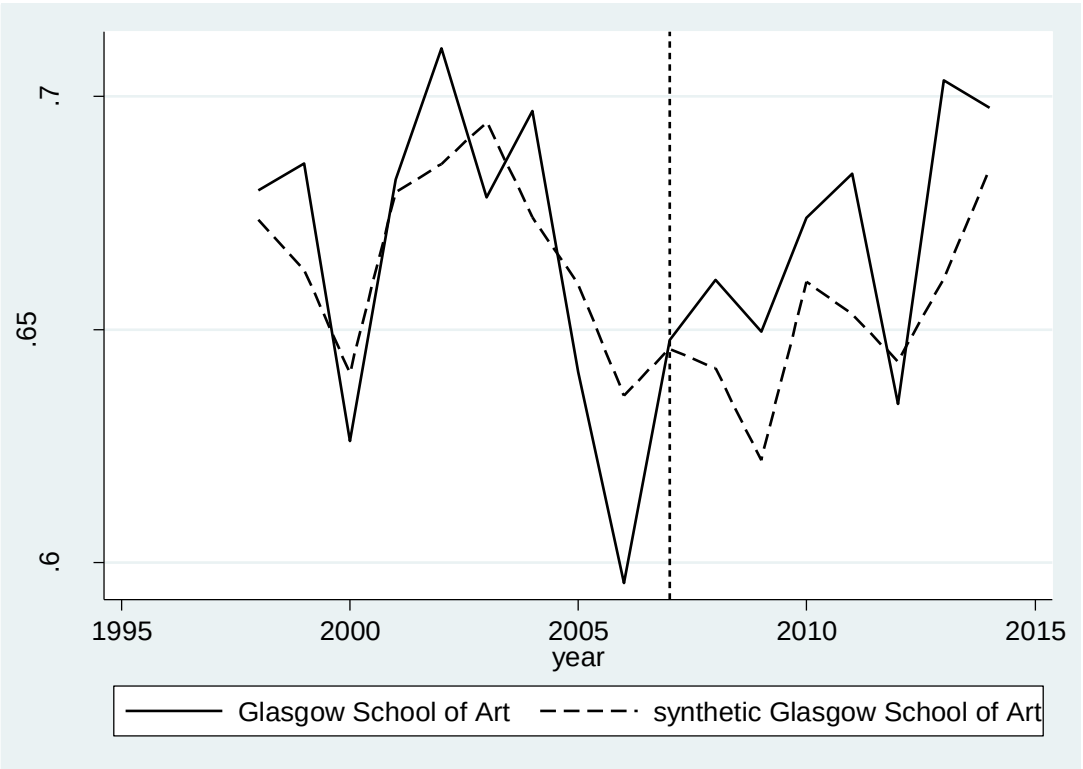
University of Dundee



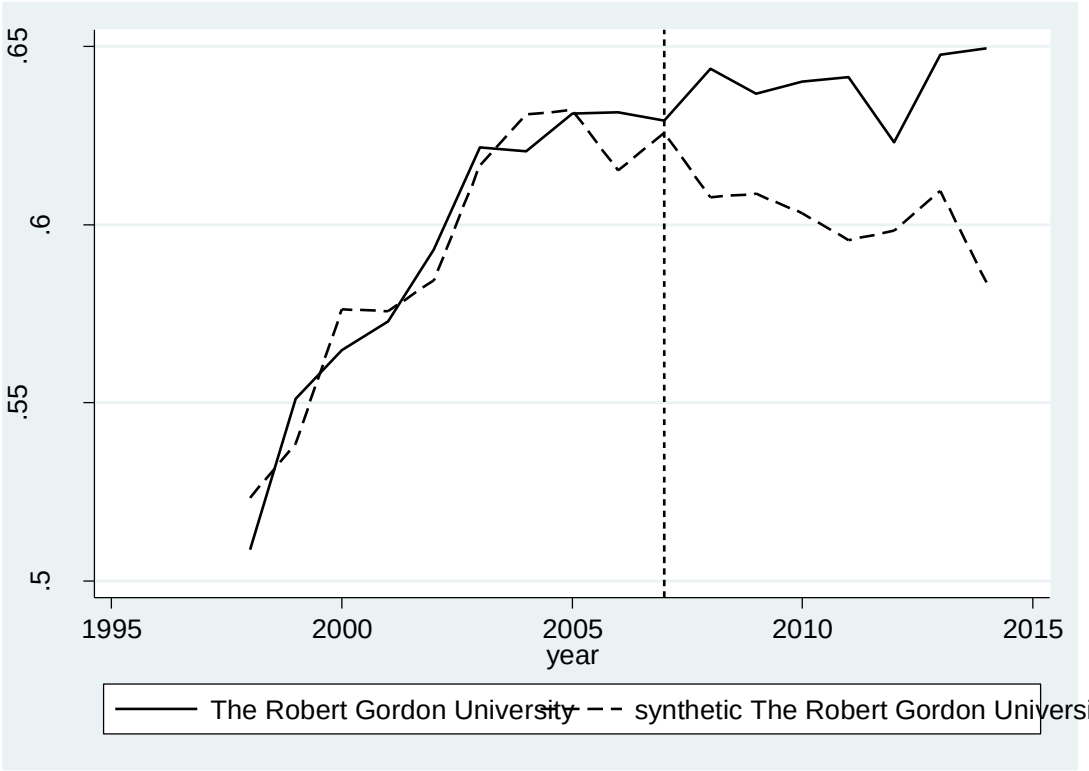
Heriot Watt University



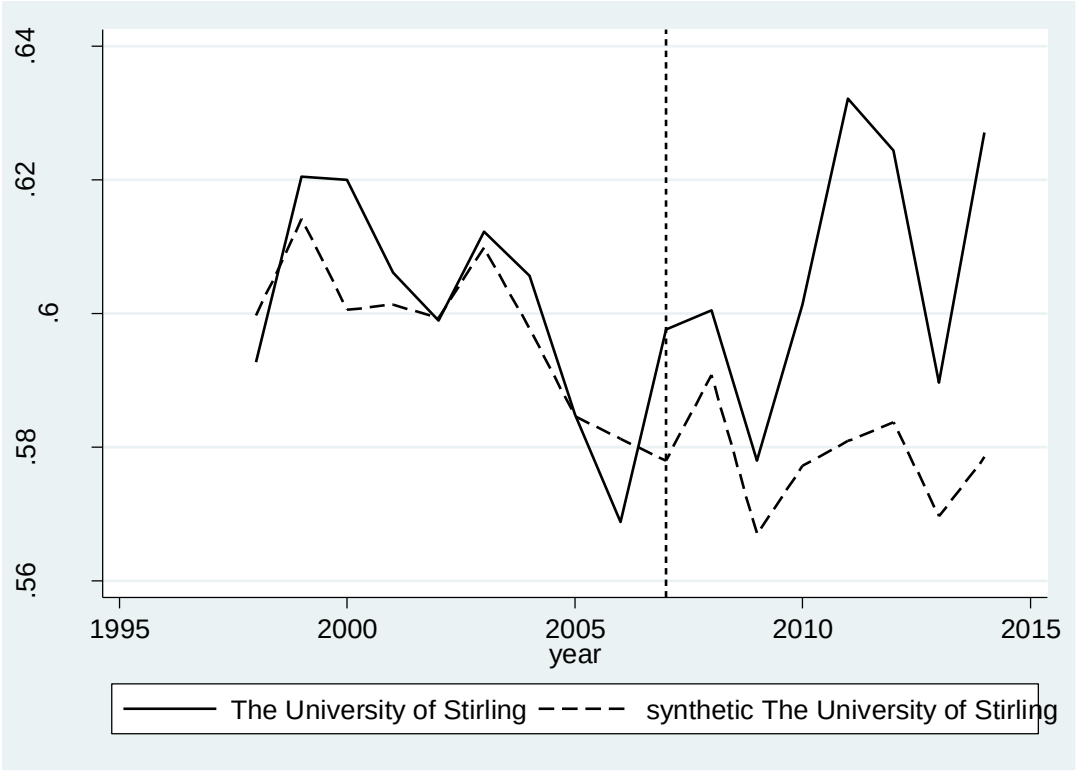
Glasgow School of Art



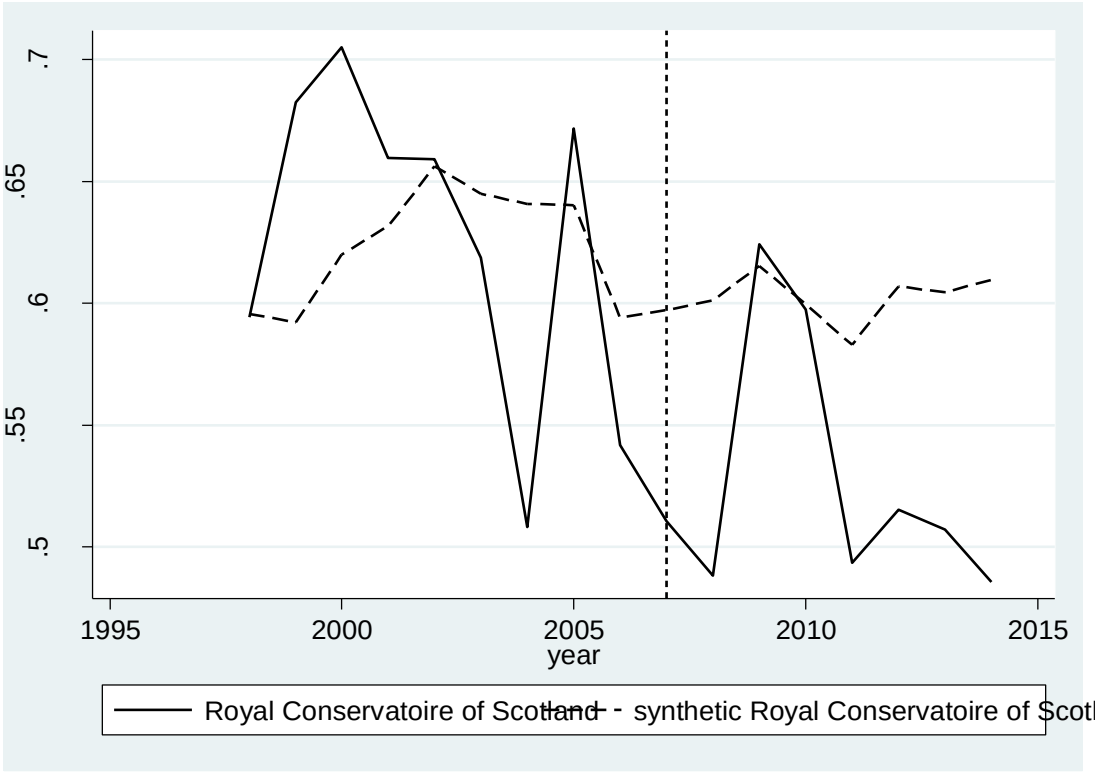
The Robert Gordon University



University of Stirling

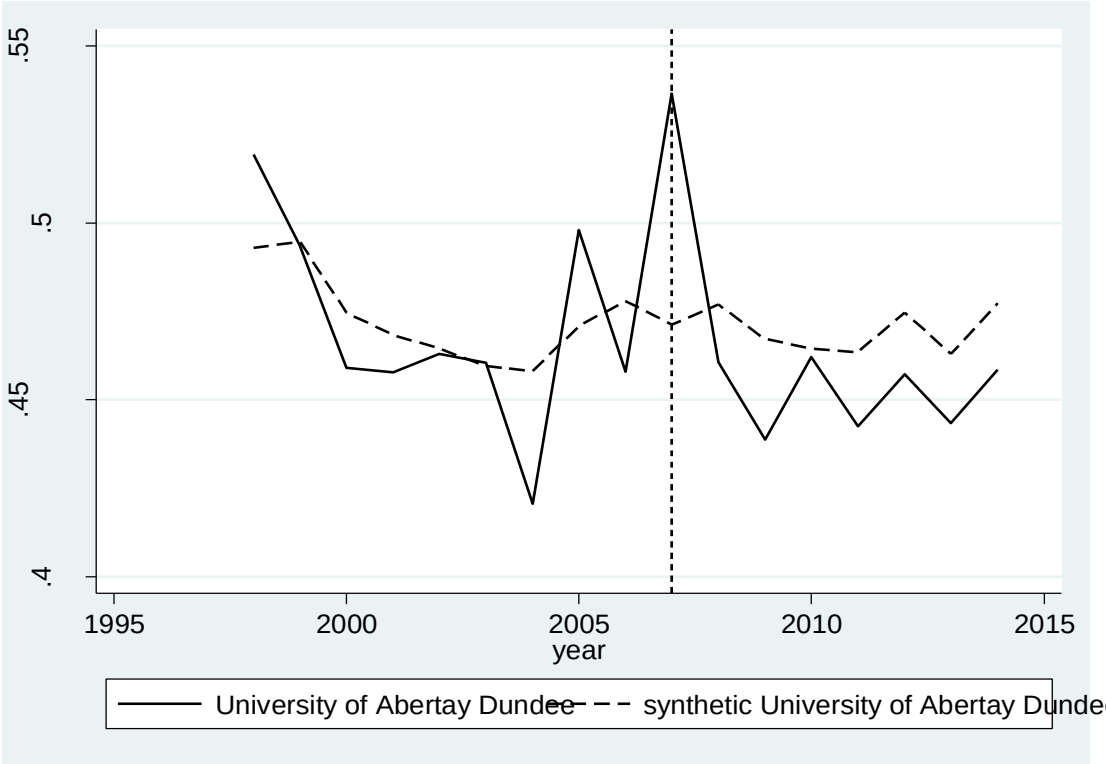


Royal Conservatoire of Scotland

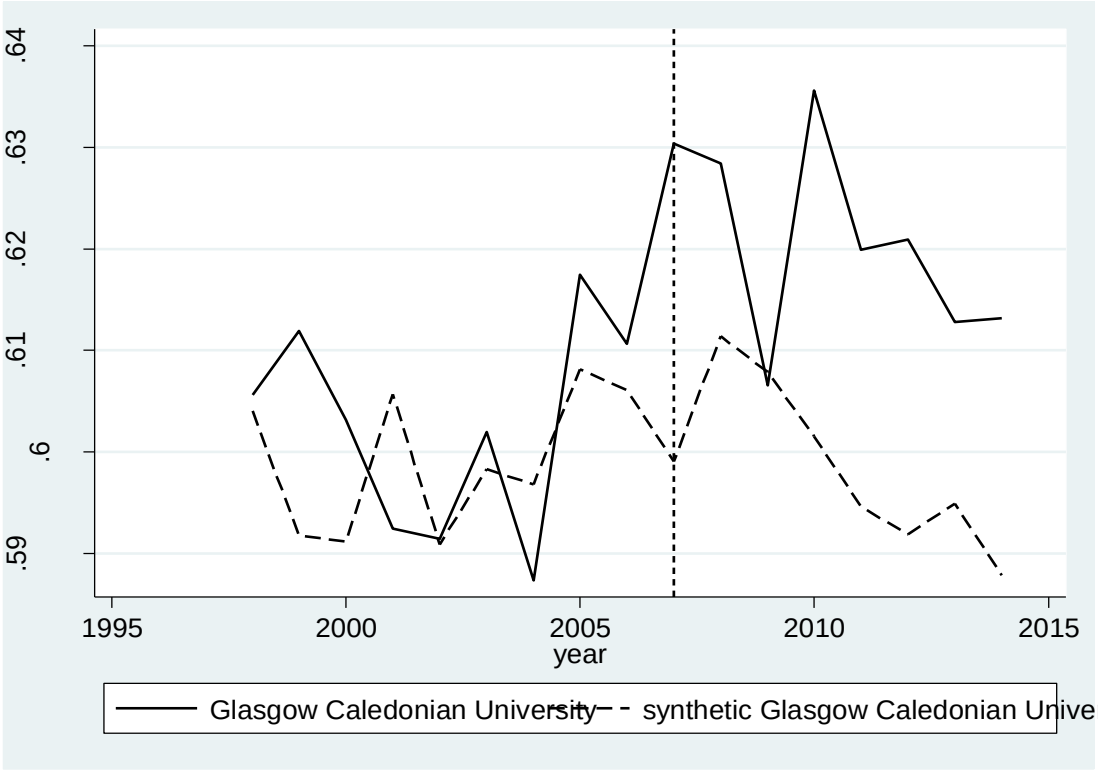


Post-1992 institutions

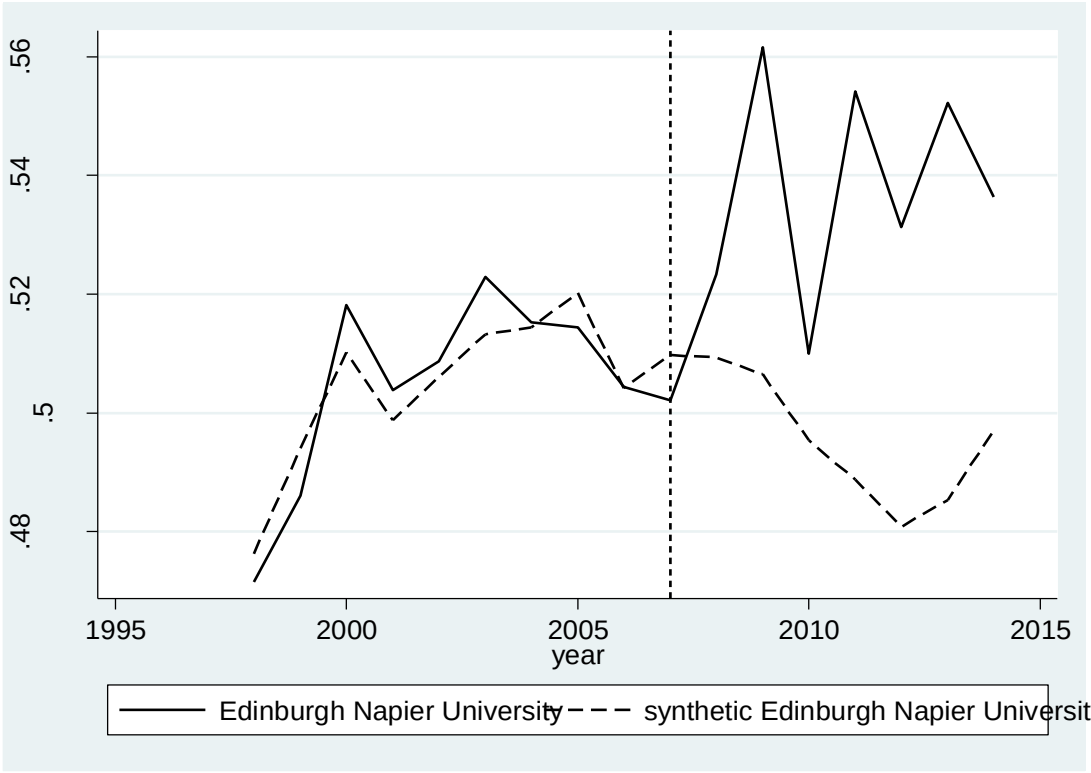
University of Abertay



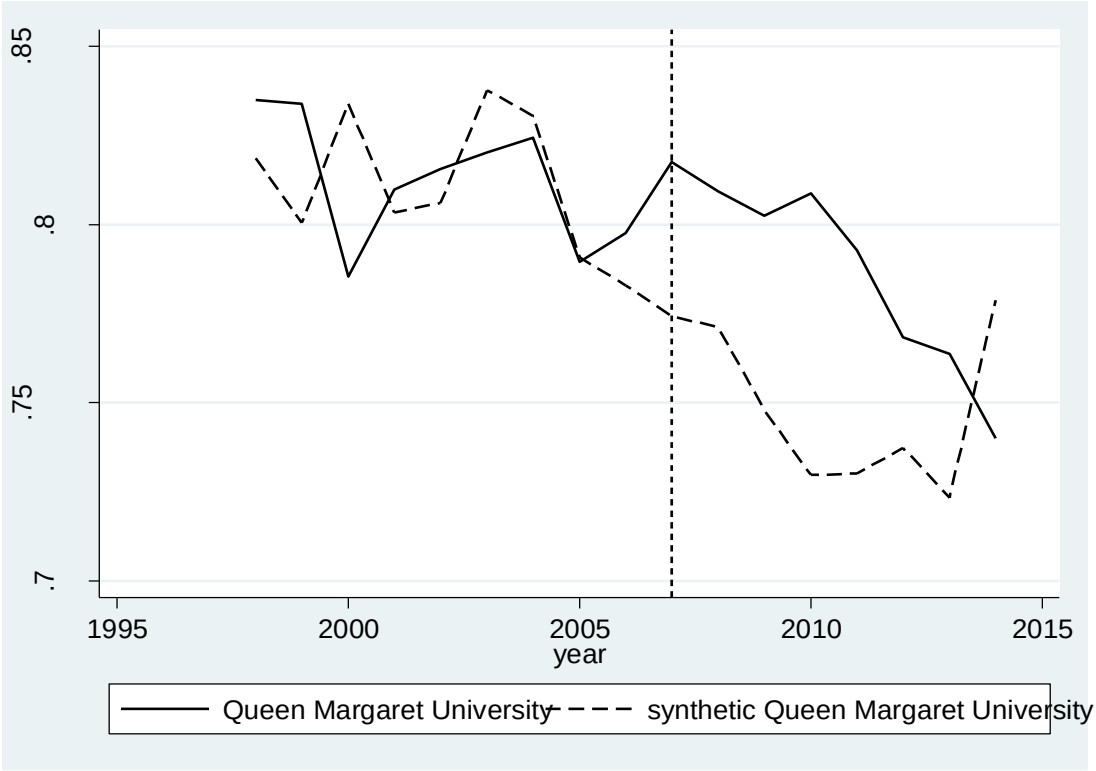
Glasgow Caledonian University



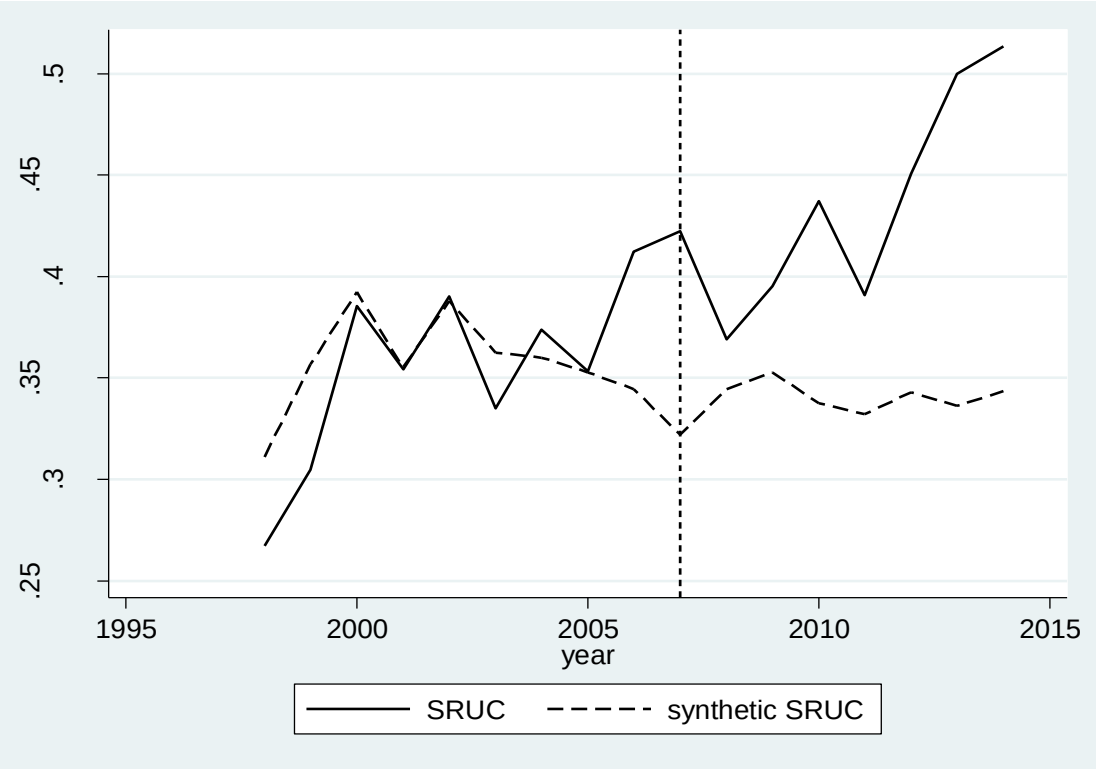
Edinburgh Napier University



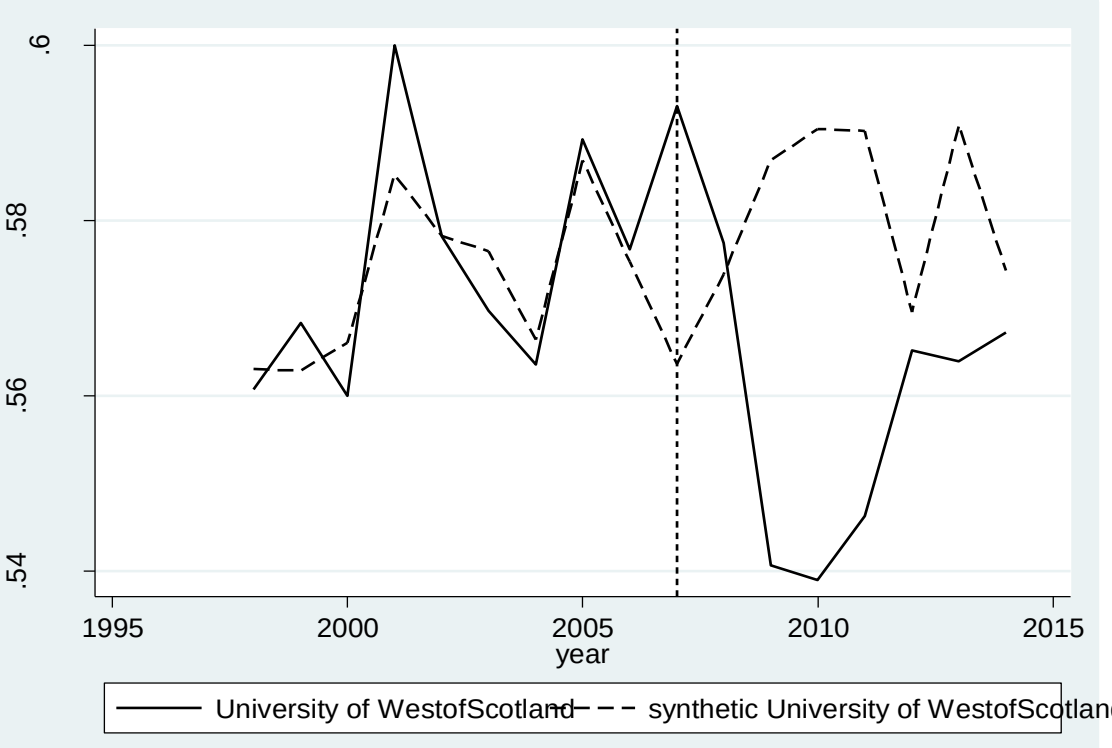
Queen Margaret University



SRUC



University of the West of Scotland



3.4.6 Discussion of synthetic control results

The above charts in Figure 3.9 represent the percentage share of females enrolling at each institution in Scotland in a given year along with the institution's synthetic counterpart comprised of weights using English and Welsh institutions.

Results for the 17 higher education institutions show that the abolition of the GE has increased the female share of participants in a large proportion of the Scottish institutions. The synthetic control estimates for each institution in Scotland vary. Appendix C displays the matching weights applied to each of the control institutions taken from England and Wales. For example, the weights taken for the University of Edinburgh prior to the GE being abolished are best reproduced using a combination of the Universities of Bristol, Liverpool, Oxford, Newman, Birmingham, York, Exeter, the Royal Veterinary College and Bishop Grosseteste. All other universities within the potential pool are assigned zero as the weight. Models that show a clear similarity in terms of the synthetic control tracking the share of females at a given institution provide the most accurate identification of whether the policy change affected the female share at the institution. This is in terms of the synthetic control providing a justified approximation to the share of females at the institution that would have been observed had the Graduate Endowment fee not been abolished. This allows us to study the impact the abolition of the GE fee had on the share of female participation.

From the analysis, it is interesting to note that the synthetic institution weight for each Scottish institution is similar to the actual share of females prior to the Graduate Endowment fee being removed. The synthetic control modelling has been particularly insightful for the Universities of Edinburgh and Glasgow, St Andrews, Strathclyde, Dundee, Glasgow School of Art, Edinburgh Napier, Robert Gordon and Stirling. This is true to the extent that the synthetic female share of participation means for each of the institutions does relatively well at mirroring the trends in the female share prior to the removal of the Graduate Endowment fee.

The synthetic control modelling results are split into the institution classifications Russell Group, pre-1992 and post-1992. In terms of the two Russell Group institutions in Scotland, the results show the share of females at the University of Edinburgh was not affected by the

abolition of the GE fee whereas the share of females at the University of Glasgow increased following the policy change.

The pre-1992 institutions also show some differences depending on institution. The model for the University of Aberdeen, for example, reveals a sharp decline in the share of females entering the institution following the removal of the GE fee. The weights assigned to this model track the share of females moderately well, particularly in the year prior to the policy change. Although some of the synthetic controls do not exactly mirror the Scottish institution prior to the GE fee being removed, it is interesting to note that the magnitude of the difference between the Scottish institution and its synthetic control significantly increases following the policy change in Scotland. This statement is particularly prevalent in the cases of St Andrews, Strathclyde, Dundee, Glasgow School of Art and Robert Gordon, whereby there was an increase in the female share following the GE abolition and, moreover, the difference between these institutions and their synthetic control counterpart significantly increased in 2007.

In terms of the post-1992 institutions the results are mixed depending on institution. Napier University provides an interesting example where the synthetic control weight does a reasonable job at tracking the share of females prior to the policy change. The synthetic Napier thus provides a sensible approximation to the share of females that would have been apparent in the institution had the GE not be abolished. The difference between Napier and synthetic Napier highlights the policy had a positive effect on the female share of participants at this institution. The other post-1992 institutional analysis provide some interesting results where the majority, it seems, have not increased their share following the policy change. For Abertay, Caledonian, Queen Margaret, SRUC and the West of Scotland, there appears to have been an increase in the share of females enrolling prior to the abolition of the GE fee, with the increases occurring in 2005 and 2006. Nonetheless, it appears the abolition still had an effect on the female share of participation if we consider the discrepancies between the two lines for each of the institutions. That is to say the female share of participation is higher than would be predicted had the policy intervention not occurred; as is the cases of Caledonian, Queen Margaret and SRUC. Thus, it appears, that in at least some of the higher education institutions in Scotland, the increases in the female share of participation has been driven by the abolition of the graduate endowment fee.

3.4.7 Falsification testing

In order to evaluate the significance of the above estimates placebo tests were conducted. Using placebo tests will allow us to determine whether the results are driven by the policy change in Scotland, or whether the results occurred by chance. This approach of falsification testing is following the method used by Abadie, Diamond and Hainmueller (2010). Placebo studies were conducted whereby the policy intervention was reassigned to a year other than 2007. This method allows us to test the credibility of the synthetic control models for each institution.

The placebo test reassigned the treatment period to 2002, five years prior to the actual policy intervention, and the middle of the pre-treatment period. A placebo test was conducted for each of the seventeen higher education institutions in Scotland, using the same out of sample process as previously conducted. The 2002 treatment period should bear no significance, whereas a large placebo result would suggest that the policy intervention had little to no significant impact on the share of females at higher education institutions in Scotland. The results from the placebo tests are displayed in Appendix D. The placebo test show very mixed results depending on institution. For the Russell Group institutions, the tests show some significance to the 2002 treatment, signifying the synthetic control method used for the GE abolition may be undermined. The pre-1992 institutions studies show some promising results, particularly for the Universities of Strathclyde and Stirling where the placebo policy did not have an effect on the female share of participation. The post-1992 institutional analysis suggests the synthetic control method is appropriate for the Universities of Abertay, Caledonian, Napier, Queen Margaret and SRUC. From these institutions, Napier is the one that witnessed a notable increase in the female share participants, with an approximate increase of two percentage points in the year following the Graduate Endowment abolition. Abertay, Queen Margaret and SRUC all experienced a decrease in the share of females. This implies the male share of entrants to these institutions increased.

It is clear from these results that the synthetic control method does a better job at modelling the post-1992 institutions than for the Russell Group. The analysis for the pre-1992 institutions provide mixed results. This may be due to the fact that, typically, individuals from lower socio-economic backgrounds are less inclined to attend Russell Group institutions and more likely to attend post-1992 institutions (Forsyth and Furlong, 2003). Moreover, these

individuals are more likely to be price sensitive to enrolment than those from higher socio-economic backgrounds.

3.4.8 Limitations

We do not currently have data on early years' attainment and this is something which can be developed in future research. Recent studies use administrative data combining HESA and administrative tax data to analyse student's prior attainment on higher education outcomes (Britton, Dearden, Shephard and Vignoles, 2016). Other studies match HESA data to Labour Force Survey (LFS) data to measure selectivity of courses based on prior attainment (Walker and Zhu, 2017). Additionally, the results of the current study are based on traditional students entering higher education (those aged 17 to 20) and therefore may be biased.

3.5 Conclusions

There have been significant changes in regards to enrolment patterns between males and females over the last two decades that has resulted in a puzzle emerging. Existing literature points to the notion of early year's attainment, social characteristics, non-cognitive skills and marriage/divorce rates as a means to explain the apparent differences. The existing literature has predominantly used data from the United States to establish these reasons. However, there have been no studies focussing on this within the context of Scotland.

An empirical model, aimed at establishing some of the factors contributing to increased female participation in higher education in Scotland, was developed in Section 3.4. The model shows that the share of female participation in higher education in Scotland is positively influenced by the employment rate for those who have obtained higher education and the log of the population aged 17. The male model shows the share of males entering higher education is negatively associated with an increase in the employment rate for males with a degree.

Additional studies were conducted to establish whether females are price sensitive to enrolling in higher education. Synthetic control methods were employed for the 17 higher education institutions in Scotland to assess the effects of the removal of the Graduate Endowment Fee on the share of female participants. The results show the share of female participants has increased in some Scottish institutions as a result of the abolition of the

Graduate Endowment Fee. This is particular relevant to Edinburgh Napier University and The University of Stirling where the female share has increased. For the other institutions, the results are varied and imply females entering these institutions were either unaffected by the policy change or the enrolment share of females declined. Indeed, previous studies assert that females are more likely to be influenced by the costs of higher education than males. This study shows the impact of the abolition of the Graduate Endowment Fee on the female share of entrants is very much sensitive to the institutions. It is plausible that females were unaffected by this policy.

Chapter 4 Geographical Mobility in Higher Education

4.1 Introduction

The geographical mobility of higher education students and subsequent mobility of graduates have been a key focus within economic literature in recent years. Individuals wishing to study at university are assumed to have a degree of choice in terms of the institution. Some typical factors they consider are the appropriateness of the course and the reputation of the higher education institution[20]. The institution decides whether the individual should receive a place at the institution following the individual's application and the decision is predominantly based on academic attainment. It therefore follows that the more academically able the individual, the more choices of institution are available (Sjaastad, 1962; Faggian, McCann and Sheppard, 2006). From a theoretical perspective, several studies note that the previous migration of an individual has a positive effect on migrating again (see for example DaVanzo, 1976). In consequence, individuals who moved for university are more likely to move for employment. This increased graduate mobility has implications on the operation of higher education, particularly when higher education is publicly funded (Felbermayr and Reczkowski, 2015). This is often referred to as a brain drain.

This paper provides an analysis of student migration using British university data. The paper utilises data from the Higher Education Statistics Agency (HESA) which collects data from higher education institutions within Great Britain. The paper is organised as follows: the second part details the theoretical framework on which the study will be based, specifically assessing current literature on student migration in section 4.2. Section 4.3 summarises the literature in terms of the case of Great Britain. The fourth section details the methodology that will be adopted and describes the data that are used, in addition to reporting the results of the econometric study. Section 4.5 provides key conclusions and points of policy to be addressed in the final chapter.

[20] University league tables are published within the UK.

4.2 Literature review

4.2.1 The economics of migration

Many of the features existing in migration literature can be applied to student mobility. The geographical mobility of workers has received considerable attention in economic literature from both a theoretical and empirical perspective. This section will review economic literature relating to migration, with a view to drawing parallels with student migration behaviours. From a theoretical perspective, individuals are incentivised to move for economic and other reasons (Bowles, 1970). As is the case with many other decisions, a rational individual is expected to consider the present values of the net costs and benefits associated with migrating. The expected benefits of migrating may include increased wages, or more desirable social surroundings. The expected costs are anticipated to include the financial cost of moving, in addition to the psychological cost of making new acquaintances and uncertainties surrounding the future (DaVanzo, 1980). It could be the case that the individuals who do migrate place lower than average valuations on these costs.

Economic migrants are considered to be those individuals seeking employment and other economic advantages in a new country or region with the expectation of enhancing their and their family's lives (Constant and Zimmermann, 2013). An economic migrant is assumed to be following the Mincerian human capital model derived from the notion that migration is an investment in human capital (Schulz, 1961 and Sjaastad, 1962).

An individual is assumed to be rational and therefore considers the information available to them in the decision making process of migrating. In this regard, an individual is assumed to consider future payoffs arising from staying in the home region and those which come as a result of moving. Given that future payoffs are difficult to ascertain in both situations, an individual will consider the present value of the expected benefits, with the expected present value of the cost of moving subtracted to allow for a more realistic overview of the outcome. The decisions are believed to be rational *ex ante* but may not necessarily reflect a rational decision *ex post* (DaVanzo, 1980).

An individual is expected to choose the location which is believed to provide the greatest net gain. The net gain can be calculated by taking the present discounted value of expected

future real income and anticipated utility from moving and from not moving. DaVanzo (1980, p.6) conceptualises an individual's decision to move where:

i denotes the current location

j denotes potential future location

PV_{ij} denotes the present value of the net gain from moving from location i to location j

U_k^t denotes the expected utility from either location (where k = i or j) at time t

C_{ij}^t denotes the costs incurred from moving to j from i at time t

$(1+r)^t$ denotes the discount factor. DaVanzo (1980) notes the discount factor is utilised to account for the notion that individuals will ordinarily place a lower value on future utility than the present.

DaVanzo (1980) states an individual will move from area i when:

$$PV_{ij} = \sum_{t=1}^{T} \frac{U_j^t - U_i^t - C_{ij}^t}{(1+r)^t} > 0$$

for at least one area $j(\neq i)$ and will select the location with the highest PV_{ij}.

An individual is typically faced with a degree of choice in terms of location, and with these choices come a number of different potential payoffs. The preferred location is anticipated to be the one that is expected to give the largest net gain.

The above equation is similar to those presented for the investment in human capital decision in Chapter 2. Another way of presenting the model is to state that an individual will migrate based on the internal rate of return. An individual is expected to migrate if the internal rate of return is higher than alternative investments.

The model could be enhanced by the presence of perfect information about the costs and benefits associated with migrating in order to make a well-informed decision. In reality, perfect information is not always possible and thus perceived values are used based on the information that the individual has when making the decision (DaVanzo, 1980). Moreover, the expected utility from migrating will differ by individual given their attitudes towards risk. Those who are risk averse, for example, are anticipated to approach the decision by assigning disutility to the uncertainty they are faced with (DaVanzo, 1980). This implies risk averse

individuals have a lower probability of moving than those who are risk neutral or risk seeking. Given that investment in migration can only be pursued for one location at any given time, the riskiness attached to migration is believed to be relatively high. Unlike other investment decisions, one cannot simply spread the investment across varying levels of riskiness, as is the case with an investment portfolio of stocks and shares. DaVanzo (1980) notes one way of offsetting some of the risk would be for the individual to obtain as much information prior to the migration decision. Specific characteristics influencing migration decisions for higher education and employment will be discussed in the following sections.

4.2.2 Migration for higher education

The economics of migration literature outlines the decision making process involved in migrating. Typically an individual will migration when the expected present value of moving to a new location is greater than the expected present value of remaining in the current location, other things being equal. This theoretical concept can be applied within the context of migrating for higher education. Migration, in the context of the theoretical literature outlined above is broadly defined and does not distinguish between a short and a long distance migration process. The existing empirical literature on migration, and migration for higher education, provides a narrower focus in many cases where the study concerns cross country migration or analyses various distance bands to disentangle migration patterns.

The below sections will outline the decisions involved for an individual considering higher education with particular reference to institution choice in addition to providing an overview of characteristics that can affect mobility choices in the context of higher education.

4.2.3 Institution choice

Opportunities in higher education have significantly grown over time with the number of institutions and courses available becoming more accessible to wider groups of individuals. Individuals are faced with a number of options when leaving high school; in a broad sense one can choose to enter the labour market or continue with education. Where the latter is chosen, individuals are faced with a myriad of decisions. One important factor is the institution choice of the individual which is believed to be influenced by a number of factors.

Conforming to human capital theory and the economics of migration, a student is assumed to base their decision on location of institution using a cost-benefits approach. Tuckman (1970) states that an individual will choose to migrate for higher education when the expected benefits exceed the costs associated with migrating. Indeed, it may be the case that consumption benefits are identical across institutions and thus individuals will find it in their own interest to migrate if the price of higher education is lower (Tuckman, 1970). Students base their migration decision on the present value of the future benefits and will migrate for higher education if they believe the benefits could be increased in doing so. Notwithstanding, spatial mobility is believed to be significant in an individual's experience of higher education. Institution choice is greater for those achieving high grades at school and thus these individuals have spatial flexibility in terms of where they choose to study for higher education. According to Christie (2007) staying at home for university imposes a barrier to many social and spatial aspects related to one's experience at university.

A wealth of studies focussing on factors influencing institution choice have come from the United States. The emerging reasons for an individual's institution choice are related to location of the institution, the reputation of the establishment (Litten and Hall, 1989), the courses offered (Tuckman, 1970; Mortimer, 1997) and the career prospects (Murray, Murray and Lann, 1997). A UK study by Moogan and Baron (2003) finds individuals choose their institution based on their schooling experience, academic achievements, access, cost and information. Thus, it is apparent that a number of factors exist in determining the mobility of students in higher education.

Previous discussions have focussed on student choice and the attraction of institutions to individuals. Individuals fundamentally choose institutions based on their idea of fitting in, assuming they have no financial constraints and have the necessary grade requirements. These assertions are based on the notion that there is an adequate supply of institutions available. Indeed, it could be the case that there are a limited number of places at a given institution, or alternatively, the institutions available within close proximity to the individual may not meet the student's requirements. This may in turn lead to individuals seeking higher education outside the local area (Tuckman, 1970).

4.2.4 Socio-economic background

Socio-economic background is believed to influence many aspects in life. With respect to higher education, social background is expected to have an impact on whether an individual goes to university and location choice of higher education institution (Paulsen, 1990). It is well documented that those from lower socio-economic backgrounds tend to be underrepresented in the population of students in higher education (Biffl and Isaac, 2002). Lower attainment in school, and lower preferences to enrol in higher education are more prevalent in those from lower socio-economic backgrounds (Declercq and Verboven, 2015). Additionally, the decision to enrol in higher education has been associated with socio-cultural experiences in those from lower socio-economic backgrounds. A study by Archer, Hollinsworth and Halsall (2007) finds those from lower socio-economic backgrounds are marginalised within the context of enrolling in higher education. The study reveals individuals from lower socio-economic backgrounds are more likely to avoid higher education as a result of the belief that higher education is "not for me" (Archer et al, 2007, p.234).

Socio-economic background is not only linked to mobility in higher education, but also to completion rates. Parental occupation, used as a proxy for socio-economic background, is linked to non-completion rates in universities, with those from lower socio-economic backgrounds being more likely to experience non-completion in higher education than those from typically higher socio-economic backgrounds (Johnes, 1990).

As explained in Chapter 2, direct and indirect costs are associated with participating in higher education. The largest direct cost is typically associated with tuition fees and the indirect costs relate to foregone earnings, accommodation and transportation. Students who move from the parental home to study typically face higher indirect costs, as it will be necessary for them to pay for student accommodation.

Given the foregoing, individuals are anticipated to base their institution selection on cost and distance from domicile (Paulsen, 1990). Those from lower socio-economic backgrounds are believed to be disadvantaged not only in entering higher education, but also with respect to their institution choice. Christie (2007) notes that those from lower socio-economic backgrounds who are typically non-traditional students in higher education are more likely to continue living with parents to offset costs of living away from home. This is believed to

be caused as a result of financial constraints in addition to their attachments to family and friends.

A number of studies have found significant differences in the mobility patterns of students based on their socio-economic background. A recent UK study by Raffe and Croxford (2013) used Universities and Colleges Admissions Service (UCAS) data to analyse cross border applications to higher education institutions in the UK from 1996 to 2010. The study found that moving away for higher education is linked to parental occupation status, used as a proxy for socio-economic background, with those whose parents who are in the managerial and professional category (those from the highest socio-economic background) being more inclined to attend a higher education institution in a different part of the UK to where they reside. These findings are consistent with a Scottish study conducted by Forsyth and Furlong (2003) who found that students from lower socio-economic backgrounds in Scotland restricted their choices of institution and subject area due to the financial constraints they are presented with. These findings are also present in U.S. studies. McPherson and Schapiro (1998) analysed 1994 data for university entrants in the U.S. and found an individual's choice of institution becomes increasingly determined by finances the further down the socio-economic spectrum one travels; those from lower socio-economic backgrounds tend to confine themselves more to the local institution pool than those from higher socio-economic backgrounds.

Consistent with the arguments by Raffe and Croxford (2013) presented above, a UK study by Patiniotis and Holdsworth (2005) finds students from non-traditional backgrounds (those from lower socio-economic backgrounds) are more likely to study at a higher education institution closer to their home. The study surveyed 32 British students between 2002 and 2003. It is interesting to note that the study also revealed moving away for higher education may also be influenced by unquantifiable, non-rational, cultural factors. According to Patiniotis and Holdsworth (2005), those from higher socio-economic backgrounds regard moving away for higher education as a shift from adolescence to adulthood, while for those from lower socio-economic backgrounds, who are typically non-traditional entrants to higher education, are more inclined to remain at home, not only for monetary reasons, but also in terms of psychological support from friends and family. Whittaker (2014) finds that barriers to student mobility in the UK are more prominent among those from a working class socio-economic background and from a Pakistani or Bangladeshi British background. Whittaker

(2014) draws on a number of reasons for the lack of mobility among these groups, including the costs associated with moving away from the family home, family commitments and social circumstances.

Literature from the U.S. also points to the idea of parental encouragement as being a prominent influence on their child's decision. While a 1996 poll suggests that 92% of parents believe the biggest financial investment is for their child's higher education, it may be the case that parents are not in the financial position to afford to pay for their child's education. Linked to the affordability argument is the idea that parents may not be able to open up free choice of institution to their child given the implied costs associated with migrating for higher education and the fact that the costs can vary between institutions (Cabrera and La Nasa, 2000).

Research suggests that parental awareness of higher education costs are correlated with those from higher incomes, potentially because those higher earning parents have attended higher education themselves (Miller, 1997). This in turn could further create barriers as those from lower socio-economic backgrounds may overestimate the costs (and underestimate the benefits) associated with participating in higher education (Usher, 1998 and Scott-Clayton, 2012). This may prevent them from entering higher education, particularly if they are of the belief that costs are prohibitively high, or are unaware of the financial support that is available.

A U.S. study by Bowles (1970) contextualises socio-economic background and race within the labour market. Bowles (1970) finds whereas those of White ethnicity from upper and middle socio-economics backgrounds have increased probability of being more geographically mobile, African Americans tend to be less likely to respond to higher incomes stemming from migrating. These findings are consistent when analysing socio-economic background within the context of higher education.

Thus it appears that socio-economic background plays a dominant role in the higher education destinations of individuals. This, to an extent, can be used as a proxy for student mobility whereby proximity to university is determined by socio-economic background, with those from higher socio-economic backgrounds experiencing greater mobility.

4.2.5 Gender

It is well known that males and females have differences in their attitudes and experiences in schooling, this was discussed extensively in Chapter 3. Gender differences are also apparent in the mobility choices of higher education.

Significant changes in the last few decades have occurred in the labour market by gender. Traditionally, a disproportionally low percentage of females were economically active in the labour market. Females who entered the labour market were more inclined to choose a job which was closer to their residence. According to Madden (1981), there were two prominent reasons for this trend. On the one hand, females were anticipated to have greater household commitments, thus reducing their likelihood of an extensive commute due to time constraints. On the other hand, females received, on average, lower wages which in turn also affected the incentive to commute, as a longer commute implies a higher cost of commuting. Moreover, the study found that for married employed couples, the dominant influence of residential location was more affected by the male's place of work rather than the females. The findings from the 1981 study conducted by Madden are somewhat outdated, but nevertheless provide an overview of females in the labour market. It is now the case that females have come to experience greater equality in the labour market over the last fifty years (Perrons, 2009). Historically, it was also the case that fewer females entered higher education. However females now outnumber males in 67 of 120 countries worldwide (Becker, Hubbard and Murphy, 2010). There have, however, been persistent differences in the mobility patterns of males and females. Previous literature has pointed to a number of reasons for these differences.

The differences in male and female mobility propensities is believed to be caused by their attitudes to risk and preferences (Booth and Nolen, 2012). Several studies have pointed to the notion that a female's choice of institution is based on striving to be within close proximity to home (see, for example, Shank and Beasley, 1998). A UK study by Moogan and Baron (2003), for example, found females were more apprehensive regarding moving away from home for higher education and they also spent longer in their search for a higher education institution. The same study also found significantly different factors motivating males and females to study at institutions. The study found that females were driven by course content while males were more influenced by the reputation of the institution. This

is consistent with the findings of McClelland and Gandy (2012) who use UCAS university admissions data to establish females have a greater propensity to stay within their home region for higher education, with approximately 59% of female students in the UK choosing an establishment within their home region in 2008. An Italian study conducted by Marinelli (2013) uses multinomial probit models to establish, among other factors, whether gender plays a significant role in the spatial choice of graduates. Using a dummy variable for females, the study concludes that gender does not affect the mobility choice of Italian graduates. The literature points to the notion that there is conflicting evidence regarding geographical mobility and gender which is dependent upon the country being analysed. The issue of how gender affects choices post-graduation will be addressed in the next section.

4.2.6 Labour market mobility

The majority of individuals enter higher education with the hope of enhancing their labour market prospects. Typically, individuals with more human capital tend to be more mobile in the labour market (Faggian, McCann and Sheppard, 2007). Given human capital is believed to influence economic growth, a wealth of studies have devoted focus to the relationship between student and labour market mobility.

In terms of job mismatches arising following on from education, Hensen, Robert de Vries and Corvers (2009) find that the more geographically mobile a graduate is, the higher is the prospect of finding employment related to the level of education obtained. According to the spatial mismatch hypothesis (Kain, 1992) unemployment/underemployment can arise due to distance between an individual's dwelling and employment location, creating mismatches within the labour market when individuals are unable to move for work (Hensen et al, 2009).

According to DaVanzo (1983), individuals who have previously migrated are more knowledgeable regarding moving which is acquired through moving initially. For example, an individual who had previously moved away may have reduced anxieties about the likelihood of meeting new friends having already moved to university and made new friends, thus removing this as a factor against future migration. DaVanzo (1983) argues that the knowledge obtained from migrating initially, reduces the information cost associated with a subsequent move. Migrants have a significantly higher probability of migrating again when compared to those who have not migrated. This is due to the idea that those individuals who have not

experienced moving are less informed and therefore less likely to migrate than those who have migrated previously.

A UK study by Faggian, McCann and Sheppard (2007) analysed student migration and subsequent labour market mobility for graduates by gender for the period 1997 to 2000. They adopt a multinomial logit model to analyse migration patterns by level of human capital and gender of individuals. Using a spectrum of five categories, Faggian et al (2007) are able to separate graduates into groups: those who move away to go to university and subsequently move again for employment following graduation: those who move away to go to university but return to their original location for employment following graduation: those who move away to go to university and remain in the university's location for employment following graduation: those who remain in their original location for university and subsequently move away for employment following graduation: those who remain in their original location for university and stay in that location for employment (within 15km). The results of their study show that, based on the aforementioned categories, whereas males are on the whole more likely to migrate than females, females are more likely to move away to go to university and subsequently move again for employment following graduation, thus showing that females are indeed overall more mobile than males. Additionally, the study finds the older an individual is in entering higher education, the less likely they are to migration upon graduation. Overall, the results show that moving away for employment is significantly linked to previously moving away for higher education. The study provides some rationale for the findings for females. Females, to a greater degree, are believed to experience more discrimination in the labour market. Faggian et al (2007) state that females make themselves more available to move for employment to account or offset some of this discrimination.

According to Faggian and McCann (2009b) some graduates base their labour market migration decision on the attractiveness of the region in terms of the innovation it generates. Notwithstanding, the innovation generated by a region is said to be influenced by the graduates the region attracts. Thus, those regions with graduate appeal are believed to already be comprised of a pool of graduates who subsequently aid the innovation generated by the region, thus endogeneity may become an issue. These findings were consistent for England and Wales.

According to Faggian and Mccann (2009a) the changes to the labour market, have not only led to more demand for a highly skilled workforce, but also for greater demand in terms of labour market mobility. Consequently, Faggian et al (2009a) argue that regional issues surrounding human capital, higher education institutions and economic growth are significantly different to those issues on the national scale. Given that individuals are now more geographically mobile, augmented by globalisation and advances in technology, Faggian et al (2009a), argue that although higher education institutions benefit the local economy (at the local authority level, for example), externalities associated with such come in two forms. The first is whether the investment in human capital creates or contributes to increased productivity in the home country (should the individual remain in the home country for employment). The second is concerned with the fact that individuals who have obtained higher education exhibit a higher likelihood of migrating.

Faggian et al (2009a) note that when both factors are observed in parallel in a region, the region will experience growth whereas if students do not return to their domiciled region, having moved for higher education (or if they do not remain in the host region for employment), the regions will underperform and suffer as a result. Consequently, their paper argues that the important factor to consider is whether migration of those who have obtained higher education within that region is common. Rodrigues (2013) finds that individuals who have a period of higher education study abroad have an increased probability of being more geographically mobile upon completion of higher education, reflecting the findings of DaVanzo's 1983 study (see above). This may have implications for regions if they offer attractive higher education institutions but less favourable employment opportunities.

Students can not only move across administrative jurisdictions (such as between England and Wales) in their own country but also internationally. According to Rodrigues (2013) students who have undertaken some form of higher education study abroad are more likely to continue more years of higher education, perhaps in the form of postgraduate study. Consequently, the geographically mobile students on average go into the labour market later in life. Rodrigues (2013) states that individuals who have studied abroad for a period are not found to be more productive than those who have not studied abroad, rather the increase in their wages are believed to be explained by other factors. Interestingly, in recent years, UK students have been encouraged by the government to spend a period of time studying abroad to enhance their cultural awareness and skills. This recommendation was introduced

in 2006 following the 'Prime Minister's Initiative on International Education' (Brooks and Waters, 2010).

In terms of studying abroad, studies have analysed the likelihood of returning to the home country for employment following a period of study abroad. A German study, conducted by Dustmann (1996), finds that students who are younger and study abroad are more likely to stay in the host country as they are believed to have developed skills and education relevant to that country. Moreover, Dustmann argues that a return to the individual's home country can prove expensive if the education they have developed is not convertible, for example, a student from Germany studying a Scottish law degree. This further emphasises the notion of a brain drain from the home country following an individual's experience of studying abroad.

Parey and Waldinger (2011) quantify the likelihood of employment abroad for German graduates who have had a period of study abroad to be approximately 6 percentage points using an OLS study and 15 percentage points with an instrumental variable model. The discrepancies are attributed to the heterogeneity in the effects. Moreover, the study finds that students are more inclined to work in the country they spent their study period abroad in. Parey et al (2011) note that of the reasons stated for working abroad, students specified that they wanted to work abroad because of the environment of that country.

Teichler and Janson (2007) state the value of a period of study in another country is diminishing. The study reveals that there is a growing prominence in individuals wishing to study abroad for a period, whereas this was a much rarer occurrence two decades ago. Participation increased from a few thousand in the late 1980s, to approximately 150,000 participants annually in the early 2000s (Teichler and Janson, 2007). The popularity of studying abroad was regarded by the European Commission as a means to enhance an individual's overall experience of higher education, while developing their foreign language skills. Thus programmes such as ERASMUS established in 1987 were introduced in higher education institutions to promote financially assisted temporary study abroad. Many studies have argued that foreign language skills improve following a period of study abroad, and students have the potential to become fluent in the language (Rodrigues (2013) and Di Pietro (2014).

Several studies have documented that studying abroad for either all or part of one's higher education experience has a positive effect on a number of aspects. A major benefit claimed by the literature suggests that the employability of graduates who study abroad is greater

than those who do not experience time abroad (Di Pietro, 2014). The human capital obtained by those who have studied abroad is increased as well as the individual becoming more culturally aware (Oosterbeek and Webbink, 2009).

A pertinent question in the economics of student mobility is concerned with the notion that a brain drain may emerge (Oosterbeek and Webbink, 2009). Individuals who study away from home as part of their higher education experience, may choose either to remain or to return to the home region following completion of higher education. This in turn leads to a brain drain as workers remain in the region when entering the labour market. Several studies have shown a correlation between higher education attainment and the propensity to either move or stay away from home when entering the labour market (see, for example, Sjaastad, 1962, and Faggian, McCann and Sheppard, 2007). An area with a higher concentration of graduates will attract more outside investment. It may also be cheaper to employ individuals to carry out graduate jobs if they live locally rather than to incentivise outsiders to come in. Higher education is believed to contribute to economic growth and therefore regions will want to retain/ regain the students to enhance growth.

Oosterbeek et al (2009) argue the potential brain drain may pose potential pressure on the expenditure on education in the home country. The individual's education may have been financed by the home government, however the individual may have migrated to the host region for employment. Graduate mobility thus determines how regions perform in terms of the returns from policies related to higher education; those regions which attract a higher number of graduates are deemed to have received greater returns to these policies (Faggian and McCann, 2009b). Indeed several U.S. studies have been concerned with student migration, predominantly because of the brain drain notion. This is particularly prominent due to the fact that revenue is generated from tuition fees within the U.S. and thus negative net migration negatively impacts revenues.

In recent years, a number of studies have analysed return migrants. Mayr and Peri (2008) postulate that return migrants benefit the home country as they have greater productivity than those who have remained in the home country. Moreover, the study finds that return migrants invest more in terms of education than those who remain in the home country. A study by Teichler and Jahr (2001) analysed the impact of the ERASMUS programme on the labour market mobility of students. The study shows a strong occurrence of return migrants following the programme with 82% of the students employed in the home country after

graduation, while 9% were employed in the country of the ERASMUS study and a further 9% were employed in a different country.

4.3 Great Britain analysis

Higher education in the UK has experienced distinct changes in the administrative processes over the last two decades. The most noteworthy changes in Scotland and Wales was the detachment of higher education institutions from the UK higher education administrative system in 1992. These changes became more prominent as a result of the devolution of power to the Scottish and Welsh assemblies in 1998. Perhaps, the most radical policy changes occurred in consequence of the implementation of the 2010 Browne Report: given the increased government budgetary constraints, the Browne Report made recommendations to increase tuition fees in England on the basis that fees would be paid upfront by the government through a "Student Finance Plan" (Browne Report, 2010, p. 5) with the individual liable for repayment upon graduation when their earnings reached £21,000 or over. According to Raffe and Croxford (2013), the distinct administrative entities in Scotland and Wales did not implement such change in fees. This subsequently meant these countries were susceptible to changes in patterns of students coming to institutions within these countries. This is predominantly because institutions in the UK, particularly between England and Wales[21], possess a number of similarities in terms of the types of institutions and the courses they offer. Thus, Raffe and Croxford raise the question of whether higher education in the UK represents a single administrative system rather than the separate entities which were intended given the shared "brand" that is portrayed.

A fundamental difference across UK higher education institutions is the varying stances on tuition fees across countries. Tuition fees were abolished in Scotland in 2000 and replaced with a graduate endowment fee in 2001. The graduate endowment fee was subsequently lifted in 2007. Tuition fees during this time remained in place in England and were increased in 2006 to £3,000 per year in the style of income contingent fees which were deferred until graduation when the individual began earning above an amount deemed sufficient by the government. In 2007, Wales implemented the same system as England had done the

[21] As discussed in previous chapters, Scotland's higher education system differs from England and Wales. A university degrees takes four years to complete in Scotland, and three years in England and Wales.

previous year. Given this, Scottish domiciled students were incentivised to remain in Scotland to complete their higher education as they would be forced to pay tuition if they chose to study in England or Wales. Since 2006, fees in England and Wales have been increased to a maximum of £9,000 per year (implemented in 2012). The apparent differences in tuition fees across the UK thus play a key role in the mobility of students, with potentially fewer students from Scotland moving to another country within the UK for higher education.

Applicants to higher education typically apply through the Universities and Colleges Admissions System (UCAS). Each individual can make up to five applications (this can be a combination of different courses offered at the same institution or five different institutions). The varying stances on tuition fees across Britain may impact the institutional choice of individual. This may be particularly relevant to individuals domiciled in Scotland given the higher education tuition fee is free should they decided to remain in Scotland. However, Scottish domiciled students would be obliged to pay tuition fees if they decided to go to university in England or Wales, thus forfeiting their free tuition. Given previous discussions relating to the cost-benefit analysis assumed to be conducted by students before entering higher education, would lead us to believe that moving from Scotland to England or Wales for higher education would be deterred, unless the student was of the opinion that they would benefit from attending the institution outside Scotland (arising due to course specific advantages or institution prestige, such as the appeal of the Universities of Oxford or Cambridge).

A UK study conducted by Baty (2001) cited in Moogan and Baron (2003), found several institutions to have more local students, with more than half of their students coming from within 50 miles radius of the institution.

Institution classification in Great Britain

Higher education providers within the UK significantly differ in terms of prestige based on a number of key factors. One prominent factor in determining an institutions prestige is concerned with the age of the establishment, the statement of received consensus for this being, the older the institution, the more prestige it holds. A common mode of classification is for a university to fall into one of the following: 'Russell Group', 'Other old universities' and 'New universities'. 'Russell Group' universities are a group of 24 UK universities perceived as leaders in research and teaching, 'Other Old universities' receive this classification if they

were established as an institution prior to 1992 and were typically polytechnics ('pre-1992'), while 'New universities' were established after 1992 ('post-1992').

The above hierarchies of institutions have been used in the UK as a means to formalise higher education providers. Prior to these classifications and until 1992, higher education institutions were divided between universities and polytechnics (Croxford and Raffe, 2015). According to Johnes and Soo (2004) the most noticeable difference between universities and polytechnics prior to 1992 was concerned with the focus of the institutions, polytechnics were only associated with teaching while universities focussed on both teaching and research. Polytechnics were given university status following the revision of classification in 1992. A majority of polytechnic institutions have subsequently increased their research output, with many becoming renowned in this field. Post-1992 institutions differ from pre-1992 institutions in the sense that they are not research intensive.

There are clear distinctions between pre and post-1992 institutions for a number of factors. A study by Johnes and Soo (2004) identifies pre-1992 institutions are better performing in terms of degree classification (defined by grades obtained), entry grades, student-staff ratios, facilities and library spending, student satisfaction and, the most prominent difference, research score.

4.3.1 Traditional and non-traditional students in Britain

Historically, it was typical for students to leave the parental home and attend a higher education institution further from their home town (Christie, 2007). This was true for the times when traditional students were entering higher education. Traditional students typically constitute individuals from higher socio-economic backgrounds who normally entered higher education from school. The expansion of higher education has had a marked effect on the diversity of students enrolling in higher education, particularly those from lower socio-economic backgrounds or those who are older, typically referred to as non-traditional students.

In recent times, a smaller proportion of students in the UK are found to move away to go to university. The reason for the increased number of individuals choosing to stay at home stems from the idea that higher education institutions have become more appealable to local students which has in turn reduced mobility of students for higher education (Holdsworth,

2009). This could be due to the fact that there has been an increase in the overall number of higher education institutions since 1992, meaning an individual is more likely to find an institution that provides that individual's desired course or more closely matches their academic ability. Widening participation in higher education has been a key policy issue within Britain for several years, however, since those from less privileged backgrounds are more frequently entering higher education than they did in the past, as discussed in the previous section, it is likely those individuals will be less inclined to move away for their studies in higher education.

Holdsworth (2009) notes that the widening of participation in higher education in the UK, particularly increased access to those from non-traditional backgrounds, has produced a two-tier scheme: those who are from traditional backgrounds have the financial capacity to move away to study, while those who are from non-traditional backgrounds do not. Moreover, the post-1992 institutions (regarded as the 'newest' universities) tend to have an overrepresentation of home based students (Christie, 2007). A UK study by Reay, Crozier and Clayton (2009) interviewed 27 students from lower socio-economic backgrounds. The study found that individuals from lower socio-economic backgrounds are less likely to attend a Russell Group university than their peers from higher socio-economic backgrounds, even in circumstances where they have obtained the necessary qualifications to do so. The study states the reason for this is due to perceptions of fitting in, or standing out, at the more renowned institutions. Moreover, Reay et al. (2009) state that although the post-1992 institutions attract those from lower socio-economic backgrounds, their attempt to widen participation in higher education has only been marginally successful within the pre-1992 and Russell Group institutions.

According to Bourdieu (1990), students choose institutions where there are students similar to themselves (in terms of background) in order to feel comfortable with the environment (in Reay et al 2009). Moreover, individuals from higher socio-economic backgrounds are more inclined to enter institutions established before 1992 which is believed to be due to the notion that both the individual and institution possess characteristics of the elite (Sutton Trust, 2000).

Characteristics of the institution thus reflect the types of students they attract according to qualitative studies such as Reay et al (2009). Within the UK there is a clear distinction between pre and post-1992 institutions and with that comes the types of students they

attract. For the post-1992 institutions, students attending tend to stay at home and be in part-time employment while the pre-1992 students tend to stay on campus (implying they have moved away to go to university or choose to live away from home to engage with the student experience) (Reay, 2009).

4.4 Contribution

While a number of studies (see, for example, Christie, 2005 and Patiniotis and Holdsworth, 2005) analyse the effects of staying at home/moving away for university, they do so on a small scale using survey/qualitative data to assess the factors influencing individuals to move for higher education. Other UK studies use university admissions (UCAS) data to derive analysis on student mobility. Most studies relating to mobility (see, for example Faggian, McCann and Sheppard, 2007 and Marinelli, 2013) focus on labour market outcomes of graduates. This study aims to explore the reasons for country mobility for higher education within the context of England, Scotland and Wales. Building on a body of research that has analysed the factors influencing student mobility, this study uses micro British university enrolment data to assess the individual factors likely to contribute to a move from one country to another in Great Britain, for higher education, for example an individual from Glasgow enrolling at The University of Manchester (that is a move from Scotland to England).

This study will aim to answer the questions of whether family background, age, institutional prestige, subject area and domicile region affect the probability of an individual moving country within Great Britain for higher education. The availability of micro data will allow the study to disentangle mobility with respect to gender and regional effects, whereby males and females in Scotland, England and Wales will be analysed separately in order to ascertain whether migration patterns are specific to gender and country of origin. The study aims to identify the push factors (those factors which impact moving from domicile to another country) in addition to pull factors (those factors which attract individuals to a particular country) with respect to moving away for university.

The contribution of this paper to the existing literature is to provide analysis of both personal characteristics and regional variables. Indeed, in terms of UK analysis, a handful of studies have identified there is a relationship between background and migration patterns. This paper aims to supplement existing literature by disaggregating gender and country while

considering a plethora of personal characteristics coupled with regional variables. It is worth noting that the data used for this study reflect not only more recent years but also contain additional variables not previously studied within the context of the UK. Using these data should facilitate rigour in terms of addressing migration of students in the UK, particularly in terms of country specific push and pull factors. Moreover, this study allows controls for a number of factors and permits both the separation and interaction of regional location and personal attributes. These research questions are pertinent to policy regarding the provision of higher education as well as the future of student mobility within the context of Great Britain.

A study by Faggian and McCann (2009b) found Scottish students were less geographically mobile than those from England and Wales. One potential explanation for fewer individuals in Scotland moving for higher education stems for the notion that remaining in Scotland would mean these individuals would be exempt from tuition fees, whereas if they moved to England/Wales, they would incur tuition fees. This study aims to explore whether the two are linked.

4.4.1 Methodology

Overview of data

This research draws on data which were provided by the Higher Education Statistics Agency (HESA) for the period 1998/99 – 2015/16. These administrative data are collected annually from higher education institutions in Great Britain and capture all full-time entrants to undergraduate study. This study focuses on data for England, Scotland and Wales.

The HESA dataset provides entry to higher education details from 1998/99 to 2015/16 on the following: gender, age, subject area, higher education provider, country of higher education provider, socio-economic classification, term-time accommodation, term-time sector postcode, domicile sector postcode, distance travelled from domicile to campus (km), and distance travelled from term-time address to campus (km).

Data cleaning

Data obtained from HESA were analysed in the first instance to identify any duplicates. From the 7,476,557 observations in the entrant's data, 2,251,776 were deleted due to duplications or having key data missing. Moreover, a potential bias in the data was identified during this

process whereby students studying more than one subject area had multiple entries in the data set (this was identified using the unique id, academic year and, at the same time, ensuring the other variables other than subject area remained constant). Thus, in order to overcome multiple entries for individuals due to more than one subject being studied, data cleansing was required to merge duplicates of individuals who studied more than one subject area. It was the case that students within this dataset studied up to six subject areas in the same institution in a given year.

In order to avoid multiple entries per student who studied in more than one subject area in a given year, the data were transposed to align students who studied in more than one subject area, ensuring that academic year and unique identifier were matched throughout the process. This method identified 735,354 duplicate observations and these were transposed in order to keep their second, third, fourth, fifth and sixth subject without double counting the individuals (336,277 individuals studied in more than one subject area). The number of observations was thus reduced to 4,489,427. Figures 4.1 to 4.3 below shows the number of individuals entering higher education by year and country of domicile. From the charts, it is clear English domiciled students outnumber those from Scotland and Wales, comprising, on average 87% of all entrants from the data. Figure 4.1 shows a sharp decrease in English domiciled entrants to higher education between 2011/12 and 2012/13. The decrease in enrolments can be attributed to the fact that tuition fees significantly increased in 2012/13 in England and Wales and therefore more individuals entered higher education the year prior to the increase (in 2011/12). For example, an individual considering a gap year between completing high school and university in 2011/12 may have forgone the gap year in order to avoid the increase in tuition fees in 2012/13. This in turn resulted in fewer individuals enrolling in higher education in 2012/13. A more detailed analysis of tuition fees and enrolments is presented in Chapter 2.

The largest intake of students occurred in 2015/16, with 336,271 British domiciled students entering higher education in Britain. It is interesting to note that the data show student numbers have increased from 128,686 in 1998/99 to 336,271 in 2015/16.

Given HESA collects all entrants to higher education, no sample weightings were required to analyse the data. The charts below indicate annual summary figures for the number of individuals entering higher education institutions by country.

Figure 4.1: Number of Full-Time Entrants to Higher Education Institutions in Great Britain by Year (English domiciled)

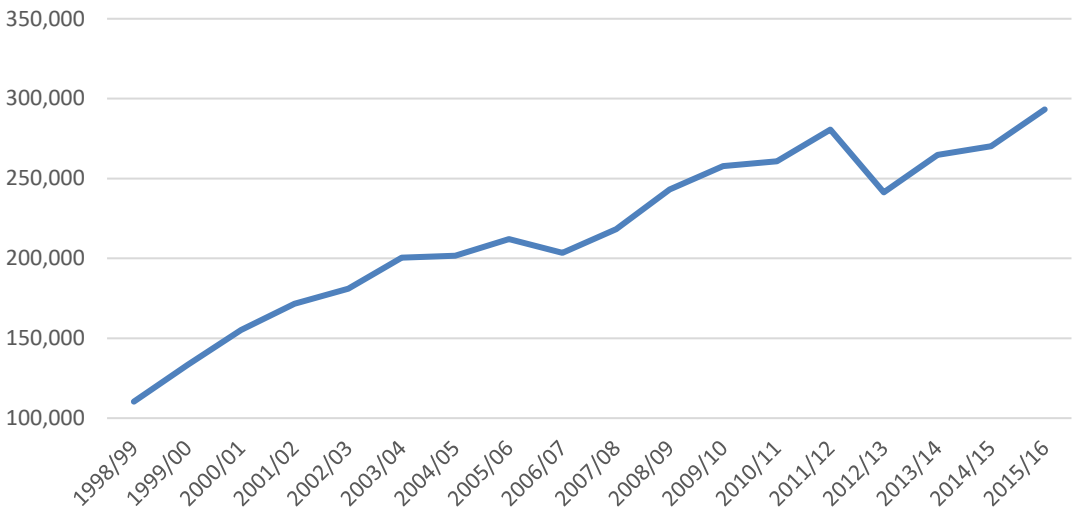


Figure 4.2: Number of Full-Time Entrants to Higher Education Institutions in Great Britain by Year (Scottish domiciled)

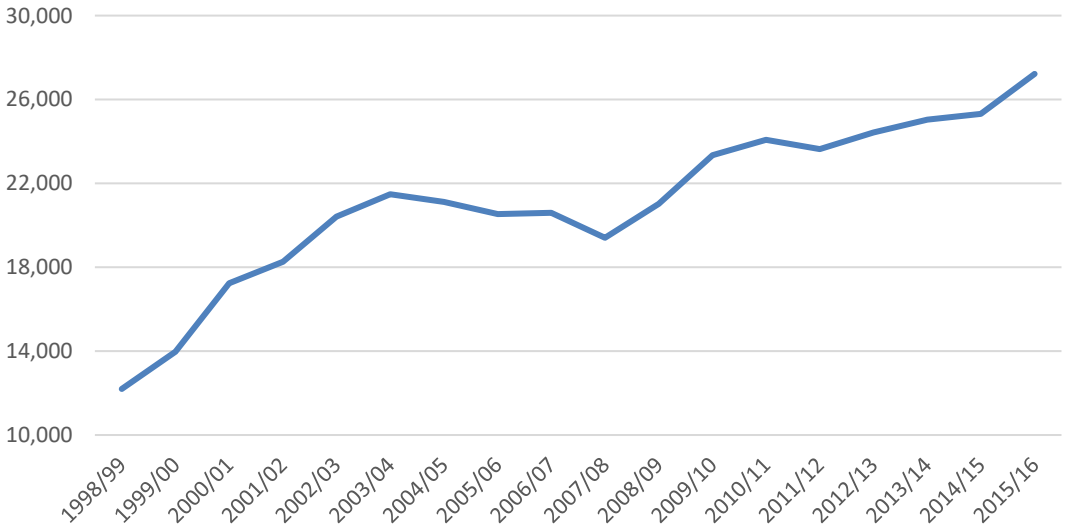
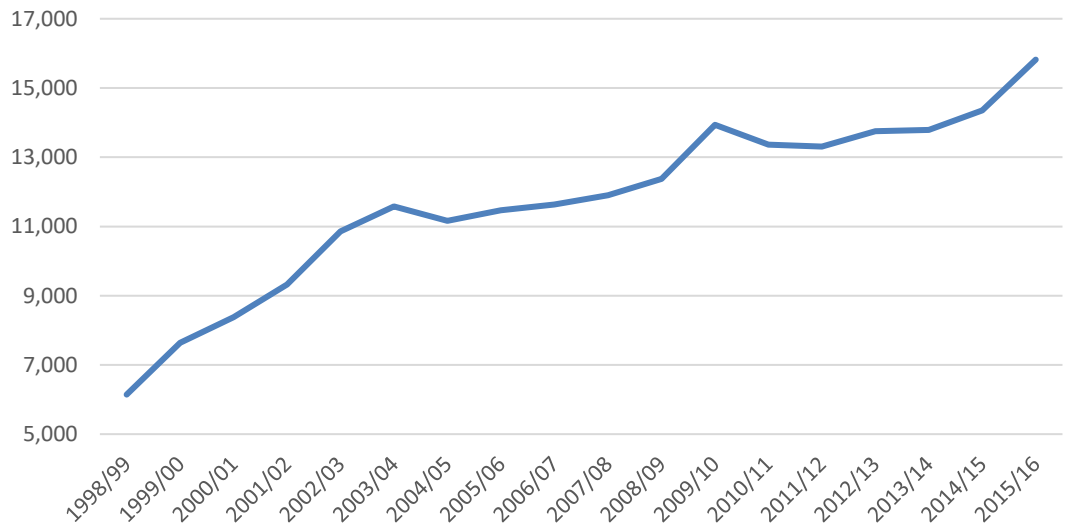


Figure 4.3: Number of Full-Time Entrants to Higher Education Institutions in Great Britain by Year (Welsh domiciled)



Source: HESA (2017). *Notes:* The charts show the number of full-time entrants to higher education in England, Scotland and Wales respectively.

From the data, 85.2% of individuals studied at institutions in England, 9.2% studied in Scotland and 5.6% studied in Wales. The percentage shares were relatively consistent between 1998/99 and 2015/16.

4.4.2 Characterising student mobility

In order to evaluate student mobility in higher education, a number of variables were captured both at the individual and country level. Data were collected to include information on social background, personal characteristics, institution classifications and domicile regions. Descriptive statistics for the entrant's data are contained within the table below. It should be noted at this stage that explanatory variables were binary, taking the value of 1 if the characteristic was present for the individual and a value of 0 if the individual did not possess the characteristic. Variables were also categorised in terms of socio-economic background, age, institution classification, subject and gender.

The below describes the variables captured in each section:

Socio-economic background and personal characteristics

AGE: denotes the age of the individual when entering higher education

SES: denotes parental occupation used as a proxy for socio-economic background

FEMALE: 1 denotes female; 0 denotes male

SCOTLAND: 1 denotes Scottish domiciled; 0 denotes England/Welsh domiciled.

Institution classification/ subject area

RUSSELLGROUP: Institution classification

PRE1992: Institution classification

POST1992: Institution classification

SUBJECTAREA: The data contain information on 18 subject areas studied. These were converted to individual dummy variables e.g. LAW, ENGINEERING, BUSINESS etc.

Domicile Regions

REGIONS_ENGLAND: East England, East Midlands, London, North East England, North West England, South East England, South West England, West Midlands and Yorkshire and the Humber

REGIONS_SCOTLAND: Glasgow/Strathclyde, Edinburgh, Aberdeen, Dundee, Central Scotland, Highlands and South Scotland

REGIONS_WALES: North East Wales, North West Wales, Mid Wales, South East Wales and South West Wales.

The primary aim of the study is to derive analysis on geographical mobility in higher education in Great Britain. In terms of the analysis of this study, an individual is deemed to be a migrant if his/her country of domicile differs from the country of the higher education provider. The data provided by HESA contain age information. Notwithstanding the notion that over 70% of students enter higher education at school leaving age (aged between seventeen and twenty), this study will focus on the total population entering full-time higher education (from 1998/99 to 2015/2016). This will permit the study to use age as a potential explanatory variable to ascertain whether migration for higher education is influenced by

age. The first study will analyse geographical mobility in higher education and the studies that follow with disaggregate male and female migration for higher education.

In order to ascertain whether certain characteristics are present among groups of individuals, some descriptive statistics were generated. Table 4.1 details the overarching variables with their respective categories that were included as dummy variables. Additional analysis of these variables will follow in the subsequent sections.

Table 4.1: Descriptive Statistics, Entrants from 1998/99 to 2015/16

	Variable	Observations	Mean	Standard Deviation	Min	Max
SES	SES_HIGH	4,489,427	0.5296	0.4991	0	1
	SES_MIDDLE	4,489,427	0.2697	0.4438	0	1
	SES_LOW	4,489,427	0.2007	0.4006	0	1
Age	Age17	4,489,427	0.0250	0.1562	0	1
	Age18	4,489,427	0.5199	0.4996	0	1
	Age19	4,489,427	0.2297	0.4207	0	1
	Age20	4,489,427	0.0681	0.2519	0	1
	Age21_25	4,489,427	0.0842	0.2776	0	1
	Age26_30	4,489,427	0.0274	0.1633	0	1
	Age31plus	4,489,427	0.0456	0.2087	0	1
Institution Classification	RUSSELLGROUP	4,489,427	0.2538	0.4352	0	1
	PRE1992	4,489,427	0.2291	0.4203	0	1
	POST1992	4,489,427	0.5171	0.4997	0	1
Subject Area	MEDICINE	4,489,427	0.0256	0.1581	0	1
	SBJECTSTOMEDICINE	4,489,427	0.0892	0.2850	0	1
	BIOLOGICALSCIENCE	4,489,427	0.1170	0.3214	0	1
	AGRICULTURE	4,489,427	0.0100	0.0996	0	1
	PHYSICALSCIENCE	4,489,427	0.0537	0.2255	0	1
	MATHSCIENCE	4,489,427	0.0235	0.1516	0	1
	COMPUTERSCIENCE	4,489,427	0.0530	0.2240	0	1
	ENGINEERING	4,489,427	0.0605	0.2384	0	1
	ARCHITECTURE	4,489,427	0.0198	0.1393	0	1
	SOCIALSTUDIES	4,489,427	0.1059	0.3077	0	1
	LAW	4,489,427	0.0443	0.2058	0	1
	BUSINESS	4,489,427	0.1195	0.3244	0	1
	COMMUNICATION	4,489,427	0.0354	0.1847	0	1
	LANGUAGES	4,489,427	0.0741	0.2620	0	1
	HIST_PHILOSOPHY	4,489,427	0.0547	0.2274	0	1
	CREATIVEARTS	4,489,427	0.1154	0.3196	0	1
	EDUCATION	4,489,427	0.1154	0.3195	0	1
	COMBINED	4,489,427	0.0209	0.1429	0	1

Notes: The table presents descriptive statistics for entrants to higher education within Great Britain on socio-economic background (SES_HIGH, SES_MIDDLE and SES_LOW), age, institution classification and subject area. The number of observations, mean, standard deviation and the minimum and maximum are presented. The summary statistics cover the period 1998/99 to 2015/16.

Data taxonomy

To establish the factors influencing spatial mobility in higher education, it is necessary to split the data to account for mobility when entering higher education. Two groups were established to account for this: stayers (those who remained/resided in the domicile country when going to university) and leavers (those who moved away to study at an institution in Great Britain not located within the country in which they resided prior to going to university). This taxonomy was created using two variables (see table 4.2). The first was created using domicile sector postcode to match to country, this allowed identification of domicile country. The second variable was taken from the HESA data set to identify institution country. It should be noted at this stage that HESA provided institution country with respect to being either within Scotland or England/Wales and thus matching was required to identify those institutions in Wales to allow for separate country analysis.

Table 4.2: Student mobility taxonomy

Stayer	Leaver
Institution lies within country of domicile	Institution does not lie within country of domicile

4.4.3 Summary statistics

From the 4,489,427 observations, 6.4% (287,673 individuals) moved country within Britain for higher education. The below table shows the proportions of stayers for each year of entry according to country of domicile.

From the below table is it clear Welsh students are the most migratory when moving country within Great Britain for higher education. English and Scottish domiciled students appear to have similar patterns, with approximately 5% of English domiciled students moving to Scotland or Wales for higher education and approximately 6% of Scottish domiciled students moving to England or Wales for higher education. These findings are not surprising given Wales has fewer institutions than Scotland and England and is in line with Tuckman (1970), confirming the motivation to migrate is significantly reduced when the country has a number of universities offering a number of courses across all institution classifications.

Table 4.3: Percentage of Stayers Full-Time Entrants to Higher Education Institutions in Great Britain by Year and Location of Domicile

	England		Scotland		Wales	
	Stayers	Percent (%)	Stayers	Percent (%)	Stayers	Percent (%)
1998/99	104,417	95	11,118	91	3,173	52
1999/00	126,287	95	12,759	91	4,003	52
2000/01	146,855	95	15,912	92	4,107	49
2001/02	162,496	95	16,864	92	4,932	53
2002/03	171,922	95	19,106	94	6,335	58
2003/04	190,229	95	19,996	93	6,547	57
2004/05	191,374	95	19,781	94	6,226	56
2005/06	201,585	95	19,172	93	6,614	58
2006/07	194,171	95	19,367	94	7,491	64
2007/08	209,110	96	18,185	94	7,810	66
2008/09	233,792	96	19,737	94	8,285	67
2009/10	246,559	96	22,107	95	9,487	68
2010/11	249,813	96	22,787	95	8,422	63
2011/12	268,579	96	22,298	94	8,077	61
2012/13	230,945	96	23,413	96	8,017	58
2013/14	253,519	96	23,836	95	7,986	58
2014/15	258,134	96	24,209	96	7,994	56
2015/16	280,973	96	25,969	95	8,872	56
Total	3,720,760	95	356,616	94	124,378	59

Source: Author's calculations from HESA (2017). Notes: Table shows the number and percentage of individuals entering higher education by domicile country (England, Scotland and Wales) who remain in their domicile country for education.

As noted previously, it is anticipated that Scottish students may be less inclined to move outside Scotland for higher education, given tuition is free for Scottish domiciled students who choose to study in Scotland. Scottish students studying at an institution in the UK outside Scotland are required to pay tuition fees, thus disincentivising mobility within the UK for higher education, particularly from those from lower socio-economic backgrounds. This is apparent from the above table when Scottish domiciled students are compared to Welsh domiciled students. It is interesting to note that English domiciled students are also less inclined to study at institutions in Scotland and Wales. This could be due to the notion that England is served with the greatest number of higher education institutions. The table below shows the percentage share of institutions in England, Scotland and Wales by institution classification. It is apparent that Wales not only has fewer institutions, but it also only has one Russell Group institution (Cardiff University), compared with Scotland which has two

Russell Group institutions (The Universities of Edinburgh and Glasgow) and England has twenty institutions, five of which are located in London (see Appendix E)[22].

Socio-economic background

Data on parental occupation were used as a proxy for socio-economic background. HESA provided data on eight occupation classifications which were grouped into three socio-economic background variables. Table 4.4 below shows the groupings.

Table 4.4: Socio-economic background classifications

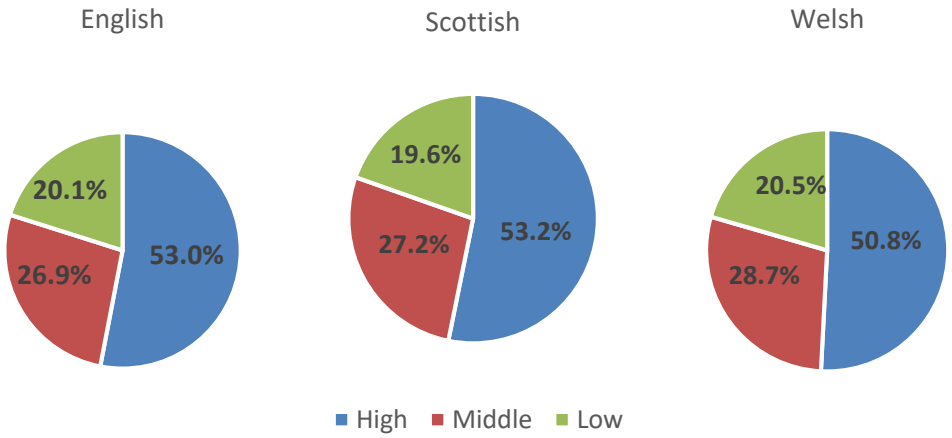
Classification	Parental occupation
High	Higher managerial & professional occupations
	Lower managerial & professional occupations
	Intermediate occupations
Middle	Small employers & own account workers
	Lower supervisory & technical occupations
	Semi-routine occupations
Low	Routine occupations
	Never worked & long-term unemployed

Notes: Table presents a proxy for socio-economic background based on parental occupation of individuals entering higher education. The categories are consistent with Office for National Statistics Socio-Economic Classifications (NS-SEC).

The charts below in Figure 4.4 summarise socio-economic background of those entering higher education by domicile country. From the charts it is clear the largest proportion of those entering higher education come from high socio-economic backgrounds, with over 50% falling into this category across domicile countries. The lowest share of socio-economic background comes from those with low socio-economic background, those whose parental occupation is Semi-routine, Routine or Never Worked/long term unemployed.

[22] One additional Russell Group institution is in Northern Ireland, Queen's University Belfast.

Figure 4.4: Percentage of entrants to higher education by socio-economic background and domicile country



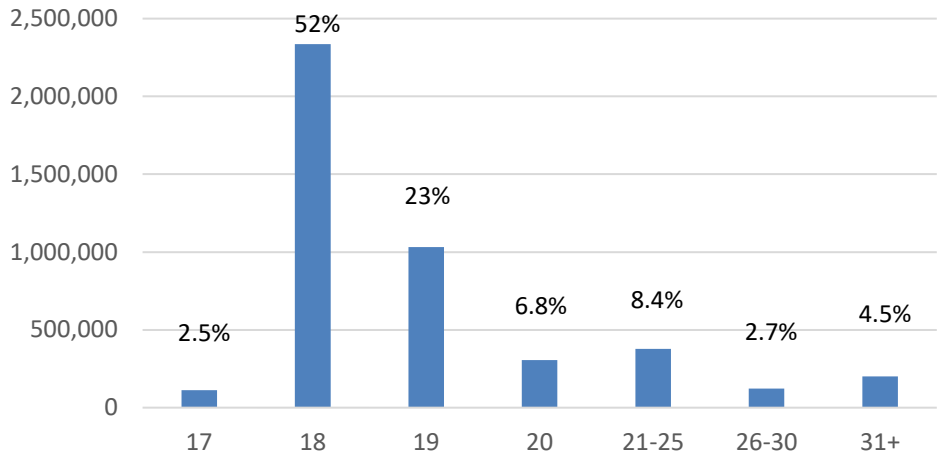
Notes: Figure shows the composition of entrants to higher education by socio-economic background and domicile country within Great Britain for the period 1998/99 to 2015/16. Socio-economic background classifications are based on ONS NS-SEC classifications.

Age

The data provided by HESA contain information on the age of individuals when entering higher education. Figure 4.5 provides a summary of entrants to higher education by age grouping. The age when entering higher education ranges from 17 to 74, where the mean age is 19.9. A majority of students enrol in higher education either directly, or very close to completing secondary school. For the purpose of this study, it is interesting to include age variables, where those lying within the majority, that is, those aged 20 and under, are included as single year of age dummy variables and those aged 21 and over are categorised in various groups to denote those who are older when entering higher education.

From the data, 84% of entrants were aged 20 and under. Given this, age classifications were established to group those ages with smaller proportions of entrants. The age categories, distribution and respective percentage shares are show in the chart below.

Figure 4.5: Entrants to Higher Education by Age



Notes: Figure shows the composition of entrants to higher education by age within Great Britain for the period 1998/99 to 2015/16.

Institution classifications

Institutions were matched, based on information from Wilkinson (2005), to three statuses; namely Russell Group, pre-1992 and post-1992. The data provided by HESA contain 151 institutions across England/Wales and Scotland which were split into three classifications; Russell Group, pre-1992 and post-1992. From the data used within this study, 25.3% (1,139,428) of students attended Russell Group universities, 22.9% (1,027,423) attended pre-1992 institutions and 51.7% (2,322,576) attended post-1992 institutions.

The rationale for assigning a classification to each institution stems from the notion that the classification of a higher education institution may attract individuals from specific socio-economic backgrounds, for example those from higher socio-economic backgrounds may be more likely to attend a Russell Group or pre-1992 institution. Moreover, given institution quality is linked to the anticipated value of a qualification (McHugh and Morgan, 1984), it is interesting to determine whether moving country for higher education can be attributed to institution classification. This study will analyse recent data to update the findings of Forsyth and Furlong (2003) for Scotland in order to ascertain whether parental occupation (used as a proxy for socio-economic background in this study) has an effect on the institution attended

based on the three aforementioned classifications. Dummy variables were established for each of the three classifications and included in the model.

The largest proportion of individuals entering higher education in the UK enter a post-1992 institution. There were 151 institutions used within the study, of which 23 were Russell Group, 56 were pre-1992 and 72 were post-1992 institutions. Appendix E shows all institutions in Great Britain by institution classification.

Table 4.5 provides a summary of the number of institutions in England, Scotland and Wales followed by the share of institutions in each of the institutions classifications. In terms of pre-1992 institutions, Wales has the fewest, totalling 4 institutions, followed by Scotland with 8 institutions and England with 44 institutions. Post 1992 institutions are more prevalent in England, with 61 institutions, Scotland has 8 post-1992 institutions and Wales has 3.

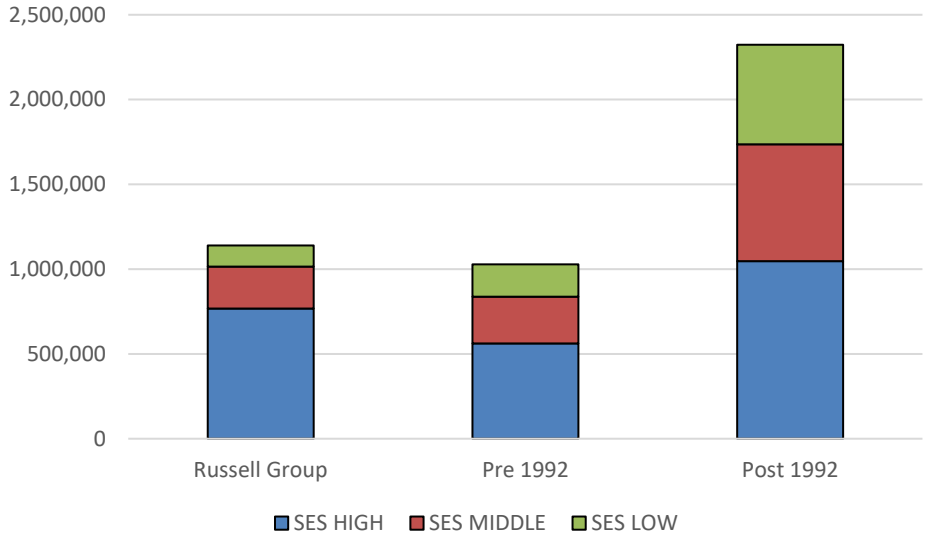
Table 4.5: Summary of Institutions by Country and Proportions of Institutions by Classification

	Number of Institutions	Russell Group	Pre-1992	Post-1992
England	125	16.0%	35.2%	48.8%
Scotland	18	11.1%	44.4%	44.4%
Wales	8	12.5%	50.0%	37.5%

Source: Author's calculations from HESA (2017). *Notes:* Table shows number and percentage of institutions in each country by institution classification (Russell Group, Pre-1992 and Post-1992).

It is interesting to analyse entry into each of the higher education institution classifications by socio-economic background to ascertain whether patterns emerge. Figure 4.6 shows the number of individuals entering higher education by institution classification and socio-economic background for the period 1998/99 to 2015/16. Post-1992 institutions attracted the higher proportion of enrolments across all socio-economic backgrounds. From the chart, it is clear socio-economic background influences the classification of institution an individual attends. Those from higher socio-economic backgrounds contribute the largest proportion of entrants to each institution. The low socio-economic background category is underrepresented in both Russell Group and pre-1992 institutions.

Figure 4.6: Individuals Entering Higher Education by Institution Classification and Socio-Economic Background



Source: Author's calculations from HESA (2017). *Notes:* Figure shows the number of individuals entering higher education in Great Britain by institution classification.

Subject area

Data on subject area studied were provided by HESA for each of the 4,489,427 individuals. Eighteen broad subject areas were created based on Joint Academic Coding System (JACS code 3.0), which is used by HESA and higher education institutions across the United Kingdom as a means for classifying subjects provided by institutions (HESA, 2012)[23]. Table 4.6 below details the percentage share of individuals by subject area and institution country.

The subject with the largest percentage of enrolments was business and administrative studies, with 11.3% of the total number of enrolments between 1998/99 and 2015/16. The table shows distinct differences in the enrolment patterns by subject area and country. One of the largest differences across countries occurs in enrolments for creative arts and design. There is a noticeable difference between Scotland and England/Wales where the total share of those enrolling is 5.9%, compared to 11.6% and 10.5% for England and Wales respectively. For Welsh institutions, the most popular subject field was biological science, with a share of 14.9% of all enrolments, this is compared to 10.6% for England and 11.1% for Scotland.

[23] Veterinary science was included with medicine and dentistry given that less than 1% of individuals studied this subject area.

Table 4.6: Percentage share of individuals entering higher education by subject area and institution country, 1998/99 – 2015/16

	England	Scotland	Wales	Total
(1) Medicine & dentistry	2.5%	3.7%	2.3%	2.6%
(2) Subjects allied to medicine	8.7%	9.5%	7.9%	8.7%
(3) Biological sciences	10.6%	11.1%	14.9%	10.9%
(5) Agriculture & related subjects	0.9%	1.0%	1.2%	1.0%
(6) Physical sciences	4.9%	5.5%	6.4%	5.0%
(7) Mathematical sciences	2.1%	1.9%	1.7%	2.1%
(8) Computer science	5.1%	5.6%	4.2%	5.1%
(9) Engineering & technology	5.6%	8.6%	5.4%	5.9%
(A) Architecture, building & planning	1.9%	2.7%	1.2%	1.9%
(B) Social studies	9.6%	8.5%	8.7%	9.4%
(C) Law	4.2%	4.1%	4.3%	4.2%
(D) Business & administrative studies	11.2%	13.9%	9.3%	11.3%
(E) Mass communications & documentation	3.3%	2.1%	2.3%	3.1%
(F) Languages	6.5%	5.1%	7.2%	6.4%
(G) Historical & philosophical studies	4.7%	4.2%	5.5%	4.7%
(H) Creative arts & design	11.6%	5.9%	10.5%	11.0%
(I) Education	4.7%	4.0%	5.5%	4.7%
(J) Combined	2.0%	2.5%	1.7%	2.1%

Source: Author's calculations from HESA (2017). *Notes:* Table presents the percentage share of individuals entering higher education in Great Britain by country of institution and subject area for the period 1998/99 to 2015/16.

Country identification

HESA provided data on domicile sector postcodes for individuals entering higher education. Great Britain has approximately 9,000 sector postcodes (Ordnance Survey, 2017). The postcode data were matched to local authorities in the first instance and then aggregated to region and country level. From the data, it is apparent that 86.9% of students are from England, 8.4% are from Scotland and the remaining 4.7% are from Wales (3,899,357, 379,298 and 210,772 respectively).

There are consistent trends in terms of the migration patterns by domicile country. On average, 70.4% of English domiciled students who migrated studied in Wales and the remaining 29.6% studied in Scotland. Scottish and Welsh domiciled students favoured England over the other country. For Scottish domiciled students, 96% of students who

migrated studied at in institution in England and in terms of Welsh domiciled student migrants, 98% studied in England, on average.

The most popular universities for English domiciled students studying outside England were Cardiff (taking 22.7% of English domiciled students studying in Wales or Scotland) and The University of Edinburgh (11.2%) followed by Aberystwyth University (11%).

The most popular university among Scottish domiciled students who studied in England was Newcastle University (8.9% of Scottish domiciled studying in England or Wales attended here) followed by Northumbria University (taking 5.5% of Scottish domiciled students who study in England or Wales) and the University of Cambridge (5% of Scottish domiciled students in England or Wales). The significant proportions going to Newcastle and Northumbria could be due to the proximity to Scotland. The University of Cambridge ranks one of the highest institutions in the world and therefore this may attract Scottish students to move to Cambridge given the prestige of the institution.

For Welsh domiciled students studying in England or Scotland, the University of the West of England, Bristol was most popular, attracting 6% of Welsh domiciled students studying in England or Scotland, followed by Liverpool John Moores University with 4.4% and the University of Chester with 4%.

There are two plausible explanations for these results; the first regards proximity. England borders Scotland and Wales and is therefore the closest country and a shorter distance for a student to travel than for examples if they were from Wales and migrated to Scotland for higher education. The second explanation concerns the duration of higher education. A Batchelor's degree takes four years to complete in Scotland, and only three years in England and Wales. Thus, English and Welsh domiciled students, who have a preference to move to another country for higher education, may move to the country that offers the three year course, rather than moving to Scotland to study for four years. This is consistent with the literature concerning opportunity costs associated with participation in higher education. An additional year of study would constitute an additional year of foregone earnings.

Regional analysis

In order to provide a more coherent analysis, and given the data provided by HESA contains sector postcode information, regional analysis can be conducted with respect to determining whether students move country by influence of their domicile region. Regional compositions

were based on pre-defined official regions for England. There are no official regions for Scotland and Wales, and thus regions were created based on location for Scotland and Wales. For example, the region Glasgow and Strathclyde consists of 12 local authorities that were grouped together. Tables 4.7 to 4.9 show the regional classifications and percentage of students from the respective country who were domiciled in the region. It is clear from Table 4.7 that London had the largest proportion of domiciled students enrolling in higher education with a share of 18.3%. The lowest share was found in those from the North East of England, with a share of 4.9%. Table 4.8 shows Glasgow/Strathclyde had a significant share of the total number of students from Scotland entering higher education, with 41.6%. The lowest share was found in the South of Scotland, with a share of 4.8%. Almost one half of students from Wales were domiciled in the South West (48%). The lowest proportion of domiciled students from Wales have come from Mid Wales (7.3%).

Table 4.7: Regional Classifications England

Regions England	Number of students domiciled in region	Percentage
London	713,963	18.3%
SE England	647,619	16.6%
NW England	529,207	13.6%
East England	410,365	10.5%
West Midlands	391,625	10.0%
East Midlands	349,261	9.0%
SW England	342,675	8.8%
Yorkshire Humber	325,162	8.3%
NE England	189,480	4.9%

Table 4.8: Regional Classifications Scotland

Regions Scotland	Number of students domiciled in region	Percentage
Glasgow/Strathclyde	157,972	41.6%
Edinburgh Lothian Fife	80,910	21.3%
Aberdeen	44,017	11.6%
Dundee	33,544	8.8%
Central Scotland	19,064	5.0%
Highlands	25,552	6.7%
South Scotland	18,239	4.8%

Table 4.9: Regional Classifications Wales

Regions Wales	Number of students domiciled in region	Percentage
SE Wales	101,135	48.0%
SW Wales	49,487	23.5%
NW Wales	22,715	10.8%
NE Wales	22,129	10.5%
Mid Wales	15,306	7.3%

Source: Author's calculations from HESA (2017). *Notes:* Table shows regional classifications for England, Scotland and Wales respectively. Classifications for England were based on pre-defined regions, while regions for Scotland and Wales were based on geographical location. Tables show the number and percentage of students who are domiciled in each region.

Econometric analysis

To study the geographical mobility of entrants to higher education in the UK, logit models were employed. The rationale for using such models is derived from the notion that the dependent variable within the model is dichotomous indicating whether a country move within Great Britain took place for higher education (a value of zero for no country move and a value of one for a move). The characteristics of the individual are included as categorical explanatory variables within the model and thus logit models are necessary for this analysis (Long, 1997 and Verbeek, 2012).

Scottish, English and Welsh student migration patterns

Data were obtained to match domicile postcode to local authority level and then used to determine domicile country. From the 4,489,427 observations, 86.9% were English domiciled, 8.4% were Scottish domiciled and 4.7% were Welsh domiciled. This study aims to use domicile information to determine mobility among countries, i.e. this study aims to analyse the countries of domicile within Great Britain to ascertain the reasons for moving between countries.

In order to conduct this study, logit models will be employed for each country to analyse individuals who chose to study at a university in another country in Great Britain, for example, why a Scottish domiciled individual moves to England for higher education. Moreover, given the apparent differences in male and female migratory patterns discussed in previous literature, this study will treat males and females separately for each model to

ascertain whether migration patterns are different by gender. The study covers the period 1998/99 to 2015/16. This begins by considering the impact of an individual's characteristics on the probability of migration to a different country within the UK. The below equation denotes the multinomial logit model where *n* denotes the individual who has a choice between *J* options. V_{nj} denotes the utility of the individual which is known and ε_{nj} and $\forall j$ denote the unknown which are assumed to be random (Train, 2009).

$$U_{nj} = V_{nj} + \varepsilon_{nj} \, \forall j$$

Reference group

For each of the models, it is necessary to use a reference group on which to base the results. The reference groups chosen are omitted from the output and the categories not used as the reference group can then be compared to the reference group. Reference groups were chosen for each individual based on the following: for age, the lowest age group was used as the reference category, that is to say, those aged 17 were used as the benchmark. The rationale for using those aged 17 is due to the fact that this represents the lowest age of entrants to higher education, and thus those who are older than 17 can be compared to those aged 17 in terms of the likelihood of moving to another country in Britain for higher education.

The reference group for subject area was chosen based on the subject area attracting the largest proportions of individuals. Table 4.6 showed the uptake for each subject area. It is evident the largest proportion of entrants enter the Business and administration field with 11.3% of all entrants falling into this category, followed by Creative arts and design with 11%. Business and administrative studies will be the group used as the reference category in terms of subject area as this has received the largest uptake.

In terms of socio-economic background, three categories were created based on parental occupation which is used as a proxy here for socio-economic background. From the data, 53% of individuals came from a high socio-economic background, 27% were from middle socio-economic background and the remaining 20% came from low socio-economic backgrounds. For the purpose of the study, low socio-economic background was used as the reference group as this will permit an analysis between the two largest categories, SES_HIGH and SES_MIDDLE to ascertain whether differences are apparent when compared with the reference group SES_LOW.

Post-1992 institutions were chosen to be the reference category for the study. The post-1992 institutions attracted 52% of entrants in Britain between 1998/99 and 2015/16, followed by Russell Group with 25% and Pre-1992 institutions with 23% of entrants.

In terms of the regional dummy, the reference group was the South East of for England; for Scotland, Glasgow/Strathclyde was used; and Mid Wales was used for Wales.

Tables 4.10 to 4.12 show the logit results for the higher education migration process for England, Scotland and Wales. Each table shows the estimates for the probability of obtaining higher education outside England, Scotland, and Wales relative to obtaining higher education in these countries. The variable INST_DIFF was defined to represent those individuals who studied at an institution in another country in Britain, based on the location of the institution they were studying at compared to their domicile country (as determined by domicile postcode). Each model will be discussed in turn whereby the likelihood of obtaining higher education outside the country of domicile (Scotland, England and Wales) is denoted by a value of one in the logit model. Odds ratios are provided in the table to denote the estimated probabilities whereby an increase in the odds of the outcome is expressed with an odds ratio greater than one and a decrease in the odds is demonstrated by a ratio of less than one.

Table 4.10: Binary Logit model estimates using pooled cross-sections for English domiciled individuals obtaining higher education outside England for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.315	(40.27)	***	1.370	0.008
SES_MIDDLE	0.174	(20.02)	***	1.190	0.005
AGE18	-0.063	(-1.65)	*	0.939	-0.002
AGE19	0.021	(0.55)		1.021	0.001
AGE20	-0.213	(-5.38)	***	0.808	-0.006
AGE21_25	-0.370	(-9.31)	***	0.691	-0.009
AGE26_30	-0.796	(-17.51)	***	0.451	-0.015
AGE31PLUS	-1.292	(-28.25)	***	0.275	-0.034
RUSSELLGROUP	1.328	(174.82)	***	3.773	0.036
PRE1992	1.842	(261.88)	***	6.311	0.043
MEDICINE	0.343	(23.99)	***	1.409	0.009
SBJECTSTOMED	-0.119	(-10.66)	***	0.888	-0.009
BIOLOGICALSCIENCE	0.475	(51.16)	***	1.608	0.012
AGRICULTURE	0.482	(19.73)	***	1.619	0.012
PHYSICALSCIENCE	0.238	(21.15)	***	1.269	0.006
MATHSCIENCE	-0.283	(-16.37)	***	0.753	-0.007
COMPUTERSCIENCE	-0.313	(-19.18)	***	0.731	-0.009
ENGINEERING	-0.151	(-11.41)	***	0.859	-0.004
ARCHITECTURE	0.125	(5.78)	***	1.133	0.002
SOCIALSTUDIES	-0.090	(-9.18)	***	0.914	-0.003
LAW	-0.153	(-10.24)	***	0.858	-0.004
COMMUNICATION	-0.140	(-7.85)	***	0.869	-0.004
LANGUAGES	0.270	(28.12)	***	1.310	0.007
HIST_PHILO	0.353	(34.81)	***	1.423	0.009
CREATIVEARTS	0.105	(9.97)	***	1.111	0.003
EDUCATION	-0.405	(-22.09)	***	0.667	-0.011
COMBINED	0.110	(5.93)	***	1.116	0.002
EAST ENGLAND	-0.535	(-50.34)	***	0.586	-0.013
EAST MIDLANDS	-0.369	(-32.23)	***	0.692	-0.010
LONDON	-0.756	(-78.44)	***	0.470	-0.017
NE ENGLAND	0.142	(10.73)	***	1.153	0.003
NW ENGLAND	-0.191	(-21.32)	***	0.827	-0.006
SW ENGLAND	0.969	(120.13)	***	2.636	0.043
WEST MIDLANDS	0.416	(47.52)	***	1.516	0.012
YORKSHIRE HUMBER	-0.506	(-42.2)	***	0.603	-0.013
FEMALE	-0.076	(-14.54)	***	0.926	-0.002
CONSTANT	-4.190	(-104.28)	***		
No. of observations	3,899,357				
Prob > Chi^2	0				
Log likelihood	-639899.29				
Pseudo R^2	0.1175				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile South East England (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.11: Binary Logit model estimates using pooled cross-sections for Scottish domiciled obtaining higher education outside Scotland for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.661	(28.89)	***	1.938	0.023
SES_MIDDLE	0.205	(7.97)	***	1.228	0.006
AGE18	0.631	(29.68)	***	1.880	0.019
AGE19	1.277	(51.39)	***	3.585	0.054
AGE20	1.016	(31.43)	***	2.763	0.038
AGE21_25	1.032	(35.06)	***	2.808	0.039
AGE26_30	0.787	(17.71)	***	2.196	0.026
AGE31PLUS	-0.131	(-2.69)	***	0.878	-0.003
RUSSELLGROUP	0.843	(44.09)	***	2.322	0.046
PRE1992	-0.501	(-23.58)	***	0.606	-0.015
MEDICINE	0.545	(13.54)	***	1.725	0.020
SBJECTSTOMED	0.099	(2.95)	***	1.104	0.004
BIOLOGICALSCIENCE	-0.097	(-3.23)	***	0.908	-0.004
AGRICULTURE	1.060	(19.47)	***	2.886	0.040
PHYSICALSCIENCE	0.469	(13.42)	***	1.598	0.018
MATHSCIENCE	0.372	(7.05)	***	1.451	0.014
COMPUTERSCIENCE	-0.583	(-11.99)	***	0.558	-0.022
ENGINEERING	0.508	(16.46)	***	1.663	0.019
ARCHITECTURE	0.122	(2.34)	**	1.130	0.005
SOCIALSTUDIES	0.365	(13.26)	***	1.441	0.014
LAW	0.095	(2.38)	**	1.099	0.004
COMMUNICATION	0.521	(11.42)	***	1.684	0.020
LANGUAGES	0.525	(16.94)	***	1.691	0.020
HIST_PHILO	0.301	(8.82)	***	1.351	0.011
CREATIVEARTS	1.358	(52.29)	***	3.888	0.051
EDUCATION	-0.468	(-9.38)	***	0.626	-0.018
COMBINED	0.614	(13.62)	***	1.847	0.023
EDINBURGH	0.986	(53.05)	***	2.680	0.041
ABERDEEN	0.614	(24.35)	***	1.849	0.021
DUNDEE	0.542	(19.05)	***	1.719	0.018
CENTRAL SCOTLAND	0.441	(12.18)	***	1.554	0.014
HIGHLANDS	0.210	(6.09)	***	1.234	0.006
SOUTH SCOTLAND	1.395	(48.72)	***	4.034	0.071
FEMALE	-0.056	(-3.58)	***	0.946	-0.002
CONSTANT	-4.839	(-130.7)			
No. of observations	379,298				
Prob > chi^2	0				
Log likelihood	-74053.73				
Pseudo R^2	0.1264				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile Glasgow/Strathclyde (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.12: Binary Logit model estimates using pooled cross-sections for Welsh domiciled obtaining higher education outside Wales for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.559	(41.59)	***	1.749	0.131
SES_MIDDLE	0.165	(11.27)	***	1.180	0.037
AGE18	-0.600	(-5.66)	***	0.549	-0.149
AGE19	-0.470	(-4.42)	***	0.625	-0.117
AGE20	-0.731	(-6.79)	***	0.482	-0.180
AGE21_25	-1.028	(-9.56)	***	0.358	-0.248
AGE26_30	-1.653	(-14.79)	***	0.192	-0.366
AGE31PLUS	-2.334	(-20.89)	***	0.097	-0.453
RUSSELLGROUP	0.060	(4.63)	***	1.062	0.015
PRE1992	-1.144	(-91.6)	***	0.319	-0.252
MEDICINE	1.051	(31.81)	***	2.860	0.250
SBJECTSTOMED	0.391	(18.53)	***	1.478	0.093
BIOLOGICALSCIENCE	0.077	(4.1)	***	1.080	0.018
AGRICULTURE	0.859	(19.64)	***	2.361	0.204
PHYSICALSCIENCE	0.588	(25.58)	***	1.800	0.140
MATHSCIENCE	0.682	(20.51)	***	1.978	0.162
COMPUTERSCIENCE	-0.107	(-4.03)	***	0.899	-0.025
ENGINEERING	0.552	(23)	***	1.737	0.131
ARCHITECTURE	0.863	(22.31)	***	2.371	0.205
SOCIALSTUDIES	0.305	(15.55)	***	1.357	0.073
LAW	0.159	(6.43)	***	1.173	0.038
COMMUNICATION	0.421	(13.97)	***	1.524	0.100
LANGUAGES	0.477	(22.85)	***	1.611	0.113
HIST_PHILO	0.439	(19.01)	***	1.551	0.104
CREATIVEARTS	0.487	(25.83)	***	1.628	0.116
EDUCATION	-0.638	(-26.1)	***	0.528	-0.152
COMBINED	0.720	(19.6)	***	2.055	0.171
NORTH EAST WALES	0.721	(30.87)		2.057	0.174
NORTH WEST WALES	0.270	(11.8)	***	1.310	0.067
SOUTH EAST WALES	-0.745	(-39.18)	***	0.475	-0.177
SOUTH WEST WALES	-0.736	(-35.95)	***	0.479	-0.175
FEMALE	-0.035	(-3.29)	***	0.966	-0.008
CONSTANT	0.424	(3.9)	***		
No. of observations	210,772				
Prob > Chi^2	0				
Log likelihood	-123678.85				
Pseudo R^2	0.133				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile Mid Wales (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Preliminary results

The results reported in Tables 4.10 to 4.12 show the logistic regression results for cross-sectional pooled data for England, Scotland and Wales. From the results, it is clear there are a number of influencing factors which contribute to the decision to migrate for higher education within Great Britain. The logit models were produced using the reference group low socio-economic background, age 17, attending a post-1992 institution and studying business and the regional dummies were South East England for England, Glasgow Strathclyde for Scotland and Mid Wales for Wales. The logit model results for England can be expressed using:

$$logit\big(\hat{p}(x)\big) = \log\frac{\hat{p}(x)}{1-\hat{p}(x)} = \hat{\alpha} + \hat{\beta}x = -4.19 + 0.32\,SES_{HIGH} + 0.17\,SES_{MIDDLE} - 0.06\,Age18 + 0.02\,Age19 - 0.21\,Age20 - 0.37\,Age21_{25} - 0.80\,Age26_{30} - 1.29\,Age31plus + 1.33\,RussellGroup + 1.84\,Pre1992 + 0.34\,Medicine - 0.12\,SubjectsMedicine + 0.48\,BiologicalScience + 0.48\,Agriculture + 0.24\,PhysicalScience - 0.28\,MathScience - 0.31\,ComputerScience - 0.15\,Engineering + 0.13\,Architecture - 0.09\,SocialStudies - 0.15\,Law - 0.14\,Communciation + 0.27\,Languages + 0.35\,HistPhil + 0.11\,CreativeArts - 0.41\,Education + 0.11\,Combined - 0.54\,EastEngland - 0.37\,EastMidlands - 0.76\,London + 0.14\,NEEngland - 0.19\,NWEngland + 0.97\,SWEngland + 0.42\,WestMidlands - 0.51\,YorkshireHumber - 0.08\,Female$$

Where $\hat{p}$ denotes the estimated probability of moving country for higher education. Given the coefficients are in the form of log-odds unit, it is useful to convert them to odds ratios for the purpose of interpretation, as the coefficients alone do not permit substantive interpretation. Odds ratios are a simple way of interpreting the effects of the independent variables. An odds ratio value of one signifies the variable does not affect the odds of moving away for university, an odds ratio greater than one shows the independent variable leads to higher odds of moving away and an odds ratio less than one shows the independent variable produces lower odds of moving away. Given all independent variables are binary, this method of analysis conveys the odds of moving away based on a number of personal characteristics, institution classifications, subject choices and regional variations. Each variable will be represented by the dummy variable therefore signifying whether the presence of this variable (whether it be characteristic or institution specific) is associated with higher or lower odds of moving away with respect to the reference group.

The logistic regressions confirm there are apparent differences in mobility preference between countries in Great Britain. A number of personal, institution and regional variables were included within the models, these will be discussed in turn, with respect to the reference group mentioned above. In terms of the socio-economic background variables, it is interesting to note that SES_HIGH is significantly, and positively related to moving country for higher education for those domiciled in England, Scotland and Wales; given the odds ratios are 1.37, 1.94 and 1.75 respectively. SES_MIDDLE is also positively significant for all three countries within the study, with lower odds ratios than SES_HIGH. Therefore, as to be expected, individuals from wealthier backgrounds, ceteris paribus, are more inclined to move country for higher education than those from less wealthy backgrounds.

Age also produces contrasting results depending on domicile country, this can be attributed to the fact that the age of entry to higher education differs by country within the UK. For Scottish domiciled students, secondary schooling typically finishes when individuals are aged 17 or 18 while individuals are typically 18 or 19 when they leave secondary school in England and Wales. The results show that individuals are more likely to move country for higher education at age 19 in Scotland whereas, for those in England, although the variable age 19 has a positive coefficient, it is statistically insignificant. The other age variables for England are statistically significant and show a negative relationship with moving, when compared with the age 17 reference group. The age dummies for Wales provide negative coefficients (and therefore odds ratios of less than one) across all ages when compared to the reference age of 17.

From the perspective of institution classification, Scotland and Wales present similar results in the sense that individuals are most likely to move country to attend a Russell Group institution, while for English domiciled students, the tendency to move away for higher education is largest for pre-1992 institutions. It should be noted that Russell Group institutions are significant and have positive odds across all countries.

Perhaps the starkest difference across countries in terms of the logit model comes from subject area. The reference group of business as a subject area was used for all country models and thus the likelihood of moving by subject area can be compared to business studies. In terms of the subject area with the highest likelihood of individuals moving country within Great Britain to study, agriculture has the highest odds in English domiciled students followed by biological science. For Scottish domiciled students, creative arts is the subject

area which attracts most individuals to migrate followed by agriculture. Medicine and architecture have the highest odds of country mobility among those who are Welsh domiciled migrants.

A dummy variable to establish whether gender was important in determining the migratory experience of individuals was included in the model. From the results, it is clear the FEMALE variable is negatively related to moving country for higher education in England, Scotland and Wales. This may be due to the notion that females typically are more inclined to be price sensitive to higher education than males (see for example Wilkins, Shams and Huisman, 2013) and thus may be less willing to move country (which can typically cost more than living in domicile country) for higher education. Moreover, studies have shown females prefer to stay closer to home for higher education (see, for example, Moogan and Baron (2003).

Given the aforementioned significance of the female dummy variable for the countries used within the study, it is interesting to investigate whether key differences by gender emerge in the study, given the negative significant female coefficients.

4.4.4 Male-female differentials

In order to ascertain whether gender differences emerge in the country migration of students, the aforementioned models were re-estimated to test for apparent differences by gender. According to the literature, differences occur in the migration behaviour of males and females. It is therefore interesting to analyse these with respect to migration for higher education within the context of Great Britain, particularly given the notion that the dummy variables for female, included in the previous models, was found to be both significant and negatively related to the migration behaviours in England, Wales and Scotland. Results for the separate models are reported in Tables 4.13 to 4.18.

The separation of males and females from the pooled models provides interesting differentials. First, it is necessary to note that comparing logit coefficients across groups can be somewhat troublesome given the notion that the coefficients presented in logit models are influenced by residual variations across groups. This can subsequently lead to conclusions to be drawn about the differences in coefficients which may be inflated or biased based on the differences in the residuals (Allison, 1999). A potential method, which is not bounded by these limitations is proposed by Long (2009).

Long (2009) states that results derived from a model where the residual variation is different depending on group can lead to incorrect inferences being drawn. Long (2009) proposes a way to mitigate this potential pitfall by using predicted probabilities. According to Long (2009), predicted probabilities permits comparisons across groups and allows one to establish whether groups are affected in the same way by variables. Predicted probabilities were obtained in order to ensure interpretation of the results do not capture residual variability. Using predicted probabilities is thus useful in determining whether independent variables are equal across females and males in country migration across Great Britain.

Predicted probabilities, using conditional marginal effects, are thus compared across groups whereby levels are assessed between males and females for each variable, while holding all other variables constant. This method will reveal the change in the probability of moving for higher education when the independent variables increase by one unit. Given the independent variables are binary, this can be interpreted using the change from not present (having a value of zero) to present (having a value of one). Thus, the study will determine whether there are apparent differences in the predicted outcomes when analysing independent variables. The results reported for males and females are again calculated with respect to the reference group, age 17, low SES, post-1992 institution, studying business and domicile South East England, Glasgow/Strathclyde and Mid Wales for England, Scotland and Wales respectively.

4.4.5 Results

In terms of personal characteristics, socio-economic background shows little difference between females and males across all countries. Females and males from a higher or middle socio-economic background are more likely to move country for higher education when compared to the reference group low socio-economic background. This is the case for England, Scotland and Wales. The change in the probability when socio-economic background moves from low to high increases by 0.01 for English domiciled females and the results show very little effect for males. The Scottish results show similar effects for males and females (0.022 and 0.024 respectively). The largest male-female differentials occur for Welsh domiciled students whereby the change in the probability of a move to England or

Scotland for higher education increases 13.7 percentage points for females and 12 percentage points for males when socio-economic background moves from low to high.

Using the odds ratios, the odds of English domiciled females moving to Scotland or Wales for higher education increase by a factor of around 1.4 times if they are from high socio-economic background and 1.2 if they are from middle socio-economic background, when compared to those from low socio-economic background. Similar results are reported for male English domiciled individuals. The odds ratios of males and females from middle socio-economic backgrounds are almost identical in Scotland and Wales while the odds of moving for those from high socio-economic backgrounds are slightly higher for females from both countries; (2 times (females) versus 1.8 times (males) for Scottish domiciled; and 1.8 (females) versus 1.7 (males) for Welsh domiciled, when compared to those from lower socio-economic backgrounds.

The age variables are similar across females and males in England and Wales in terms of having an inverse relationship with moving away. Furthermore, the odds of moving away significantly decrease with age. The exception to this is found in English domiciled males aged 19 whereby the odds are greater than one (with a marginal effect of less than one percentage point (0.003)) but the variable is statistically insignificant. In terms of Scottish domiciled males and females the odds of moving to England or Wales for higher education are positively related to age, whereby the greatest odds of moving are among those age 19, with odds ratios of around three for females and four for males. This signifies females age 19 are three times more likely, and males are four times more likely, to move to England or Wales than an individual age 17. Indeed, the marginal effects show the probability of moving increases by 4.8 percentage points for females and 6 percentage points for males aged 19 when compared to those aged 17, both of which are statistically significant. The exception to the similar patterns in male and female odds by age arises for those age 31 plus whereby females are less likely to move away as the odds ratios, (and conditional marginal effect) is significantly less than one (a decrease of one percentage point) while the male ratio (conditional marginal effect) remains above one (is 0.004).

For the institution classification variables, Russell Group is positively related with all groups with the exception of Welsh domiciled females whereby there is a negative relationship. It is plausible the Russell Group effect is driven by the most prestigious institutions (namely the

Universities of Oxford, Cambridge, Imperial College London, the London School of Economics and University College London), all of which are located in England.

Pre-1992 institutions appear to have a different effect dependent on domicile country. The marginal effects of moving away for a pre-1992 institution for English domiciled males and females are greater than Russell Group institutions (for females pre-1992 has a marginal effect of 5.7 percentage points compared to Russell Group with a 4% marginal effect, and for males pre-1992 is 5 percentage points, with Russell Group at 3.3 percentage points).

For Scottish domiciled males and females the probability of moving away and attending a pre-1992 are lower when compared to the reference group, implying individuals are more likely to move for a post-1992 institution than a pre-1992, indeed for both males and females, the probability of moving decreases by 1.5 percentage points . For Welsh domiciled female students, pre-1992 and Russell Group institutions have decreasing marginal effects which implies Welsh domiciled female students are more likely to move to attend a post-1992 institution. These findings are particularly prevalent for Welsh domiciled males whereby the probability of moving for a pre-1992 institutions decreases by 23 percentage points when compared to post-1992 institutions. Indeed, if individuals are more inclined to move for post-1992 institutions, this may reflect the fact that Wales currently has three post-1992 providers and it could be the case that individuals feel the need to move to England to study courses that are perhaps not offered at the post-1992 institutions in Wales.

In terms of the subject variables, there are some differences in male and female behaviour by country of domicile. First, English domiciled males have a decreasing probability of moving for architecture and creative arts while females have a small, but positive probability of moving, when compared to the reference group of those studying business. This shows males are ostensibly less likely to move country to study these subjects whereas females are more likely to move country to study these subjects, when compared to business students.

For Scotland, both genders have the same patterns emerging in terms of subject area with the exception of subjects allied to medicine whereby the analysis shows an insignificant relation for females and a positive, significant relation for males with an increased probability of moving which equates to approximately 2 percentage points. Furthermore, for Welsh domiciled students, the relative effects of subject areas are similar for males and females with the exception of social studies whereby females have a decreased probability of moving, while males have a 7.5 percentage point increase.

The highest marginal effects of subject area significantly vary by country and gender. For English domiciled females, those studying architecture and biological science have the highest probabilities of moving, with an increase of 1.3 percentage points when compared to business students. Agriculture has the highest probability of males moving at an increase of 1.9 percentage points, followed by biological science with an increase of 1.3 percentage points, compared to the probability of moving to study business and administrative studies. For Scottish domiciled students, studying creative arts has the highest probability across females and males in terms of being migrants to England or Wales for higher education when compared to studying business and administrative studies, with increases of 5.3 and 4.6 percentage points respectively.

Given fewer English and Scottish domiciled individuals move to study than Welsh domiciled students, this could contribute to the marginal effects of some subject areas being rather small. The results for Wales give greater marginal effects for subject area, both positive and negative. The output for female Welsh domiciled students shows studying engineering has the highest probability of influencing females to move, with an increase of 21.2 percentage points. This is followed by studying medicine, which increases the female probability of moving by 19 percentage points when compared to business and administrative studies. Welsh domiciled males have 18.5 percentage points increase in the probability of moving to England or Scotland to study medicine when compared to business and administrative studies. This is followed by architecture (15.6 percentage point increase). The results from the logistic regression also show some negative probabilities for subject area for Welsh domiciled students. The largest decrease in the probability of moving is found to be among those studying education for females, with a decrease of 22.9 percentage points when compared to those studying business. The same is also true for males but on a smaller magnitude (a decreased probability of 11.3 percentage points). Seven of the eight higher education institutions in Wales offer courses in education and therefore Wales is well served in terms of studying subjects in the field of education.

Regional variables were included in the models to ascertain whether individuals move country based on their location within the home country. The results of the logit models will be discussed with respect to the reference groups South East England, Glasgow/Strathclyde (Scotland) and Mid Wales.

The migratory patterns in terms of regional analysis are very similar for males and females in the English study. When compared with the reference group, South East England, individuals who are living in South West England, the West Midlands and the North East of England have higher probabilities of moving across males and females. Those living in East England, East Midlands, London, the North West and Yorkshire and the Humber have lower probabilities of moving when compared to those domiciled in the South East. Perhaps these results reflect the proximity to country borders, as the three regions with the highest probabilities of moving are within relatively close proximity to Scotland (North East England) and Wales (South West England and West Midlands). Moreover, there is a possibility of an independent London effect where there is a substantial London wage premium that could typically be lowering the number of individuals who move from London for higher education.

The Scottish domiciled studies were conducted with respect to the reference group of those domiciled in Glasgow/Strathclyde. It is interesting to note all regional variables produced positive probabilities in terms of moving to England and Wales for higher education. This implies individuals living in Glasgow/Strathclyde are less likely to move to England and Wales for higher education than those domiciled in Edinburgh, Aberdeen, Dundee, Central Scotland, the Highlands and the South of Scotland.

The Welsh study was conducted with respect to Mid Wales being the reference group. Similar to the two other studies, patterns have emerged between males and females with respect to the regional variables. The study shows that the probability of migrating for higher education are higher among female from the North East of Wales, with an increase of 16.2 percentage points. For males the probability of moving increases by 18.5 percentage points for those from the North East of Wales. Both males and females domiciled in the South (East and West) have negative probabilities of moving when compared to those from Mid Wales, implying these individuals have higher odds of staying within Wales for their education rather than moving to England or Scotland. The results show females have a decreased probability of moving by around 20 percentage points if they are domiciled in the South East and, for males, the probability of moving decreases by around 15 percentage points for those from the South West and South East.

Table 4.13: Binary Logit model estimates using pooled cross-sections for English domiciled females obtaining higher education outside England for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.313	(29.14)	***	1.368	0.007
SES_MIDDLE	0.175	(14.59)	***	1.191	0.004
AGE18	-0.079	(-1.61)		0.924	-0.002
AGE19	-0.035	(-0.71)		0.966	-0.001
AGE20	-0.323	(-6.24)	***	0.724	-0.009
AGE21_25	-0.544	(-10.45)	***	0.581	-0.013
AGE26_30	-1.061	(-17.15)	***	0.346	-0.021
AGE31PLUS	-1.528	(-25.19)	***	0.217	-0.025
RUSSELLGROUP	1.490	(143.59)	***	4.436	0.040
PRE1992	1.783	(180.29)	***	5.950	0.057
MEDICINE	0.413	(22.87)	***	1.511	0.010
SBJECTSTOMED	-0.124	(-7.7)	***	0.883	-0.003
BIOLOGICALSCIENCE	0.503	(42.53)	***	1.654	0.013
AGRICULTURE	0.388	(11.77)	***	1.473	0.010
PHYSICALSCIENCE	0.352	(21.69)	***	1.422	0.009
MATHSCIENCE	-0.070	(-2.69)	***	0.933	-0.002
COMPUTERSCIENCE	-0.403	(-9.34)	***	0.668	-0.010
ENGINEERING	-0.240	(-7.97)	***	0.787	-0.006
ARCHITECTURE	0.535	(16.39)	***	1.708	0.013
SOCIALSTUDIES	-0.120	(-9)	***	0.887	-0.003
LAW	-0.093	(-4.94)	***	0.911	-0.002
COMMUNICATION	0.019	(0.83)		1.019	0.000
LANGUAGES	0.291	(24.69)	***	1.338	0.007
HIST_PHILO	0.399	(29.73)	***	1.490	0.010
CREATIVEARTS	0.199	(14.94)	***	1.221	0.005
EDUCATION	-0.364	(-17.03)	***	0.695	-0.009
COMBINED	0.285	(12.14)		1.330	0.007
EAST ENGLAND	-0.566	(-38.19)	***	0.568	-0.013
EAST MIDLANDS	-0.379	(-24.02)	***	0.685	-0.009
LONDON	-0.755	(-56.85)	***	0.470	-0.016
NE ENGLAND	0.164	(9.14)	***	1.178	0.005
NW ENGLAND	-0.168	(-13.72)	***	0.846	-0.004
SW ENGLAND	0.971	(87.52)	***	2.642	0.045
WEST MIDLANDS	0.400	(33.19)	***	1.492	0.014
YORKSHIRE HUMBER	-0.483	(-29.57)	***	0.617	-0.011
CONSTANT	-4.313	(-83.32)	***		
No. of observations	2,132,249				
Prob > Chi^2	0				
Log likelihood	-339164.81				
Pseudo R^2	0.1237				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile South East England (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.14: Binary Logit model estimates using pooled cross-sections for English domiciled males obtaining higher education outside England for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.308	(27)	***	1.361	0.009
SES_MIDDLE	0.168	(13.22)	***	1.183	0.004
AGE18	-0.042	(-0.69)		0.959	-0.001
AGE19	0.087	(1.43)		1.091	0.003
AGE20	-0.105	(-1.69)	*	0.900	-0.003
AGE21_25	-0.200	(-3.22)	***	0.818	-0.006
AGE26_30	-0.511	(-7.42)	***	0.600	-0.001
AGE31PLUS	-0.946	(-13.43)	***	0.388	-0.027
RUSSELLGROUP	1.120	(99.58)	***	3.064	0.033
PRE1992	1.894	(188.53)	***	6.644	0.055
MEDICINE	0.183	(7.73)	***	1.200	0.007
SBJECTSTOMED	-0.196	(-11.98)	***	0.822	-0.005
BIOLOGICALSCIENCE	0.382	(24.94)	***	1.465	0.013
AGRICULTURE	0.579	(15.66)	***	1.785	0.019
PHYSICALSCIENCE	0.119	(7.25)	***	1.127	0.006
MATHSCIENCE	-0.457	(-19.15)	***	0.633	-0.010
COMPUTERSCIENCE	-0.427	(-21.78)	***	0.652	-0.012
ENGINEERING	-0.227	(-13.33)	***	0.797	-0.004
ARCHITECTURE	-0.221	(-7.48)	***	0.802	-0.004
SOCIALSTUDIES	-0.094	(-6.23)	***	0.910	-0.001
LAW	-0.287	(-11.62)	***	0.751	-0.006
COMMUNICATION	-0.401	(-13.98)	***	0.670	-0.010
LANGUAGES	0.182	(10.78)	***	1.200	0.008
HIST_PHILO	0.244	(15.48)	***	1.277	0.010
CREATIVEARTS	-0.061	(-3.53)	***	0.940	-0.001
EDUCATION	-0.362	(-9.99)	***	0.696	-0.009
COMBINED	-0.181	(-6)	***	0.834	-0.003
EAST ENGLAND	-0.501	(-32.81)	***	0.606	-0.015
EAST MIDLANDS	-0.361	(-21.69)	***	0.697	-0.012
LONDON	-0.754	(-53.75)	***	0.470	-0.020
NE ENGLAND	0.115	(5.85)	***	1.122	0.002
NW ENGLAND	-0.214	(-16.3)	***	0.807	-0.009
SW ENGLAND	0.967	(82.1)	***	2.630	0.048
WEST MIDLANDS	0.436	(34.21)	***	1.547	0.014
YORKSHIRE HUMBER	-0.532	(-30.13)	***	0.587	-0.016
CONSTANT	-4.075	(-64.28)	***		
No. of observations	1,766,985				
Prob > Chi^2	0				
Log likelihood	-298945.29				
Pseudo R^2	0.1155				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile South East England (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.15: Binary Logit model estimates using pooled cross-sections for Scottish domiciled females obtaining higher education outside Scotland for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.710	(22.93)	***	2.035	0.024
SES_MIDDLE	0.224	(6.42)	***	1.251	0.006
AGE18	0.614	(21.7)	***	1.847	0.018
AGE19	1.190	(35.59)	***	3.288	0.048
AGE20	1.030	(23.93)	***	2.800	0.038
AGE21_25	1.002	(25.02)	***	2.723	0.037
AGE26_30	0.614	(9.53)	***	1.848	0.018
AGE31PLUS	-0.383	(-5.53)	***	0.682	-0.007
RUSSELLGROUP	0.697	(26.53)	***	2.007	0.035
PRE1992	-0.518	(-18.02)	***	0.596	-0.015
MEDICINE	0.686	(13.17)	***	1.986	0.024
SBJECTSTOMED	-0.004	(-0.09)		0.996	0.000
BIOLOGICALSCIENCE	-0.082	(-2.09)	**	0.921	-0.003
AGRICULTURE	1.335	(18.28)	***	3.799	0.048
PHYSICALSCIENCE	0.700	(13.69)	***	2.014	0.025
MATHSCIENCE	0.352	(4.12)	***	1.421	0.013
COMPUTERSCIENCE	-0.174	(-1.7)	*	0.840	-0.006
ENGINEERING	1.042	(17.82)	***	2.836	0.037
ARCHITECTURE	0.388	(4.57)	***	1.474	0.014
SOCIALSTUDIES	0.325	(8.79)	***	1.384	0.012
LAW	0.163	(3.13)	***	1.177	0.006
COMMUNICATION	0.513	(8.41)	***	1.671	0.018
LANGUAGES	0.586	(15.05)	***	1.798	0.021
HIST_PHILO	0.380	(8.23)	***	1.462	0.014
CREATIVEARTS	1.473	(43.71)	***	4.361	0.053
EDUCATION	-0.431	(-7.1)	***	0.650	-0.015
COMBINED	0.731	(12.24)	***	2.077	0.026
EDINBURGH	0.967	(38.3)	***	2.630	0.038
ABERDEEN	0.542	(15.69)	***	1.719	0.017
DUNDEE	0.529	(13.66)	***	1.697	0.017
CENTRAL SCOTLAND	0.447	(9.18)	***	1.564	0.014
HIGHLANDS	0.174	(3.71)	***	1.191	0.005
SOUTH SCOTLAND	1.453	(38.02)	***	4.278	0.074
CONSTANT	-4.891	(-102.84)	***		
No. of observations	211,194				
Prob > chi^2	0				
Log likelihood	-40111.71				
Pseudo R^2	0.1312				

Notes: The constant term shows the probability of migrating to another country within Great Britain for females with the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile Glasgow/Strathclyde (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.16: Binary Logit model estimates using pooled cross-sections for Scottish domiciled males obtaining higher education outside Scotland for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.598	(17.55)	***	1.818	0.022
SES_MIDDLE	0.183	(4.8)	***	1.201	0.005
AGE18	0.653	(20.19)	***	1.922	0.020
AGE19	1.382	(37.03)	***	3.982	0.061
AGE20	0.999	(20.32)	***	2.715	0.036
AGE21_25	1.069	(24.48)	***	2.912	0.040
AGE26_30	0.953	(15.36)	***	2.594	0.033
AGE31PLUS	0.155	(2.24)	**	1.168	0.004
RUSSELLGROUP	0.975	(34.67)	***	2.652	0.058
PRE1992	-0.521	(-16.34)	***	0.594	-0.015
MEDICINE	0.371	(5.8)	***	1.449	0.014
SBJECTSTOMED	0.531	(8.98)	***	1.701	0.021
BIOLOGICALSCIENCE	-0.107	(-2.32)	**	0.898	-0.004
AGRICULTURE	0.733	(8.95)	***	2.082	0.028
PHYSICALSCIENCE	0.260	(5.42)	***	1.297	0.010
MATHSCIENCE	0.349	(5.14)	***	1.418	0.014
COMPUTERSCIENCE	-0.729	(-12.77)	***	0.482	-0.028
ENGINEERING	0.334	(8.59)	***	1.397	0.013
ARCHITECTURE	-0.054	(-0.81)		0.948	-0.002
SOCIALSTUDIES	0.422	(10.11)	***	1.524	0.016
LAW	0.012	(0.19)		1.012	0.000
COMMUNICATION	0.509	(7.41)	***	1.663	0.020
LANGUAGES	0.478	(9.13)	***	1.614	0.019
HIST_PHILO	0.191	(3.78)	***	1.211	0.007
CREATIVEARTS	1.175	(28.48)	***	3.239	0.046
EDUCATION	-0.432	(-4.83)	***	0.649	-0.017
COMBINED	0.475	(6.91)	***	1.608	0.018
EDINBURGH	1.022	(37.09)	***	2.779	0.043
ABERDEEN	0.720	(19.41)	***	2.054	0.026
DUNDEE	0.579	(13.8)	***	1.785	0.019
CENTRAL SCOTLAND	0.449	(8.27)	***	1.566	0.014
HIGHLANDS	0.286	(5.61)	***	1.331	0.008
SOUTH SCOTLAND	1.344	(30.98)	***	3.835	0.067
CONSTANT	-4.823	(-89.36)	***		
No. of observations	168,084				
Prob > chi^2	0				
Log likelihood	-33691.83				
Pseudo R^2	0.1269				

Notes: The constant term shows the probability of migrating to another country within Great Britain for males with the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile Glasgow/Strathclyde (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.17: Binary Logit model estimates using pooled cross-sections for Welsh domiciled females obtaining higher education outside Wales for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.594	(33.08)	***	1.812	0.137
SES_MIDDLE	0.161	(8.25)	***	1.175	0.035
AGE18	-0.524	(-3.8)	***	0.592	-0.130
AGE19	-0.387	(-2.8)	***	0.679	-0.097
AGE20	-0.676	(-4.81)	***	0.509	-0.166
AGE21_25	-1.056	(-7.53)	***	0.348	-0.249
AGE26_30	-1.768	(-12.09)	***	0.171	-0.372
AGE31PLUS	-2.363	(-16.27)	***	0.094	-0.438
RUSSELLGROUP	-0.054	(-3.04)	***	0.948	-0.013
PRE1992	-1.254	(-73.56)	***	0.285	-0.270
MEDICINE	0.812	(19.33)	***	2.253	0.190
SBJECTSTOMED	-0.214	(-7.88)	***	0.807	-0.050
BIOLOGICALSCIENCE	-0.071	(-2.97)	**	0.931	-0.017
AGRICULTURE	0.740	(12.84)	***	2.096	0.173
PHYSICALSCIENCE	0.390	(11.43)	***	1.476	0.091
MATHSCIENCE	0.323	(6.55)	***	1.381	0.075
COMPUTERSCIENCE	-0.251	(-4.14)	***	0.778	-0.059
ENGINEERING	0.909	(15.21)	***	2.482	0.212
ARCHITECTURE	0.532	(7.58)	***	1.702	0.124
SOCIALSTUDIES	-0.043	(-1.77)	*	0.958	-0.010
LAW	-0.089	(-2.94)	***	0.915	-0.021
COMMUNICATION	0.176	(4.46)	***	1.192	0.041
LANGUAGES	0.272	(11.21)	***	1.312	0.063
HIST_PHILO	0.241	(8)	***	1.273	0.056
CREATIVEARTS	0.321	(13.47)	***	1.379	0.075
EDUCATION	-0.980	(-34.39)	***	0.375	-0.229
COMBINED	0.368	(7.93)	***	1.445	0.086
NORTH EAST WALES	0.670	(21.39)	***	1.954	0.161
NORTH WEST WALES	0.195	(6.33)	***	1.215	0.048
SOUTH EAST WALES	-0.864	(-33.63)	***	0.421	-0.203
SOUTH WEST WALES	-0.821	(-29.65)	***	0.440	-0.194
CONSTANT	0.723	(5.12)			
No. of observations	118,977				
Prob > Chi^2	0				
Log likelihood	-67974.868				
Pseudo R^2	0.1509				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile Mid Wales (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 4.18: Binary Logit model estimates using pooled cross-sections for Welsh domiciled males obtaining higher education outside Wales for 1998-2015

Variable	Coefficient	z		Odds Ratio	Predicted Probabilities
SES_HIGH	0.503	(24.69)	***	1.654	0.120
SES_MIDDLE	0.163	(7.32)	***	1.177	0.037
AGE18	-0.709	(-4.29)	***	0.492	-0.175
AGE19	-0.582	(-3.52)	***	0.559	-0.144
AGE20	-0.798	(-4.78)	***	0.450	-0.197
AGE21_25	-0.975	(-5.84)	***	0.377	-0.239
AGE26_30	-1.410	(-8.14)	***	0.244	-0.332
AGE31PLUS	-2.168	(-12.42)	***	0.114	-0.453
RUSSELLGROUP	0.197	(10.01)	***	1.217	0.049
PRE1992	-1.020	(-55.25)	***	0.360	-0.231
MEDICINE	0.763	(14.45)	***	2.145	0.185
SBJECTSTOMED	-0.242	(-7.42)	***	0.785	-0.059
BIOLOGICALSCIENCE	-0.268	(-8.18)	***	0.765	-0.065
AGRICULTURE	0.416	(6.07)	***	1.516	0.101
PHYSICALSCIENCE	0.309	(9.01)	***	1.362	0.075
MATHSCIENCE	0.552	(11.81)	***	1.737	0.134
COMPUTERSCIENCE	-0.365	(-10.51)	***	0.694	-0.088
ENGINEERING	0.214	(6.61)	***	1.239	0.052
ARCHITECTURE	0.645	(13.07)	***	1.906	0.156
SOCIALSTUDIES	0.311	(9.32)	***	1.365	0.075
LAW	-0.011	(-0.26)		0.989	-0.003
COMMUNICATION	0.244	(5.09)	***	1.277	0.059
LANGUAGES	0.313	(7.82)	***	1.367	0.076
HIST_PHILO	0.211	(5.72)	***	1.235	0.051
CREATIVEARTS	0.107	(3.26)	***	1.113	0.026
EDUCATION	-0.468	(-9.4)	***	0.626	-0.113
COMBINED	0.602	(9.86)	***	1.826	0.146
NORTH EAST WALES	0.773	(21.94)	***	2.165	0.185
NORTH WEST WALES	0.373	(10.92)	***	1.453	0.093
SOUTH EAST WALES	-0.612	(-21.58)	***	0.542	-0.148
SOUTH WEST WALES	-0.633	(-20.75)	***	0.531	-0.152
CONSTANT	0.625	(3.68)	***		
No. of observations	91,785				
Prob > Chi^2	0				
Log likelihood	-55395.77				
Pseudo R^2	0.1141				

Notes: The constant term shows the probability of migrating to another country within Great Britain for the following characteristics: age 17, low SES, post-1992 institution, studying business and domicile Mid Wales (these are the reference groups for the categorical variables). *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Decomposing results

The models used within the study are based on a dichotomous dependent variable used within logit models. This poses problems when attempting to analyse and quantify the contributions of each of the gender groups with respect to the dependent variable, thus calculating the percentage predicted correctly for each model. Given we are using logit models with binary outcomes, it is necessary to apply a Blinder-Oaxaca style decomposition with respect to the model (this method was initiated by Blinder, 1973 and Oaxaca, 1973) and developed by Fairlie (2003) to apply to logit models.

The primary purpose of the decomposition within the context of this study is to analysis the extent to which differences in mobility by gender can be explained by differences in other factors such as socio-economic background, age, institution classification and subject choice. The Blinder-Oaxaca decomposition allows us to analyse the mobility differentials using two components. The first component is concerned with the decomposition of the mean differences in gender mobility using regression models. The differences in gender mobility within the model are divided into “explained” and “unexplained” differences. The “explained” component captures differences in mobility characteristics which are due to group differences while the other component, “unexplained” captures the residuals which are not due to differences in gender.

The conventional approach to conduct a Blinder-Oaxaca decomposition is to use an OLS regression to ascertain the explained and unexplained component of each model. The models used within this study are based on binary dependent variables and modelled using logistic regressions. This poses problems when attempting to analyse and quantify the contributions of each of the gender groups with respect to the dependent variable. Given we are using logit models with binary outcomes, it is necessary to apply a Blinder-Oaxaca decomposition with respect to the non-linear model. According to Fairlie (2003), Blinder-Oaxaca decompositions cannot be used in their conventional way when the model of concern is non-linear and thus Fairlie provides insight into how to deal with this. Moreover, Fairlie and Robb (2009) note that the decomposition results can vary greatly depending on the group used for the first stage of the decomposition (in the context of this model, this would be the choice between males and females) and thus suggest using a pooled sample of the two groups in order to mitigate potential biases arising due to the group used within the first

stage of the decomposition. This method is used to estimate the decomposition with respect to logit regressions using a pooled sample of males and females.

The non-linear decomposition varies from a linear model and can be illustrated using the following equation:

$$\bar{Y}^m - \bar{Y}^f = \left[\sum_{i=1}^{N^m} \frac{F\left(X_i^m \hat{\beta}^m\right)}{N^m} - \sum_{i=1}^{N^f} \frac{F\left(X_i^f \hat{\beta}^m\right)}{N^f}\right] + \left[\sum_{i=1}^{N^f} \frac{F\left(X_i^f \hat{\beta}^m\right)}{N^f} - \sum_{i=1}^{N^f} \frac{F\left(X_i^f \hat{\beta}^f\right)}{N^f}\right]$$

Where N^j is the sample for gender j which is comprised of N^m (males) and N^f (females).

This decomposition is derived from Fairlie (2003) and provides a decomposition for the non-linear models given we cannot assume $\bar{Y} = F(\bar{X}\hat{\beta})$. The first terms within the brackets constitute the proportion of the gender gap that can be attributed to group differences in the distributions of X, known as the "explained" component. The second term in the brackets captures the proportion of differences in the groups which produce the levels of Y, otherwise known as the "unexplained" component of the gap. The "unexplained" component also comprises the factors which are not contained within the model.

As previously stated, OLS regressions cannot be used to estimate the decomposition within this study as the dependent variable is binary. The independent variables included were dummy variables to capture socio-economic background, age, institution classification (prestige), subject area studied and domicile region. The analysis focuses on the "explained" components of the model which are due to differences in the characteristics included in the model. The "unexplained" estimates are not reported in the study given the ambiguity surrounding the unmeasurable characteristics (Fairlie and Robb, 2009)

The results from the male-female decomposition using coefficients from a pooled sample of both genders are presented in Table 4.19. The pooled regression for males and females is estimated in terms of the parameters for both genders. The comparison groups used within

the study are males and females. Dummies were included for each of the independent variables in the same method that was used in the logistic regressions. The explained percentage is calculated by dividing the coefficient of the category by the male/female gap (method derived from Fairlie (2003) and implemented using the Stata code 'fairlie' developed by Jann (2006)).

The decompositions greatly differ by country. For Scotland, for example, the decomposition suggests that a large proportion of the gender difference in moving country for higher education are due to differences in the coefficients, rather than the apparent differences in the characteristics of males and females, given the model shows 16.9% as the percentage explained. England is also similar to Scotland in this respect given the percentage explained totals 25%. These results suggest a large proportion of the male and female gap in mobility is unexplained.

The Welsh domiciled model provides distinct findings. The total percentage explained, 69.6%, signifies that a large proportion of gender differences in mobility can be explained by socio-economic background, age, institution classification and subject area. Age provides the largest contribution to the reported factors explained, 44.2% of the male/female gap in mobility for Welsh domiciled students can be attributed to age. Socio-economic background accounts for 23.8% of the gap. It is interesting to note that the diversity in the differentials between England/Scotland and Wales may be partially attributed to the notion that a larger proportion of Welsh domiciled students migrate to England and Scotland whereas England and Scotland have significantly lower proportions of migrants. Indeed, it is also the case that Wales has fewer higher education institutions than England and Scotland.

Table 4.19: Decomposition of male/female gap in country mobility for higher education in Great Britain

Decomposition of male/female gaps in mobility	Country		
Contribution from gender differences in:	England	Scotland	Wales
Socio-economic background	-0.00066	-0.00242	-0.00559
	20.6%	57.0%	23.8%
Age	-0.0015	-0.00418	-0.01039
	46.6%	98.5%	44.2%
Institution classification	-0.00846	-0.00214	-0.0005
	263.1%	50.3%	2.1%
Subject	0.002484	0.00345	-0.00354
	-77.3%	-81.2%	15.0%
Region	0.007329	0.004574	0.003641
	-228.0%	-107.7%	-15.5%
Total explained	25.0%	16.9%	69.6%

Notes: The table presents the results from the non-linear decomposition of the male-female gap in geographical mobility for higher education by country of domicile (England, Scotland and Wales). The table provides a decomposition by socio-economic background, age, institution classification, subject area and domicile region. The decomposition for each of the countries provides the total percentage 'explained'.

4.4.6 Limitations

Data used within the study constitute a number of valuable factors that aid the analysis of student mobility within the UK, in terms of higher education institution. The data were obtained from HESA and provide information on the mobility within Great Britain, and therefore limitations exist in excluding those students who studied abroad for the duration of their studies. Additionally, while the study incorporates the majority of higher education institutions in the UK, data were not included for those who studied through the Open University as this facilitates distance learning, which is not a primary objective of the current study.

This study incorporated many personal and institutional attributes that contribute to migration for higher education across Great Britain. A limitation exists in the analysis relating to push and pull factors of student mobility. The study, to a great extent, does not include country specific push factors, particularly in terms of labour market indicators.

A further limitation of the data stems from the notion that it does not contain information on institution capacity in terms of the number of places available at each university, thus the study is based on the assumption that individuals gain a place at their chosen institution

regardless of capacity (which is the unknown). It may be the case that demand exceeds capacity at some institutions which implies the individual will attend another institution.

4.5 Conclusions

This chapter has analysed the geographical differences in higher education mobility within the context of Great Britain. The empirical analysis revealed stark differences in the inter-country mobility patterns of undergraduate students from England, Scotland and Wales. It is apparent that a smaller proportion of Scottish and English domiciled students move outside their home country to one of the other countries in Great Britain for higher education when compared to Welsh domiciled students. Moreover, the results show that Scottish and Welsh domiciled students are more likely to move to England rather than Wales and Scotland, respectively. There are two plausible explanations for this. First, Scotland and Wales border England, and given England has a significantly higher number of institutions, offering all courses across all institution types, it would appear England may be more attractive to students wishing to move, than, for a student to move to Scotland or Wales. Second, the Scottish higher education system is distinct from those of England and Wales. Scottish Batchelor's degree takes four years to complete, while degrees in the rest of the UK only take three years to complete. This has repercussions in terms of the opportunity and indirect costs associated with an additional year of education for those from England and Wales. Welsh domiciled students are significantly more geographical mobile than English or Scottish domiciled. This can be attributed to the fact that Wales only has 8 higher education institutions whereas England and Scotland have 125 and 18 respectively.

A number of personal characteristics were assessed using logit regressions. First, socio-economic background was used to ascertain whether this has an influence on the probability of moving to another country in Great Britain for higher education. The results show that those from high and middle socio-economic background are more likely to move when compared to those from lower socio-economic backgrounds. Those domiciled in Wales have a higher probability of moving than those domiciled in England or Scotland. The results show similar patterns across males and females in terms of socio-economic background. This is consistent with the literature reviewed in this chapter.

Age was also used as a factor within the study. The results show that the probability of moving country significantly decreases with age across English and Welsh students, when compared to those aged 17. Scottish domiciled students have positive probabilities of moving across age groups when compared to those aged 17, signifying older students are more likely to move, with the exception of females aged 31 and over.

A Russell Group institution is positively related to a move across all countries in Great Britain (with the exception of females domiciled in Wales whereby a negative relationship is found). This is compared to the reference group of post-1992 institutions and reveals individuals are attracted to Russell Group institutions and this is characterised by a move from their domicile country. The Russell Group effect is potentially driven by the most elitist institutions which are found in England. The pre-1992 variables produced slightly differing results depending on the domicile country. English domiciled students have a higher probability of moving country to enrol in a pre-1992 institution when compared to post-1992 institutions, while females and males in Scotland and Wales have lower probabilities.

A subject variable was included to determine whether subject studied influenced a move. This result provided the largest variance in the independent variables across males and females for all countries. Indeed, it is well-known there are asymmetric distributions across subject fields; where a large proportion of females study in fields of subjects allied to medicine, languages and education; while a larger proportion of males are found to study in engineering and computer science (Chapter 2 provided an overview of gender specific subject areas using data for Scotland). The results from the analysis in Chapter 4 reveal English domiciled females are more likely to move to study architecture while males are less probable to move to study this subject. Females have the highest probabilities of moving to study architecture, biological science and medicine when compared to business and administrative studies. English domiciled males have the highest probabilities of moving to study agriculture, biological science and historical and philosophical studies.

The Scottish logit models produce similar results in terms of males and females whereby those studying creative arts have the highest probabilities of moving to England or Wales for higher education, when compared to the reference group of those studying business. Welsh domiciled female students have higher probabilities of moving to study engineering and for males the subject that generated the highest positive marginal effect is medicine. These

results could imply a lack of offering in terms of these subjects or alternatively fewer attractions to study these subjects within the country of domicile.

Regional variables were also included and show similar patterns across males and females. For English domiciled individuals, those from the South West of England have a higher probability of moving, when compared to those from the South East of England. These results are to be expected given the South West is within close proximity to Wales. For Scotland, those domiciled in Glasgow and Strathclyde are less likely to move than those from any other region in Scotland, while those from the South have the highest probability of moving. These findings point to the notion that Glasgow offers a number of higher education institutions, across all institution classifications and subject offerings and thus these individuals are not obliged to move to England or Wales for university, particularly given Scottish domiciled students are exempt from tuition fees if they remain in Scotland for higher education. Males and females from the North East of Wales have the highest probability of moving to Scotland or England for higher education.

The decomposition shows noteworthy differences by males and females depending on domicile country. The Welsh model provides the largest explanation in terms of gender differences that can be attributed to the explanatory variables. The results for the Welsh domiciled model show a large proportion of gender differences in mobility can be explained by socio-economic background, age, institution classification and subject area for Wales, with age providing the largest contribution.

The results from this chapter and previous chapters are discussed in terms of policy and recommendations in the next chapter.

Chapter 5 Conclusion

5.1 Summary and main findings

The demand and supply of higher education has significantly expanded worldwide in the last few decades. This has brought profound changes for providers and students alike. Some of the most prominent changes regard funding, the composition of gender participation and student mobility for higher education.

The purpose of this thesis is to investigate factors influencing participation in higher education in Great Britain, with particular reference to Scotland. The impact of the abolition of tuition fees on higher education enrolment was analysed in detail in Chapter 2. The factors contributing to the increased participation in higher education among females was investigated in Chapter 3. The geographical differences in higher education mobility in Great Britain were investigated in Chapter 4. The findings of this study are anticipated to offer policy recommendations to funding providers, governments and institutions themselves. This chapter will discuss key findings from the three empirical chapters. Policy implications, based on the findings from the three studies, will follow.

The main findings of the empirical models developed in this thesis show that the abolition of tuition fees in 2000 in Scotland, significantly increased enrolments in higher education for those aged 17-20 in the years immediately following the abolition. Gender enrolment differences are apparent in Scotland. For the last two decades female participation in higher education has exceeded male participation. The employment rate for female graduates in Scotland has a positive impact on female enrolment in higher education. The determinants of student mobility for higher education differ across Great Britain. Personal characteristics, such as age and socio-economic background, institution classification, subject area and regional location all contribute to the probability of individuals moving country to participate in higher education, with the largest mobility differences across males and females occurring by subject area.

5.2 Policy implications

The first unique contribution of this paper is to assess the impact of the abolition of tuition fees on higher education participation. The empirical analysis presented in Chapter 2 revealed student enrolment in higher education in Scotland increased following the abolition of tuition fees in 2000. The difference-in-differences analysis used the API for Scotland and England/Wales to reveal a significant increase, of 2.64, in the API in Scotland in the years following the abolition. This was particularly prevalent for those aged 17-20. Many studies have analysed the impact of implementing or increasing tuition fees and find these policies to have negative impacts on student enrolments. This study is consistent with the literature to the extent that students are price sensitive. Enrolments in higher education are affected by the abolition (this study) or the imposition of tuition fees (previous studies).

The analysis has established significant increases in enrolments for engineering and technology and business and administrative studies in Scottish higher education institutions following the abolition of fees. At the same time, decreases were witnessed in the uptake of subjects allied to medicine. Nevertheless, this study confirms specific shortages in enrolments in STEM subjects have improved from the abolition of tuition fees in Scotland. Conversely, the enrolments in STEM subjects, such as engineering and technology and mathematical science, increased. Contrary to the position of detractors that the abolition of tuition fees will increase the number of individuals studying soft subjects, there was no increase in subjects such as creative arts. King (2001) notes that increased funding for subjects such as engineering would increase demand for studying this subject, given its marketable status (increased wages for the individual). This may be true in the case of Scotland, but one must also consider the public benefits that arise from studying this subject. STEM graduates have the opportunity to enhance and develop technologies to deliver economic benefits in society. As such, it can be argued the increase in enrolment in these subjects, as a result of the abolition of tuition fees, creates vast public benefits for Scotland.

An empirical model, aimed at establishing some of the factors contributing to increased female participation in higher education in Scotland was developed in Chapter 3. The model shows that the share of female participation in higher education institutions in Scotland is positively influenced by the female employment rate for those who have obtained higher education, implying females are affected by current labour market conditions for graduates.

The share of female participation was also positively affected by the population variable for those aged 17. These findings emphasise findings from previous literature, where males and females are motivated by different factors, with females being more responsive to changes in the demand for women in the labour market who were more academically able (Pissarides, 1981 and Goldin et al, 2006). Empirical studies were also conducted to establish whether females are price sensitive to enrolling in higher education. Synthetic control methods were employed for the 17 higher education institutions in Scotland to assess the effects of the removal of the Graduate Endowment Fee on the share of female participants. The results show the share of female participants has increased in a fraction of Scottish institutions as a result of the abolition of the Graduate Endowment Fee. This is particular relevant to Edinburgh Napier University and The University of Stirling where the female share has increased. For the other institutions, the results imply females entering these institutions were either unaffected by the policy change, or the enrolment share of females declined. Previous literature points to the notion that females are more influenced, than males, by the costs associated with higher education. This study finds limited support that the abolition of the Graduate Endowment Fee influenced more females than males to enter higher education in Scotland. It could be the case that females are influenced more by the imposition or increase in tuition fees.

The main findings developed in the final empirical chapter show that mobility patterns within Great Britain are significantly different across countries. Fewer individuals from England and Scotland move across Great Britain to study when compared to Welsh domiciled students. Of the Scottish and Welsh domiciled students who move country, a larger proportion move to England than to the other two countries. These findings reveal a number of things: first, there are very few higher education institutions in Wales (currently eight). Given the Welsh education system is almost identical to the English education system, it is relatively easy for a Welsh domiciled student to move to England for higher education, particularly if they desire to study at a Russell Group institution. Second, previous empirical literature (Faggian, McCann and Sheppard (2007) has found that previous migration for education positively influences subsequent migration in the labour market, this has implications for the current study. For English and Scottish domiciled students, given the popular choice is to remain in domicile country for higher education could indicate they are more likely to remain in the domicile country, rather than move country, for employment, resulting in less of a “brain

drain" from the pool of graduates in Scotland and England. To confirm this speculation, future studies could incorporate labour market data (this will be discussed in the next section).

A number of personal characteristics were assessed using separate male and female logit regressions for England, Scotland and Wales. The results show those from high and middle socio-economic background are more likely to move when compared to those from lower socio-economic backgrounds. Younger English and Welsh domiciled individuals are more likely to move, whereas the reverse is true for Scottish domiciled students. Institution classification also has an impact on the mobility of students. Students have a higher probability of moving to attend a Russell Group institution than a post-1992 institution (with the exception of Welsh domiciled females where there is a lower probability). English domiciled students also have a higher probability of moving to enrol in a post-1992 institution, while Scottish and Welsh domiciled students have a higher probability of moving to enrol in a pre-1992 institution (when compared to a post-1992 institution). These findings point to the attraction of Russell Group institutions, and given there are only 24 in the UK, the appeal and prestige of these institutions increases the probability of an individual moving to attend. Moreover, given Wales has one Russell Group institution, it may be the case that Welsh domiciled individuals wishing to attend one of the top research institutions (based on the Russell Group status) in the country, have no choice but to move to England or Scotland.

The largest variation in mobility patterns across males and females is found in subject area. English domiciled females are more likely to move to study architecture while males are less probable to move to study this subject. Scottish domiciled students (males and females) have similar mobility patterns in creative arts, with a higher probability of moving to study this than business and administrative studies. Welsh domiciled female students have higher probabilities of moving to study engineering and for males the subject that generated the highest positive marginal effect is medicine. These results may imply a lack of offering in terms of these subjects in the home country, or alternatively fewer attractions to study these subjects within the country of domicile.

There are also some notable decreased probabilities of moving by subject area. Studying education is negatively associated with a move to England or Scotland for Welsh domiciled students. This implies the subject is well-provided in Wales. Indeed, of the eight higher education institutions in Wales, seven offer courses in the education field. From a policy perspective, it could be the case that if higher education institutions were to have more of a

subject offering, based on the patterns identified above, this could lead to fewer individuals choosing to relocate. This would subsequently benefit the institution and the local area, not only in terms of ensuring a wide range of courses are available to local students but expenditure would also be concentrated in the local area. Moreover, this also may assist in retaining graduates (if they have not moved previously) given the literature relating a student move for higher education to a subsequent graduate move when entering the labour market.

The regional locations of English, Scottish and Welsh domiciled males and females also produced similar results in terms of mobility patterns for higher education, pointing to the notion that mobility across countries occurs due to proximity to another country. Those from the South West of England have a higher probability of moving, when compared to those from the South East of England, as the South West is within close proximity to Wales. For Scotland, those domiciled in Glasgow and Strathclyde are less likely to move than those from any other region in Scotland. This may point to the notion that Glasgow offers a number of higher education institutions, across all institution classifications and therefore individuals from Glasgow and Strathclyde do not see the need in moving to England or Wales, particularly when there are no tuition fees in Scotland for Scottish domiciled students. The results for Scotland also show those domiciled in the South have the highest probability of moving. This is not surprising given the South of Scotland borders England. The Welsh study highlights males and females from the North East of Wales have the highest probability of moving to Scotland or England for higher education, again, the results may be due to the notion that the North East of Wales borders with the West of England where a number of higher education institutions are offered. The decomposition results from Chapter 4 show the gap between males and females for Welsh domiciled students can be explained by differences the observed characteristics: socio-economic background, age, institution classification and subject area, with age providing the largest contribution.

5.3 Directions for future research

The research presented in this thesis can be developed to further understand policy implications.

The first empirical chapter revealed that the abolition of tuition fees in Scotland for Scottish domiciled and EU students significantly increased participation in the years immediately

following the abolition. Further research could be conducted to assess the implications this policy had on widening participation in higher education. This could be achieved in the future by analysing participation by socio-economic background. Data on the API could be extended to include socio-economic background to ascertain whether participation from a lower socio-economic background improved. This would be particularly relevant, given the notion that individuals from lower socio-economic backgrounds are believed to be more price sensitive to the costs of higher education (Declercq and Verboven, 2015), coupled with the belief from some scholars, that no tuition fees would only increase participation in those from higher socio-economic backgrounds.

To further enrich the data in the second empirical chapter, a significant improvement would be to include data relating to early years' attainment. This could be in the form of linking universities admissions applications and admissions data with the current dataset. If future studies could better understand female and male enrolment differences in higher education through early years' attainment, then it would be enriching to the policies implemented in Scottish schools to identify gaps, increase attainment and contribute to the knowledge driven economy. Similar empirical analyses could be employed in other countries within Great Britain in future research.

Early years' attainment data are also something which the final empirical chapter would benefit from. By including early years' attainment, it would be possible to make assertions relating student mobility to early years' attainment, although this may prove difficult in cross country comparisons given the Scottish education system differs from that in England and Wales. Since this empirical study focused on mobility in Great Britain, constituting England, Scotland and Wales, it could be extended to include data for Northern Ireland to better understand mobility in the United Kingdom. This would be particularly enriching given Northern Ireland does not share a land border with the rest of the United Kingdom, and the study may therefore provide different results to those presented in Chapter 4. A further benefit to future research would be to include additional push factors, relating to the economic conditions of regions. These may provide a better understanding of the push and pull factors of student migration. Additionally the geographical mobile could be complemented with labour market data to ascertain the labour market mobility patterns emerging in those who migrate for higher education.

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Appendix A: Descriptive Statistics – Difference-in-Differences estimates of Age Participation Index Aged 20 and under in Scotland and England/Wales (three to six years)

1997/99 - 2001/03

Scotland	Δ API
Mean	4.294
Median	3.562
Minimum	4.339
Maximum	4.979
Std. Dev.	0.326
C.V.	0.006027

England/ Wales	Δ API
Mean	2.329
Median	2.477
Minimum	2.726
Maximum	1.784
Std. Dev.	-0.48601
C.V.	-0.01525

	Δ Δ API
Mean	1.965
Median	1.085
Minimum	1.613
Maximum	3.195
Std. Dev.	0.81201
C.V.	0.021277

1996/99 - 2001/04

Scotland	Δ API
Mean	3.91
Median	3.636
Minimum	3.388
Maximum	4.979
Std. Dev.	0.60586
C.V.	0.012923

England/ Wales	Δ API
Mean	2.739
Median	2.76
Minimum	3.648
Maximum	1.784
Std. Dev.	-0.77196
C.V.	-0.02421

	Δ Δ API
Mean	1.171
Median	0.876
Minimum	-0.26
Maximum	3.195
Std. Dev.	1.37782
C.V.	0.037133

1995/99 - 2001/05

Scotland	Δ API
Mean	3.529
Median	3.358
Minimum	3.041
Maximum	4.957
Std. Dev.	0.71346
C.V.	0.015687

England/ Wales	Δ API
Mean	2.879
Median	2.597
Minimum	3.639
Maximum	3.055
Std. Dev.	-0.22201
C.V.	-0.00851

	Δ Δ API
Mean	0.65
Median	0.761
Minimum	-0.598
Maximum	1.902
Std. Dev.	0.93547
C.V.	0.024199

1994/99 - 2001/06

Scotland	Δ API
Mean	3.191
Median	3.059
Minimum	1.503
Maximum	4.957
Std. Dev.	1.03627
C.V.	0.023405

England/ Wales	Δ API
Mean	2.646
Median	2.385
Minimum	3.648
Maximum	2.638
Std. Dev.	-0.38843
C.V.	-0.0132

	Δ Δ API
Mean	0.545
Median	0.674
Minimum	-2.145
Maximum	2.319
Std. Dev.	1.4247
C.V.	0.036604

Appendix B: Descriptive Statistics – Difference-in-Differences estimates of Age Participation Index Aged 21 and above in Scotland and England/Wales (one to six years)

1998/99-2001/02

Scotland	Δ API
Mean	1.49
Median	1.49
Minimum	1.43
Maximum	1.56
Std. Dev.	0.10
C.V.	0.00

England/ Wales	Δ API
Mean	-0.23
Median	-0.23
Minimum	0.03
Maximum	-0.49
Std. Dev.	-0.37
C.V.	-0.03

	Δ Δ API
Mean	1.72
Median	1.72
Minimun	1.39
Maximun	2.05
Std. Dev.	0.47
C.V.	0.03

1997/99-2001/03

Scotland	Δ API
Mean	2.34
Median	2.14
Minimum	2.22
Maximum	2.66
Std. Dev.	0.23
C.V.	0.01

England/ Wales	Δ API
Mean	-0.21
Median	-0.49
Minimum	0.03
Maximum	-0.16
Std. Dev.	-0.13
C.V.	-0.01

	Δ Δ API
Mean	2.54
Median	2.63
Minimun	2.18
Maximun	2.82
Std. Dev.	0.36
C.V.	0.02

1996/99-2001/04

Scotland	Δ API
Mean	2.31
Median	2.18
Minimum	2.22
Maximum	2.66
Std. Dev.	0.17
C.V.	0.00

England/ Wales	Δ API
Mean	-0.19
Median	-0.32
Minimum	0.03
Maximum	-0.16
Std. Dev.	-0.10
C.V.	-0.01

	Δ Δ API
Mean	2.50
Median	2.50
Minimun	2.18
Maximun	2.82
Std. Dev.	0.27
C.V.	0.01

1995/99-2001/05

Scotland	Δ API
Mean	2.51
Median	2.22
Minimum	2.55
Maximum	2.66
Std. Dev.	-0.07
C.V.	-0.01

England/ Wales	Δ API
Mean	-0.29
Median	-0.49
Minimum	0.03
Maximum	-0.16
Std. Dev.	-0.11
C.V.	-0.01

	Δ Δ API
Mean	2.81
Median	2.71
Minimun	2.52
Maximun	2.82
Std. Dev.	0.05
C.V.	-0.01

1994/99-2001/06

Scotland	Δ API
Mean	2.71
Median	2.57
Minimum	3.55
Maximum	14.69
Std. Dev.	-0.36
C.V.	-0.04

England/ Wales	Δ API
Mean	-0.51
Median	-0.45
Minimum	-0.68
Maximum	-0.16
Std. Dev.	0.18
C.V.	0.02

	Δ Δ API
Mean	3.22
Median	3.02
Minimun	4.24
Maximun	14.84
Std. Dev.	-0.54
C.V.	-0.06

Appendix C: Synthetic Control Output, Means and Institution Weights

Female share of participation means

	Aberdeen	
Variables	Real	Synthetic
russellgroup	0.000	0.079
medicineanddentristy	0.083	0.050
subjectsalliedtomedicine	0.039	0.081
biologicalscience	0.193	0.106
veterinaryscience	0.000	0.000
agriculture	0.024	0.026
physicalscience	0.068	0.058
mathematicalscience	0.011	0.014
computerscience	0.028	0.057
engineering	0.059	0.059
architecture	0.024	0.024
socialstudies	0.105	0.114
business	0.068	0.110
masscommunication	0.000	0.011
languages	0.086	0.078
historical	0.062	0.070
creativearts	0.009	0.029
education	0.044	0.054
female(2006)	0.542	0.544
female(2002)	0.546	0.543
female(1998)	0.546	0.545

Institution weights in the synthetic Aberdeen

Institution	Weight
The University of Leicester	0.316
Aston University	0.146
University of Northumbria	0.138
Oxford Brookes University	0.103
Newcastle-upon-Tyne	0.079
Newman University	0.067
The University of Keele	0.049
St George's Hospital	0.027
Harper Adams University	0.026
Swansea University	0.024
The University of Reading	0.024

Female share of participation means

	Abertay	
Variables	Real	Synthetic
russellgroup	0.000	0.000
medicineanddentristy	0.000	0.000
subjectsalliedtomedicine	0.072	0.082
biologicalscience	0.203	0.144
veterinaryscience	0.000	0.001
agriculture	0.005	0.004
physicalscience	0.022	0.027
mathematicalscience	0.010	0.018
computerscience	0.238	0.110
engineering	0.067	0.149
architecture	0.013	0.017
socialstudies	0.108	0.061
business	0.214	0.178
masscommunication	0.001	0.017
languages	0.000	0.033
historical	0.000	0.016
creativearts	0.005	0.081
education	0.015	0.049
female(2006)	0.458	0.478
female(2002)	0.463	0.465
female(1998)	0.519	0.493

Institution weights in the synthetic Abertay

Institution	Weight
The University of Bolton	0.319
Aston University	0.275
The University of Bath	0.156
Staffordshire University	0.134
University of Worcester	0.118

Female share of participation means

	Caledonian	
Variables	Real	Synthetic
russellgroup	0.000	0.000
medicineanddentristy	0.000	0.009
subjectsalliedtomedicine	0.209	0.119
biologicalscience	0.068	0.077
veterinaryscience	0.000	0.012
agriculture	0.003	0.007
physicalscience	0.020	0.022
mathematicalscience	0.014	0.011
computerscience	0.056	0.060
engineering	0.090	0.068
architecture	0.056	0.014
socialstudies	0.061	0.057
business	0.346	0.180
masscommunication	0.025	0.033
languages	0.000	0.020
historical	0.000	0.012
creativearts	0.027	0.242
education	0.000	0.027
female(2006)	0.611	0.606
female(2002)	0.591	0.591
female(1998)	0.606	0.604

Institution weights in the synthetic Caledonian

Institution	Weight
The University of Surrey	0.242
Anglia Ruskin University	0.211
University of the Arts, London	0.211
Cardiff Metropolitan University	0.08
London South Bank University	0.08
Middlesex University	0.049
University of Chester	0.045
Oxford Brookes University	0.041
St George's Hospital	0.015
The Royal Veterinary College	0.013
The City University	0.011
Bishop Grosseteste University	0.001

Female share of participation means

	Dundee	
Variables	Real	Synthetic
russellgroup	0.000	0.176
medicineanddentristy	0.123	0.121
subjectsalliedtomedicine	0.135	0.113
biologicalscience	0.092	0.083
veterinaryscience	0.000	0.081
agriculture	0.000	0.014
physicalscience	0.035	0.037
mathematicalscience	0.010	0.016
computerscience	0.034	0.038
engineering	0.035	0.035
architecture	0.054	0.001
socialstudies	0.105	0.103
business	0.076	0.070
masscommunication	0.000	0.011
languages	0.046	0.047
historical	0.030	0.031
creativearts	0.130	0.128
education	0.028	0.040
female(2006)	0.588	0.591
female(2002)	0.622	0.620
female(1998)	0.571	0.571

Institution weights in the synthetic Dundee

Institution	Weight
The University of Keele	0.185
Roehampton University	0.181
St George's Hospital	0.159
Staffordshire University	0.137
The Royal Veterinary College	0.092
Imperial College of Science	0.084
LSE	0.076
Norwich University of the Arts	0.055
Newcastle-upon-Tyne	0.016
Goldsmiths College	0.011
The University of Chichester	0.005

Female share of participation means

	Edinburgh	
Variables	Real	Synthetic
russellgroup	1.000	0.886
medicineanddentristy	0.064	0.064
subjectsalliedtomedicine	0.013	0.043
biologicalscience	0.148	0.113
veterinaryscience	0.024	0.036
agriculture	0.006	0.007
physicalscience	0.112	0.104
mathematicalscience	0.030	0.039
computerscience	0.034	0.027
engineering	0.063	0.067
architecture	0.017	0.009
socialstudies	0.097	0.103
business	0.040	0.027
masscommunication	0.000	0.003
languages	0.110	0.114
historical	0.104	0.103
creativearts	0.017	0.025
education	0.084	0.065
female(2006)	0.551	0.549
female(2002)	0.567	0.561
female(1998)	0.529	0.535

Institution weights in the synthetic Edinburgh

Institution	Weight
The University of Bristol	0.316
The University of Liverpool	0.304
The University of Oxford	0.11
Newman University	0.082
The University of Birmingham	0.077
The University of York	0.045
The University of Exeter	0.034
The Royal Veterinary College	0.02
Bishop Grosseteste University	0.011

Female share of participation means

	Glasgow School of Art	
Variables	Real	Synthetic
russellgroup	0.000	0.000
medicineanddentristy	0.000	0.000
subjectsalliedtomedicine	0.000	0.001
biologicalscience	0.000	0.000
veterinaryscience	0.000	0.005
agriculture	0.000	0.019
physicalscience	0.000	0.197
mathematicalscience	0.000	0.005
computerscience	0.000	0.001
engineering	0.000	0.003
architecture	0.264	0.003
socialstudies	0.000	0.010
business	0.000	0.000
masscommunication	0.000	0.024
languages	0.000	0.009
historical	0.000	0.054
creativearts	0.736	0.132
education	0.000	0.333
female(2006)	0.596	0.636
female(2002)	0.710	0.686
female(1998)	0.680	0.674

Institution weights in the synthetic Glasgow School of Art

Institution	Weight
Norwich University of the Arts	0.294
Writtle College	0.254
Bishop Grosseteste University	0.246
UniversityofWalesTrinity	0.203
The Royal Veterinary College	0.002
St George's Hospital	0.001

Female share of participation means

	Glasgow	
Variables	Real	Synthetic
russellgroup	1.000	0.597
medicineanddentristy	0.089	0.064
subjectsalliedtomedicine	0.077	0.069
biologicalscience	0.169	0.145
veterinaryscience	0.024	0.014
agriculture	0.001	0.006
physicalscience	0.074	0.077
mathematicalscience	0.024	0.026
computerscience	0.047	0.046
engineering	0.094	0.070
architecture	0.001	0.015
socialstudies	0.062	0.074
business	0.048	0.048
masscommunication	0.008	0.010
languages	0.092	0.067
historical	0.053	0.062
creativearts	0.027	0.048
education	0.045	0.125
female(2006)	0.541	0.544
female(2002)	0.578	0.577
female(1998)	0.562	0.561

Institution weights in the synthetic Glasgow

Institution	Weight
The University of Liverpool	0.494
Newman University	0.149
The University of Chichester	0.104
Imperial College of Science	0.103
The University of Bradford	0.067
Staffordshire University	0.046
Bangor University	0.034
The University of Bolton	0.004
The Royal Veterinary College	0.001

Female share of participation means

	Heriot Watt	
Variables	Real	Synthetic
russellgroup	0.000	0.434
medicineanddentristy	0.000	0.072
subjectsalliedtomedicine	0.000	0.006
biologicalscience	0.098	0.126
veterinaryscience	0.000	0.000
agriculture	0.001	0.007
physicalscience	0.100	0.086
mathematicalscience	0.087	0.041
computerscience	0.081	0.080
engineering	0.254	0.190
architecture	0.055	0.017
socialstudies	0.022	0.022
business	0.191	0.093
masscommunication	0.000	0.002
languages	0.046	0.035
historical	0.000	0.042
creativearts	0.058	0.161
education	0.002	0.002
female(2006)	0.403	0.423
female(2002)	0.397	0.399
female(1998)	0.412	0.408

Institution weights in the synthetic Heriot Watt

Institution	Weight
Imperial College of Science	0.294
The University of Oxford	0.134
Norwich University of the Arts	0.078
The University of Warwick	0.006

Female share of participation means

	Napier	
Variables	Real	Synthetic
russellgroup	0.000	0.034
medicineanddentristy	0.000	0.008
subjectsalliedtomedicine	0.126	0.107
biologicalscience	0.121	0.088
veterinaryscience	0.000	0.001
agriculture	0.006	0.011
physicalscience	0.007	0.032
mathematicalscience	0.005	0.019
computerscience	0.094	0.103
engineering	0.095	0.102
architecture	0.036	0.031
socialstudies	0.042	0.064
business	0.263	0.199
masscommunication	0.069	0.060
languages	0.005	0.024
historical	0.000	0.003
creativearts	0.093	0.091
education	0.000	0.017
female(2006)	0.504	0.504
female(2002)	0.509	0.506
female(1998)	0.472	0.476

Institution weights in the synthetic Napier

Institution	Weight
London South Bank University	0.458
Southampton Solent University	0.169
The University of Bath	0.166
University of West of England	0.106
The University of Lincoln	0.06
Imperial College of Science	0.034
Royal Northern College of Music	0.006
Staffordshire University	0.001

Female share of participation means

	Queen Margaret	
Variables	Real	Synthetic
russellgroup	0.000	0.000
medicineanddentristy	0.000	0.000
subjectsalliedtomedicine	0.326	0.040
biologicalscience	0.108	0.025
veterinaryscience	0.000	0.000
agriculture	0.010	0.002
physicalscience	0.000	0.014
mathematicalscience	0.000	0.004
computerscience	0.000	0.003
engineering	0.000	0.004
architecture	0.000	0.000
socialstudies	0.032	0.027
business	0.245	0.043
masscommunication	0.144	0.024
languages	0.001	0.056
historical	0.000	0.044
creativearts	0.134	0.156
education	0.000	0.557
female(2006)	0.798	0.783
female(2002)	0.816	0.806
female(1998)	0.835	0.819

Institution weights in the synthetic Queen Margaret

Institution	Weight
University of Cumbria	0.201
University of the Arts, London	0.105
Leeds Trinity University	0.072
Edge Hill University	0.004
Writtle College	0.002

Female share of participation means

	Robert Gordon	
Variables	Real	Synthetic
russellgroup	0.000	0.000
medicineanddentristy	0.000	0.000
subjectsalliedtomedicine	0.254	0.064
biologicalscience	0.029	0.050
veterinaryscience	0.000	0.217
agriculture	0.000	0.033
physicalscience	0.029	0.029
mathematicalscience	0.000	0.005
computerscience	0.071	0.068
engineering	0.099	0.067
architecture	0.080	0.025
socialstudies	0.047	0.040
business	0.245	0.154
masscommunication	0.050	0.017
languages	0.000	0.022
historical	0.000	0.011
creativearts	0.082	0.111
education	0.000	0.056
female(2006)	0.632	0.615
female(2002)	0.593	0.584
female(1998)	0.509	0.523

Institution weights in the synthetic Robert Gordon

Institution	Weight
Sheffield Hallam University	0.256
The Royal Veterinary College	0.247
Birmingham City University	0.098

Female share of participation means

	Royal Conservatoire	
Variables	Real	Synthetic
russellgroup	0.000	0.324
medicineanddentristy	0.000	0.072
subjectsalliedtomedicine	0.000	0.003
biologicalscience	0.000	0.074
veterinaryscience	0.000	0.243
agriculture	0.000	0.041
physicalscience	0.000	0.071
mathematicalscience	0.000	0.032
computerscience	0.000	0.029
engineering	0.000	0.076
architecture	0.000	0.000
socialstudies	0.000	0.005
business	0.000	0.006
masscommunication	0.000	0.000
languages	0.000	0.021
historical	0.000	0.022
creativearts	0.806	0.112
education	0.194	0.194
female(2006)	0.542	0.594
female(2002)	0.659	0.656
female(1998)	0.594	0.596

Institution weights in the synthetic Royal Conservatoire

Institution	Weight
Imperial College of Science	0.324
Newman University	0.298
The Royal Veterinary College	0.277
Norwich University of the Arts	0.102

Female share of participation means

	SRUC	
Variables	Real	Synthetic
russellgroup	0.000	0.883
medicineanddentristy	0.000	0.196
subjectsalliedtomedicine	0.000	0.008
biologicalscience	0.051	0.100
veterinaryscience	0.000	0.000
agriculture	0.685	0.020
physicalscience	0.033	0.193
mathematicalscience	0.000	0.084
computerscience	0.000	0.060
engineering	0.000	0.208
architecture	0.000	0.000
socialstudies	0.000	0.000
business	0.153	0.013
masscommunication	0.000	0.000
languages	0.000	0.000
historical	0.000	0.000
creativearts	0.001	0.117
education	0.079	0.000
female(2006)	0.412	0.345
female(2002)	0.390	0.388
female(1998)	0.267	0.311

Institution weights in the synthetic SRUC

Institution	Weight
Imperial College of Science	0.883
Royal Northern College of Music	0.117

Female share of participation means

	St Andrews	
Variables	Real	Synthetic
russellgroup	0.000	0.568
medicineanddentristy	0.090	0.025
subjectsalliedtomedicine	0.012	0.020
biologicalscience	0.128	0.080
veterinaryscience	0.000	0.087
agriculture	0.000	0.011
physicalscience	0.143	0.094
mathematicalscience	0.045	0.035
computerscience	0.024	0.024
engineering	0.000	0.041
architecture	0.000	0.002
socialstudies	0.096	0.101
business	0.021	0.041
masscommunication	0.000	0.009
languages	0.163	0.128
historical	0.167	0.157
creativearts	0.000	0.072
education	0.111	0.037
female(2006)	0.559	0.553
female(2002)	0.593	0.582
female(1998)	0.516	0.523

Institution weights in the synthetic St Andrews

Institution	Weight
University of Durham	0.439
UniversityofWalesTrinity	0.169
The Royal Veterinary College	0.109
The University of Oxford	0.105
Roehampton University	0.082
Queen Mary University of London	0.07
Imperial College of Science	0.025

Female share of participation means

	Stirling	
Variables	Real	Synthetic
russellgroup	0.000	0.008
medicineanddentristy	0.000	0.005
subjectsalliedtomedicine	0.114	0.112
biologicalscience	0.151	0.146
veterinaryscience	0.000	0.024
agriculture	0.003	0.015
physicalscience	0.034	0.034
mathematicalscience	0.012	0.011
computerscience	0.039	0.039
engineering	0.000	0.033
architecture	0.000	0.000
socialstudies	0.097	0.089
business	0.244	0.122
masscommunication	0.065	0.089
languages	0.070	0.070
historical	0.067	0.056
creativearts	0.000	0.014
education	0.082	0.107
female(2006)	0.569	0.581
female(2002)	0.599	0.599
female(1998)	0.593	0.600

Institution weights in the synthetic Stirling

Institution	Weight
Leeds Trinity University	0.366
The University of Keele	0.196
Bangor University	0.126
The City University	0.088
The University of Bradford	0.066
Aston University	0.041
Teesside University	0.028
The Royal Veterinary College	0.027
Swansea University	0.018
School of OrientalAfricanStudies	0.014
Harper Adams University	0.012
LSE	0.008
The University of East Anglia	0.006
The University of Lancaster	0.003

Female share of participation means

	Strathclyde	
Variables	Real	Synthetic
russellgroup	0.000	0.114
medicineanddentristy	0.000	0.025
subjectsalliedtomedicine	0.071	0.074
biologicalscience	0.063	0.098
veterinaryscience	0.000	0.000
agriculture	0.000	0.005
physicalscience	0.088	0.070
mathematicalscience	0.029	0.036
computerscience	0.037	0.044
engineering	0.203	0.149
architecture	0.043	0.035
socialstudies	0.044	0.078
business	0.207	0.119
masscommunication	0.002	0.017
languages	0.040	0.040
historical	0.012	0.020
creativearts	0.016	0.068
education	0.106	0.101
female(2006)	0.497	0.507
female(2002)	0.526	0.526
female(1998)	0.519	0.519

Institution weights in the synthetic Strathclyde

Institution	Weight
Oxford Brookes University	0.264
The University of Surrey	0.241
Loughborough University	0.187
Bishop Grosseteste University	0.116
Imperial College of Science	0.114
The University of Bath	0.075
London South Bank University	0.003

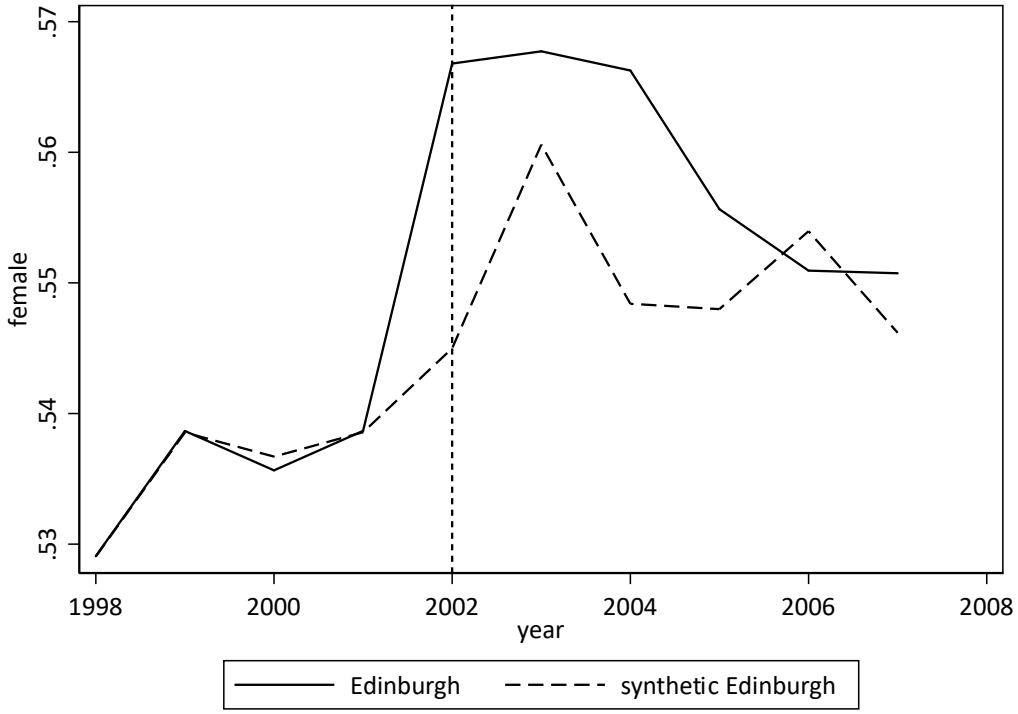
Female share of participation means

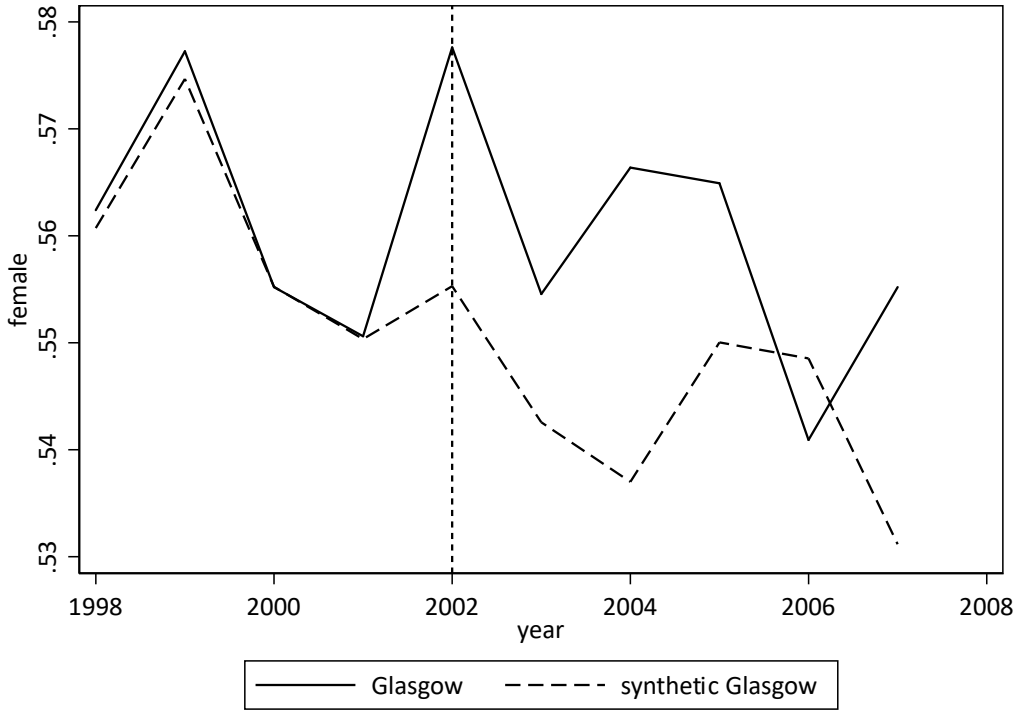
	West of Scotland	
Variables	Real	Synthetic
russellgroup	0.000	0.000
medicineanddentristy	0.000	0.000
subjectsalliedtomedicine	0.117	0.118
biologicalscience	0.074	0.092
veterinaryscience	0.000	0.082
agriculture	0.000	0.013
physicalscience	0.021	0.018
mathematicalscience	0.001	0.021
computerscience	0.104	0.103
engineering	0.113	0.083
architecture	0.000	0.010
socialstudies	0.117	0.079
business	0.247	0.131
masscommunication	0.089	0.068
languages	0.008	0.014
historical	0.000	0.004
creativearts	0.042	0.094
education	0.064	0.021
female(2006)	0.577	0.575
female(2002)	0.578	0.578
female(1998)	0.561	0.563

Institution weights in the synthetic West of Scotland

Institution	Weight
The University of East London	0.409
The City University	0.231
The University of Surrey	0.207
The Royal Veterinary College	0.093
The University of Northampton	0.053
University of Cumbria	0.007

Appendix D: Placebo Tests Synthetic Control



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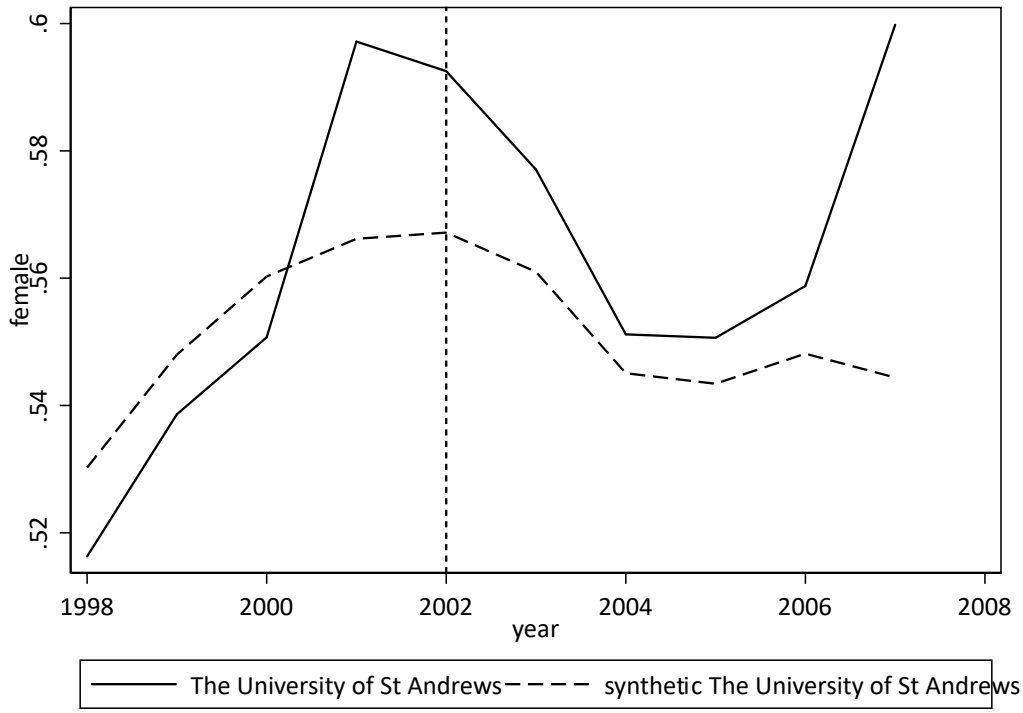
female
1998
2000
2002
2004
2006
2008
year
Aberdeen
synthetic Aberdeen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1998
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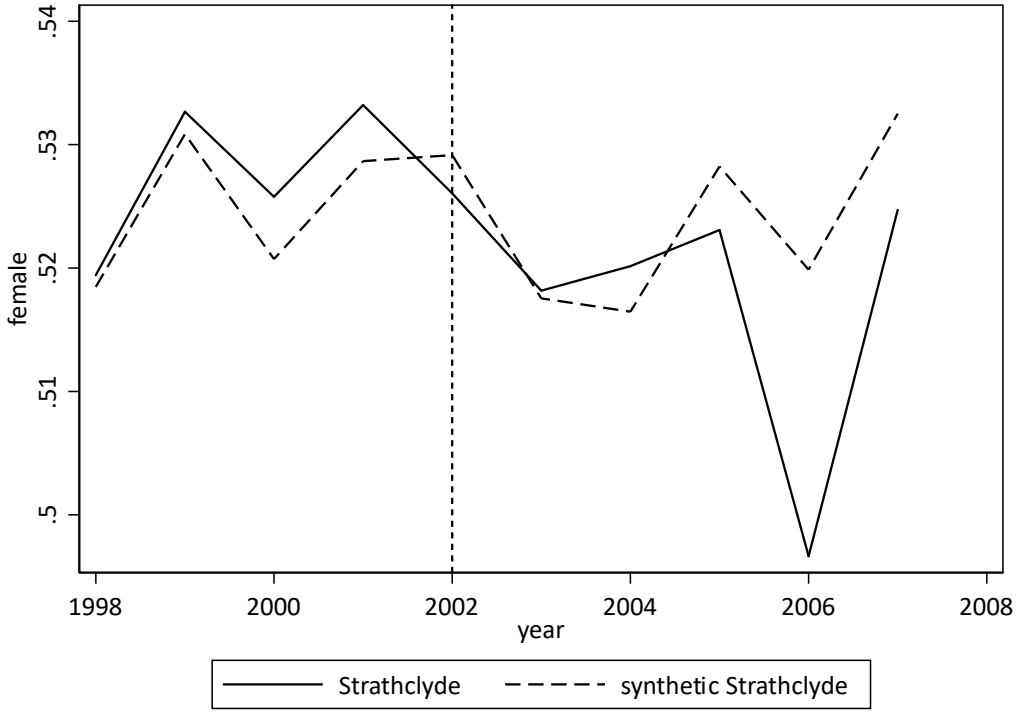
year
The University of St Andrews
synthetic The University of St Andrews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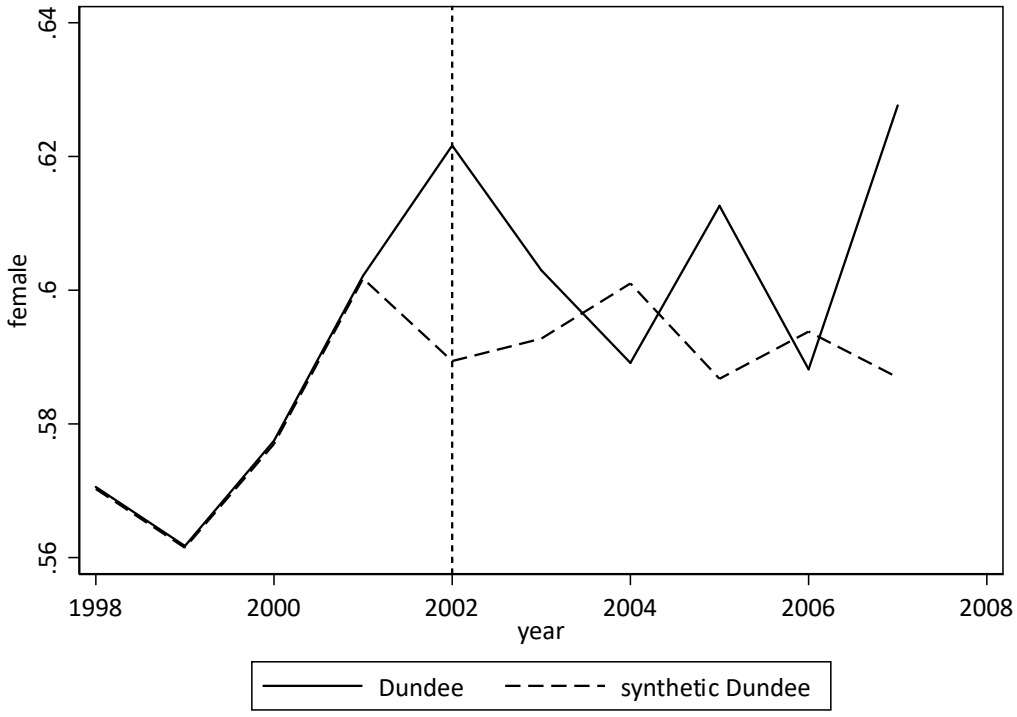
year
Strathclyde
synthetic Strathclyde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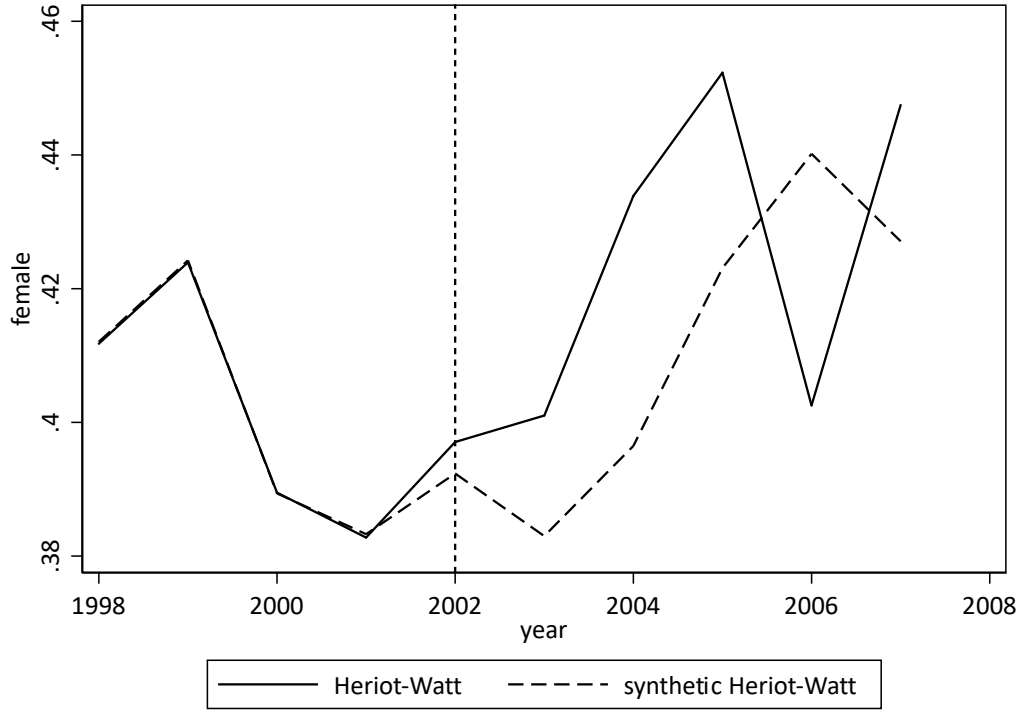
year
Dundee
synthetic Dundee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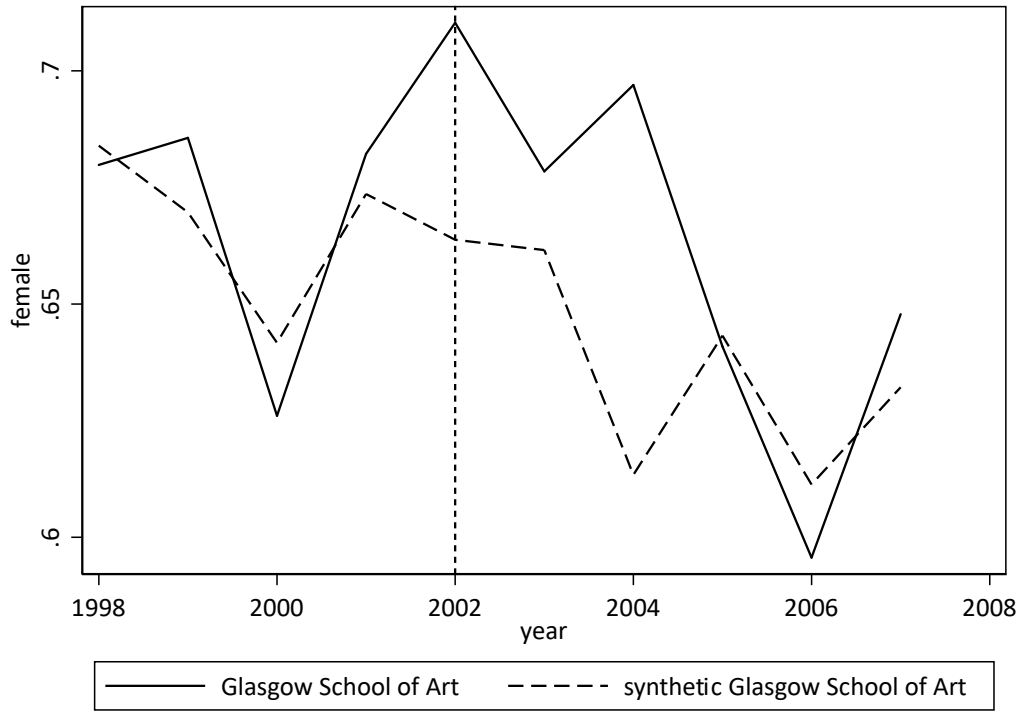
1998
2000
2002
2004
2006
2008
year
Heriot-Watt
synthetic Heriot-Watt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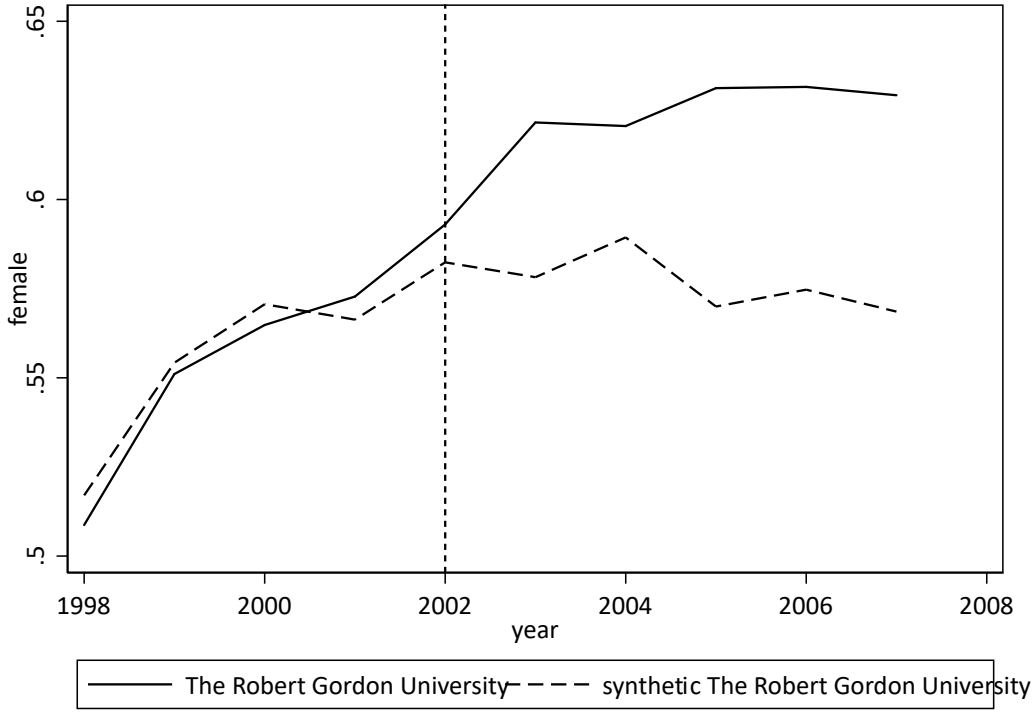
female
1998
2000
2002
2004
2006
2008
year
Glasgow School of Art
synthetic Glasgow School of Art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2000
2002
2004
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2008
year
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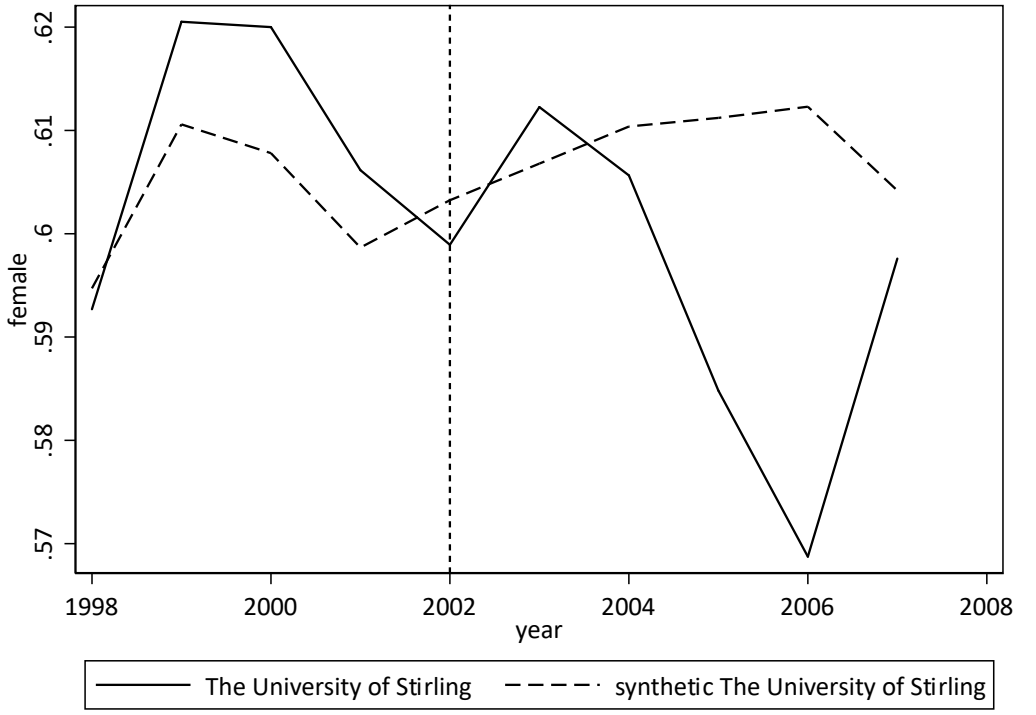
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2008
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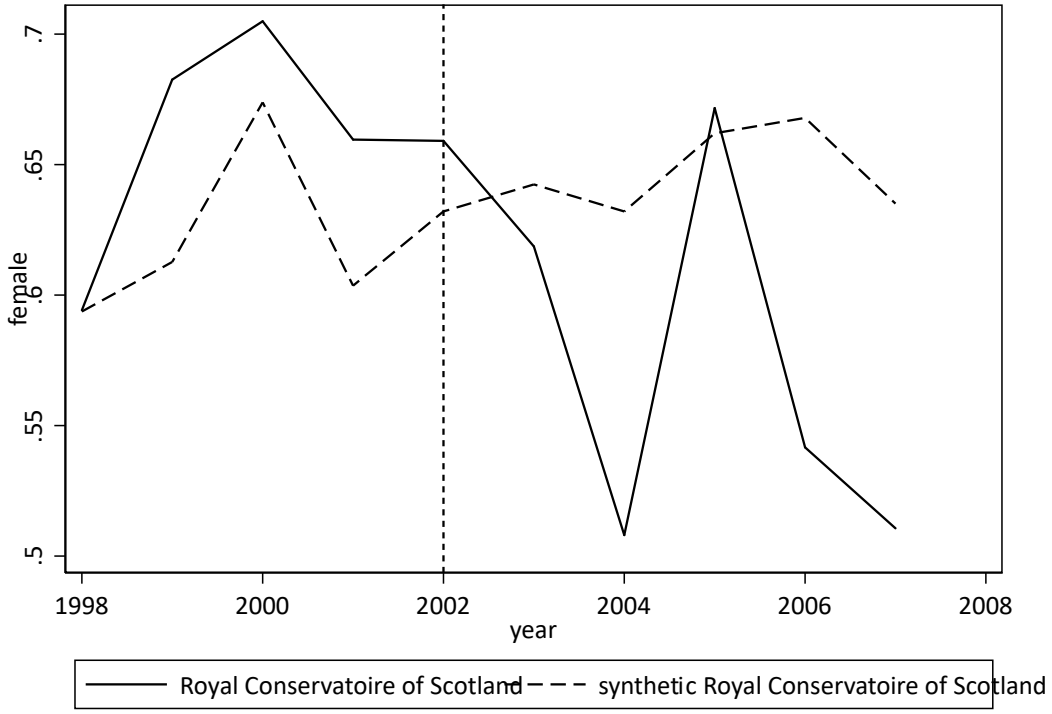
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2006
2008
year
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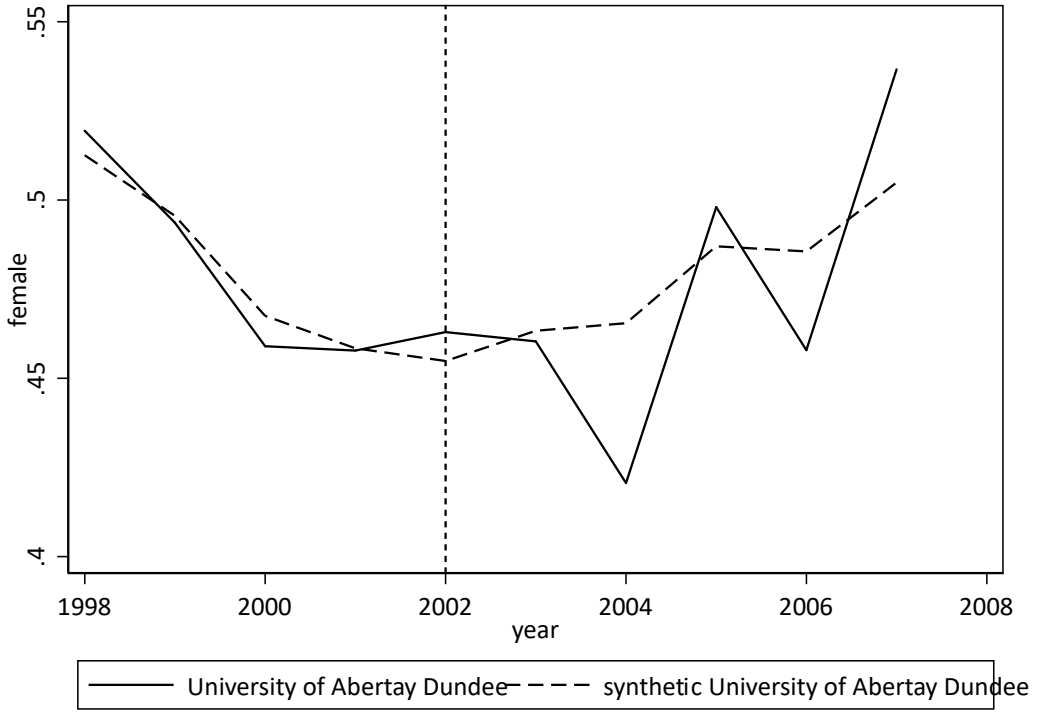
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2008
year
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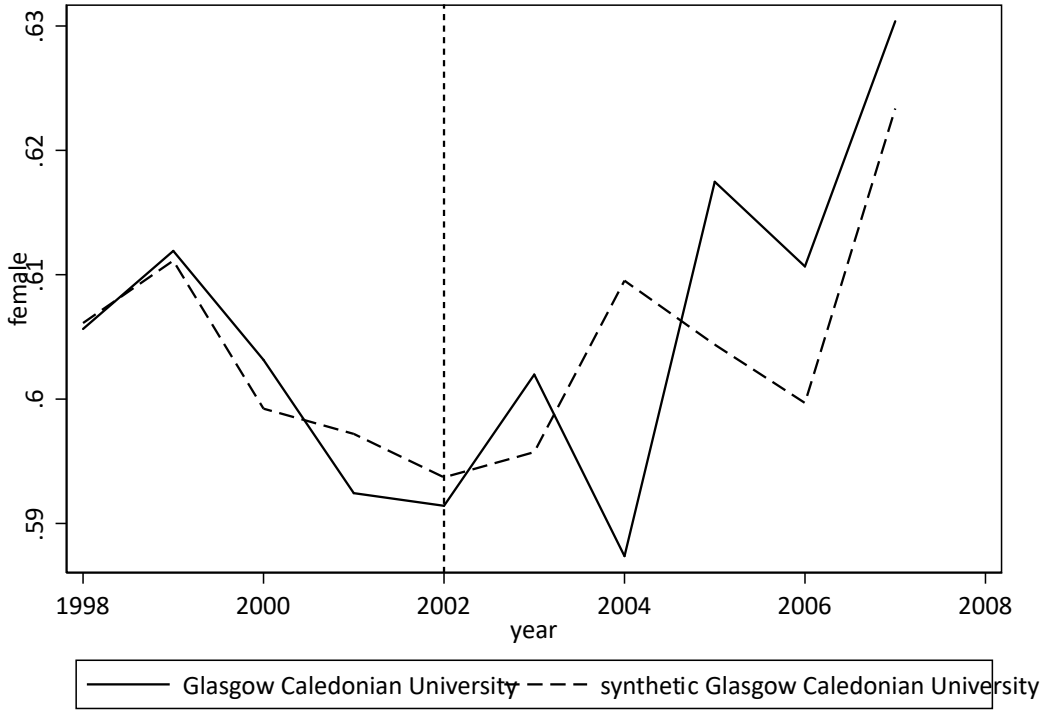
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year
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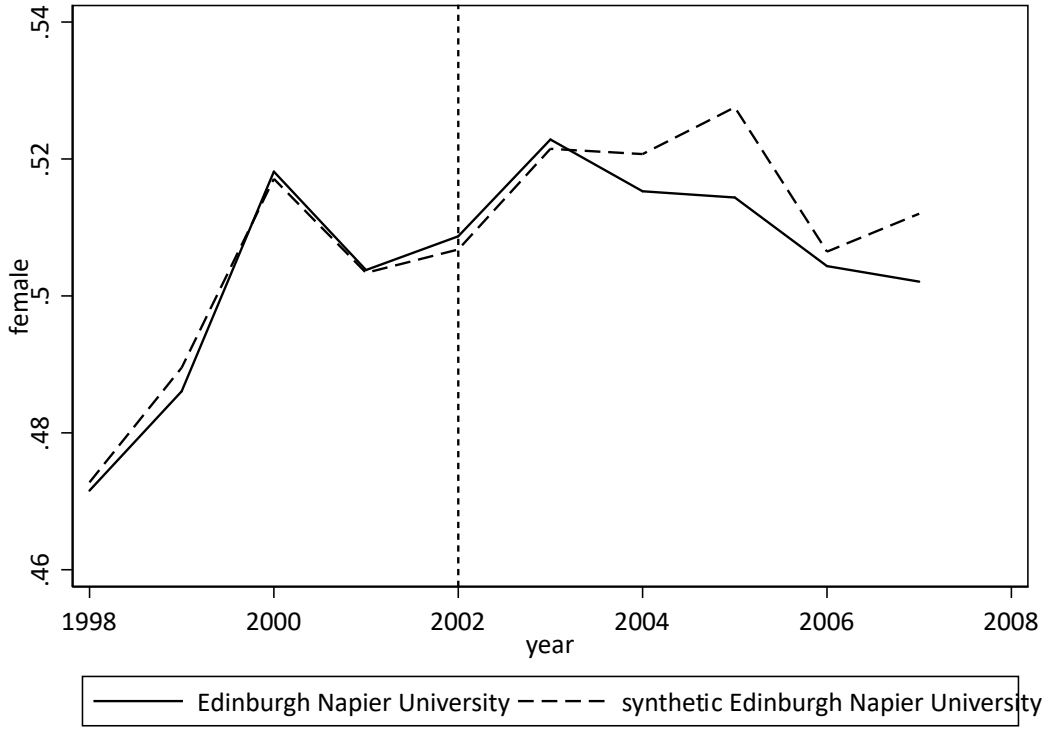
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2004
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2008
year
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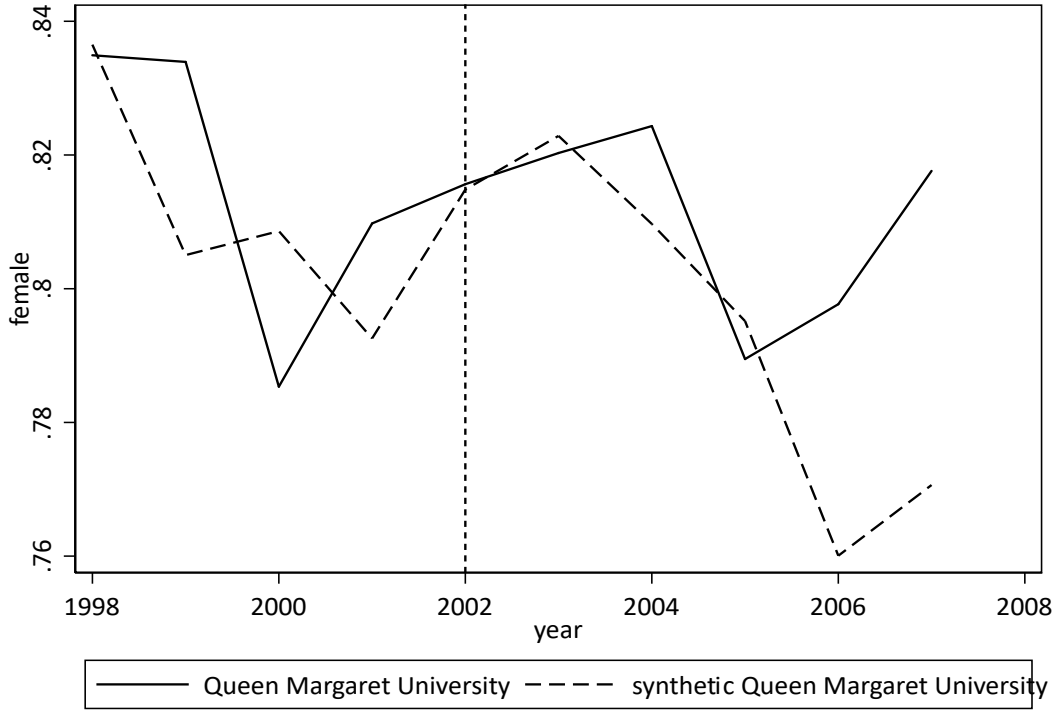
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2002
2004
2006
2008
year
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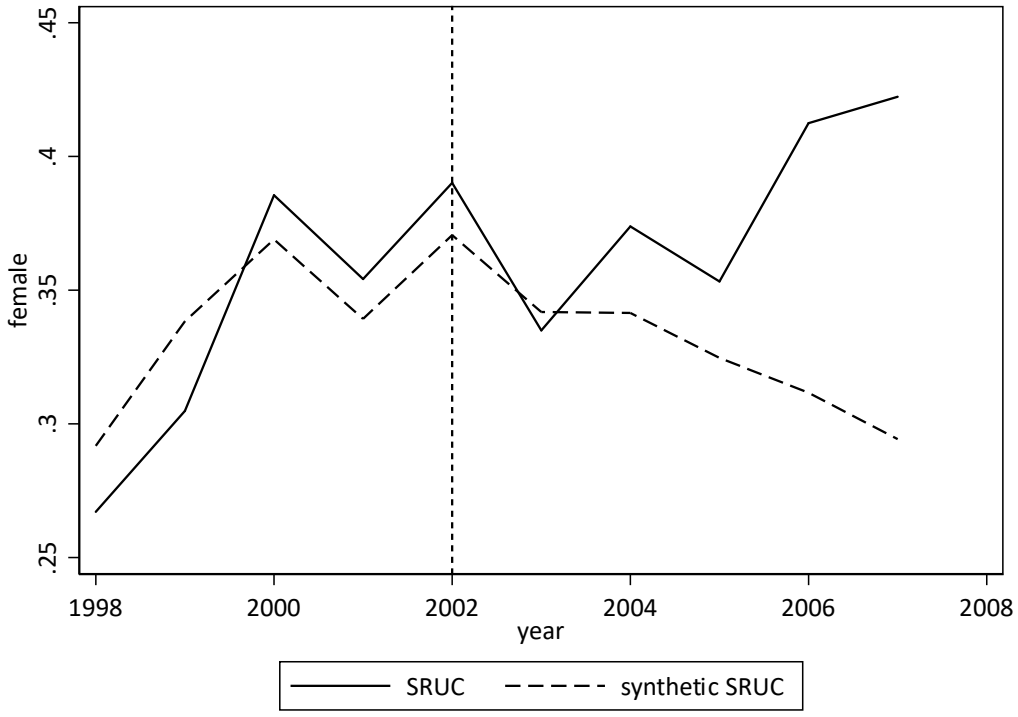
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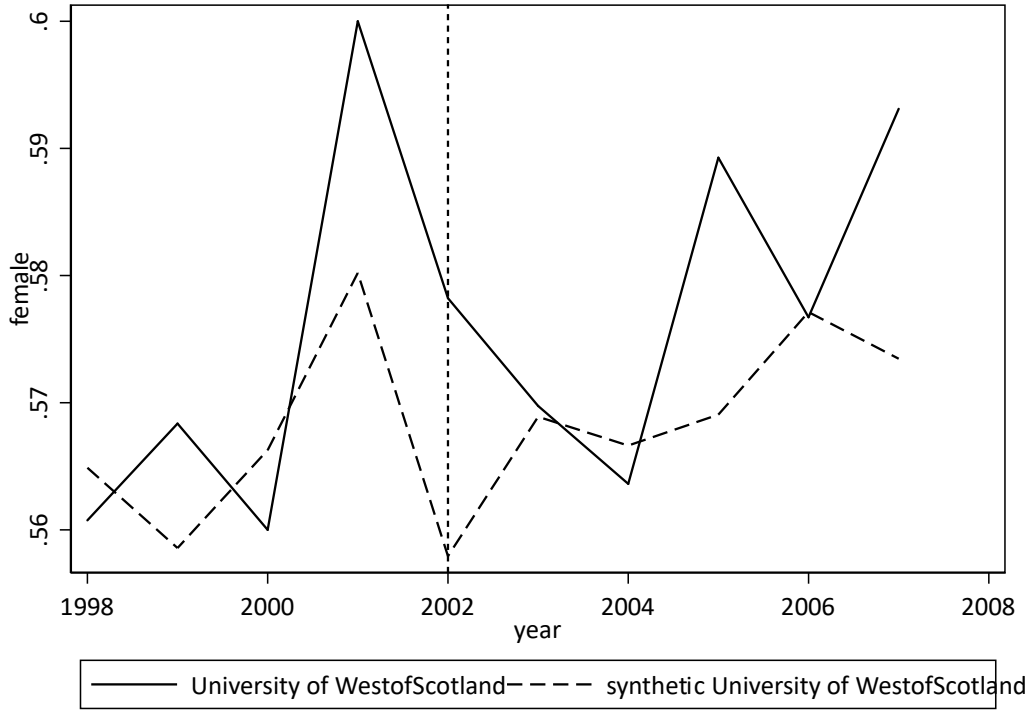
2006
2008
year
SRUC
synthetic SRUC


.6
.59
.58
.57
.56
female
1998
2000
2002
2004
2006
2008
year
University of WestofScotland
synthetic University of WestofScotland

Appendix E: Institutions in Great Britain by Classification

Classification	Institution
Russell Group	The University of Birmingham
	The University of Bristol
	The University of Cambridge
	University of Durham
	The University of Exeter
	The University of Leeds
	The University of Liverpool
	Imperial College of Science, Technology and Medicine
	King's College London
	London School of Economics and Political Science
	Queen Mary University of London
	University College London
	Newcastle University
	University of Nottingham
	The University of Oxford
	The University of Sheffield
	The University of Southampton
	The University of Warwick
	The University of York
	The University of Edinburgh
	The University of Glasgow
	Cardiff University
	The University of Manchester
Pre-1992	Cranfield University
	The Royal Central School of Speech and Drama
	University of St Mark and St John
	University of the Arts, London
	Newman University
	Ravensbourne
	Rose Bruford College
	Royal Academy of Music
	Royal College of Music
	Royal Northern College of Music
	The Manchester Metropolitan University
	Royal Conservatoire of Scotland
	Aston University
	The University of Bath
	The University of Bradford
	Brunel University London

	City, University of London
	The University of East Anglia
	The University of Essex
	The University of Hull
	Keele University
	The University of Kent
	The University of Lancaster
	The University of Leicester
	Birkbeck College
	Goldsmiths College
	Royal Holloway and Bedford New College
	The Royal Veterinary College
	St George's, University of London
	The School of Oriental and African Studies
	University of London (Institutes and activities)
	Loughborough University
	The University of Reading
	The University of Salford
	The University of Surrey
	The University of Sussex
	The University of Strathclyde
	The University of Aberdeen
	Heriot-Watt University
	The University of Dundee
	The University of St Andrews
	The University of Stirling
	University of Wales Trinity Saint David
	Aberystwyth University
	Bangor University
	Swansea University
	Royal Agricultural University
	The Arts University Bournemouth
	Courtauld Institute of Art
	The University of Buckingham
	Heythrop College
	Leeds College of Music
	Guildhall School of Music and Drama
	Leeds College of Art
	Plymouth College of Art
	Glasgow School of Art
Post-1992	Bishop Grosseteste University

	Buckinghamshire New University
	University of Chester
	Canterbury Christ Church University
	York St John University
	Edge Hill University
	Falmouth University
	Harper Adams University
	The University of Winchester
	Liverpool Hope University
	University of Bedfordshire
	The University of Northampton
	Roehampton University
	Southampton Solent University
	University of Cumbria
	St Mary's University, Twickenham
	Leeds Trinity University
	Trinity Laban Conservatoire of Music and Dance
	University of Worcester
	Anglia Ruskin University
	Bath Spa University
	The University of Bolton
	Bournemouth University
	The University of Brighton
	Birmingham City University
	The University of Central Lancashire
	University of Gloucestershire
	Coventry University
	University of Derby
	The University of East London
	The University of Greenwich
	University of Hertfordshire
	The University of Huddersfield
	The University of Lincoln
	Kingston University
	Leeds Beckett University
	Liverpool John Moores University
	Middlesex University
	De Montfort University
	University of Northumbria at Newcastle
	The Nottingham Trent University
	Oxford Brookes University

	University of Plymouth
	The University of Portsmouth
	Sheffield Hallam University
	London South Bank University
	Staffordshire University
	The University of Sunderland
	Teesside University
	The University of West London
	University of the West of England, Bristol
	The University of Chichester
	The University of Westminster
	The University of Wolverhampton
	Glyndŵr University
	Cardiff Metropolitan University
	University of South Wales
	University of Abertay Dundee
	Queen Margaret University, Edinburgh
	The Robert Gordon University
	The University of the West of Scotland
	Glasgow Caledonian University
	Edinburgh Napier University
	SRUC
	Writtle University College
	Norwich University of the Arts
	University of the Highlands and Islands
	University College Birmingham
	London Metropolitan University
	University for the Creative Arts
	The Liverpool Institute for Performing Arts
	University of Suffolk