Discussion Paper Series

IZA DP No. 18547

April 2026

Levelling up? The Role of Need and Merit Based University Grants in Non-Selective Higher Education

Daniela Sonedda
University of Insubria and IZA@LISER

Marcello Matranga
University of Piemonte Orientale

Gianluigi Vernasca
University of Essex

Mariacristina Rossi
University of Turin

Francesco Figari
University of Piemonte Orientale

IZA@LISER NETWORK
ISSN: 2365-9793

IZA DP No. 18547 April 2026

Levelling up? The Role of Need and Merit Based University Grants in Non-Selective Higher Education*

Abstract

We study the interaction between need- and merit-based university grants in a non-selective higher education system. Using administrative data from a northern Italian university, we analyse how eligibility criteria affect enrolment, academic performance, and labour market outcomes. We document a trade-off between the two criteria, with merit requirements acting as endogenous screening. We rationalise this trade-off with a three-period model predicting that merit thresholds increase effort among students with higher expected ability but may discourage effort among students at risk of falling short, as losing the grant reduces expected utility. We support these predictions using a difference-in-differences estimator for multiple treatments, separately analysing students switching into and out of need- and merit-based eligibility. Our results show that grants target disadvantaged but academically strong students, generate perverse incentive effects that vary by gender, and fail to retain a substantial share of initial recipients.

JEL classification

I22, I23, J24

Keywords

university grants, educational outcomes, non selective higher education

Corresponding author

Daniela Sonedda

daniela.sonedda@uninsubria.it

* We are grateful to Massimiliano Bratti, Carlos Carrillo-Tudela, Thomas Cornelissen, Emilia Del Bono, Xavier D'Haultfoeuille, Emma Duchini, Marco Francesconi, Michele Pellizzari and Francesca Salvati for useful discussions and comments. We also benefited from participants in several seminars, workshops and conferences for constructive feedback. Daniela Sonedda gratefully acknowledges the mobility research funding provided by the University of Insubria. We acknowledge the CINECA award under the ISCRA initiative, for the availability of high-performance computing resources and support. Our gratitude also extends to InsIDE Lab, University of Insubria for providing access to their servers. We are especially grateful for the excellent IT support from Giovanni Riganti.

1 Introduction

According to the theory of human capital formation, individuals invest in education when the expected returns exceed the associated costs, including tuition fees, living expenses, and forgone earnings (Becker, 1964; Card, 1999, 2001). These costs can deter even highly talented individuals from disadvantaged backgrounds from pursuing higher education. As a result, governments increasingly rely on higher education subsidies to promote equal opportunities (Chetty et al., 2014) and to exploit the positive externalities associated with education (Sianesi and van Reenen, 2003). Reflecting these objectives, many countries have set explicit targets for tertiary education attainment.[1]

A common policy instrument used to expand access to higher education is financial aid. Governments support students through loans (Marx and Turner, 2019; Dearden, 2019), tuition fee exemptions (Dearden et al., 2011), and grants. Grants may be awarded on the basis of merit (Thistlethwaite and Campbell, 1960; Cornwell et al., 2006), financial need (Colas et al., 2021), or a combination of both (Angrist et al., 2023; Scott-Clayton and Schudde, 2020; Minaya et al., 2022). While combining need- and merit-based criteria is intended to target resources efficiently, it also introduces a fundamental policy trade-off. Merit requirements may exclude disadvantaged students who lack sufficient academic preparation, particularly in higher education systems where admission criteria do not screen students on academic readiness.

This trade-off is especially relevant in non-selective university systems, where tuition fees are relatively low and formal admission requirements are minimal or absent. In such contexts, access to university is broad, but academic preparedness varies substantially across students. Merit-based grant eligibility may therefore act as an ex post screening mechanism, potentially discouraging or excluding students who are financially eligible but struggle to meet academic performance thresholds. By contrast, in selective university systems, admission requirements already screen students on academic ability, and the primary policy concern is ensuring that liquidity constraints do not prevent talented students from enrolling.

In this paper, we examine a university grant policy that combines need- and merit-based eligibility criteria within a non-selective university system. We study the trade-off between these two criteria and analyse how it shapes students' educational choices, academic performance, and labour market behaviour. The policy aims, on the one hand, to promote equity by supporting students from disadvantaged backgrounds and, on the other hand, to ensure efficiency by conditioning financial support on academic progress. However, if some students lack the

[1] For example, EU countries are expected to reach a 45% graduate rate by 2030. In England, a 50% rate was achieved in 2017–2018, while Italy lags behind with a proportion of 30.6% in 2023. Interestingly, recent UK policy has moved away from a sole focus on university graduation—previously set at 50% of the cohort—towards a broader objective of engaging around two-thirds of young people in either higher education or apprenticeship programmes.

educational foundations required to meet merit thresholds, the policy may fail to achieve its equity objectives.

We structure the paper in two parts. First, we provide a descriptive analysis of the trade-off between need- and merit-based eligibility requirements, a feature that is likely to arise in all non-selective higher education systems. Our empirical setting is the Italian university system, which provides a particularly clear illustration of this issue. Italian universities do not impose formal admission requirements: secondary school grades are not considered, and entrance examinations—when present—do not restrict enrolment. In our data, drawn from an Italian university located in the northern part of the country, tuition fees are low, averaging 613 euros per year and reaching at most 1,600 euros even for students in the highest income bracket. Universities independently determine fee levels and may introduce competency tests that are typically informative rather than binding. While this institutional context is specific, the mechanisms we study are not.

We formalise these mechanisms using a simple theoretical model and provide reduced-form empirical evidence consistent with its predictions. We develop a three-period model in which students differ in ability and parental income, choose effort over time, and update beliefs about their academic ability. A subset of students is eligible for a need-based scholarship, conditional on meeting academic performance thresholds that may increase over time. The model predicts a trade-off between eligibility criteria: the scholarship increases effort among students with higher expected ability, but may discourage effort among students who are more likely to fall short of the merit requirement. For these students, the risk of losing the scholarship reduces expected future utility and lowers the marginal benefit of exerting effort, particularly when performance thresholds become more stringent over time.[2]

In the second part of the paper, we provide reduced-form estimates of the model's implications using a unique dataset that links three administrative sources through an anonymous student identifier. The main data source contains enrolment and academic records from an Italian university located in the northern region (Anagrafe Nazionale Studenti). Our outcomes of interest include enrolment probabilities, annual credit accumulation, and the likelihood of achieving an average grade of at least 25 out of 30. These data are merged with administrative records on university grants, allowing us to observe grant receipt and its duration. Eligibility depends jointly on a need-based criterion—measured by the ISEE income and wealth indicator—and a merit-based criterion, defined by minimum annual credit accumulation.

We further link these data to regional labour market records (Comunicazioni Obbligatorie), which track students' employment while enrolled at university. These records provide detailed

[2] In our institutional context, failure to meet the merit requirement may also trigger repayment of the scholarship. However, the trade-off would arise even in the absence of repayment through students' endogenous updating of beliefs about their own productivity. Similar mechanisms may operate in systems based on student loans rather than grants.

information on employment status, contract type, and job characteristics, allowing us to assess whether grants enable students to reduce labour supply and focus on their studies. We construct a balanced panel of four cohorts of students who enrolled between 2014 and 2017, were no older than 22 at first enrolment, and are followed for the full legal duration of the bachelor's degree programme.

To estimate reduced-form effects, we implement the difference-in-differences estimator proposed by de Chaisemartin and D'Haultfœuille (2023), which accommodates multiple treatments. This approach allows us to separately analyse students who switch into and out of need-based and merit-based eligibility while holding the other criterion fixed. With two eligibility criteria and two types of switchers, we estimate four first-difference regressions using different subsamples. We conduct placebo tests to assess whether estimated effects reflect causal impacts or endogenous self-selection. While we do not claim to identify fully causal effects, our design allows us to isolate the key mechanisms through which mixed grant policies operate in a non-selective setting.

Our results yield three main findings. First, the policy successfully targets disadvantaged but academically strong students, who exhibit higher enrolment persistence and lower dropout rates. Second, the policy generates incentive effects that differ by gender and by proximity to the merit threshold, including substitution between the quantity and quality of academic performance. Third, the policy fails to retain a substantial share of initial recipients: only 30% of students who receive the grant in the first year retain it throughout their studies. These patterns raise concerns about the effectiveness of mixed grant designs in achieving equity objectives in non-selective systems.

While mentoring and tutoring programmes may mitigate some challenges (Barrow et al., 2014), early investments in cognitive and non-cognitive skills increase later learning productivity, whereas late remediation tends to be costlier and less effective (Heckman and Cunha, 2007; Heckman and Kautz, 2012; OECD, 2025). Merit-based eligibility may therefore systematically disadvantage some students even when additional support is provided.

We contribute to the literature by providing new evidence on the interaction between need- and merit-based grants in a non-selective system. Existing studies focus primarily on recipients judged capable of meeting requirements (Angrist et al., 2023), whereas we show how merit criteria act as endogenous screening. We disentangle the effects of each eligibility requirement while holding the other constant, and situate our findings in the broader higher-education finance literature (Black, Turner and Denning, 2023; Black, Denning, Dettling, Goodman and Turner, 2023; Black, Denning and Rothstein, 2023; Dearden, 2019; Britton et al., 2019; Scott-Clayton and Schudde, 2020; Montalbán, 2022) and in the empirical literature on Italy (Modena et al., 2020; Graziosi et al., 2020; Minaya et al., 2022; Rattini, 2023). Although the Italian context provides a clear illustration of the trade-off, the mechanisms are relevant wherever academic preparedness, ability, and family resources are unevenly distributed and policymakers pursue targets for a high proportion of university graduates. In the absence of such objectives, the exclusion of less-prepared students is less consequential, and expansion may simply increase university access for less talented students from advantaged family backgrounds (Ichino et al., 2024).

The remainder of the paper is organised as follows. Section 2 describes the institutional context. Section 3 presents the data and provides a descriptive account of the trade-off between the two eligibility requirements. Section 4 outlines the theoretical model, while Section 5.1 details the empirical strategy. Section 5.2 reports the main findings. The paper concludes in Section 6.

2 Institutional Background

Public financial aid programmes for university students in Italy rely on grants rather than loans. Since 2003, while the central government defines the essential level of this service, regional governments have been responsible for its regulation and implementation. Across all Italian regions, grant allocation is based on two eligibility criteria: a means-tested requirement and a merit-based requirement. These criteria are assessed by regional administrative units, which collect students' applications and rank eligible applicants accordingly. Once the ranking is completed, grants are awarded in descending order until the available funds are exhausted. Although funding shortages may in principle occur—resulting in some eligible students not receiving a grant—such situations are not observed in our data, where all eligible applicants receive financial support.

As a nationwide rule, eligibility criteria for first-year students differ from those applied in subsequent years. In the first year, students facing potential financial hardship are eligible for grants. Financial hardship is assessed through income and wealth thresholds, reported in Panel (a) of Table 1 for the period 2014–2020.

Both indicators are computed on the basis of the student's household financial situation. The Indicatore della Situazione Economica Equivalente (ISEE) measures annual net household income, adjusted for rental expenses, plus 20 per cent of household wealth, and is then equivalised by household size. The ISPE indicator, by contrast, captures household financial and real assets, net of any outstanding mortgage on the primary residence, and is also equivalised. To qualify for a grant, students must satisfy both the income and the wealth thresholds. For example, a student whose ISEE lies below the relevant cutoff but whose ISPE exceeds the threshold would be deemed ineligible. In practice, however, such cases are rare, given that wealth already enters the ISEE calculation.

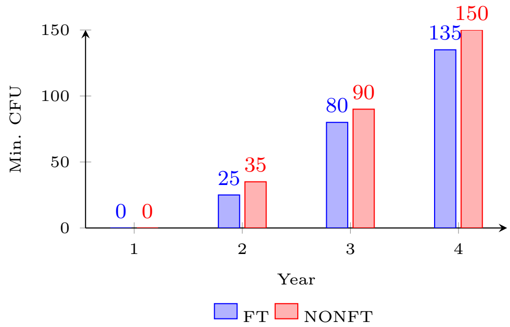
From the second year onwards, the financial eligibility criterion is complemented by a merit-based requirement, as shown in Panel (b) of Table 1. Merit standards are systematically higher

Table 1: Eligibility requirements

(a) Wealth Requirement

Year	ISEE	ISPE
2014	19596	33068
2015	20956	35364
2016	23000	50000
2017	23000	50000
2018	23253	50500
2019	23253	50500
2020	23626	51362

(b) Merit Requirement



Note: FT denotes first-time applicants, NONFT indicates non-first-year applicants.

for non-first-time applicants. For instance, while first-time applicants are required to obtain 25 university credits by August at the end of the first academic year, continuing students must earn 35 credits over the same period. As a result, even in the first year, the credit requirement may deter some financially eligible students from applying for the grant. This higher academic burden for grant recipients persists over time. While the rule may encourage new applications, it simultaneously raises the bar for incumbent beneficiaries, making it more difficult for them to retain eligibility.[3]

Grant amounts vary according to two ISEE cutoffs, with students below the lower threshold receiving a slightly higher transfer. Moreover, students within the same ISEE bracket do not necessarily receive identical amounts. Those residing within 45 minutes of the university campus receive a baseline grant, while students living between 45 and 90 minutes away are entitled to an additional allowance to cover commuting costs. Students residing at greater distances may receive subsidised accommodation in addition to a higher cash transfer. Our analysis does not exploit variation in grant size as in Rattini (2023), but instead focuses on the highest eligibility threshold, above which students are ineligible for support. Between 2015 and 2020, the nominal value of the grant remained broadly stable, averaging approximately 2,800 euros, with no substantial fluctuations. In addition to direct financial support, grant recipients are fully exempt from university tuition fees.[4]

[3]The difference in merit requirements between first-time and non-first-time applicants is a specific feature of the regional setting considered in this study. Other aspects of the system, although they may vary in the number of credits required, apply uniformly across universities nationwide.

[4]Since 2017, eligibility for the No-Tax Area has been automatically granted upon submission of ISEE certification for all students below the thresholds reported in Table 1a.

3 Descriptive Account of the trade-off between the two eligibility requirements

3.1 Data and sample selection

Our dataset combines three sources. The first consists of administrative records from a medium-sized university in Northern Italy, detailing students' demographics, high school background, university programme choices, academic performance, and changes in student status. We analyse three educational outcomes: enrolment (one if enrolled), annual CFU earned, and an indicator equal to one if average exam grade exceeds 25.[5] Students are formally expected to earn 60 CFU per year and graduate with 180 CFU within three years, though in practice there is no strict time limit, and examinations may be retaken until passed.

Income and wealth data are captured through ISEE and ISPE, provided by INPS if students consent to full disclosure. Non-disclosing students are assigned to the highest income bracket and charged maximum tuition. In our sample, 23.03% report ISEE in all years, 42.17% in at least one year, and 34.8% never disclose. Non-disclosers are imputed an ISEE of 85,000 euros; missing values for students with at least one observed ISEE are imputed using average year-on-year growth, capped at 85,000 euros. This produces a complete panel of observed or imputed ISEE values for each student-year.

The second source links students to scholarship applications and awards, including reasons for ineligibility. Two treatment indicators are defined: one equals one if ISEE is below the eligibility threshold and zero otherwise, and the other equals one if the student is subject to the university credit requirement due to grant status and zero otherwise. Given potential measurement error in ISEE, we do not employ a regression discontinuity design with two running variables, which would also complicate distinguishing switching into and out of eligibility. Nevertheless, suggestive RDD evidence around the ISEE threshold is presented in Online Appendix 1.1.

The third source consists of regional COB records, tracking all job flows since 2008. These allow reconstruction of students' labour market histories during university and from their first labour market entry.[6] Six outcomes—working, fixed-term employment, permanent employment, apprenticeship, part-time work, and atypical contracts—are computed as yearly averages of monthly binary indicators. Two continuous outcomes capture total days worked and the number of distinct jobs held per year.

Italian higher education follows one-tier and two-tier structures.[7] We focus on bachelor's degrees,

[5] Passing grades range from 18 to 30.

[6] Students are tracked even if employed outside the university region, provided they reside there.

[7] One-tier degrees (e.g., Medicine, Law) require at least five years; two-tier degrees allow graduation after three years, followed by a two-year master's programme.

which represent the first stage of the two-tier system and account for about 80% of enrolments. Programmes span six semesters; students graduating in the seventh are considered on time and exempt from additional fees.

We study four cohorts who enrol in higher education by age 22 within two years of high school completion.[8] Cohort sizes are 1,777, 2,299, 2,711, and 2,445, for a total of 9,234 students. Each student is observed over four years, yielding a balanced panel of 36,928 observations, with the fourth capturing the additional (seventh) semester. Using a balanced panel ensures constant cohort composition. About 90% reside in Northern Italy, 40% hold a Liceo diploma, and the average high school grade is 75/100.[9]

Descriptive statistics for educational and labour market outcomes are summarised here (full statistics in Online Appendix 1.2). Students earn on average 24 CFU per year, fewer than half of the expected 60. Only about 35% accumulate credits steadily, and fewer than 30% achieve an average grade above 25.[10] Employment rises from 6% in the first year to 17.8% in the fourth.[11] Average weeks worked increase from 19 to 28. Initially, atypical and fixed-term contracts dominate, but by the fourth year, permanent contracts account for 40% of total work weeks. Part-time employment remains 40% of days worked. Overall work experience grows from 145 days in the first year to 376 days in the fourth.

Finally, in the reduced-form analysis, we restrict the sample to students with ISEE values between 0 and 46,000 euros.[12]

3.2 Descriptive account of the trade-off between the two eligibility requirements

As discussed, need- and merit-based eligibility criteria can generate a policy trade-off: while need-based grants aim to support disadvantaged students, merit requirements may exclude those unable to meet academic thresholds. We begin by examining how this trade-off manifests in practice. Specifically, we investigate whether the regional government altered the allocation of public funds for university grants during our observation period, and whether the same students consistently benefit from the programme over time.

Table 2a shows that the proportion of students receiving grants remains stable at around six per cent, indicating no major policy changes. However, the stability of grant allocation masks

[8] Foreign students are excluded because ISEE-U accuracy cannot be verified.

[9] Grades range from 60 to 100.

[10] An average of 25 is substantially below the 105/110 graduation benchmark, relevant for many employment opportunities.

[11] In Online Appendix 1.2, we report the statistics conditional on employment.

[12] A narrower window is infeasible due to limited sample size; switching into and out of eligibility remains most likely near the threshold.

substantial differences between eligibility and actual receipt. Table 2b reports the proportion of students eligible for the grant each year. In the first year, 32% of students are eligible—far exceeding the six per cent who receive the grant—suggesting that many eligible students do not apply, potentially due to concerns about retaining the grant or anticipated difficulties in meeting future merit thresholds. In subsequent years, eligibility declines to 12% in year two and 8% in year three, remaining above the actual proportion of recipients. This reduction is not driven by changes in household income or wealth, which remain largely stable, but by students' inability to maintain the required credit load.

Table 2: Aid recipients and eligibility across university years

(a) Aid recipients

	Year 1	Year 2	Year 3	Year 4	Total
No	8698.00	8711.00	8706.00	8706.00	34821.00
	94.22	94.36	94.30	94.30	94.29
Yes	534.00	521.00	526.00	526.00	2107.00
	5.78	5.64	5.70	5.70	5.71
Total	9232.00	9232.00	9232.00	9232.00	36928.00
	100.00	100.00	100.00	100.00	100.00

(b) Aid eligibility

	Year 1	Year 2	Year 3	Year 4	Total
No	6203.00	8051.00	8459.00	8455.00	31168.00
	67.19	87.21	91.63	91.58	84.40
Yes	3029.00	1181.00	773.00	777.00	5760.00
	32.81	12.79	8.37	8.42	15.60
Total	9232.00	9232.00	9232.00	9232.00	36928.00
	100.00	100.00	100.00	100.00	100.00

An alternative explanation for the gap between eligibility and take-up is limited awareness of the programme, particularly in the first academic year. Table 3 presents suggestive evidence against this hypothesis. We conduct balancing tests on covariates included in our regression models. In columns (1)–(3) (Always grantees vs Leavers), we compare students who retain the grant until graduation (Treated) with those who lose it (Controls), all below the ISEE threshold. Columns (4)–(6) (Grantees in Year 1 vs Later Grantees) compare students receiving the grant in the first year (Treated) with those receiving it in later years (Controls), also all below the threshold. Using proximity to the university as a proxy for programme awareness, we include province fixed effects and indicators for residence in major provincial towns. Table 3 shows that treated and control groups are largely similar across observable characteristics. Differences mainly reflect high school grades or type of school attended, which are more likely to influence perceived academic ability than awareness of the grant. Treated groups tend to have higher grades and more frequently attend academically oriented schools (Licei).

While differences in observable characteristics appear minor, Tables 2a and 2b suggest that grant allocation involves selection on unobserved factors. Table 4 examines the composition of recipients over time. Although the total number of grants awarded remains stable, there is substantial turnover, with individuals moving in and out of eligibility. Online Appendix 1.3 presents similar balancing tests comparing students who switch in or out of each eligibility criterion while holding the other constant, confirming that selection is largely driven by unobservables rather than observable traits. Interestingly, students who retain the grant throughout all four years are exclusively female and all come from a Liceo, the most academically demanding type of high

Table 3: Balancing tests on covariates

	Always with grant vs Leavers			Grantees in year 1 vs later grantees		
	(1)	(2)	(3)	(4)	(5)	(6)
	Treated	Control	Diff	Control	Treated	Diff
Age	22.00	20.95	1.05	20.98	20.96	-0.02
	(0.00)	(1.49)	(0.86)	(1.47)	(1.51)	(0.05)
Female	1.00	0.68	0.32	0.71	0.68	-0.03*
	(0.00)	(0.46)	(0.27)	(0.45)	(0.47)	(0.02)
Province FE	8.67	7.02	1.65	6.97	7.09	0.12
	(0.58)	(2.27)	(1.31)	(2.24)	(2.25)	(0.08)
Urban Areas	0.00	0.21	-0.21	0.23	0.24	0.01
	(0.00)	(0.41)	(0.24)	(0.42)	(0.43)	(0.02)
High School Grade	86.33	82.96	3.37	78.79	81.67	2.89***
	(8.02)	(10.98)	(6.35)	(10.58)	(11.05)	(0.39)
Type High School	1.00	2.26	-1.26*	2.19	2.29	0.10**
	(0.00)	(1.24)	(0.72)	(1.21)	(1.23)	(0.04)

Notes: Always Grantees vs Leavers: balancing test between those who will maintain the grant till the graduation and those who will lose (always below the ISEE threshold) Grantees in year 1 vs later grantees: balancing test between those who earn it in the first year and those who will earn it in subsequent years (always below the ISEE threshold)

school in Italy.

These dynamics directly illustrate the trade-off between need- and merit-based eligibility. In a non-selective university system, while financial need defines the potential pool of beneficiaries, merit requirements constrain actual grant receipt. Only 6.15% of switchers exit due to failing the wealth requirement; the remainder fail to maintain sufficient credits. Thus, the merit component limits the number of students who can benefit from the programme, even among those who are financially eligible, highlighting the tension central to our analysis.

Table 4: Scholarship dynamics

	Year 1	Year 2	Year 3	Year 4
Switchers-in	534	267	169	69
Stable in two consecutive years	0	254	355	457
Switchers-out	0	280	166	67
Total	534	521	524	526

4 Model Overview and Key Implications

This section provides a brief overview of the model and discusses its main implications. A full description of the model, together with all derivations is presented in Online Appendix Section 2.

4.1 Model Overview

We consider a three-period model in which students enrolled in a university degree choose effort over time and update their beliefs about their academic ability. Students differ in ability and parental income. A subset of students is eligible for a need-based scholarship, which is awarded conditional on meeting minimum academic performance thresholds that may increase over time.

In each period t, academic performance depends on effort and ability and is observed with noise. Students update their beliefs about ability using observed performance and choose effort to maximise expected utility, taking into account effort costs, adjustment costs across periods, the possibility of dropping out, and the risk of losing the scholarship. Retaining the scholarship yields both current and future financial benefits, while losing it implies the loss of future payments and, in some cases, repayment obligations.

Effort choices are characterised by a first-order condition that can be written as:

$$\bar{s}_{E,e}(\hat{\theta}_t, e_t) - c'(e_t) - \psi(e_t - e_{t-1}) + (1 - \bar{d}_t)\left[\underbrace{\frac{\partial \Pi_t}{\partial e_t}\Delta V_{t+1}}_{\text{threshold (retention) channel}} + \underbrace{\kappa_t\, \mathcal{V}'_{t+1}}_{\text{learning channel}}\right] - \frac{\partial \bar{d}_t}{\partial e_t}\,\mathbb{E}[V_{t+1}] = 0, \tag{1}$$

where $\hat{\theta}_t$ denotes the posterior belief about ability, e_t denotes effort, Π_t is the probability of meeting the academic threshold, $\bar{d}_t$ is the expected dropout probability and ΔV_{t+1} is the difference in value functions between retaining and losing the scholarship. The term $\bar{s}_{E,e}(\cdot)$ denotes the immediate marginal gain in expected academic performance from effort. The term $-c'(e_t)$ is the marginal private cost of effort while $\psi(e_t - e_{t-1})$ captures adjustment costs (absent in the first period). The term κ_t measures how effort affects next period's beliefs through the noisy signal and $\mathcal{V}'$ represents the expected sensitivity of the value function to belief. Finally, the last term in (1) reflects the effect of effort on reducing the probability of dropping out or losing the scholarship and the associated expected loss in the value function.

Equation (1) highlights two key mechanisms through which scholarships affect effort. The *threshold (retention) channel* captures incentives to meet academic requirements in order to retain the scholarship. The *learning channel* reflects how effort affects information about ability, updating beliefs and thereby shaping future expected utility.

Figure 1 provides a stylised illustration of how these two channels interact to generate heterogeneous effort responses across students with different beliefs about ability. The figure is purely illustrative and does not represent a quantitative prediction of the model.

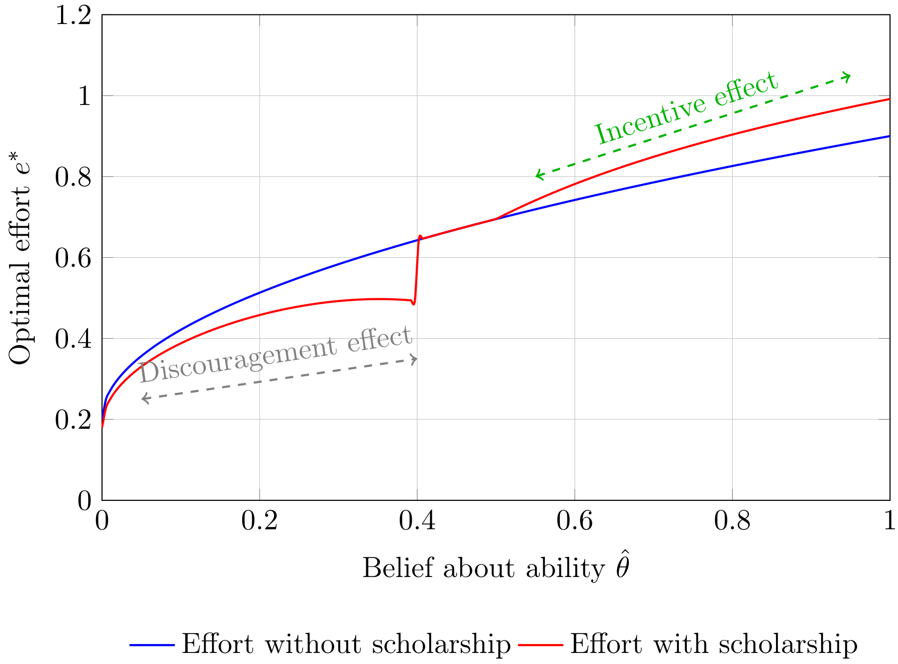


Figure 1: Nonlinear effects of scholarships on effort: the incentive effect for high-belief students (green) and the belief-driven discouragement for low ability students (grey). Baseline effort is assumed concave to highlight diminishing returns.

4.2 Key Implications

Scholarships and Effort. The model predicts heterogeneous effects of scholarships on student effort. For students who expect a high probability of meeting academic requirements, the scholarship increases the marginal return to effort through both channels in (1). First, higher effort raises the likelihood of retaining the scholarship, which is particularly valuable when the value function gap ΔV_{t+1} is large. Second, effort improves academic performance and leads to more favourable belief updates, increasing expected future utility. As a result, students with strong beliefs about their ability exert more effort when holding a scholarship. These students correspond to those who retain the scholarship throughout the degree or successfully obtain it at a later stage. For students with low expected probabilities of meeting academic thresholds, the scholarship may instead reduce effort. As beliefs about ability are revised downwards, the expected gains from retention decline and the threshold channel weakens. At the same time, unfavourable belief updates lower future expected utility, dampening incentives through the learning channel. Consequently, the marginal benefit of effort falls, and some students optimally exert less effort when holding a scholarship, making them more likely to lose it early. This belief-driven discouragement effect is illustrated by the lower segment of Figure 1.

Academic Thresholds and Effort. The model also implies non-monotonic responses to changes in academic thresholds. An increase in the performance requirement affects effort incentives through its impact on the retention probability Π_t and the associated value functions. For students close to the threshold, higher requirements increase the stakes of scholarship retention. Since effort remains effective in raising the probability of meeting the requirement, the threshold channel strengthens and effort increases. For students whose beliefs place them far below the threshold, higher requirements substantially reduce the probability of retaining the scholarship regardless of effort. Expected value functions decline, weakening incentives through both the threshold and learning channels. In this case, effort falls and some students may optimally choose not to apply for the scholarship despite being eligible.

Summary. Overall, the model implies that performance-based scholarships generate strong incentives for students who expect to succeed, but may discourage effort and participation among students whose beliefs imply a low likelihood of meeting academic requirements. Academic thresholds play a central role in shaping these incentives, amplifying effort among high-belief students while generating belief-driven discouragement effects among others. This mechanism is general and does not rely on institutional features such as repayment obligations, making the model broadly applicable across different higher education systems.

5 Reduced form analysis

5.1 Methodology

Given the presence of many switchers in and out of treatment, we apply the estimator proposed by de Chaisemartin and D'Haultfœuille (2023) in a static difference-in-differences setting with two treatments. In our context, the first treatment pertains to the ISEE eligibility requirement, while the second treatment concerns the university credit constraint required to retain the grant. With binary treatments, this estimator extends the approach developed in de Chaisemartin and D'Haultfœuille (2020), which compares the outcomes of students switching into or out of treatment between academic years $t-1$ and t with those of students whose treatment status remains unchanged:

$$DID_M = \sigma^S = E\left[\frac{1}{N_S}\sum_{(i,t):Z_{i,t}\neq Z_{i,t-1}} N_{i,t}\left[Y_{i,t}(1) - Y_{i,t}(0)\right]\right]. \tag{2}$$

Here, N_S denotes the total number of switching units, so that the weights correspond to the switchers' shares in each academic year.

The estimator DID_M, defined in Equation 2, identifies the parameter σ^S as a weighted average across all academic years t of two types of difference-in-differences parameters. First, the parameter denoted DID_+ contrasts the outcomes of students i who transition into treatment between $t-1$ and t with those of students who remain untreated in both periods. We refer to this switching group as the "joiners". The identifying assumption is that, in the absence of treatment, the outcomes of joiners would have evolved in parallel with those of the group untreated in both periods. This parallel trends assumption rests on the untreated potential outcome $Y_{i,t}(0)$.

Second, the parameter DID_- compares the evolution of outcomes from $t-1$ to t for students treated in both periods with that of students transitioning out of treatment, referred to as the "leavers". In this case, DID_- depends on a parallel trends assumption on the treated outcome $Y_{i,t}(1)$. If the leavers had maintained their treatment, their outcomes would have followed a trend parallel to that of students treated in both periods.

As students may switch into and out of treatment, treatment status is not an absorbing state. Consequently, a "no carryover" assumption is required, as discussed in Roth et al. (2023). This assumption implies that potential outcomes depend only on current treatment status and not on the entire treatment history. In our context, this assumption appears plausible. Satisfying the ISEE eligibility requirement in one period does not guarantee eligibility in subsequent periods, and similarly, having met the university credit requirement in the past does not ensure its fulfilment in the future.

The DID_M estimator can be extended to settings with multiple treatments. In this context, the DID_+ estimator compares outcome changes from $t-1$ to t for individuals adopting a specific treatment (i.e. switchers in), while holding all other treatments constant, with those of a control group whose treatment vector remains unchanged and coincides with that of the joiners in period $t-1$. Analogously, DID_- compares the outcome evolution of leavers (i.e. switchers out of a given treatment), whose other treatments do not change, with that of a control group whose treatment vector remains unchanged and equal to the leavers' status prior to switching.

Given our setting with two treatments and two types of switchers, we specify four regression models.

Joining the ISEE Threshold Without Changing the University Credit Requirements (Z_1)

For each academic year t, we estimate a linear regression in first differences within the subsample of students who move from above to below the ISEE threshold without any change in their university credit requirements, that is, without receiving the grant in either period. This group is compared with students who remain above the ISEE threshold and therefore fail both grant criteria in both periods.

$$\Delta y_{i,t} = c + \gamma \Delta Z_{1,i,t} + \boldsymbol{\theta}'\mathbf{X} + \varepsilon_{i,t}. \tag{3}$$

Here, Z_1 is a dummy variable equal to 1 if the student is below the ISEE threshold and 0 otherwise. The term $\Delta Z_{1,i,t}$ is positive and equal to 1 for joiners, and zero for the control group. The coefficient γ captures the differential evolution of outcomes for students who move below the ISEE threshold without obtaining the grant, relative to those who remain above the threshold and are ineligible throughout. This specification allows us to isolate the effect of being below the ISEE threshold. The vector $\mathbf{X}$ includes time dummies and predetermined covariates: age, gender, high school final grade, type of high school fixed effects, province fixed effects, and an indicator for residence in an urban area (defined as the capital of the province within the university's region) or in a rural area.

Leaving the ISEE Threshold Without Changing the University Credit Requirements (Z_2)

We follow an analogous approach for leavers of the ISEE threshold. Although Equation 4 is formally similar to Equation 3, it is estimated on a distinct sub-sample and differs crucially in the definition of $\Delta Z_{2,i,t}$, which takes the value -1 for leavers. The coefficient δ compares the evolution of outcomes for students who move from below ($Z_2 = 1$) to above ($Z_2 = 0$) the ISEE threshold without any change in university credit requirements.

$$\Delta y_{i,t} = d + \delta \Delta Z_{2,i,t} + \boldsymbol{\theta}'\mathbf{X} + \varepsilon_{i,t}. \tag{4}$$

These students do not receive the grant, even when eligible on the basis of ISEE. Their outcome evolution is compared with that of students who remain below the threshold without receiving the grant in both periods.

Joining the University Credit Requirement Without Changing the ISEE Eligibility Threshold (Z_3)

We follow the same procedure to estimate Equation 5 for each academic year and compute the parameter of interest as a weighted average of the year-specific estimates α.

$$\Delta y_{i,t} = a + \alpha \Delta Z_{3,i,t} + \boldsymbol{\theta}'\mathbf{X} + \varepsilon_{i,t}. \tag{5}$$

In this specification, $\Delta y_{i,t}$ denotes the change in educational and labour market outcomes. The variable Z_3 is a dummy equal to 1 if the student is subject to the university credit requirement in order to retain the grant and avoid repayment, and 0 otherwise. The term $\Delta Z_{3,i,t}$ is positive, indicating that joiners are those who move from not being subject to credit requirements (and hence not receiving the grant) in $t-1$ to being subject to them (and receiving the grant) in t, without any change in their ISEE eligibility. As only students below the ISEE threshold are eligible, both joiners and controls satisfy this criterion in both periods.

The outcome evolution of joiners is compared with that of students who do not change either their university credit requirements or their ISEE status, and who remain below the ISEE threshold without credit requirements in both periods.

Leaving the University Credit Requirement Without Changing the ISEE Eligibility Threshold (Z_4)

Using the same methodology, we estimate:

$$\Delta y_{i,t} = b + \beta \Delta Z_{4,i,t} + \boldsymbol{\theta}'\mathbf{X} + \varepsilon_{i,t}. \tag{6}$$

In Equation 6, $\Delta Z_{4,i,t}$ is negative and equal to -1, as leavers are students who, in period t, are no longer subject to credit requirements after losing the grant they held in $t-1$. Their ISEE eligibility remains unchanged, and they are below the threshold in both periods.

The outcome evolution of these students is compared with that of students who do not alter either their university credit requirements or their ISEE status, and who remain below the ISEE threshold while receiving the grant in both periods.

Placebo Tests

Following de Chaisemartin and D'Haultfœuille (2023), we implement placebo tests to assess the plausibility of a causal interpretation for each of the regression specifications described above. The placebo test consists of estimating each equation using the evolution of the outcome in the period preceding the switch, that is, from $t-2$ to $t-1$, for students in the corresponding treated and control groups. Intuitively, this test examines whether differences in outcome trends between switchers and controls were already present prior to treatment adoption or removal.

For expositional clarity, we describe the placebo test with reference to Equation 5, noting that the same procedure is applied to the remaining three equations. Specifically, we estimate the following specification:

$$\Delta y_{i,t-1} = a + \phi \Delta Z_{3,i,t} + \boldsymbol{\theta}'\mathbf{X} + \varepsilon_{i,t}. \tag{7}$$

The number of feasible placebo tests depends on data availability. In our dataset, each student cohort is observed for four academic years. This structure allows us to implement a placebo test based on the first lag of the outcome change, as in Equation 7, for students who switch treatment status in their third or fourth academic year.[13]

A causal interpretation of the parameter α in Equation 5 is warranted only if the placebo coefficient ϕ is not statistically different from zero. A statistically significant estimate of ϕ would indicate that joiners and the control group exhibited differential outcome trends even prior to the switch, thereby casting doubt on the identifying parallel trends assumption underlying the difference-in-differences design. While such a finding would weaken the causal interpretation of the estimated effect, it remains informative from a policy perspective, as it would suggest the presence of self-selection into the policy and help to clarify the scope and role of the grant.

5.2 Results

We first examine educational outcomes for the full sample, then explore gender heterogeneity, and finally assess labour market responses to distinguish incentive effects from financial distress.

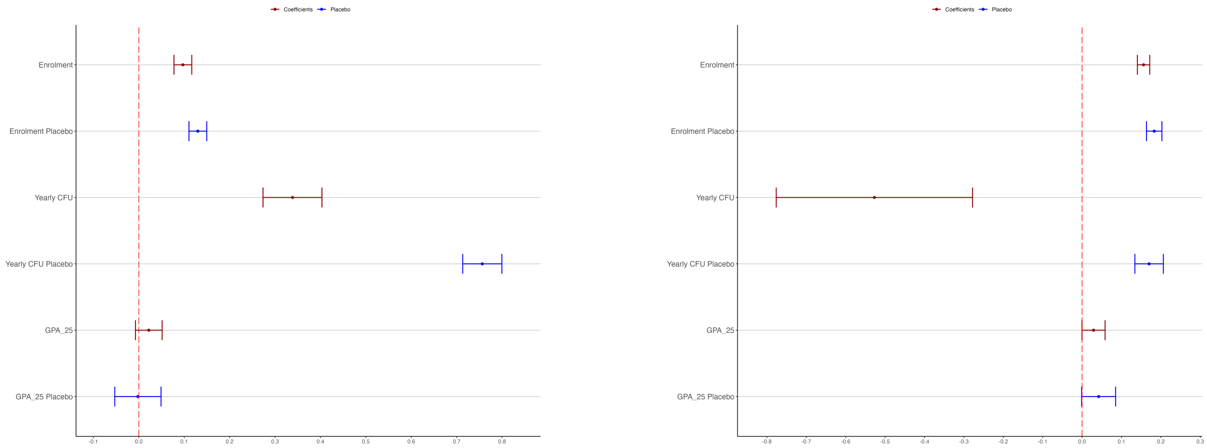
5.2.1 Educational outcomes: all sample

We focus on the subsample centred around the ISEE threshold and examine three educational outcomes: the probability of enrolment, the annual flow of university credits, and the probability of achieving a grade point average (GPA) above 25. Baseline estimates for joiners are in Figure 2, and for leavers in Figure 3. Each figure reports need-based (ISEE, left) and merit-based (credit requirement, right) effects, alongside placebo coefficients to assess pre-switch trends.

Joiners For students moving below the ISEE threshold (without changing credit requirements), we observe higher enrolment probability and annual credit flow, but no significant difference in GPA. Placebo estimates indicate that these students were already performing better one year prior to the switch, suggesting that the observed differences reflect pre-existing selection rather than the causal effect of need-based eligibility. This aligns with the idea that students farther from satisfying both requirements are more likely to drop out if performance deteriorates, consistent with Scott-Clayton and Schudde (2020).

When students join the credit requirement while remaining below the ISEE threshold, they exhibit a higher enrolment probability, a lower yearly credit flow, and no significant change in GPA relative to non-switchers, who are likewise below the ISEE threshold and thus financially eligible

[13] In addition, it is possible to conduct a placebo test using the second lag of the outcome change, restricting the analysis to students who switch in their fourth academic year. However, doing so leads to a substantial reduction in the number of observations.



(a) Need-based criterion (ISEE)

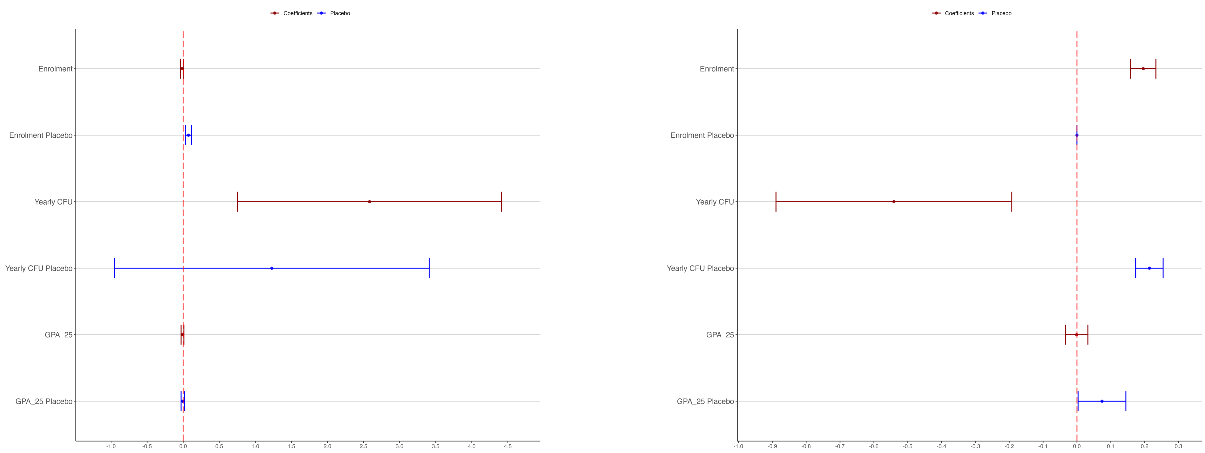
(b) Merit-based criterion (credits)

Figure 2: Joiners: Estimated effects on educational outcomes. Each point represents the coefficient for a given outcome: enrolment probability, yearly credit flow, and probability of GPA above 25. Horizontal lines indicate 95% confidence intervals. Red points and lines denote the DiD estimates for joiners, while blue points and lines show the placebo estimates one year prior to switching.

but don't satisfy the merit requirement. Placebo coefficients point to anticipatory behaviour, as future joiners were already more likely to be enrolled prior to switching. Once the grant is obtained, students appear to reallocate effort towards meeting the minimum credit threshold required for retention, generating perverse incentives in credit accumulation. This pattern is consistent with the findings of Rattini (2023), who documents a negative effect of additional financial aid on university credit production.

Leavers Students losing need-based eligibility exhibit lower enrolment relative to students who remain below the ISEE threshold, suggesting discouragement effects. For merit-based leavers, comparisons with students who retain the grant indicate that leavers exhibit a slightly higher yearly credit flow, but lower GPA and lower enrolment, reflecting a combination of selection and perverse incentives. To clarify why merit-based leavers can display a higher yearly credit flow, consider the following example. Suppose a student always satisfies the ISEE requirement but does not receive the grant in the first academic year, accumulating 30 credits. In the second year, the student becomes eligible for the grant by meeting the merit requirement (25 credits). To retain the grant in the third year, the student must accumulate 90 total credits by the end of the second year. If the student reaches 80 credits, their yearly credit flow in the second year is 50 credits (80–30), yet they lose the grant. Now consider a second student who receives the grant from the first year onwards. In our empirical design, such always-treated students can serve as controls for merit-based leavers unless they themselves switch out. Suppose this student earns 45 credits in the first year, retains the grant, and earns another 45 credits in the second year, retaining the grant again. Their yearly credit flow is therefore 45 credits (90–45), which is lower than that of the switcher-out student. This example illustrates how merit-based leavers may mechanically exhibit higher yearly credit accumulation, even though they fail to meet the cumulative requirement needed to retain the grant. At the same time, some switchers may become discouraged by their inability to maintain eligibility, contributing to a lower enrolment probability relative to the comparison group. By construction, both groups must have been enrolled in the academic year prior to the switch, as reflected both in the example and in the zero coefficients observed in the placebo regressions. Finally, this example highlights that targeting a minimum credit requirement is not necessarily optimal. The most efficient strategy for maintaining eligibility is to accumulate credits at a steady pace—above the sample average (24 credits per year) and not far below the expected yearly amount required to graduate on time (60 credits). For many students, sustaining such a pace may be difficult, contributing to the observed patterns of switching and attrition.

Overall, movements around the ISEE threshold primarily reflect selection and persistence, whereas merit requirements induce anticipatory effort and distortions in credit accumulation.



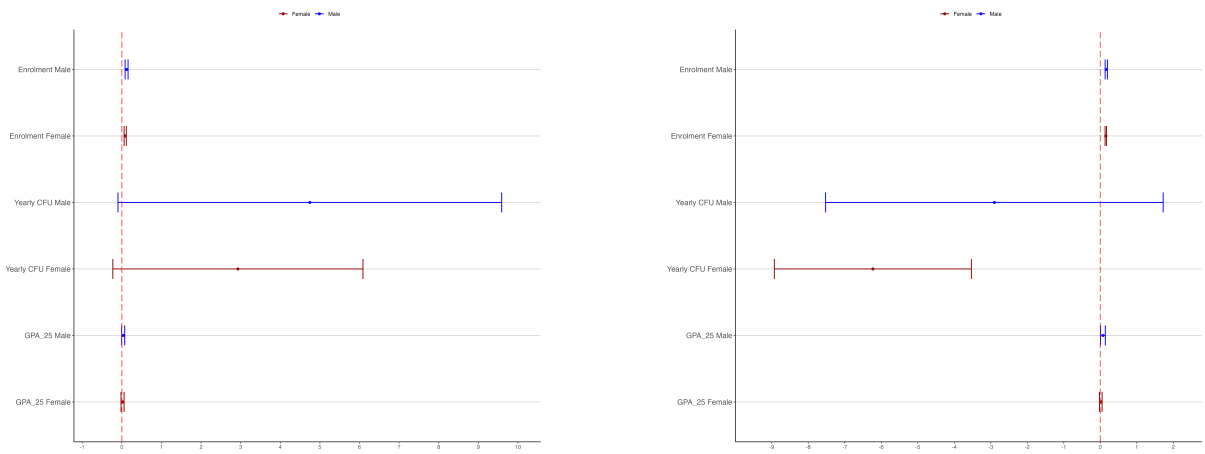
(a) Need-based criterion (ISEE) (b) Merit-based criterion (credits)

Figure 3: Leavers: Estimated effects on educational outcomes. Each point represents the coefficient for enrolment probability, yearly credit flow, and probability of GPA above 25. Horizontal lines indicate 95% confidence intervals. Red points and lines correspond to DiD estimates for leavers, and blue points and lines show the placebo estimates one year prior to switching.

5.2.2 Gender Heterogeneity

Extensive research has documented differences in behaviour, aspirations, and attitudes across genders, largely influenced by social norms and stereotypes (Cozzi et al., 2018; La Ferrara, 2019). For example, stereotypes perpetuated by teachers may erode women's self-confidence, thereby hampering their efforts to fully realise their potential in education (Mengel et al., 2018; Carlana, 2019). Consequently, the outcomes of a self-targeting policy could vary between women and men. To explore this, we replicate the analysis by gender (Figures 4 and 5).

Joiners Under the ISEE criterion, both female and male students transitioning below the threshold exhibit higher enrolment and credit flow than non-switchers, with placebo coefficients confirming pre-existing differences (Online Appendix 3). For the merit requirement, female joiners reduce credit accumulation despite higher enrolment, while male joiners experience smaller reductions, sometimes trading off GPA for credit quantity. These patterns indicate that perverse incentives disproportionately affect women.

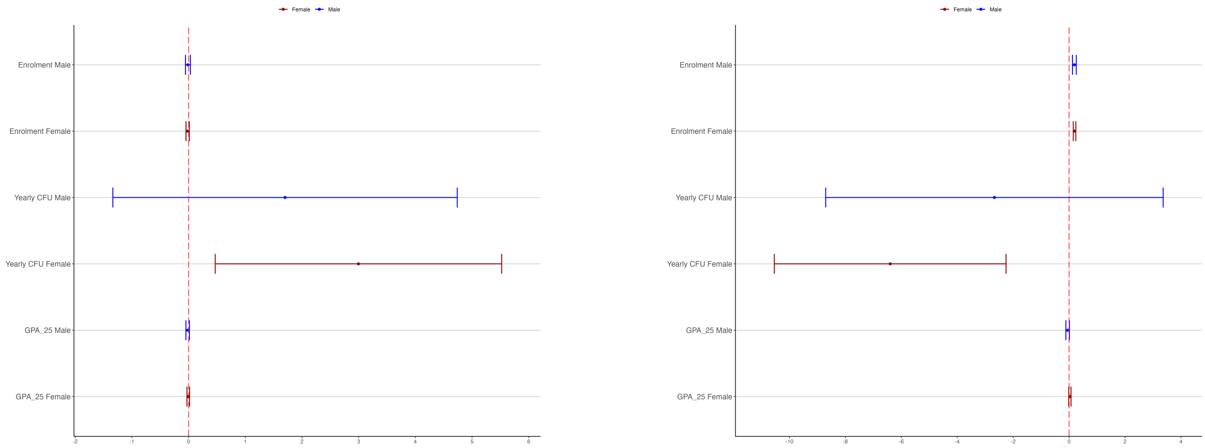


(a) Need-based criterion (ISEE) (b) Merit-based criterion (credits)

Figure 4: Joiners: Estimated effects on educational outcomes by gender. Dark red markers report estimates for female students, while blue markers report estimates for male students. Dots represent difference-in-differences coefficients, and horizontal lines denote 95% confidence intervals.

Leavers Female students losing need-based eligibility experience enrolment declines of similar magnitude to their male counterparts, consistent with discouragement effects operating for both genders. In the case of merit-based leavers, female students display more pronounced reductions in yearly credit accumulation, while GPA effects remain statistically insignificant. Male students, by contrast, exhibit smaller adjustments in credit flow, accompanied by modest but observable changes in GPA.

Overall, the graphical evidence indicates that gender differences in responses to grant loss are most evident in credit accumulation: female students appear more sensitive to perverse incentives and self-targeting mechanisms embedded in the merit requirement, whereas male students adjust performance margins primarily along GPA rather than credit intensity.



(a) Need-based criterion (ISEE)

(b) Merit-based criterion (credits)

Figure 5: Leavers: Estimated effects on educational outcomes by gender. Dark red markers report estimates for female students, while blue markers report estimates for male students. Dots represent difference-in-differences coefficients, and horizontal lines denote 95% confidence intervals.

5.2.3 Labour market outcomes: all sample

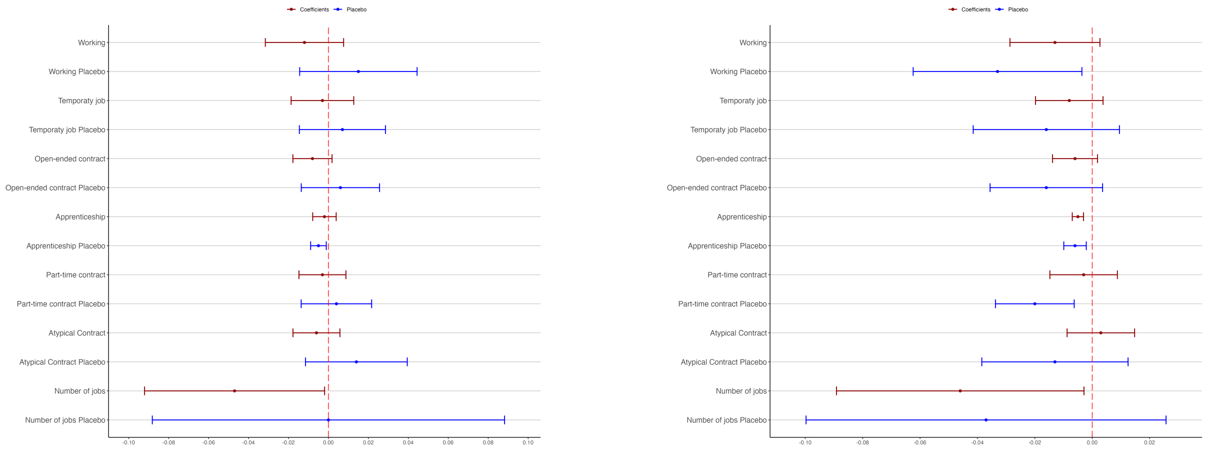
Labour market outcomes could capture financial distress during studies.[14] Figures 6 and 7 show effects for joiners and leavers, respectively, with ISEE effects on the left and merit effects on the right.

Joiners Students moving below the ISEE threshold show no significant change in labour activity, and placebo estimates indicate pre-existing differences. Joining the merit requirement slightly reduces apprenticeship and part-time work, suggesting a reallocation of effort toward studies rather than a response to financial need. The apprenticeship contract is utilised instead as an alternative form of human capital investment by those who are more likely to discontinue their university education (see also results on the educational outcomes).

Leavers Loss of need-based eligibility does not significantly alter labour outcomes. Merit-based leavers slightly increase labour market engagement, but differences are quantitatively modest.

Overall, this graphical evidence shows that movements around the ISEE threshold do not induce

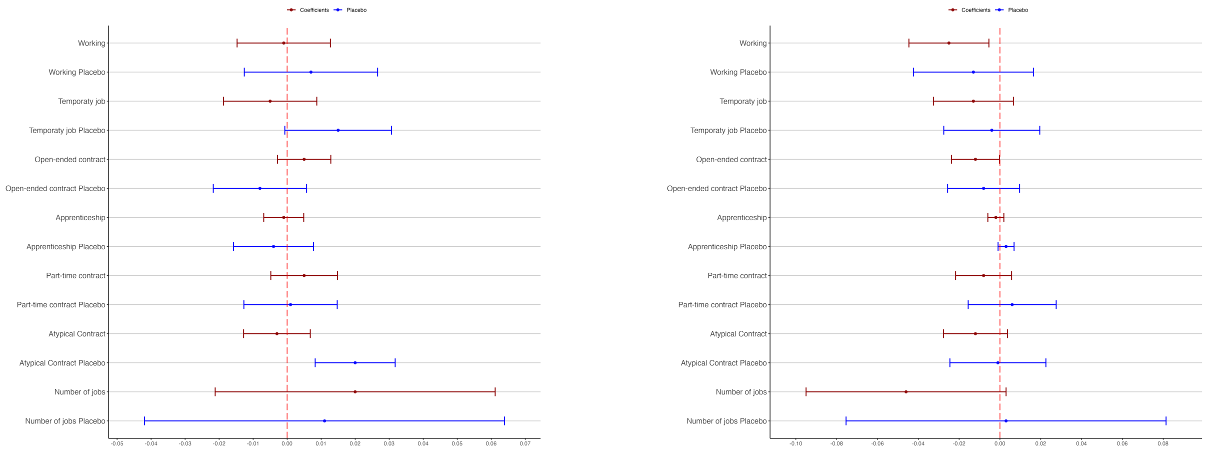
[14] Analysing labour outcomes post-graduation poses several challenges. Firstly, the youngest cohort, who commenced university in 2017, cannot be observed long after graduation. Secondly, for comparability, it is preferable to align observations relative to first enrolment rather than graduation, given that students graduate at different ages and some pursue a master's degree. Thirdly, the presence of switchers in and out of the grant complicates the estimation of dynamic models with two treatment dimensions. Due to limited sample sizes, it is not feasible to isolate all combinations of credit and ISEE switches for a fully dynamic analysis.



(a) Need-based criterion (ISEE)

(b) Merit-based criterion (credits)

Figure 6: Joiners: Estimated effects on labour market outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals. Placebo estimates are included for comparison.



(a) Need-based criterion (ISEE)

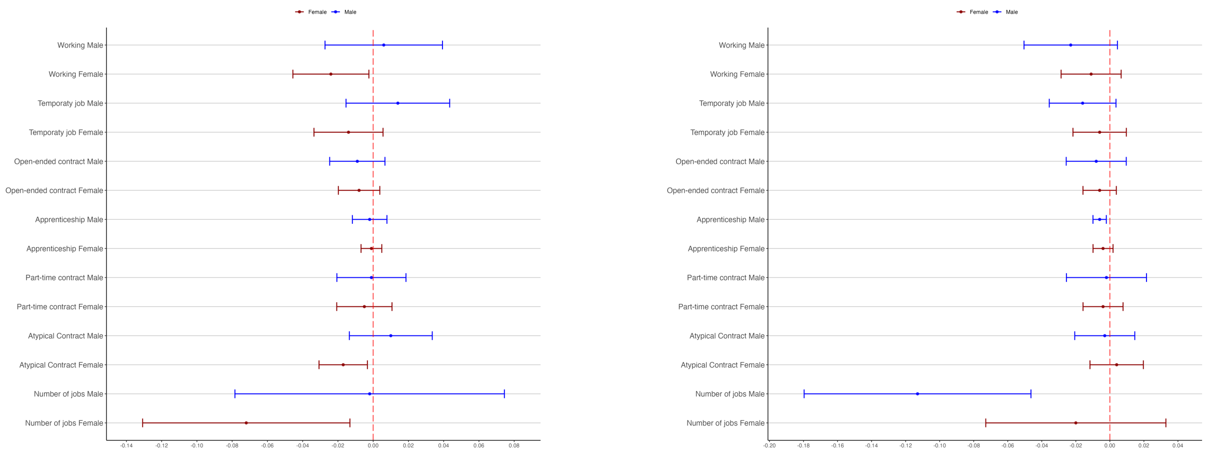
(b) Merit-based criterion (credits)

Figure 7: Leavers: Estimated effects on labour market outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals. Placebo estimates are included for comparison.

substantial changes in labour market outcomes. While labour supply could in principle reflect financial distress, the absence of systematic responses suggests that grant loss does not translate into increased labour participation during studies. By contrast, the merit requirement influences academic engagement for those who are able to meet it, reflecting a reallocation of effort towards credit accumulation rather than labour market activity.

5.2.4 Labour Market outcomes by gender

Figures 8 and 9 replicate the analysis by gender. Placebo coefficients, reported in Online Appendix 3, are used to assess the presence of pre-switch trends. For both women and men, there are no statistically significant differences in main labour market outcomes between switchers into the need requirement and non-switchers.



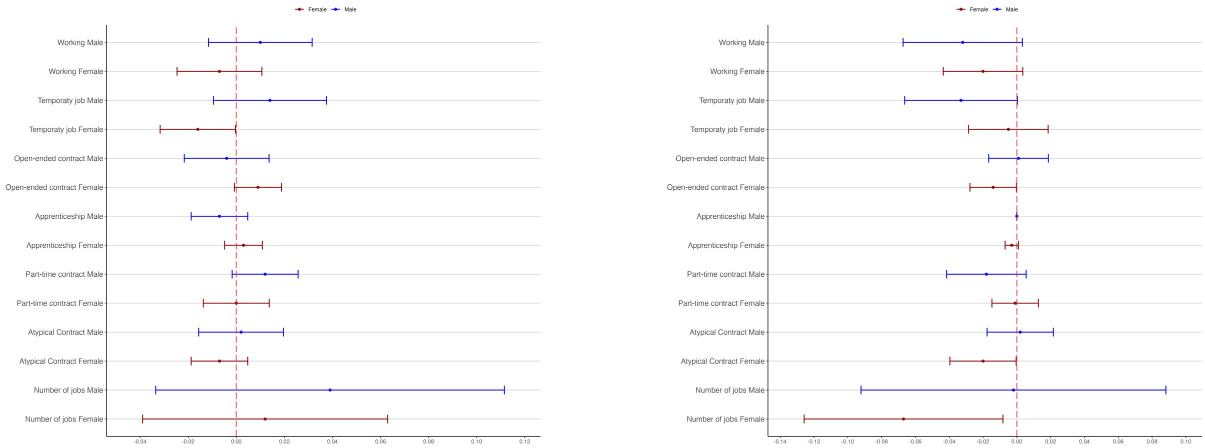
(a) Need-based criterion (ISEE)

(b) Merit-based criterion (credits)

Figure 8: Joiners: Estimated effects on labour market outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals.

Female leavers failing the merit requirement reallocate effort to permanent jobs, while males show smaller adjustments. Given the well-documented labour market penalties faced by women (e.g., Blundell et al., 2016; Casarico and Lattanzio, 2024), it is notable that women who stop receiving the grant after failing the credit requirement are more successful than men in securing permanent rather than temporary jobs. This pattern does not emerge one year earlier, when future leavers were still exposed to the merit requirement and received the grant. These findings suggest that, in contexts where child penalties (Adda et al., 2017; Kleven et al., 2019) are less relevant and where educational attainment is relatively high, gender gaps in employment outcomes may operate in favour of women, particularly among relatively highly educated individuals.

Summary Overall, the results highlight that need-based eligibility primarily affects enrolment through selection and persistence, with limited impact on credit accumulation or labour mar-



(a) Need-based criterion (ISEE)

(b) Merit-based criterion (credits)

Figure 9: Leavers: Estimated effects on labour market outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals.

ket participation. By contrast, merit-based requirements generate both anticipatory effort and distortions in study behaviour: students who meet the criteria often concentrate on minimum credit accumulation, sometimes at the expense of GPA, and adjust labour market engagement accordingly. Gender differences are most pronounced for merit-based incentives, with female students more sensitive to perverse effects on credit accumulation, while male students exhibit small trade-offs between GPA and credits. Placebo analyses confirm that pre-existing differences play an important role, consistent with self-targeting around the eligibility thresholds.

6 Conclusions

Education systems in many countries aim to provide equal opportunities in higher education, enabling students from all backgrounds to fulfil their potential and promoting social mobility. Need-based grants are a common tool to support disadvantaged students, but limited public resources often necessitate the inclusion of merit-based eligibility criteria. In this paper, we examine the trade-offs and policy implications of need- and merit-based university grants in a non-selective university system. We begin with a descriptive account of the trade-off between need- and merit-based eligibility, showing how merit criteria can act as endogenous screening and potentially exclude students despite financial eligibility. We then formalise these mechanisms in a three-period theoretical model, which predicts that merit requirements increase effort among students with higher expected ability but may discourage effort among those at risk of falling short, as losing the grant reduces expected utility. Finally, we provide empirical evidence consistent with these mechanisms using reduced-form estimates from a difference-in-differences design, separately analysing students switching into or out of need- and merit-based eligibility while holding the other criterion constant. Our findings indicate that the policy effectively targets talented students from disadvantaged backgrounds. At the same time, it generates perverse incentives, particularly among women, as the pressure to maintain the grant may lead students to prioritise credit accumulation over broader educational goals. Moreover, only a limited share of students retain the grant, raising questions about its overall effectiveness. Labour market evidence suggests that students do not reduce their studies to work in the absence of the grant. Without foundational cognitive and non-cognitive skills, not all students can fully benefit from the policy's levelling effect. Importantly, our evidence on apprenticeship contracts suggests that non-selective universities should be complemented by vocational education and training, providing alternative pathways for students who struggle to meet merit thresholds. Overall, the results highlight a central trade-off in non-selective systems: while financial support can enhance equity, merit requirements may systematically exclude students who lack adequate preparation. These mechanisms are relevant beyond Italy wherever academic preparedness, ability, and family resources are unevenly distributed and policymakers pursue high graduate targets. Finally, since some targeted students do benefit from the grants, we cannot rule out that, from a welfare perspective, the gains of the policy could outweigh its costs—including those arising from perverse incentives and the exclusion of less-prepared students—relative to a counterfactual highly selective system, in which these students might otherwise struggle to access university.

References

Adda, J., Dustmann, C. and Stevens, K. (2017). The career costs of children, *Journal of Political Economy* **125**(2): 293 – 337.

Angrist, J., Autor, D. and Pallais, A. (2023). Marginal effects of merit aid for low-income students, *The Quarterly Journal of Economics* **137**(2): 1039–1090.

Barrow, L., Richburg-Hayes, L., Rouse, C. E. and Brock, T. (2014). Paying for Performance: The Education Impacts of a Community College Scholarship Program for Low-Income Adults, *Journal of Labor Economics* **32**(3): 563–599.
URL: *https://www.journals.uchicago.edu/doi/10.1086/675229*

Becker, G. (1964). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, First Edition*, National Bureau of Economic Research, Inc.

Black, S. E., Denning, J. T., Dettling, L. J., Goodman, S. and Turner, L. J. (2023). Taking it to the limit: Effects of increased student loan availability on attainment, earnings, and financial well-being, *American Economic Review* **113**(12): 3357–3400.

Black, S. E., Denning, J. T. and Rothstein, J. (2023). Winners and losers? the effect of gaining and losing access to selective colleges on education and labor market outcomes, *American Economic Journal: Applied Economics* **15**(1): 26–67.

Black, S., Turner, L. and Denning, J. (2023). Plus or minus? the effect of graduate school loans on access, attainment, and prices, *NBER Working Papers 31291*, National Bureau of Economic Research, Inc.

Blundell, R., Costa Dias, M., Meghir, C. and Shaw, J. (2016). Female labor supply, human capital, and welfare reform, *Econometrica* **84**: 1705–1753.

Britton, J., Dearden, L., Shephard, N. and Vignoles, A. (2019). Is improving access to university enough? socio-economic gaps in the earnings of english graduates, *Oxford Bulletin of Economics and Statistics* **81**(2): 328–368.

Card, D. (1999). The causal effect of education on earnings, *in* O. Ashenfelter and D. Card (eds), *Handbook of Labor Economics*, 1 edn, Vol. 3, Part A, Elsevier, chapter 30, pp. 1801–1863.

Card, D. (2001). Estimating the return to schooling: Progress on some persistent econometric problems, *Econometrica* **69**(5): 1127–60.

Carlana, M. (2019). Implicit stereotypes: Evidence from teachers' gender bias, *The Quarterly Journal of Economics* **134**(3): 1163–1224.

Casarico, A. and Lattanzio, S. (2024). What firms do: Gender inequality in linked employer-employee data, *Journal of Labor Economics* .

Chetty, R., Hendren, N., Kline, P. and Saez, E. (2014). Where is the land of opportunity? the geography of intergenerational mobility in the united states, *The Quarterly Journal of Economics* **129**(4): 1553–1623.

Colas, M., Findeisen, S. and Sachs, D. (2021). Optimal need-based financial aid, *Journal of Political Economy* **129**(2): 492 – 533.

Cornwell, C., Mustard, D. and Sridhar, D. J. (2006). The enrollment effects of merit-based financial aid: Evidence from georgia's hope program, *Journal of Labor Economics* **24**(4): 761–786.

Cozzi, G., Francesconi, M., Lundberg, S., Mantovan, N. and Sauer, R. M. (2018). Advancing the economics of gender: New insights and a roadmap for the future, *European Economic Review* **109**: 1–8. Gender Differences in the Labor Market.

de Chaisemartin, C. and D'Haultfœuille, X. (2020). Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects, *American Economic Review* **110**(9): 2964–2996.
URL: *https://pubs.aeaweb.org/doi/10.1257/aer.20181169*

de Chaisemartin, C. and D'Haultfœuille, X. (2023). Two-way fixed effects and differences-in-differences estimators with several treatments, *Journal of Econometrics* **236**(2): S0304407623001963.

Dearden, L. (2019). Evaluating and designing student loan systems: An overview of empirical approaches, *Economics of Education Review* **71**(C): 49–64.

Dearden, L., Fitzsimons, E. and Wyness, G. (2011). The impact of tuition fees and support on university participation in the uk, *Cee discussion papers*, Centre for the Economics of Education, LSE.

Graziosi, G., Sneyers, E., Agasisti, T. and De Witte, K. (2020). Can grants affect student performance? evidence from five italian universities, *Journal of Higher Education Policy and Management* **43**: 1–25.

Heckman, J. and Cunha, F. (2007). The technology of skill formation, *American Economic Review* **97**(2): 31–47.

Heckman, J. and Kautz, T. (2012). Hard evidence on soft skills, *Labour Economics* **19**(4): 451–464.

Ichino, A., Rustichini, A. and Zanella, G. (2024). College, cognitive ability, and socioeconomic disadvantage: policy lessons from the uk in 1960-2004, *Mimeo*.

Kleven, H., Landais, C., Posch, J., Steinhauer, A. and Zweimuller, J. (2019). Child penalties across countries: Evidence and explanations, *AEA Papers and Proceedings* **109**: 122–26.

La Ferrara, E. (2019). Presidential Address: Aspirations, Social Norms, and Development, *Journal of the European Economic Association* **17**(6): 1687–1722.

Marx, B. and Turner, L. (2019). Student loan nudges: Experimental evidence on borrowing and educational attainment, *American Economic Journal: Economic Policy* **11**(2): 108–41.

Mengel, F., Sauermann, J. and Zölitz, U. (2018). Gender Bias in Teaching Evaluations, *Journal of the European Economic Association* **17**(2): 535–566.

Minaya, V., Agasisti, T. and Bratti, M. (2022). When need meets merit: The effect of increasing merit requirements in need-based student aid, *European Economic Review* **146**(C): S0014292122000927.

Modena, F., Rettore, E. and Tanzi, G. M. (2020). The effect of grants on university dropout rates: Evidence from the italian case, *Journal of Human Capital* **14**(3): 343 – 370.

Montalbán, J. (2022). Countering Moral Hazard in Higher Education: The Role of Performance Incentives in Need-Based Grants*, *The Economic Journal* **133**(649): 355–389.

OECD (2025). Skills that matter for success and well-being in adulthood: Evidence on adults' social and emotional skills from the 2023 survey of adult skills.

Rattini, V. (2023). The effects of financial aid on graduation and labor market outcomes: New evidence from matched education-labor data, *Economics of Education Review* **96**: 102444.

Roth, J., H.C., Sant'Anna, P., Bilinski, A. and Poe, J. (2023). What's trending in difference-in-differences? a synthesis of the recent econometrics literature, *Journal of Econometrics* **235**(2): 2218–2244.

Scott-Clayton, J. and Schudde, L. (2020). The Consequences of Performance Standards in Need-Based Aid: Evidence from Community Colleges, *Journal of Human Resources* **55**(4): 1105–1136.
URL: *http://jhr.uwpress.org/lookup/doi/10.3368/jhr.55.4.0717-8961R2*

Sianesi, B. and van Reenen, J. (2003). Education and economic growth: A review of the literature, *Journal of Economic Surveys* **17**(2): 157–200.

Thistlethwaite, D. L. and Campbell, D. T. (1960). Regression-discontinuity analysis: An alternative to the ex post facto experiment, *Journal of Educational Psychology* **51**(6): 309–317.

Online Appendix

Levelling up? The Role of Need and Merit-Based University Grants in Non-Selective Higher Education

Daniela Sonedda[a,e,f], Marcello Matranga[b], Gianluigi Vernasca[c], Maria Cristina Rossi[d], and Francesco Figari[b]

[a] University of Insubria
[b] University of Piemonte Orientale
[c] University of Essex
[d] University of Turin
[e] Centre for North South Economic Research (CRENoS), Cagliari, Italy
[f] LABORatorio Riccardo Revelli, Turin, Italy

Contents

1 Data description (Section 3)

1.1 Some insights using the Regression Discontinuity Design

We present a graphical analysis to assess the presence of discontinuities in educational outcomes at the ISEE eligibility threshold. Specifically, we examine enrolment, yearly accumulated credits, and average exam grades above and below the cutoff. For each outcome, we report local linear polynomial estimates using a triangular kernel. The optimal bandwidth, chosen symmetrically on both sides of the threshold, is selected according to a mean squared error (MSE) minimisation procedure. Figure 1 displays the results for the enrolment rate, Figure 2 for yearly credit accumulation, and Figure 3 for average exam grades.

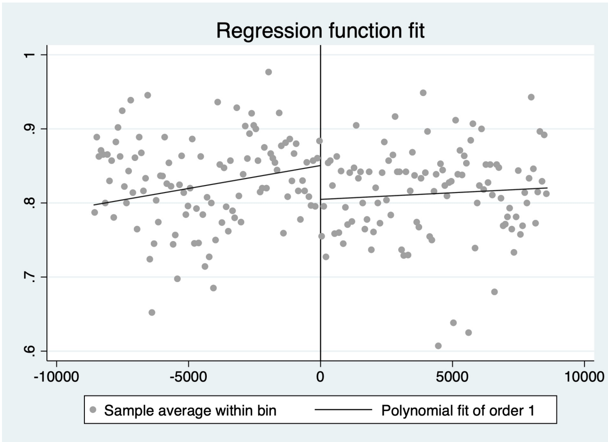


Figure 1: RDD enrolment - imputed ISEE

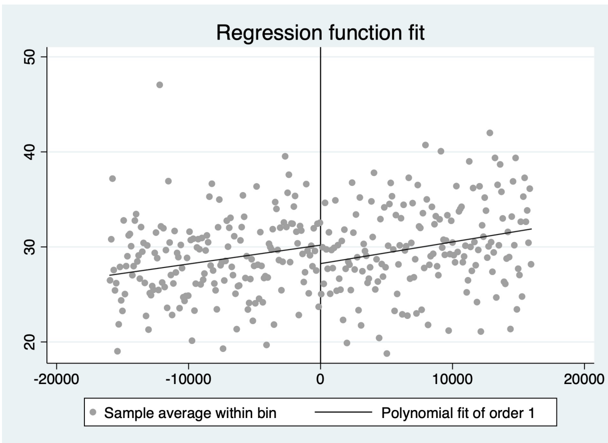


Figure 2: RDD credits - imputed ISEE

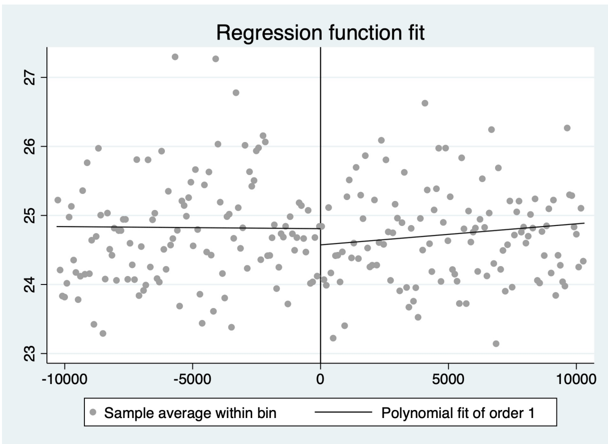


Figure 3: RDD average exams' grade - imputed ISEE

1.2 Descriptive Statistics

Table 1.1: Descriptive statistics by Cohorts

	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Age	19.40	19.36	19.33	19.35
	(0.79)	(0.81)	(0.79)	(0.83)
Female	0.62	0.63	0.62	0.62
	(0.48)	(0.48)	(0.48)	(0.49)
ISEE	41,250.25	45,172.26	50,833.46	49,718.26
	(31,864.22)	(32,515.51)	(33,150.77)	(32,961.15)
North	0.90	0.90	0.89	0.93
	(0.30)	(0.31)	(0.31)	(0.26)
Liceo	0.40	0.44	0.46	0.44
	(0.49)	(0.50)	(0.50)	(0.50)
High school grade	75.16	76.48	76.53	76.62
	(10.29)	(10.70)	(10.73)	(11.11)
N	1,777	2,299	2,711	2,445

Table 1.2: Share of active students who earned at least one the CFU in a year

	Year 1	Year 2	Year 3	Year 4	Total
No	2267.00	3539.00	3954.00	4383.00	14143.00
	24.56	38.33	42.83	47.48	38.30
Yes	6965.00	5693.00	5278.00	4849.00	22785.00
	75.44	61.67	57.17	52.52	61.70
Total	9232.00	9232.00	9232.00	9232.00	36928.00
	100.00	100.00	100.00	100.00	100.00

Table 1.3: Descriptive Statistics by Year: Credits, Degree, Final Grades

	Mean	SD	Min	Max	N
Year 1					
Flow CFU	19.99	17.56	0.00	98.00	9,232
Degree	0.00	0.00	0.00	0.00	9,232
Final Grade	.	.	.	.	0
Year 2					
Flow CFU	25.32	25.34	0.00	145.00	9,232
Degree	0.00	0.00	0.00	0.00	9,232
Final Grade	.	.	.	.	0
Year 3					
Flow CFU	31.39	32.61	0.00	144.00	9,232
Degree	0.05	0.21	0.00	1.00	9,232
Final Grade	104.30	5.68	87.00	111.00	444
Year 4					
Flow CFU	19.58	24.76	0.00	189.00	9,232
Degree	0.28	0.45	0.00	1.00	9,232
Final Grade	100.14	7.12	80.00	111.00	2,572

Table 1.4: Labour Outcomes Conditional on Employment by Year

	Mean	SD	Min	Max	N
Year 1					
Working	0.37	0.29	0.08	1.00	576
Fixed-term job	0.26	0.24	0.00	1.00	576
Open-ended job	0.11	0.27	0.00	1.00	576
Apprenticeship	0.05	0.18	0.00	1.00	576
Part-time job	0.15	0.26	0.00	1.00	576
Atypical contract	0.19	0.24	0.00	1.00	576
Work Experience	144.76	262.47	1.33	2,964.83	576
Number of jobs	1.56	1.05	1.00	8.17	576
Year 2					
Working	0.46	0.31	0.08	1.00	1,103
Fixed-term job	0.34	0.29	0.00	1.00	1,103
Open-ended job	0.12	0.29	0.00	1.00	1,103
Apprenticeship	0.06	0.20	0.00	1.00	1,103
Part-time job	0.19	0.29	0.00	1.00	1,103
Atypical contract	0.24	0.28	0.00	1.00	1,103
Work Experience	165.23	266.54	1.33	3,330.83	1,103
Number of jobs	1.62	1.13	0.00	9.58	1,103
Year 3					
Working	0.57	0.33	0.08	1.00	1,409
Fixed-term job	0.39	0.32	0.00	1.00	1,409
Open-ended job	0.18	0.35	0.00	1.00	1,409
Apprenticeship	0.08	0.25	0.00	1.00	1,409
Part-time job	0.23	0.34	0.00	1.00	1,409
Atypical contract	0.26	0.32	0.00	1.00	1,409
Work Experience	275.40	318.84	1.25	3,696.83	1,409
Number of jobs	2.03	1.48	0.00	12.33	1,409
Year 4					
Working	0.56	0.35	0.08	1.00	1,640
Fixed-term job	0.34	0.32	0.00	1.00	1,640
Open-ended job	0.22	0.39	0.00	1.00	1,640
Apprenticeship	0.09	0.27	0.00	1.00	1,640
Part-time job	0.24	0.35	0.00	1.00	1,640
Atypical contract	0.23	0.31	0.00	1.00	1,640
Work Experience	376.15	393.94	1.33	4,062.83	1,640
Number of jobs	2.31	1.78	0.00	14.00	1,640

1.3 Balancing test on covariates

Table 1.5: Switchers in need-based eligibility, with the merit requirement held fixed

	Control (Std. Dev.)	Treated (Std. Dev.	Diff (Std. Err.)
Age	21.318	21.060	0.258***
	1.075	1.079	0.061
Female	0.623	0.642	−0.019
	0.485	0.480	0.027
Province fixed effects	6.731	6.549	0.182
	2.368	2.326	0.134
Urban Area in the region	0.214	0.212	0.002
	0.410	0.409	0.023
High school grade	76.355	76.848	−0.493
	10.722	10.733	0.607
Type of High school	2.088	2.233	−0.145**
	1.215	1.236	0.069

Table 1.6: Switchers out need-based eligibility, with the merit requirement held fixed

	Control (Std. Dev.)	Treated (Std. Dev.	Diff (Std. Err.)
Age	21.566	21.521	-0.046
	(1.268)	(1.129)	(0.051)
Female	0.652	0.651	-0.001
	(0.476)	(0.477)	(0.019)
Province fixed effects	6.632	6.615	-0.017
	(2.298)	(2.383)	(0.094)
Urban Area in the region	0.258	0.214	-0.044**
	(0.438)	(0.411)	(0.018)
High school grade	74.954	75.689	0.736*
	(10.325)	(10.726)	(0.421)
Type of High school	2.272	2.201	-0.071
	(1.199)	(1.218)	(0.049)

Table 1.7: Switchers in merit-based eligibility, with the need requirement held fixed

	Control (Std. Dev.)	Treated (Std. Dev.	Diff (Std. Err.)
Age	21.566	20.958	0.609***
	1.268	1.117	0.048
Female	0.652	0.691	−0.038**
	0.476	0.463	0.018
Province fixed effects	6.632	6.655	−0.022
	2.298	2.277	0.089
Urban Area in the region	0.258	0.224	0.034**
	0.438	0.418	0.017
High school grade	74.954	77.930	−2.976***
	10.325	10.691	0.401
Type of High school	2.272	2.234	0.038
	1.199	1.219	0.047

Table 1.8: Switchers out merit-based eligibility, with the need requirement held fixed

	Control (Std. Dev.)	Treated (Std. Dev.	Diff (Std. Err.)
Age	21.656	21.133	-0.523***
	(1.245)	(1.252)	(0.070)
Female	0.710	0.692	-0.017
	(0.454)	(0.462)	(0.026)
Province fixed effects	6.860	7.240	0.381***
	(2.246)	(2.230)	(0.126)
Urban Area in the region	0.226	0.249	0.023
	(0.418)	(0.433)	(0.024)
High school grade	81.298	78.013	-3.285***
	(10.954)	(10.295)	(0.603)
Type of High school	2.256	2.199	-0.057
	(1.234)	(1.186)	(0.068)

2 Theoretical Model (Section 4)

We develop a discrete-time model to analyse students' choices of effort and scholarship dynamics during a university degree.[1] Students differ in ability θ and parental income I. Abilities θ are drawn from a distribution $F(\theta)$ with continuous support $[\underline{\theta}, \bar{\theta}]$, and parental income I is drawn from $G(I)$ with support $[\underline{I}, \bar{I}]$, assumed independent of θ. Each student is therefore characterised by a type (θ, I). The degree lasts three periods, $t = 1, 2, 3$. Students do not know their true ability but observe a noisy signal each period: $\hat{\theta}_1 = \theta + \varepsilon_1, \quad \varepsilon_1 \sim \mathcal{N}(0, \sigma_\varepsilon^2)$, and update beliefs via Bayes' rule: $\hat{\theta}_{t+1} = \mathbb{E}[\theta \mid s_1, \ldots, s_t]$.

Students choose effort e_t in each period. Effort is costly with $c(e_t), \quad c' > 0, \; c'' > 0$, and adjustment costs:$\frac{\psi}{2}(e_t - e_{t-1})^2 \quad (t = 2, 3), \quad \psi > 0$. Observed academic performance is $s_t = \bar{s}(\theta, e_t) + \eta_t, \quad \eta_t \sim \mathcal{N}(0, \sigma_\eta^2)$, with $\bar{s}(\theta, e_t)$ increasing and concave in both arguments. The dropout probability is $d_t(\theta, e_t)$, decreasing in both θ and e_t.

Students with parental income $I \leq I_t$ are eligible for a scholarship $\Gamma(I)$, with $\Gamma'(I) < 0$. Let $\pi = \Pr(I \leq I_t)$ be the fraction of eligible students. Eligible students choose effort and whether to apply for the scholarship. Let T denote tuition. The psychological cost of holding a scholarship is $p(\theta)$, with $p'(\theta) < 0$.

In period 1, students expected utility is $\mathbb{E}[U_1^s \mid \hat{\theta}_1, e_1] = \mathbb{E}[s_1 \mid \hat{\theta}_1, e_1] - c(e_1) - T + \Gamma(I) - \mathbb{E}[p(\theta) \mid \hat{\theta}_1]$ if they apply and receive the scholarship or $\mathbb{E}[U_1^{ns} \mid \hat{\theta}_1, e_1] = \mathbb{E}[s_1 \mid \hat{\theta}_1, e_1] - c(e_1) - T$ if they don't apply.

In periods 2 and 3, students who retained the scholarship have $\mathbb{E}[U_t^s \mid \hat{\theta}_t, e_t] = \mathbb{E}[s_t \mid \hat{\theta}_t, e_t] - c(e_t) - T + \Gamma(I) - \mathbb{E}[p(\theta) \mid \hat{\theta}_t] - \frac{\psi}{2}(e_t - e_{t-1})^2$ while students who lose the scholarship (or never applied) have $\mathbb{E}[U_t^{ls/ns} \mid \hat{\theta}_t, e_t] = \mathbb{E}[s_t \mid \hat{\theta}_t, e_t] - c(e_t) - T - \frac{\psi}{2}(e_t - e_{t-1})^2$.

Define $\Pi_t(\hat{\theta}_t, e_t; k_t) = \Pr(s_t \geq k_t \mid \hat{\theta}_t, e_t)$ as the probability of meeting the academic threshold. We can identify four main different student Types: those who apply in period 1 for the grant and meet all thresholds (i.e. the stable); those who apply in period 1 but fail the academic threshold k_1 and lose the scholarship in period 2 (i.e. the switchers out); those who do not apply in period 1, but apply in period 2, and meet the academic threshold (i.e. the switchers in (type 1)); and those who do not apply in period 1, but apply in period 2, and then fail the academic threshold k_2 (i.e. the switchers in (type 2)).

2.1 Application Decision and Optimal effort level

Eligible students apply in period 1 if the condition $\mathbb{E}[U_1^s \mid \hat{\theta}_1, e_1] \geq \mathbb{E}[U_1^{ns} \mid \hat{\theta}_1, e_1]$ is met. Let $\hat{\theta}_1^*(I)$ denote the belief at which a student is indifferent. Then the fraction applying is

$$P_1(I) = 1 - F_{\hat{\theta}_1}(\hat{\theta}_1^*(I)) \tag{1}$$

[1] The decision of whether to enrol is not modelled.

In period 2, the fraction applying conditional on not applying in period 1 and surviving is

$$P_2(I) = (1 - \bar{d}_1) F_{\hat{\theta}_1}(\hat{\theta}_1^*(I)) \left[1 - F_{\hat{\theta}_2}(\hat{\theta}_2^*(I))\right] \tag{2}$$

In each period, every eligible student chooses the optimal effort level. Let $V_t^{\cdot}(\hat{\theta}_t, e_{t-1}, I)$ denote the value function in period t, where the superscript indicates the scholarship status: s: student holds the scholarship in that period; ns: student does not hold the scholarship and does not have to repay it, ls: student lost the scholarship and must repay it.

Expectations over s_t and $\hat{\theta}_{t+1}$ are implicit in value functions. We can then define value functions for each period and each type.

Final Period (t=3) In the last period, the value functions are:

$$V_3^s(\hat{\theta}_3, e_2, I) = \max_{e_3} \left\{ \mathbb{E}[s_3 \mid \hat{\theta}_3, e_3] - c(e_3) - T + \Gamma(I) - \mathbb{E}[p(\theta) \mid \hat{\theta}_3] - \frac{\psi}{2}(e_3 - e_2)^2 \right\}, \tag{3}$$

$$V_3^{ns}(\hat{\theta}_3, e_2) = \max_{e_3} \left\{ \mathbb{E}[s_3 \mid \hat{\theta}_3, e_3] - c(e_3) - T - \frac{\psi}{2}(e_3 - e_2)^2 \right\}, \tag{4}$$

$$V_3^{ls}(\hat{\theta}_3, e_2, I) = \max_{e_3} \left\{ \mathbb{E}[s_3 \mid \hat{\theta}_3, e_3] - c(e_3) - T - \Gamma(I) - \frac{\psi}{2}(e_3 - e_2)^2 \right\}. \tag{5}$$

Penultimate Period (t=2) For students holding the scholarship in period 2 (Stable and Switchers In), the value function accounts for the value function in period 3:

$$\begin{aligned} V_2^s(\hat{\theta}_2, e_1, I) = \max_{e_2} \Big\{ & \mathbb{E}[s_2 \mid \hat{\theta}_2, e_2] - c(e_2) - T + \Gamma(I) - \mathbb{E}[p(\theta) \mid \hat{\theta}_2] - \frac{\psi}{2}(e_2 - e_1)^2 \\ & + (1 - \bar{d}_2)[\Pi_2 V_3^s + (1 - \Pi_2) V_3^{ls}] \Big\}. \end{aligned} \tag{6}$$

2.2 Optimal effort and comparative Statics

Each eligible student chooses effort e_t in each period to maximise expected utility, taking into account current costs and benefits, adjustment costs, the possibility of retaining a scholarship, and the effect of effort on learning about their own ability. The first-order condition (FOC) for optimal effort in period t is:

$$\bar{s}_{E,e}(\hat{\theta}_t, e_t) - c'(e_t) - \psi(e_t - e_{t-1}) + (1 - \bar{d}_t) \left[\underbrace{\frac{\partial \Pi_t}{\partial e_t} \Delta V_{t+1}}_{\text{threshold (retention) channel}} + \underbrace{\kappa_t \mathcal{V}'_{t+1}}_{\text{learning channel}} \right] - \frac{\partial \bar{d}_t}{\partial e_t} \mathbb{E}[V_{t+1}] = 0, \tag{7}$$

where $\bar{s}_{E,e} = \partial \mathbb{E}[s_t \mid \hat{\theta}_t, e_t]/\partial e_t$ is the marginal gain in expected academic performance from effort; $\psi(e_t - e_{t-1})$ represents the adjustment cost of changing effort across periods (absent in period 1); $\Delta V_{t+1} = V^s_{t+1} - V^{ls}_{t+1}$ captures the **threshold (retention) channel**, i.e., the value of meeting the scholarship requirement in the next period; $\kappa_t \mathcal{V}'_{t+1}$ captures the **learning channel**, i.e., how current effort affects updated beliefs about ability and thereby future expected utility; $\frac{\partial \bar{d}_t}{\partial e_t}\mathbb{E}[V_{t+1}]$ captures the effect of effort on reducing the switchers out probability and the associated expected loss in the value function.

The FOC highlights the key mechanisms. First, the return channel: effort increases expected academic performance ($\bar{s}_{E,e}$) but comes at a private cost $c'(e_t)$ and, for $t \geq 2$, an adjustment cost $\psi(e_t - e_{t-1})$. Second, the threshold (retention) channel: exerting more effort raises the probability Π_t of meeting the academic requirement for keeping the scholarship, which is valued through ΔV_{t+1}. This channel is stronger for students likely to retain the scholarship. Third, the learning channel: effort improves the precision of observed signals about ability, updating beliefs and increasing the value function via $\kappa_t \mathcal{V}'_{t+1}$. Fourth, **the switching out (dropping out) channel**: higher effort reduces the probability to lose the scholarship, thereby avoiding the expected loss in future utility $\mathbb{E}[V_{t+1}]$.

2.2.1 Effect of an increase in the amount of the scholarship$\Gamma(I)$

To understand how the optimal effort changes when students are eligible for a scholarship versus when they are not, we conduct a comparative static exercise in which the scholarship amount $\Gamma(I)$ increases as it is surelt the case when it goes from zero to a positive value. An increase in $\Gamma(I)$ raises the value function V^s and the expected future gain from retaining the scholarship, captured by ΔV_{t+1}. This affects students' optimal effort through two main channels. The first is the direct effect of a larger scholarship $\Gamma(I)$: Increasing the scholarship raises the value function V^s and the threshold gap ΔV_{t+1}, which strengthens the threshold channel and incentivises more effort for students likely to retain the scholarship (Stable students and Switchers In Type 1). The second is the belief-driven discouragement effect. For marginal students whose updated beliefs about their ability fall below the threshold, the threshold channel weakens. Effort is less rewarded through the retention mechanism, and the student may reduce effort. This captures a generalised discouragement effect that depends primarily on beliefs. As students update beliefs on their true ability downward, the future utility flows lowers and consequently the marginal benefit of exerting additional effort. Graph 4 visualises these two channels that create the trade-off between the two eligibility requirements. It is presented for illustrative purposes only, and no significance should be attributed to the numerical values shown.

2.2.2 Effect of raising the academic threshold k_t

Increasing the performance requirement k_t alters the optimal effort differently strengthen the results of the previous comparative static exercise. For students near the threshold, raising k_t increases $\frac{\partial \Pi_t}{\partial e_t}$, making effort more effective in improving the probability of meeting the requirement. This induces these students to exert more effort. For low-ability students far

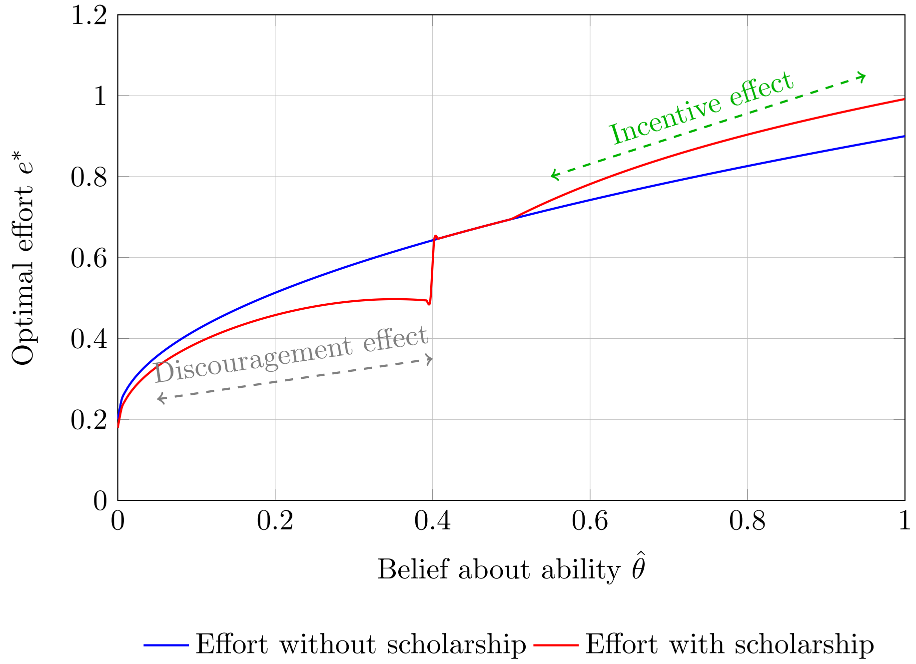


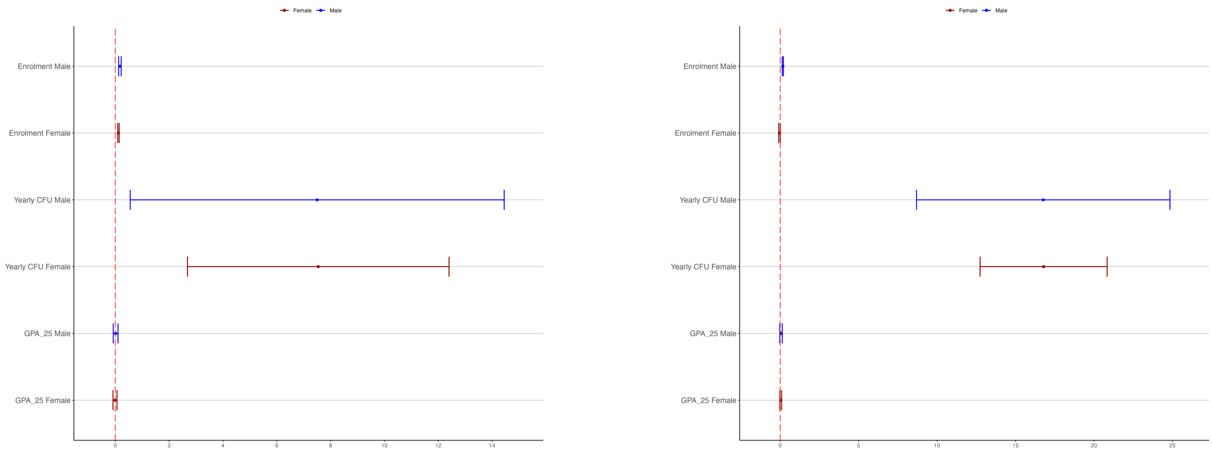
Figure 4: Nonlinear effects of scholarships on effort: the incentive effect for high-belief students (green) and the belief-driven discouragement for low ability students (grey). Baseline effort is assumed concave to highlight diminishing returns.

below the threshold, the increase in k_t moves them into the tail of the distribution of s_t, where $\frac{\partial \Pi_t}{\partial e_t}$ is small. As a result, the expected benefit of effort via the threshold channel declines, producing a belief-driven discouragement effect. These students may reduce effort and may even choose not to apply for the scholarship, despite being eligible.

Summary In our model, the effects of scholarships on effort emerge from two main channels. The threshold channel, where effort today increases the probability of meeting academic requirements for continued scholarship eligibility, valued by the difference in value functions. The learning / belief channel, where effort affects the signal about ability, updating students' posterior beliefs, which in turn affects the expected value function.

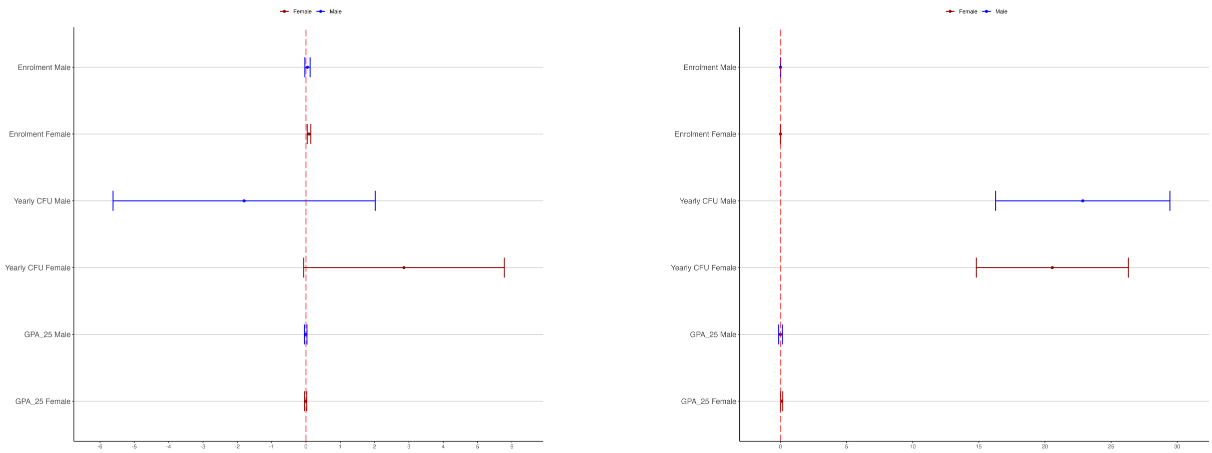
High-ability students or those likely to meet future thresholds benefit from scholarships through both channels, increasing effort. Marginal or low-ability students may experience a discouragement effect if their updated beliefs imply low chances of retaining the scholarship. This mechanism is general and does not rely on institutional features such as repayment obligations, making the model broadly applicable across different higher education systems.

3 Placebo analysis (Section 5)



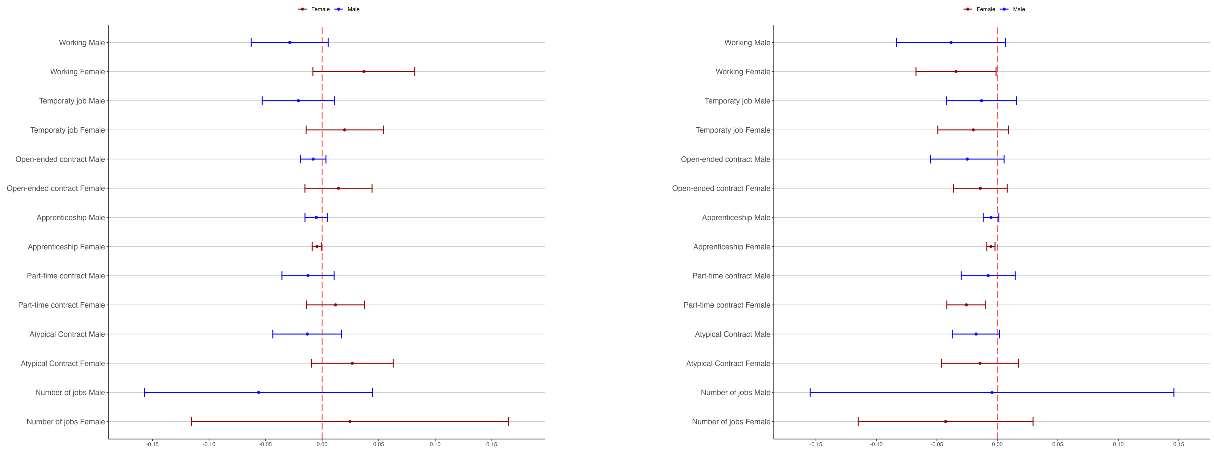
Need-based criterion (ISEE) Merit-based criterion (credits)

Figure 5: Joiners: Estimated effects on educational outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals.



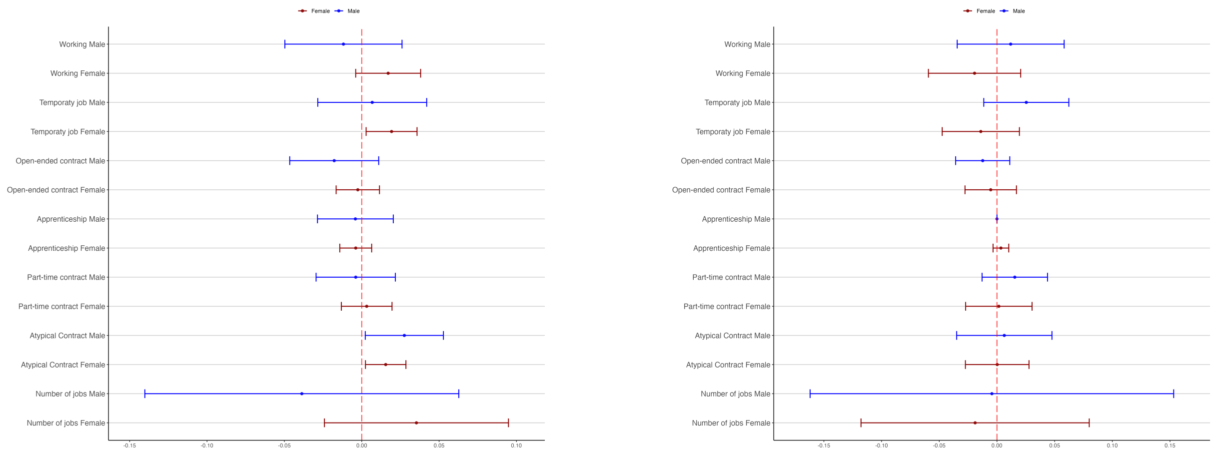
Need-based criterion (ISEE) Merit-based criterion (credits)

Figure 6: Leavers: Estimated effects on educational outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals.



Need-based criterion (ISEE) Merit-based criterion (credits)

Figure 7: Joiners: Estimated effects on labour market outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals.



Need-based criterion (ISEE) Merit-based criterion (credits)

Figure 8: Leavers: Estimated effects on labour market outcomes. Each dot represents the coefficient for a given outcome, with horizontal lines indicating 95% confidence intervals.