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by

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Paying Tuition under Few Credit Constraints: Debt, Field of Study, and Drop Out *

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Abstract

This study examines the effects of increased tuition fees in a context with minimal credit constraints—namely, the United Kingdom. It focuses on the effects on students' financing choices, field of study selection, and dropout rates. Exploiting the UK's institutional setting, a tuition fee reform that tripled tuition fees, and administrative datasets, I find that higher fees significantly increase the use of government loans but have minimal impact on field of study selection or dropout rates. Suggestive evidence indicates that enrollment is also unaffected. These findings suggest that addressing credit constraints could enable higher tuition fees without significantly harming students.

JEL Codes: I21, I22, I28

Keywords: Tuition fee; Credit constraint; Student loan; Field of study;

Drop out.

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1 Introduction

Higher education worldwide is under growing financial pressure (Johnstone, 2009). Its economic importance is well-established (Murphy, Scott-Clayton, and Wyness, 2019), and governments have heavily subsidized it (UNESCO, 2022). However, rising costs have increasingly strained public budgets.¹ This has prompted policymakers to explore whether alternative, non-subsidization policies might be viable for maintaining access to higher education.

A key question is whether subsidies are truly needed—that is, whether current tuition costs are so high that they deter students from enrolling, or students are willing to pay but unable to due to credit constraints. If the latter is true, policies addressing credit constraints could be a viable alternative to extensive subsidies. Still, this question remains underexplored, as most studies on higher education costs do not distinguish between the effects of direct costs and credit constraints. For instance, while studies agree that financial aid (i.e., lowering costs) increases enrollment, they often do not clarify whether this is because aid reduces direct costs (i.e., increases returns to human capital investment)—making students more willing to pay—or alleviates credit constraints, thereby enabling enrollment, or both.²

This study contributes to this underexplored question by examining the impact of increased tuition fees in a setting with minimal credit constraints—the United Kingdom—to isolate the effect of direct costs from credit constraints. UK students have guaranteed access to government-backed, borrower-friendly loans that fully cover tuition, ensuring that changes in fees would not deter enrollment. I leverage this institutional feature to argue that, in this context, variations in tuition fees primarily affect students through direct costs, as credit constraints are effectively eliminated.

I exploit the UK's 2012 tuition fee reform, which tripled undergraduate

¹ In countries that previously offered free higher education, this led to the introduction of tuition fees—such as in Australia (1989), the UK (1998), and Germany (2007), although Germany re-abolished fees in 2014. In the US, aid schemes have grown more complex to ease the fiscal burden, inadvertently hindering their effectiveness (Dynarski et al., 2023).

² Dynarski, Page, and Scott-Clayton (2023) provide a comprehensive review of this literature.

tuition fees for English students while leaving fees largely unchanged for most Scottish students, as a natural experiment. Compared to other tuition fee reforms, the 2012 reform is relatively simpler. It substantially increased tuition fees—from £3,375 to £9,000—applied uniformly across all UK universities. Apart from this, it introduced only minor adjustments to the government loan system, including a slightly higher interest rate, an extended write-off period, and a marginal reduction in the annual repayment amount. As such, the reform's impact primarily reflects the effect of increased tuition fees, making it particularly well-suited for studying such an effect on students. Scotland provides an appropriate counterfactual for England in studying the impact of tuition fee policy. Both are constituent countries of the UK, sharing an open border, language, currency, and significant cultural and institutional ties. They also share most of their laws, but tuition fee policy is an area of exception.³ This counterfactual enables a difference-in-differences strategy for estimating the reform's impact by comparing English and Scottish students.⁴

I use two proprietary datasets from Jisc.⁵ The first is the Student Record, an administrative dataset covering all students in UK universities from 2007 to 2016. The second is the Destinations of Leavers from Higher Education (DLHE), an administrative survey of UK university graduates from 2008 to 2017, with a response rate of 75%. These individual-level, repeated crosssectional datasets provide comprehensive coverage of the university student population.⁶ They also include hard-to-find information, such as students' primary funding sources and post-graduation salaries. The analysis focuses on three undergraduate outcomes: students' main funding source for tuition,

³ The Scottish Parliament holds separate legislative powers in many areas.

⁴ This approach has become increasingly common in studies examining the impact of tuition fee policies in England. See, for example, Sá (2019), Azmat and Simion (2021), and Hassani-Nezhad et al. (2021).

⁵ Jisc is the official data agency for higher education in the UK.

⁶ Using only university student data is sufficient for this study for two reasons. First, evidence suggests that the tripled fees did not reduce overall enrollment for English students. Second, with tuition fees nearly uniform across UK universities, English students had little incentive to select institutions based on costs. Together, these factors indicate that English students would both enroll and attend the same universities post-reform, meaning their composition at each institution would remain the same as pre-reform; hence, no sample selection bias.

their field of study, and their probability of dropping out.⁷

The results indicate that the tripled tuition fees had a significant impact on students' funding choices, prompting a shift from self-funding to using government loans. Specifically, students were 18 percentage points less likely to self-fund and 18 percentage points more likely to rely on government loans, with no change in their use of other financial sources. In contrast, the effects on students' choices of field of study and dropout rates were relatively modest. Students were 1–2 percentage points more likely to choose fields with high expected salaries, but these decisions did not appear to be influenced by their fields' employment rates. Additionally, students were 0.2 percentage points less likely to drop out.

Heterogeneity analyses reveal small but notable differences by gender, ethnicity, and socioeconomic status. Female students exhibited stronger debt aversion, being 3 percentage points less likely to use loans, 0.5 percentage points more likely to select fields with higher expected salaries, and 0.5 percentage points less likely to drop out. Notably, the overall decline in dropout rates was entirely driven by reduced attrition among female students. Similarly, students from lower-income families were slightly more responsive to cost increases than their higher-income peers, being 2 percentage points more likely to use loans, 2 percentage points more likely to select fields with higher expected earnings, and 0.5 percentage points less likely to drop out. Lastly, white students appear to be the least debt-averse, increasing their loan use the most while responding the least in terms of field of study and dropout.

This study contributes to the literature on higher education costs estimates of the effect of direct costs independent of credit constraints—evidence largely absent in the literature. Binding credit constraints lead to underinvestment in human capital, causing the impact of varying direct costs to be overestimated (Lochner and Monge-Naranjo, 2012). Avoiding such overestimation requires ensuring that credit constraints do not bind, a task that has been an empirical challenge.⁸ This study addresses this issue by leveraging institutional features

⁷ I focus on decisions made during the early years of study due to limited post-reform data.

 $^{^{8}}$ Some studies, including Carneiro and Heckman (2002), Cameron and Taber (2004), and

that effectively eliminate these constraints.

This study also complements the literature on access to additional borrowing, providing insights into a potential policy to ease fiscal burdens. Existing research shows that easing credit constraints—whether by offering additional loans or increasing borrowing limits—leads to higher borrowing by students,⁹ suggesting that many face binding constraints. In contrast, this study finds that when costs rise in the absence of credit constraints, students are willing to borrow more without significantly altering other educational decisions. This suggests that students remain willing to pay direct costs at this level.¹⁰ Taken together, these results imply that addressing credit constraints could enable higher tuition fees without significantly harming students.

To a lesser extent, this study adds further evidence to the literature on college major choice and dropout. The findings reveal that even in the absence of credit constraints, students responded to increased fees by selecting fields with higher expected salaries but not higher employment rates, consistent with most studies in the literature.¹¹ This suggests that these behaviors persist regardless of credit constraints. Students also slightly reduced their dropout rates, indicating a sunk-cost effect. While this finding differs from much of the existing literature,¹² its modest magnitude does not alter the general conclusion that sunk costs play little role in students' educational decisions.

The remainder of the paper is organized as follows. Section 2 details the institutional setting. Section 3 describes the datasets. Section 4 outlines the empirical methodology. Section 5 presents the main results. Section 6 explores heterogeneity. Section 7 discusses the findings. Finally, Section 8 concludes.

Brown, Scholz, and Seshadri (2012) use model-based predictions to identify if credit constraints bind. Other studies, such as Stinebrickner and Stinebrickner (2008), instead directly survey students about whether they are constrained. Findings, however, remain mixed.

⁹ See, among others, Marx and Turner (2019), Belzil, Maurel, and Sidibé (2021), Denning and Jones (2021), and Black et al. (2023).

¹⁰ Delavande and Zafar (2019) report a similar finding based on a field experiment in Pakistan.

¹¹ See, among others, Beffy, Fougère, and Maurel (2012), Long, Goldhaber, and Huntington-Klein (2015), Wiswall and Zafar (2015), Kirkeboen, Leuven, and Mogstad (2016), and Baker et al. (2018).

¹² See, among others, Garibaldi et al. (2012), Ketel et al. (2016), Fricke (2018), and Bietenbeck et al. (2023).

2 Institutional Setting

This section details the institutional setting of this study. I describe the general landscape of tuition fees for English and Scottish students during 2007-2011, followed by how the 2012 reform changed this landscape. I conclude by summarizing how these institutional features shaped this study's setting.

2.1 The Pre-2012 Landscape: Income-Contingent Loans

UK students have guaranteed access to Income-Contingent Loans (ICLs), government-backed loans first introduced in 1998. These loans fully cover tuition fees but provide a limited amount for living expenses. Loan repayment is tied to the borrower's income after graduation. In the academic year 2006/07, the repayment rate was set at 9% of earnings above £15,000, with a real interest rate of 0%. The borrowing limit for living-cost loans and earnings threshold are indexed to inflation. After 25 years, any remaining balance is written off.

Since the academic year 2006/07, undergraduate tuition fees are capped at $\pounds 3,000$ per year for UK students, which Sá (2019) notes is the amount most English universities charge.¹³ Additionally, students from families with an annual income of $\pounds 25,000$ or less received at least a 10% refund on tuition fees as bursaries from their universities. The tuition cap and family income threshold are similarly indexed to inflation, and means-tested grants were available

2.2 The Post-2012 Landscape: Tripled Tuition Fees

In November 2010, the UK government announced a new tuition fee policy to take effect for students enrolling in the academic year 2012/13 and beyond. The tuition cap was raised to £9,000 per year,¹⁴ the 0% real interest rate was replaced with a positive rate, and the loan write-off period was extended to 30 years. In return, the repayment threshold was increased to £21,000. Students who enrolled before 2012 continued to pay tuition under the pre-reform scheme.

¹³ For non-UK students, the fees are determined at the university's discretion.

¹⁴ This cap increased to $\pounds 9,250$ in the academic year 2017/18 and has remained frozen since.

	Pre-reform: 2011/12	Post-reform: 2012/13
Fee	Up to £3,375	Up to £9,000
Fee loan	Full fee loan	Full fee loan
Maintenance grant	£2,906 if household income is £25,000 or less per year. No grants available for households with an annual income exceeding £50,000.	£3,250 if household income is £25,000 or less per year. No grants available for house- holds with an annual income exceeding £42,600.
Maintenance loan	Up to £3,838 for students liv- ing at home, £4,950 for those living away from home out- side London, and £6,928 for those living away from home in London. For every £1 re- ceived as a grant, students lose 50p from their loan en- titlement. All students are guaranteed at least 72% of the maximum loan amount.	Up to £4,375 for students liv- ing at home, £5,500 for those living away from home out- side London, and £7,675 for those living away from home in London. For every £1 re- ceived as a grant, students lose 50p from their loan en- titlement. All students are guaranteed at least 65% of the maximum loan amount.
Real interest rate	0%	During study: 3% After graduation: 0% for in- comes below the repayment threshold, linearly increasing to 3% at £41,000
Repayment threshold	£15,795	£21,000
Repayment rate	9% of income above the repayment threshold	9% of income above the repayment threshold
Repayment period	25 years	30 years

Table 1: Differences Between Pre- and Post-2012 Reform Schemes

Source: Crawford and Jin (2014). Maintenance grant/loan refer to the grant/loan students can obtain to cover living expenses.

As Sá (2019) observes, most English universities immediately raised their fees to the new cap after the reform. **Table 1** highlights the key differences between the pre- and post-2012 reform schemes.

2.3 A Distinctive Landscape: Scottish Students in Scotland

While the general tuition policy applies across the UK, Scottish students faced a distinctly different situation. Since the academic year 2007/08, Scottish students attending universities in Scotland have been eligible to apply for funding from the Student Awards Agency for Scotland to cover the full tuition fee. For those not receiving funding, the tuition fee remains at £1,820, which is still lower than fees in other parts of the UK. The 2012 reform did not alter these policies and thus had little to no impact on this group of students.

For Scottish students attending universities in other UK countries, the standard tuition fees applied: £3,375 pre-reform and £9,000 post-reform.

2.4 How These Landscapes Shaped This Study's Setting

These landscapes contribute to four features that make this study feasible: a credit-constraint-free environment, near-uniform tuition fees, a relatively simple change in costs, and the availability of treatment and control groups.

2.4.1 Credit-Constraint-Free Environment

The accessibility and borrower-friendly conditions of ICLs have effectively eliminated credit constraints for UK students. With the state bearing the risk of default, and income-contingent repayment terms reducing uncertainty about monthly payments, even risk-averse students are unlikely to be deterred.¹⁵

¹⁵ Dynarski et al. (2021) argue that uncertainty in college pricing can discourage students from taking up financial aid. Their randomized controlled trial demonstrates that simplifying the aid process and providing certainty about the aid amount significantly increases aid take-up.

Barr et al. (2019) report that in the academic year 2015/16, 93.8% of English students took out fee loans, and 89.5% utilized living cost loans, indicating that ICLs have largely functioned as intended.

2.4.2 Near-Uniform Tuition Fees

Tuition levels are nearly uniform across UK universities, as most institutions set their fees at the maximum allowed by the cap during the respective period. As documented by Sá (2019), nearly all English universities set tuition fees at the cap in the academic year 2009/10. Similarly, immediately after the 2012 reform, one-third of English universities charged the maximum £9,000, and none charged less than £6,000.

This pattern can be explained by two characteristics of the UK's higher education system. First, most universities are public institutions: 164 out of 169 degree-awarding universities were publicly funded. This structure gives the government substantial control over tuition levels, ensuring that any tuition fee policy is applied almost universally. Second, government-imposed caps are typically set below levels adequate for university operations (Russell Group, 2010), incentivizing institutions to charge the maximum fees allowed.

This uniformity in tuition fees implies that changes in tuition levels would not affect students' preferences for universities, thereby preserving their choice rankings. For example, consider a student who prefers university X over university Y. If tuition levels change, the price difference between universities remains nearly constant, as most institutions set similar fees. Thus, the student would continue to prefer university X over university Y.

2.4.3 Relatively Simple Change in Costs

The 2012 reform introduced relatively simple changes in costs, making it well-suited for estimating the impact of higher tuition fees. It raised the tuition cap significantly—from £3,375 to £9,000—but made only minor adjustments to the loan system, including a slightly higher interest rate of 0-3%, a five-year longer write-off period, and an increased earnings threshold of £5,205. The

higher interest rate raised total debt at graduation by about £2,800, while the higher earnings threshold reduced annual repayments by up to £460. Both of these are less impactful compared to the £17,000 increase in debt at graduation resulting from the tripled fees. As such, the reform's impact primarily reflects the effect of increased tuition fees.

2.4.4 Availability of Treatment and Control Groups

English students serve as an excellent treatment group, while Scottish students attending universities in Scotland provide a control group. The 2012 reform affected English students but left Scottish students attending universities in Scotland largely unaffected. English and Scottish students are also expected to share many characteristics because their countries are part of the UK, share an open border, language, currency, most laws, and significant cultural and institutional ties. This makes Scottish students an appropriate counterfactual for English students. The availability of these groups enables the effects of the reform to be estimated using a quasi-experimental approach.

3 Data

This study uses two individual-level, repeated cross-sectional datasets from Jisc, described below. Note that in these datasets, socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. For simplicity, these classifications are referred to as Classes 1 to 8.

3.1 Student Record: An Administrative Dataset of University Students

The first dataset is the Student Record (SR), an administrative dataset covering all students enrolled in UK universities each year. It includes in-

	Country of domicile								
	Before t	he 2012 ref	form (200)	7 - 2011)	After th	ne 2012 ref	orm (2012	-2016)	
VARIADLES	(1) English	(2) Scottish	(3) Welsh	(4) Northern Irish	(5) English	(6) Scottish	(7) Welsh	(8) Northern Irish	
Country of university									
England	96.1	14.9	40.8	32.4	95.9	15.6	47.2	31.6	
Scotland	1.2	84.9	0.6	8.8	1.1	84.1	0.5	6.0	
Wales	2.5	0.2	54.2	1.1	2.8	0.2	52.2	1.2	
Northern Ireland	0.1	0.1	4.4	57.7	0.1	0.1	0.1	61.3	
Main financial source for tuition fees									
Self-funding	26.4	17.6	21.3	23.3	14.4	17.4	10.0	10.5	
Government loan/grant	67.1	70.7	69.8	69.4	78.4	68.8	82.3	80.0	
Other sources	5.1	10.3	5.4	5.3	6.5	12.2	5.1	8.0	
Unknown	1.4	1.4	3.4	2.1	0.8	1.6	2.6	1.4	
Observations	1,606,760	162,210	99,720	67,875	1,797,015	180,340	112,985	75,690	

Table 2: Enrollment Patterns of Undergraduate Entrants in the UK

Source: Jisc's Student Record. Statistics are in percentages unless stated otherwise. Observations are rounded to the nearest five in accordance with Jisc's disclosure control.

formation on demographics (age, sex, ethnicity, socioeconomic status, and parental education), the main financial source for tuition fees, the program of study (institution, college major, mode of study, expected length of study, and start date), and student status (year in the program, continuation status, and completion or leaving date). This dataset serves as the primary source for analyzing the impact of increased tuition fees on university students' behaviors.

The sample scope includes (i) undergraduate students, (ii) those between the academic years 2007/08 and 2016/17, (iii) English students attending English universities, and (iv) Scottish students attending Scottish universities. Scopes (i) and (ii) are straightforward: the tuition schemes discussed so far applied only to undergraduate students, and these academic years cover the relevant period. Scopes (iii) and (iv), however, require further explanation.

Table 2 depicts the enrollment patterns of undergraduate entrants in the UK, where scopes (i) and (ii) apply. A large majority—96%—of English students attended universities in their home country. Only small percentages enrolled in universities in Scotland, Wales, or Northern Ireland—1%, 2.5%, and 0.1%, respectively. These patterns are consistent across both the pre- and post-2012 reform periods. Given these small percentages, one might speculate that these students attended non-English universities due to unobserved factors unique to their circumstances. For this reason, I apply scope (iii) and focus on English students attending English universities. Table 2 also suggests that focusing on Scottish students attending Scottish universities is a viable strategy. A large majority—84%—of Scottish students attended universities is a their home country, similar to the pattern observed for English students. Hence, I apply scope (iv) and use this group of students as the control group.

Table 3 presents summary statistics of undergraduate entrants, where scopes (i) through (iv) apply, comparing English and Scottish entrants before and after the 2012 reform. Except for ethnicity, the distributions of characteristics were largely similar between English and Scottish entrants. The proportions of male and female students, and socioeconomic status, were comparable across the two groups, as were the age at entry, with 66% enrolling by the age of 20. In the post-reform period, the distributions of characteristics remained similar to those in the pre-reform period. Students tended to enroll at a younger age after the reform, with the percentage of those enrolling by the age of 20 increasing, while enrollment among other age groups declined.

3.2 Destinations of Leavers from Higher Education: An Administrative Survey of University Graduates

The second dataset is the Destinations of Leavers from Higher Education (DLHE), a survey conducted six months after students graduate. The survey includes all graduates from UK universities, with a response rate of approximately 75%. It focuses on employment-related information. For employed graduates, it provides details about their jobs, such as salary, how the job was obtained, whether the job required a degree, country of employment, firm size, and the employer's industry. Similar to the SR, the DLHE also contains data on demographics and the programs from which individuals graduated. This dataset is primarily used to examine whether the impact of increased tuition fees depends on employment-related outcomes, such as employment rates and expected salaries.

The sample scope is the same as that applied to the SR. **Table 4** presents summary statistics of university graduates, comparing English and Scottish graduates before and after the 2012 reform. As with the entrants' statistics, the distributions of characteristics—except for ethnicity—were similar between English and Scottish graduates. Unlike the entrants' statistics, however, the distributions remained similar in the post-reform period.

It is important to note that the statistics for graduates who reported their salaries were nearly identical to those of their respective populations. The distributions of ages at entry, sexes, ethnicity, family socioeconomic statuses, and degree honors showed minimal differences, suggesting that the missing salary data were random. This implies that, for graduates' statistics, no information should be lost by focusing only on those who reported their salaries.

	Country of domicile						
VARIABLES	Before the 2 (2007-	2012 reform -2011)	After the 2 (2012-	012 reform -2016)			
	(1) English	(2) Scottish	(3) English	(4) Scottish			
Age at entry							
≤ 17	0.3	19.9	0.2	20.9			
18-20	67.1	46.9	73.2	49.9			
21-24	12.7	13.3	11.1	12.3			
25-29	6.9	7.5	5.7	6.5			
≥ 30	13.0	12.4	9.8	10.4			
Sex							
Male	45.7	43.6	45.0	42.4			
Female	54.3	56.4	55.0	57.6			
Ethnicity							
White	70.4	90.7	68.4	91.3			
Asian	12.2	4.0	13.6	4.4			
Black	9.0	1.0	9.9	1.2			
Others	8.4	4.3	8.1	3.1			
Family socioeconomic status							
Classes 1-2	31.1	33.1	34.0	38.3			
Classes 3-5	18.7	19.8	20.3	21.6			
Classes 6-8	15.2	15.5	17.8	17.0			
Not classified/Unknown	35.0	31.6	27.9	23.1			
Observations	1,544,570	137,640	1,723,675	151,650			

Table 3: Summary Statistics of Undergraduate Entrants in the UK

Source: Jisc's Student Record. Socioeconomic status is based on parental occupations, classified as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. Statistics are in percentages unless stated otherwise. Statistics on students cover only those who attended universities in their own country. Observations are rounded to the nearest five in accordance with Jisc's disclosure control.

	Country of domicile									
	Befor	e the 2012	reform (2007	7–2011)	After the 2012 reform (2012–2016)					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		
	English	$\operatorname{Scottish}$	English	$\operatorname{Scottish}$	English	$\operatorname{Scottish}$	English	$\operatorname{Scottish}$		
			(w/salary)	(w/salary)			(w/salary)	(w/salary)		
Age at entry										
≤ 17	0.3	22.7	0.3	21.6	0.2	21.9	0.1	21.5		
18–20	76.8	50.8	75.7	47.9	78.1	53.3	76.2	51.7		
21–24	8.9	9.8	9.2	10.3	8.7	10.3	9.3	10.7		
25-29	4.2	5.3	4.7	6.3	4.2	5.2	4.9	5.9		
≥ 30	9.7	11.5	10.1	13.9	8.8	9.3	9.5	10.3		
Sex										
Male	42.8	40.6	41.3	38.1	43.1	40.4	42.4	38.4		
Female	57.2	59.4	58.7	61.9	56.9	59.6	57.6	61.6		
Ethnicity										
White	78.5	93.3	82.9	94.8	75.8	93.5	78.4	94.7		
Asian	10.7	3.0	8.6	2.0	11.7	3.4	10.5	2.6		
Black	5.0	0.5	3.7	0.3	6.6	0.8	6.0	0.7		
Others	5.8	3.2	4.7	2.9	5.7	2.2	5.2	2.0		
Family socioeconomic status										
Classes 1-2	39.6	38.4	40.9	36.4	40.6	42.2	40.6	41.1		
Classes 3-5	19.3	18.9	19.2	18.0	19.0	19.9	19.0	20.2		
Classes 6-8	13.3	12.4	12.7	12.6	15.4	14.4	15.2	14.8		
Not classified/Unknown	27.8	30.4	27.3	32.9	25.1	23.4	25.2	23.9		

 Table 4: Summary Statistics of University Graduates in the UK

Degree honors								
First-class honors	15.2	12.2	16.9	13.2	23.0	16.5	24.4	16.9
Upper second-class honors	48.5	38.0	49.5	37.5	49.0	41.5	48.6	39.2
Lower second-class honors	25.2	18.5	22.1	16.7	18.4	15.4	17.3	14.2
Third-class honors/Pass	9.2	27.3	10.5	30.5	7.2	23.4	8.3	27.9
(Not applicable)	2.0	3.9	1.0	2.1	2.4	3.2	1.4	1.7
Employment								
Full-time employed	50.4	52.6	87.9	88.5	56.5	57.7	87.6	88.1
Other types of employment	21.9	21.1	12.0	11.4	18.4	18.4	12.0	11.7
Further study only	13.3	15.1	0.0	0.0	13.8	14.7	0.0	0.0
Unemployed/out of workforce	14.4	11.2	0.1	0.1	11.2	9.2	0.3	0.2
Mean salary (GBP)			20,609	$21,\!140$			21,665	21,865
Standard error (GBP)			(7, 483)	(6,925)			(7, 878)	(6,963)
Size of the employing firm								
≥ 250			53.3	56.0			52.2	60.6
50-249			14.8	9.5			13.9	11.4
< 50			18.5	12.6			13.2	11.6
Not known/not reported			13.4	21.8			20.7	16.4
Observations	$1,\!055,\!475$	90,710	333,775	26,320	1,212,190	98,205	531,245	39,920

Source: Jisc's Destination of Leavers from Higher Education. Socioeconomic status is based on parental occupations, classified as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. Statistics are in percentages unless stated otherwise. Statistics on students cover only those who attended universities in their own country. Observations are rounded to the nearest five in accordance with Jisc's disclosure control.

4 Methodology

This study examines the impact of the 2012 tuition fee reform by comparing educational outcomes between students affected by the reform and those unaffected. As outlined in Section 3, the treatment group consists of English students studying in England, while the control group comprises Scottish students attending universities in Scotland. For simplicity, these groups are referred to as English and Scottish students, respectively.

The analysis investigates three key outcomes: the main financial source for tuition fees, the field of study, and the probability of dropping out.

4.1 Identification Strategy: Difference-in-Differences

I use a difference-in-differences (DiD) approach to estimate the effects of the tuition fee increase, leveraging the variation in tuition schemes experienced by the treatment and control groups. The analysis relies on the key identifying assumption, known as the common-trends assumption, which posits that, in the absence of the reform, trends in these outcomes would have been similar for both groups.

The analysis begins with an event study to evaluate whether the commontrends assumption holds. If the assumption appears valid, I proceed to estimate the average treatment effect of the 2012 reform. The specifications for each analysis are outlined below.

4.1.1 Event Study: A Check of the Common-Trends Assumption

For the event study, I use a linear probability model:

$$P(Y_{igt} = 1 | \boldsymbol{X}_{igt}) = \delta_{gt} + \gamma_g + \tau_t + \boldsymbol{X}_{igt}\boldsymbol{\beta} + \varepsilon_{igt}, \qquad (1)$$

where Y_{igt} is a dummy variable indicating whether the event of interest occurred for student *i* from group *g* (English or Scottish) in year *t*. Examples of events of interest include whether the student took loans, chose a STEM major as their field of study, or dropped out. The variables γ_g and τ_t represent group- and time-fixed effects, respectively, while X_{igt} is a vector of student characteristics. Sample is clustered at the country level to address the issue of serial correlation, as discussed in Bertrand, Duflo, and Mullainathan (2004). However, with only two clusters, I acknowledge that the estimator may still overreject the null hypothesis.

The parameters of interest are the coefficients δ_{gt} , which represent the group-time fixed effects in percentage points. Suppose the reform occurred in period \hat{t} . If the common-trends assumption holds, the estimates of δ_{gt} should equal zero for g = "English" and $t < \hat{t}$.

4.1.2 Average Treatment Effect: Main Analysis

For the average treatment effect, I specify a linear probability model as

$$P(Y_{iqt} = 1 \mid \boldsymbol{X}_{iqt}) = \delta \cdot REFORM_{qt} + \gamma_q + \tau_t + \boldsymbol{X}_{iqt}\boldsymbol{\beta} + \varepsilon_{iqt}, \quad (2)$$

where $REFORM_{gt}$ is a dummy variable indicating whether the student was affected by the 2012 reform: it equals one if (i) the student is English and (ii) first enrolled in 2012 or later, and zero otherwise. The remaining variables and vectors are identical to those in Equation (1), and sample is, again, clustered at the country level.

The parameter of interest is the coefficient δ , which represents the impact of being affected by the 2012 reform, measured in percentage points.

4.2 Threats to Internal Validity

4.2.1 Sample Selection Bias: Changes in the Student Composition

As the datasets used in this study only contain information on university students, there is a potential for sample selection bias. If the 2012 reform discouraged some prospective students from enrolling, the composition of the student population after the reform may have changed. **Figure 1** shows the university participation rate of English and Scottish individuals at college-starting ages.¹⁶ Except for 2011 and 2012, the participation rate of English individuals has been increasing. Even relative to that of Scottish individuals, the participation rate of English individuals did not decline, suggesting that the reform did not discourage them from enrolling.¹⁷ Hence, sample selection bias, if any, is likely minimal.

Figure 1: University Participation Rates of English and Scottish Individuals at College-Starting Ages



Source: Office for National Statistics and Scottish Funding Council.

4.2.2 Anticipation Effect: Early Enrollments

As discussed in Section 2, the 2012 reform was announced in November 2010, over a year before its implementation. Students who enrolled before 2012

¹⁶ There is no minimum age for enrollment. However, due to their secondary education systems, English and Scottish students typically begin college at 18–19 and 17–18, respectively.

¹⁷ Murphy, Scott-Clayton, and Wyness (2019) report a similar finding in their analysis.



Figure 2: University Participation Rates of English Individuals by Ages

Source: Office for National Statistics.

also continued to pay tuition at the pre-reform rate. As such, it is possible that some students enrolled early to avoid paying the higher tuition fees.

Figure 1 indicates that this is indeed the case. The university participation rate of English students rose sharply in 2011, dropped sharply in 2012, and returned to the pre-2011 trend by 2013. Figure 2 presents the university participation rate of English individuals by age, offering further evidence for this hypothesis. A sharp rise is observed for English students aged 18 in 2011, followed by a sharp fall for those aged 19 in 2012. A similar pattern is observed for those aged 19 in 2011. This implies that some students who would have enrolled in 2012 chose to enroll earlier, in 2011.

These observations suggest that English entrants may have exhibited offtrend behaviors between 2011 and 2012. To avoid potential bias, the empirical analyses exclude these two groups of students.

4.2.3 Other External Shocks

As with any quasi-experimental study, the lack of random assignment raises the possibility that other shocks, rather than the policy change, could have driven the results. While it is unlikely that external shocks simultaneously affected all three outcomes of interest during the same period, this study acknowledges this potential limitation.

4.3 Evaluating the Common-Trends Assumption

To validate the DiD approach, I estimate the coefficients δ_{gt} specified in Equation (1). These coefficients are derived for cases where the dependent variable Y_{igt} is defined as one of the following:¹⁸

- Whether the student took out a government loan,
- Whether the student chose a STEM field,
- Whether the student selected a field with a high employment rate,
- Whether the student opted for a field with high expected salaries, and
- Whether the student dropped out by the end of their first year of study.

Overall, the pre-reform estimates of δ_{gt} are close to, but not, zero, which I argue remains consistent with the common-trends assumption between English and Scottish students. This is evident in **Figures 3**, 4, and 7, where the estimates for years prior to the reform's announcement show little variation.

In **Figures 5** and **6**, however, this is less evident. Although the estimates during the pre-reform period also hover around zero, one year has an estimate that stands out from the other three, which might suggest a deviation from the common-trends assumption. Nonetheless, excluding students from these outlier years does not alter the average treatment effects estimated by Equation (2). Hence, I argue that the common-trends assumption cannot yet be rejected, although the estimation results should still be interpreted with caution.

¹⁸ The classification criteria for fields of study—whether they are STEM, have high employment rates, or are associated with high expected salaries—are detailed in **Table A2**.



Figure 3: Estimates of δ_{gt} when Y_{igt} Indicates Whether the Student Took Out a Government Loan

Figure 4: Estimates of δ_{gt} when Y_{igt} Indicates Whether the Student Selected a STEM Field



Figure 5: Estimates of δ_{gt} when Y_{igt} Indicates Whether the Student Selected a Field with a High Employment Rate



Figure 6: Estimates of δ_{gt} when Y_{igt} Indicates Whether the Student Opted for a Field with High Expected Salaries







5 Results

This section presents the main results of the study. The analysis examines three key outcomes: (a) the main financial source for tuition fees, (b) the field of study, and (c) the probability of dropping out. The focus is on first-year students, grouped by their cohort of entry.¹⁹

5.1 Main Financial Source for Tuition Fees

Table 5 presents the estimated effects of the 2012 reform on students' main financial sources for tuition fees. Panel A shows that the reform increased the likelihood of students taking government loans by 17.9 percentage points, decreased the likelihood of self-funding by 17.2 percentage points, and had no statistically significant effect on the use of other sources.²⁰ Panel B further

 ¹⁹ Tuition finance is expected to have the greatest impact at the time of initial university enrollment. Additionally, in England, students choose their field of study prior to enrollment.
 ²⁰ The change in the use of each source within "Others" was also not statistically significant.

	(1)	(2)	(3)
VARIABLES	Loans	Self-funding	Others
Panel A: Loan vs. Self-funding	vs. Others		
REFORM	0.179^{***}	-0.172***	0.003
	(0.002)	(0.000)	(0.001)
	(0.00_)	(0.000)	(01001)
R^2	0.835	0.383	0.188
Panel B: (Loan or self-funding)	ne Others		
I and D. (Doan of seif-fanang)	03. 000013		
DEEODM	0	008	0.002
REFORM	0.	000	0.005
	(0.	002)	(0.001)
D.9		6K 0	0.100
<u> </u>	0.	958	0.188
Observations		$2,\!683,\!200$	

Table 5: The 2012 Reform's Effect on Students' Main Financial Source for Tuition Fees

Notes: The dependent variable indicates whether the student used the respective source as the main financial source for tuition fees. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

reveals that the combined probability of students taking loans or self-funding remained unchanged, indicating that students predominantly switched from self-funding to relying on government loans.

Coupled with the result in **Figure 1**, which shows that higher tuition fees did not reduce university participation rates, these estimates suggest that students are not averse to using this specific type of government-provided loan. While it could simply be that students were not debt-averse, I argue that this result highlights the government's success in alleviating credit constraints in the UK's higher education system.

5.2 Field of Study

Jisc categorizes fields of study into 163 principal subjects, each encoded by a letter and a number (e.g., A0, Q1, X9),²¹ and grouped into 19 principal areas, encoded sequentially from 1 through 9, then A through J. For this analysis, I further consolidate these principal areas to align with the study's criteria,²² with a principal subject of Nursing (B7) excluded.²³

5.2.1 STEM vs. Non-STEM Fields

The principal areas are sequentially consolidated into 10 groups: Medical Sciences, Biological Sciences, Physical and Computational Sciences, Engineering and Architecture, Social Studies, Law, Business, Language and Humanities, Fine Arts, and Education. I classify the first four of these groups collectively as STEM.

Table 6 presents the estimates of the 2012 reform's effect on students' choice of field of study. Panel A indicates that the reform increased the likelihood of students choosing a STEM field by 3.7 percentage points. The effect is most pronounced in Biological Sciences, at 1.8 percentage points, followed by Medical Sciences at 1.2 percentage points, and Physical & Computational Sciences at 0.7 percentage points. Nevertheless, given that tuition fees increased significantly—from £3,375 to £9,000—these effects seem relatively modest in magnitude. Panel B indicates that the reform reduced the likelihood of students choosing a non-STEM field by 1.3 percentage points, with notable variation across subject groups. Social Studies, Law, and Business saw an increased likelihood of being chosen, although the magnitudes of these effects are smaller than those observed for STEM fields. On the contrary, Humanities, Fine Arts, and Education experienced a decline in the likelihood of being chosen.

These results suggest that a student's field of study is indeed influenced by tuition fees, although the response seems relatively inelastic, as tripled fees

²¹ See https://www.hesa.ac.uk/support/documentation/jacs/jacs3-principal.

 $^{^{22}}$ See **Table A2** for the list of principal areas and their consolidation.

²³ Nursing was elevated to a degree-level profession in 2009, causing an influx of students and potentially altering trends between countries.

Table 6: The 2012 Reform's Effect on Students' Choice of Field of Study by STEM Classification

VARIABLES	(1)	(2)	(3)	(4)
	Medical	Biological	Physical &	Engineer &
	Sci.	Sci.	Comp Sci.	Architect
REFORM	0.012^{*}	0.018^{**}	0.007^{*}	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
\mathbb{R}^2	0.194	0.166	0.119	0.240

PANEL A: STEM FIELDS

PANEL B: NON-STEM FIELDS

	(5)	(6)	(7)	(8)	(0)	(10)
VARIABLES	Social Stud	(0) Law	Business	Humanities	Fine Arts	Education
REFORM	0.006**	-0.002	0.012**	-0.017**	-0.011**	-0.003*
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
\mathbb{R}^2	0.140	0.064	0.177	0.195	0.304	0.141
Observations			2,65	52,195		

Notes: The dependent variable indicates whether the student selected the respective field of study. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13, as well as those with a principal subject of Nursing. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

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led to only a modest increase in students choosing a STEM field. Also, STEM grouping may not be the clearest criterion, as STEM fields showed an increased likelihood of being chosen, while non-STEM fields saw more varied outcomes.

5.2.2 High vs. Low Employment Rate Fields

Panel A of **Table 7** presents the estimates of the 2012 reform's effect on students' choice of field of study by employment rate quartiles. Surprisingly, the reform did not increase the likelihood of students selecting a field in the top two quartiles. Fields in the top and lower-middle quartiles saw an increased likelihood of being chosen, while those in the upper-middle quartile saw a decrease. No change was observed for fields in the bottom quartile. These findings suggest that higher tuition fees did not pressure students to select fields with higher employment rates.

5.2.3 High vs. Low Expected Salary Fields

Panel B of **Table 7** presents the estimates of the 2012 reform's effect on students' choice of field of study by expected salary quartiles. It increased the likelihood of students selecting fields in the top and upper-middle quartiles by 1 and 2.2 percentage points, respectively. Conversely, it decreased the likelihood of fields in the lower-middle quartile being chosen by 1.3 percentage points.

These findings resemble those in **Table 6** but with a clearer pattern, which suggests that the increased likelihood of students choosing a STEM field may be due to their correlation with higher expected salaries. (See **Table A2**.)

5.3 Dropout

Following Bradley and Migali (2019), I focus on first-year students.²⁴ **Table** 8 presents the estimates of the 2012 reform's effect on the likelihood of students dropping out. The reform reduced the probability of dropping out during the

²⁴ The authors argue that most dropouts occur during the first year of study and that the determinants of dropout behavior likely vary for higher years of study.

Table 7:	The 201	2 Reform's	Effect on	Students'	Choice	of Fi	ield o	f Study	by
Employn	nent Rate	e and Expe	cted Salar	y Ranking	(s				

	(1)	(2)	(3)	(4)
VARIABLES	Top	Upper-	Lower-	Bottom
	quartile	middle	middle	quartile
		quartile	quartile	
Panel A: By employment	rate ranking			
DEEODI	0.000*			0.001
REFORM	0.009^{*}	-0.018**	0.030^{**}	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)
\mathbb{R}^2	0.229	0.392	0.455	0.218
Panel B: By expected sala	ry ranking			
DEEODM	0.010**	0.000**	0.019*	0.001
REFORM	0.010	0.022	-0.013	0.001
	(0.000)	(0.001)	(0.002)	(0.002)
R ²	0.238	0.374	0.319	0.362
Observations		$2,\!652,\!195$		

Notes: The dependent variable indicates whether the student selected a field of study within the respective quartile. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13, as well as those with a principal subject of Nursing. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

first year by 0.2 percentage points, suggesting that higher tuition fees may have discouraged students from voluntarily leaving their programs.

6 Heterogeneity

This section examines how the 2012 reform's effects on the dependent variables of interest vary by sex, ethnicity, and socioeconomic status. As a

	(1)
VARIABLES	First year
REFORM	-0.002** (0.000)
R ² Observations	$0.042 \\ 2,683,200$

Table 8: The 2012 Reform's Effect on Students' Probability of Dropping Out

Notes: The dependent variable indicates whether the student dropped out by the end of the respective year of study. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13, as well as those with a principal subject of Nursing. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

reminder, socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. For simplicity, these classifications are referred to as Classes 1 to 8.

6.1 Main Financial Source for Tuition Fees

Table 9 shows the 2012 reform's effects on students' main financial source for tuition fees, estimated separately by sex, ethnicity, and socioeconomic status. While the observed heterogeneity is minimal, some patterns stand out. By sex, females' response is about 2.5 percentage points smaller than males'. By socioeconomic status, Classes 1-2's response is the smallest, with the magnitude increasing among lower socioeconomic classes. The most noticeable heterogeneity is between ethnicities, particularly for Black students. While the effect generally ranged from 15 to 19 percentage points, it was only 7 to 10 percentage points for Black students—about half as much.

	(1)	(2)	(3)
VARIABLES	Loans	Self-funding	Others
REFORM, Male	0.194^{***}	-0.185***	0.001
	(0.002)	(0.000)	(0.000)
REFORM, Female	0.167^{***}	-0.161***	0.005
	(0.002)	(0.000)	(0.001)
REFORM White	0 188***	-0 179***	0 003*
	(0.003)	(0,000)	(0.000)
REFORM Asian	0.157***	-0 151***	0.000
	(0.001)	(0,000)	(0,000)
REFORM, Black	0.073***	-0.097***	0.016***
	(0.000)	(0.000)	(0.000)
REFORM, Mixed	0.151***	-0.136***	-0.001
	(0.003)	(0.000)	(0.000)
REFORM, Classes 1-2	0.166***	-0.154***	-0.009***
1011 01011, 0100000 1 2	(0.001)	(0.001)	(0.000)
REFORM. Classes 3-5	0.177***	-0.164***	-0.009***
	(0.000)	(0.000)	(0.000)
REFORM, Classes 6-8	0.192***	-0.187***	-0.002
,	(0.000)	(0.000)	(0.000)
Observations		2,683,200	

Table 9: The 2012 Reform's Effect on Students' Main Financial Source for Tuition Fees Across Sex, Ethnicity, and Socioeconomic Status

Notes: The dependent variable indicates whether the student used the respective source as the main financial source for tuition fees. Socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

6.2 Field of Study

Table 10 shows the 2012 reform's effect on students' choice of field of study, estimated separately by sex, ethnicity, and socioeconomic status. The magnitude of heterogeneity is small, but some patterns are worth noting. By sex and socioeconomic status, all groups appear to shift toward fields closer to STEM, with some groups being more responsive than others. Female students are generally more responsive than their male counterparts, and poorer students are more responsive than richer students. By ethnicity, however, there is no clear direction of shift, though whites are generally the least responsive.

Tables 11 and 12 show the estimates of the reform's effects on students' choice of field of study by employment rate and salary rankings, respectively. Similar patterns emerge: females are more responsive than males, poorer students are more responsive than richer students, and whites are the least responsive. The pattern is clearest with respect to the field's quartile of expected salary ranking. By sex and socioeconomic status, all groups shift toward fields in a higher quartile, but by ethnicity, only whites do so.

6.3 Dropout

Table 13 shows the 2012 reform's effects on students' probability of dropping out, estimated separately by sex, ethnicity, and socioeconomic status. Again, the magnitude of heterogeneity is small, and similar patterns emerge: females are more responsive than males, poorer students are more responsive than richer students, and whites are the least responsive. The heterogeneity between sexes and socioeconomic statuses is evident. The reform reduced the dropout probability for female students by 0.5 percentage points but had no effect on male students. Similarly, it reduced the dropout probability for the poorest students but not for the richest students. Unlike previous heterogeneity analyses, however, the reform affected all ethnicities similarly, reducing their probability of dropping out.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Medical	Biological	Physical	Engineering	g Social
	Sci.	Sci.	& Comp	& Archi-	Studies
			Sci.	tecture	
REFORM, Male	0.005^{*}	0.011^{*}	0.002	0.004^{*}	0.004^{***}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
REFORM , Female	0.017**	0.025**	0.010^{*}	-0.009***	0.008**
	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)
	, , , , , , , , , , , , , , , , , , ,		. ,	× ,	. ,
REFORM, White	0.016^{*}	0.018^{*}	0.008^{*}	-0.002	0.007^{***}
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)
REFORM, Asian	-0.019***	0.015^{**}	0.010**	-0.010**	0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM , Black	-0.009***	0.045^{***}	-0.003**	-0.037***	0.028***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Mixed	0.000	0.020**	-0.004**	0.003*	-0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
	, , , , , , , , , , , , , , , , , , ,		. ,	× ,	. ,
REFORM, Classes 1-2	0.012^{*}	0.006^{**}	0.003^{**}	-0.008**	0.006^{**}
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Classes 3-5	0.018*	0.016**	0.009**	-0.002**	0.009***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
REFORM, Classes 6-8	0.021*	0.008*	0.012**	-0.004***	0.015***
	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)
	. ,	· · ·	. ,	× /	. ,
Observations			$2,\!652,\!195$		

Table 10: The 2012 Reform's Effect on Students' Choice of Field of Study Across Sex, Ethnicity, and Socioeconomic Status

Notes: The dependent variable indicates whether the student selected the respective field of study. Socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

	(6)	(7)	(8)	(9)	(10)
VARIABLES	Law	Business	Humanitie	s Fine Arts	Education
REFORM, Male	-0.001	0.025**	-0.016**	-0.013**	-0.003**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
REFORM , Female	-0.002	-0.001	-0.017*	-0.009**	-0.001
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
DEEODM WILL	0.000	0.019**	0.001**	0.010**	0.000**
REFORM, White	0.000	0.013^{++}	-0.021	-0.012	-0.006***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
REFORM, Asian	-0.003*	0.020^{***}	0.008^{***}	-0.008***	0.007^{***}
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Black	-0.021***	0.019^{***}	-0.012***	-0.011***	0.014^{***}
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Mixed	-0.000	0.003^{*}	0.001**	-0.003***	0.012***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM Classes 1-2	-0.003	0 013***	-0 022***	-0.007**	0 002***
	(0.000)	(0.010)	(0.022)	(0,000)	(0.002)
DEEODM Classes 2 5	(0.001)	(0.000)	0.000)	(0.000)	(0.000)
REFORM, Classes 5-5	-0.009	-0.000	-0.028	-0.009	-0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Classes 6-8	-0.008*	-0.009*	-0.018^{**}	-0.025^{**}	0.009^{**}
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Observations			$2\ 652\ 195$		
			-,002,100		

Table 10: The 2012 Reform's Effect on Students' Choice of Field of Study Across Sex, Ethnicity, and Socioeconomic Status (continued)

Notes: The dependent variable indicates whether the student selected the respective field of study. Socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

	(1)	(2)	(3)	(4)
VARIABLES	Top	Upper-	Lower-	Bottom
	quartile	middle	middle	quartile
		quartile	quartile	
REFORM, Male	0.002	-0.015**	0.035^{**}	-0.005
	(0.001)	(0.001)	(0.002)	(0.002)
REFORM, Female	0.017^{**}	-0.023**	0.026^{*}	0.001
	(0.001)	(0.000)	(0.003)	(0.002)
REFORM, White	0.010^{*}	-0.019*	0.030^{*}	0.001
	(0.002)	(0.002)	(0.003)	(0.003)
REFORM , Asian	-0.012***	-0.021^{***}	0.038^{***}	0.005^{*}
	(0.000)	(0.000)	(0.000)	(0.001)
REFORM, Black	0.005^{***}	-0.058***	0.089^{***}	-0.022***
	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Mixed	0.013**	-0.005**	0.029^{**}	-0.007**
	(0.000)	(0.000)	(0.001)	(0.000)
REFORM, Classes 1-2	0.014*	-0.022***	0.015**	-0.006*
	(0.001)	(0.000)	(0.000)	(0.001)
REFORM, Classes 3-5	0.016^{**}	-0.019^{***}	0.013^{**}	-0.008*
	(0.001)	(0.000)	(0.000)	(0.001)
REFORM, Classes 6-8	0.030^{**}	-0.035**	0.008^{***}	-0.002
	(0.002)	(0.001)	(0.000)	(0.001)
Observations		2 659	0 105	
O DOLL VALIDID		∠,002	2,100	

Table 11: The 2012 Reform's Effect on Students' Choice of Field of Study by Employment Rate Ranking and Across Sex, Ethnicity, and Socioeconomic Status

Notes: The dependent variable indicates whether the student selected a field of study within the respective quartile. Socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

	(1)	(2)	(3)	(4)
VARIABLES	Top	Upper-	Lower-	Bottom
	quartile	middle	middle	quartile
		quartile	quartile	
REFORM, Male	0.005^{**}	0.036^{***}	-0.015*	-0.008
	(0.000)	(0.000)	(0.002)	(0.001)
REFORM, Female	0.012^{**}	-0.007*	-0.008	0.011
	(0.001)	(0.001)	(0.002)	(0.002)
REFORM, White	0.012^{***}	0.027^{**}	-0.017	0.001
	(0.000)	(0.001)	(0.003)	(0.002)
REFORM, Asian	-0.028***	0.027***	0.007**	0.004*
	(0.000)	(0.000)	(0.001)	(0.000)
REFORM, Black	-0.031***	0.030***	-0.009**	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)
REFORM, Mixed	-0.001	0.001	0.018**	0.012**
	(0.000)	(0.001)	(0.000)	(0.001)
REFORM, Classes 1-2	0.004	0.021^{***}	-0.016**	-0.008
	(0.001)	(0.000)	(0.001)	(0.001)
REFORM, Classes 3-5	0.018**	0.010**	-0.025**	-0.002
	(0.001)	(0.000)	(0.001)	(0.001)
REFORM, Classes 6-8	0.024**	0.003	-0.002	-0.024**
	(0.002)	(0.001)	(0.002)	(0.002)
Observations		265	2 105	
		2,004	<u>_,_</u> 00	

Table 12: The 2012 Reform's Effect on Students' Choice of Field of Study by Expected Salary Ranking and Across Sex, Ethnicity, and Socioeconomic Status

Notes: The dependent variable indicates whether the student selected a field of study within the respective quartile. Socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

	(1)
VARIABLES	First year
REFORM, Male	0.001
	(0.000)
REFORM, Female	-0.005^{*}
	(0.000)
REFORM. White	-0.003*
	(0.000)
REFORM, Asian	-0.004***
,	(0.000)
REFORM, Black	-0.010***
	(0.000)
REFORM, Mixed	-0.005**
	(0.000)
REFORM. Classes 1-2	-0.003
	(0.001)
REFORM, Classes 3-5	-0.003*
,	(0.000)
REFORM, Classes 6-8	-0.005***
, ,	(0.000)
Observations	2,683,200

Table 13: The 2012 Reform's Effect on Students' Probability of Dropping Out Across Sex, Ethnicity, and Socioeconomic Status

Notes: The dependent variable indicates whether the student dropped out by the end of the respective year of study. Socioeconomic status is based on parental occupations, classified from highest to lowest as: (1) higher managerial and professional; (2) lower managerial and professional; (3) intermediate; (4) small employers and own account workers; (5) lower supervisory and technical; (6) semi-routine; (7) routine; and (8) long-term unemployed. The sample includes first-year entrants for each academic year, excluding 2011/12 and 2012/13. Observations are rounded to the nearest five in accordance with Jisc's disclosure control. Sample is clustered at the country level, with clustered standard errors reported in parentheses.

7 Discussion

The 2012 tuition fee reform's effects can be summarized as follows. The reform did not reduce overall enrollment, but significantly changed students' financing decisions. Students were less likely to self-fund and more likely to use government-backed loans to finance their education. This shift occurred similarly across sex, ethnicity, and socioeconomic status, though male, white, and lower socioeconomic-status students exhibited marginally stronger responses.

The reform had a modest impact on students' choice of field of study. After the reform, students were more likely to choose fields with higher expected salaries, most of which are STEM, but not necessarily those with higher employment rates. Female and lower socioeconomic-status students were somewhat more responsive to cost increases, while white students were the least responsive. Nevertheless, the differences were small.

Finally, the reform was associated with a marginal decline in dropout rates, with the effect most pronounced among female and lower socioeconomic-status students. Dropout rates also declined across all ethnic groups, though white students exhibited the smallest reduction. Again, the differences were small.

7.1 Students Are Willing to Pay £9,000 in Fees

The reform's lack of impact on enrollment suggests that students believed the sticker-price tuition fee of £9,000 was below the net expected returns to higher education, implying that the original fee of £3,375 was even further below these returns. Britton et al. (2020) provide evidence that this belief is largely correct. They estimate the lifetime earnings of university graduates and find that 80% achieve positive net returns.

A criticism could be made that higher fees might have increased university budgets, which were then redistributed as additional financial aid packages. However, evidence suggests that universities did not see significantly higher budgets.²⁵ **Table A3** shows the distribution of UK universities' annual in-

 $^{^{25}}$ This conclusion differs slightly from Belfield et al. (2017), as they consider only teaching

come: since the academic year 2012/13, government support was sharply reduced, tuition income rose substantially, yet total income's growth remained relatively stable. This aligns with the 2012 reform's aim to reduce government deficit spending and shift the financial burden onto students.

Another criticism is that the effective tuition fee might be lower than the sticker-price fee. If a student expects part of their loan to be written off, the effective price would be below £9,000. While this is a valid concern, I argue that students were more likely to anticipate fully repaying the sticker-price tuition fee. Supporting this argument were the widespread student protests that followed the 2012 reform's announcement.²⁶

7.2 Addressing Credit Constraints Could Enable Higher Fees

The shift from self-funding to using government loans suggests that, while students were willing to pay, many might have been unable to enroll without access to such loans. The provision of ICLs allows students to leverage their future earnings to finance their education. Furthermore, these loans do not appear to disadvantage students from lower-income families, as differences between lower- and higher-income groups were minimal. This provision, in turn, enabled the government to impose higher fees and utilize students' willingness to pay rather than subsidizing the costs.

Of course, addressing credit constraints does not guarantee that higher fees will be feasible, particularly if current fees exceed students' willingness to pay. What it does is provide the government with room to adjust subsidies and avoid oversubsidizing costs. For example, suppose that the current costs are £30,000. A student is willing to pay £12,000 but has a fund of only £6,000. If the government deems higher education worthwhile, it could address credit constraints and subsidize £18,000 instead of £24,000 outright.

income.

²⁶ For example, see Lewis, Vasagar, Williams, and Taylor, "Student Protest Over Fees Turns Violent," *The Guardian*, November 10, 2010. https://www.theguardian.com/education/ 2010/nov/10/student-protest-fees-violent.

7.3 Differential Pricing by Field of Study Could Be Viable

This study finds that students showed minimal responsiveness to increased fees when selecting their field of study, particularly with respect to the field's employment rate and expected salary. Nevertheless, students did respond to expected salary, suggesting that they have some knowledge of the returns associated with different fields of study.

Given these findings, differential pricing could be viable for further adjusting subsidies. Belfield et al. (2017) raise concerns that uniform tuition fees incentivize universities to prioritize low-cost programs (e.g., arts and humanities) over high-cost ones (e.g., sciences and engineering). Since students have some knowledge of the returns to each field of study, allowing tuition fees to reflect a subject's operating costs could help address these incentives without significantly affecting the supply of graduates. For instance, higher fees for engineering majors might have minimal impact on students' choices, as they recognize the high expected returns of these fields. Yong, Coelli, and Kabatek (2023) provide supporting evidence from Australia, where ICLs similar to those in the UK are used. They find that students' field of study is relatively inelastic to differential pricing. However, determining the extent of differentiation remains a policy question that depends on each country's context.

A possible criticism is that the small magnitude of students' responses might be due to limited number of seats available in each major. However, I argue that seat limits are unlikely to have significantly affected the results for the following reason. In the academic year 2015/16, the UK government removed these limitations, meaning that students in the 2015 and 2016 cohorts were not subject to such restrictions. As shown in **Figure 6**, the reform's strongest effect was 4.4 percentage points, only slightly higher than the 3.2 percentage points reported in **Table 7**. This suggests that seat limits did not significantly influence students' fields of study.

7.4 Sunk-Cost Effect Exists but Marginal

This study finds evidence of a sunk-cost effect on students' decisions to drop out, albeit relatively small. This result differs from much of the existing literature, which finds no evidence of such an effect. A probable reason is that the tuition increase examined here is significantly larger than in previous studies.²⁷ Nevertheless, despite the nearly $\pounds 6,000$ tuition increase, the effect remains marginal, so the general conclusion still holds: sunk costs play little role in students' educational decisions.

7.5 Policy Implications

The findings so far indicate that in the absence of credit constraints, tuition fees—and by extension, subsidies—can be adjusted more freely. As long as fees remain within students' willingness to pay, such adjustments are unlikely to significantly affect their educational outcomes. Put simply, addressing credit constraints can improve the efficiency of subsidy use.

Therefore, policymakers are encouraged to address students' credit constraints, as this could allow for higher tuition fees and reduce the subsidies required to support higher education. Providing ICLs is one way to do so, as it has been generally successful in alleviating credit constraints worldwide.²⁸ That said, it is not the only option; other mechanisms could be equally effective if implemented appropriately.

It is also worth noting that, in the absence of credit constraints, using tuition fees to influence educational outcomes, such as field of study and dropout rates, is not recommended. Recent policies have attempted this approach. For example, Australia's 2021 Job-ready Graduate Package differentiates fees to encourage certain fields of study, while India's 2019 fee increases at the Indian Institutes of Technology aimed to reduce dropout rates. In contexts without

²⁷ For example, Garibaldi et al. (2012), Ketel et al. (2016), Fricke (2018), and Bietenbeck et al. (2023) find no sunk-cost effect for annual tuition changes of 1,000 EUR, 150 EUR, 950 CHF, and 1,000 EUR, respectively.

²⁸ See, for example, Barr et al. (2019) and Britton, van der Erve, and Higgins (2019).

credit constraints, such as the UK, such policies are unlikely to be effective, given the minimal impact on these outcomes found in this study.

8 Conclusion

This study examines the effects of increasing tuition fees in the absence of credit constraints. I leverage the UK's provision of income-contingent loans, which fully cover tuition fees, to eliminate credit constraints. The 2012 tuition fee reform serves as a natural experiment, primarily raising tuition fees for English students across UK universities—from £3,375 to £9,000—while leaving fees largely unchanged for most Scottish students. To estimate the reform's impact, I employ a difference-in-differences strategy, using two proprietary administrative datasets from Jisc, which are individual-level and repeated cross-sectional, to compare English and Scottish students.

This study finds that, in the absence of credit constraints, increasing tuition fees from £3,375 to £9,000 had minimal impact on educational outcomes, including enrollment, field of study, and dropout rates. However, it significantly changed how students financed their education, shifting from self-funding to relying on the government's income-contingent loans. These findings are largely consistent across sex, ethnicity, and socioeconomic status, with some notable variations.

These findings suggest that addressing credit constraints could enable higher tuition fees without significantly harming students. Policymakers are therefore encouraged to address these constraints, as doing so would allow the government to better leverage students' willingness to pay, reduce subsidies for higher education, and improve subsidy efficiency. However, after addressing these constraints, using tuition fees to influence educational outcomes, such as field of study and dropout rates, is not recommended. This study finds that in such contexts, tuition fees have minimal impact on these outcomes, so such policies are unlikely to be effective.

	Before	e the 2012	Reform (200'	7–2011)	After the 2012 Reform (2012–201			
SUBJECT AREA	Employment rate		Expected salary (GBP)		Employment rate		Expected salary (GBP)	
	(1) English	(2) Scottish	(3) English	(4) Scottish	(5) English	(6) Scottish	(7) English	(8) Scottish
Medicine & dentistry	94.6 (1)	95.0(1)	29,121 (1)	30,373(1)	97.4 (1)	97.3(1)	29,224 (1)	29,675(1)
Subjects allied to medicine	81.3(3)	85.2(4)	22,050 (6)	21,780(7)	89.5(3)	90.1(4)	22,624 (7)	22,091 (8)
Biological sciences	70.2(12)	74.6(11)	17,675 (16)	18,370 (14)	76.3(14)	77.4 (13)	18,825 (16)	18,302(16)
Veterinary science	87.6(2)	86.6(3)	25,473 (2)	24,959 (3)	94.2(2)	95.1(2)	26,905(2)	$25,\!810$ (3)
Agriculture & related subjects	72.8(8)	78.3(7)	17,864 (15)	18,460(13)	79.6 (11)	79.9(11)	$19,352\ (15)$	19,606(13)
Physical sciences	67.6 (15)	70.9(14)	20,277 (10)	$19,\!685(11)$	75.3(15)	75.2(15)	21,574(10)	20,571(11)
Mathematical sciences	62.7(17)	66.9(16)	22,984 (4)	22,311(5)	74.5(16)	76.5(14)	$24,\!655\ (4)$	$23,\!173\ (6)$
Computer science	72.2(10)	74.1(12)	21,982(7)	20,981 (8)	81.1(9)	81.6(8)	23,837~(6)	$23,\!269(5)$
Engineering & technology	74.8(5)	79.2(5)	24,349(3)	25,828 (2)	82.3(8)	85.1~(6)	26,175(3)	$26,\!644\ (2)$
Architecture	73.4(7)	78.4(6)	22,355 (5)	$22,\!609(4)$	84.4(5)	85.6(5)	23,937 (5)	$23,\!953\ (4)$
Social studies	69.8(13)	73.5(13)	21,007 (8)	20,951 (9)	77.5 (12)	78.4(12)	22,119 (8)	$21,\!393~(9)$
Law	62.3(18)	59.2(18)	18,802(13)	$19,\!637\ (12)$	71.5(18)	63.1(18)	19,807 (13)	20,311 (12)
Business & administration	71.2 (11)	74.8(10)	20,288 (9)	19,729(10)	80.5 (10)	81.9(7)	21,922 (9)	20,965(10)
Mass communications	74.1(6)	77.9(8)	$16,\!685(17)$	16,340(18)	82.4(7)	80.2 (10)	17,881 (17)	17,745(17)
Languages	69.8(14)	69.9(15)	18,217 (14)	$17,\!372\ (15)$	76.6(13)	75.0(16)	19,404 (14)	18,979(14)
History & philosophy	65.6(16)	66.5(17)	19,076(12)	17,364(16)	72.9 (17)	71.5 (17)	20,286 (11)	18,796(15)
Creative arts & design	72.3(9)	76.4(9)	16,539(18)	$16,\!399\ (17)$	82.6(6)	81.5(9)	$17,\!655$ (18)	17,728 (18)
Education	81.1 (4)	92.1(2)	20,111 (11)	21,785~(6)	87.1 (4)	94.3(3)	20,060 (12)	22,236(7)
Observations	942,520	76,905	345,630	26,285	1,079,610	83,715	547,100	39,895

Table A1: Employment Rates and Expected Salaries by Subject Area Six Months Post-Graduation

Source: Jisc's Destination of Leavers from Higher Education. Employment rates are in percentages, and expected salaries are in GBP. The "combined" area and "further study only" samples are excluded. For mean salary, samples without reported salaries are excluded. Field rankings are in parentheses. Observations are rounded to the nearest five in accordance with Jisc's disclosure control.

	Groups							
SUBJECT AREA	STEM field		Employment rate		Expected salary			
	(1)	(2)	(3)	(4)	(5)	(6)		
	STEM	Non-STEM	High	Low	High	Low		
Medicine & dentistry	\checkmark		\checkmark		\checkmark			
Subjects allied to medicine	\checkmark		\checkmark		\checkmark			
Biological sciences	\checkmark			\checkmark		\checkmark		
Veterinary science	\checkmark		\checkmark		\checkmark			
Agriculture & related subjects	\checkmark			\checkmark		\checkmark		
Physical sciences	\checkmark			\checkmark		\checkmark		
Mathematical sciences	\checkmark			\checkmark	\checkmark			
Computer science	\checkmark		\checkmark		\checkmark			
Engineering & technology	\checkmark		\checkmark		\checkmark			
Architecture	\checkmark		\checkmark		\checkmark			
Social studies		\checkmark		\checkmark	\checkmark			
Law		\checkmark		\checkmark		\checkmark		
Business & administration		\checkmark		\checkmark	\checkmark			
Mass communications		\checkmark	\checkmark			\checkmark		
Languages		\checkmark		\checkmark		\checkmark		
History & philosophy		\checkmark		\checkmark		\checkmark		
Creative arts & design		\checkmark	\checkmark			\checkmark		
Education		\checkmark	\checkmark			\checkmark		

Table A2: Subject Area Categorizations

Source: Jisc's Destination of Leavers from Higher Education. The "combined" area is excluded. For employment rates and expected salaries, "high" subject areas refer to those ranked 1 through 9, i.e., the top half of **Table A1**.

ACADEMIC	Г	Teaching income			Investment	Other	Total	
YEAR	Government	Tuition fees	Total	income	income	income	income	
2006/07	5.4	5.4	10.8	5.1	0.4	5.0	21.3	
2000/07	(25)	(25)	(50)	(24)	(2)	(24)	(100)	
2007/08	5.6	6.3	11.9	5.5	0.5	5.5	23.4	
2007/08	(24)	(27)	(51)	(24)	(2)	(24)	(100)	
2008/00	5.8	7.3	13.1	6.0	0.4	5.8	25.3	
2008/03	(23)	(29)	(52)	(24)	(2)	(23)	(100)	
2000/10	5.8	8.3	14.1	6.3	0.2	6.2	26.8	
2009/10	(22)	(31)	(53)	(24)	(1)	(23)	(100)	
2010/11	5.7	9.0	14.7	6.4	0.2	6.3	27.6	
2010/11	(21)	(33)	(54)	(23)	(1)	(23)	(100)	
2011/12	5.4	9.7	15.1	6.4	0.3	6.1	27.9	
2011/12	(19)	(35)	(54)	(23)	(1)	(22)	(100)	
2012/12	4.2	11.7	15.9	6.7	0.3	6.2	29.1	
2012/13	(14)	(40)	(54)	(23)	(1)	(21)	(100)	
2012/14	3.2	13.7	16.9	7.1	0.3	6.4	30.7	
2013/14	(10)	(45)	(55)	(23)	(1)	(21)	(100)	
2014/15	2.4	15.6	18.0	7.9	0.4	6.9	33.2	
2014/10	(7)	(47)	(54)	(24)	(1)	(21)	(100)	
2015/16	2.1	16.8	18.9	7.9	0.3	7.6	34.7	
2013/10	(6)	(48)	(54)	(23)	(1)	(22)	(100)	
2016/17	2.1	17.7	19.8	7.9	0.3	7.7	35.7	
2016/17	(6)	(50)	(56)	(22)	(1)	(21)	(100)	

Table A3: Distribution of UK Universities' Annual Income

Source: Universities UK (2008-2018). Figures are in billions of £, with percentages of annual income in parentheses.

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