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Closing the achievement gap? Financial aid and academic performance in higher education

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ABSTRACT

This paper evaluates the impact of scholarship aid on higher education outcomes in Morocco, examining whether financial support improves academic performance and progression. Using a sample of 13,300 graduate and undergraduate students observed between 2010 and 2023, the study applies Propensity Score Matching (PSM) with nearest-neighbor, radius, and kernel matching algorithms to compare scholarship recipients with similar non-recipients while controlling for observable characteristics. The results indicate that scholarships significantly improve academic outcomes. In particular, receiving a scholarship reduces the average time required to obtain a diploma by approximately five months and increases the likelihood of graduating with academic distinction. Balance diagnostics and sensitivity analyses confirm the robustness of these estimates. By providing new evidence from a developing-country context, this study contributes to the literature on financial aid, which has largely focused on access or evidence from high-income countries. The findings suggest that scholarship programs in Morocco could be further strengthened by combining financial aid with complementary academic support mechanisms.

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1. Introduction

In developing countries, equitable access to higher education remains a significant challenge to economic mobility and societal progress. While scholarships have long been touted to bridge the educational inequality gap, their impact on student outcomes remains elusive (Bettinger et al., 2004; Dynarski et al., 2023). Do scholarships primarily serve as financial levers, or do they induce behavioral changes that improve academic performance and persistence? This puzzle becomes particularly pertinent when economic hardships are paired with high dropout rates and suboptimal academic achievement. Addressing this problem is critical for designing policies that maximize the effectiveness of scarce educational resources.

An additional concern relates to equity in the distribution of scholarship opportunities. While financial aid programs aim to reduce socioeconomic barriers to higher education, disparities may persist across different groups of students. In particular, gender gaps in access to scholarships have been documented in several contexts, often reflecting differences in information access, application behavior, or institutional selection criteria. Understanding whether such disparities exist and how they relate to academic outcomes is therefore important for ensuring that financial aid programs effectively promote inclusive educational opportunities.

This study investigates the impact of scholarship programs on academic performance and progression in higher education. In particular, it examines two key outcomes: the time required to complete a diploma and the probability of graduating with academic distinction. The central research question guiding

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this analysis is whether financial aid improves students' academic trajectories beyond facilitating access to university. By focusing on Morocco, a context where financial aid programs remain under-evaluated, this study contributes to a better understanding of the role scholarships can play in promoting both educational equity and academic success.

This study contributes to the literature in three ways. First, while previous research has primarily examined the role of scholarships in expanding access to higher education, fewer studies have analyzed their impact on academic progression and performance (Angrist et al., 2009; Denning, 2019). Second, the study provides new empirical evidence from a developing-country context, complementing a literature that is largely dominated by evidence from high-income countries (Angrist et al., 2017; Bettinger et al., 2012; Castleman & Long, 2016; Dynarski, 2003). Third, by focusing on Morocco, the analysis helps fill an important empirical gap in the evaluation of higher education policies in North Africa, where rigorous assessments of financial aid programs remain limited.

The remainder of this paper is organized as follows. Section 2 describes the data and empirical methodology, including the matching algorithms and balance diagnostics. Section 3 presents the main results. Section 4 discusses the findings in the context of the broader literature and highlights policy implications. Finally, Section 5 concludes with recommendations for future research.

2. Methodology

2.1. Administrative data and program context

The analysis draws on administrative records related to Morocco's scholarship program, a national financial-aid program designed to support undergraduate and graduate students on the basis of social need. Eligibility is determined through an annual assessment of household economic circumstances conducted by provincial scholarship commissions, which include representatives from education authorities, tax administrations, and local councils. To qualify, students must have graduated high school in the corresponding year, be under 26 years old, enroll in an accredited higher-education institution, and meet income-based criteria defined by the commissions. Successful applicants receive scholarship support for the full duration of their enrolled program. The administrative dataset used in this study is fully anonymized and contains no personal identifiers. The study period corresponds to the academic cohorts for which scholarship decisions were made between 2010 and 2023.

2.2. Variables description

This study uses administrative data collected at the university level. The sample includes university students (mainly undergrad students) who graduated before 2023. The key variables used for our empirical approach are:

- Treatment Variable: The treatment variable is 'scholar', which is equal to 1 if a student received a scholarship at any point in her academic career and 0 otherwise.
- Outcome Variable: Given the dataset's structure, we analyze two potential outcomes. i) mention and ii) time to graduation. The first variable, 'mention', is a categorical variable that describes the level of completion of each diploma, and the second one, 'time to graduation', is a continuous variable that highlights the time (in years) for graduation.
- Covariates: In addition to our Treatment and Outcome variables, the database also includes other explanatory variables (age, gender, and institution)

Tables 1 and 2 give the descriptive statistics of the variables mentioned above.

2.3. PSM design

This study uses the propensity Score matching (PSM) method to determine the impact of scholarships on students' academic performance. The PSM method, introduced by Rosenbaum and Rubin (1983), is a

Table 1. Descriptive statistics for treatment and control groups.

Variable	Group	Mean	SD	Min	Max
Age	Treatment	23.80	2.18	20	56
	Control	29.09	8.26	19	68
Female	Treatment	0.66	0.47	0	1
	Control	0.53	0.49	0	1
Time to diploma	Treatment	2.11	1.07	0	8
	Control	1.68	1.61	0	8

Source: Authors' calculations.

Table 2. Distribution of degree classification by treatment status.

Degree classification	Treatment = 0	Treatment = 1	Total
Average	2,918 (63.85%)	1,652 (36.15%)	4,570
Above Average	3,716 (76.35%)	1,151 (23.65%)	4,867
Good	2,876 (86.78%)	438 (13.22%)	3,314
Very Good	219 (94.81%)	12 (5.19%)	231
Total	9,729 (74.94%)	3,253 (25.06%)	12,982 (100.00%)

Source: Authors' calculations.

widely used quasi-experimental technique for estimating causal effects by creating a comparison group similar to the treatment group based on observable characteristics. This method is particularly well-suited for impact evaluations in which random assignment is not feasible, such as evaluating scholarships. We first employ a logistic regression model to estimate the propensity scores used for matching. This model predicts the probability of a student receiving a scholarship based on observable characteristics. The regression equation is specified as follows:

$$\text{logit}(P(\text{scholar} = 1)) = \beta_0 + \beta_1 * \text{age} + \beta_2 * \text{age}^2 + \beta_3 * \text{age}^3 + \beta_4 * \text{female} + \beta_5 * \text{mention}_1 + \beta_6 * \text{mention}_2 \\ + \beta_7 * \text{mention}_3 + \beta_8 * \text{mention}_4 + \beta_9 * \text{timetodiploma} + \varepsilon_i$$

With;

Scholar: The treatment variable indicates whether a student received a scholarship (1) or not (0).

Age: Age of the student (linear term). age^2 : Quadratic term of age, capturing non-linear relationships. age^3 : Cubic term of age, allowing for additional non-linearities.

Female: A binary variable indicating gender (1 for female, 0 for male).

Mention_k: Represents the academic distinction received ($k = 1, 2, 3, 4$)

Time_to_diploma: Continuous variable indicating the time to complete a college diploma (in years).

The logistic regression estimates the odds of receiving a scholarship ($\text{scholar} = 1$) based on the independent variables. For instance,

β_1 : Indicates how a one-unit increase in age affects the odds of receiving a scholarship.

β_4 : Measures the log-odds difference between female and male students, holding other variables constant.

Table 3 summarizes the logistic regression results. Age has a non-linear relationship with scholarship allocation, with diminishing marginal effects and a slight increase at higher ages. Female students are significantly less likely to receive scholarships than their male counterparts ($p < 0.001$).

Figure 1 displays the distribution of estimated propensity scores for treated and control groups. The solid blue bars represent the propensity score distribution for the treated group, while the dashed black lines depict the distribution for the control group. The overlap in distributions suggests sufficient common support between the groups, which is critical for the validity of the propensity score matching approach.

The histogram reveals areas of overlap between the treated and control groups. Common support is observed across most of the range of propensity scores, though there might be regions where the control group is sparse (e.g. higher propensity scores). The overlap indicates that propensity score matching is feasible, as there are control observations with similar propensity scores to treated observations.

Table 3. Logistic regression results: determinants of scholarship allocation.

Variable	Coefficient	SE	<i>p</i> value
Intercept	-33.62	3.31	<0.001
Age	3.42	0.32	<0.001
Age2	-1.12	0.09	<0.001
Age3	0.15	0.01	<0.001
Female	-1.81	0.49	<0.001
Mention (Intermediate)	1.72	5.97	0.77
Time to Diploma	-1.43	0.20	<0.001

Source: Authors' calculations.

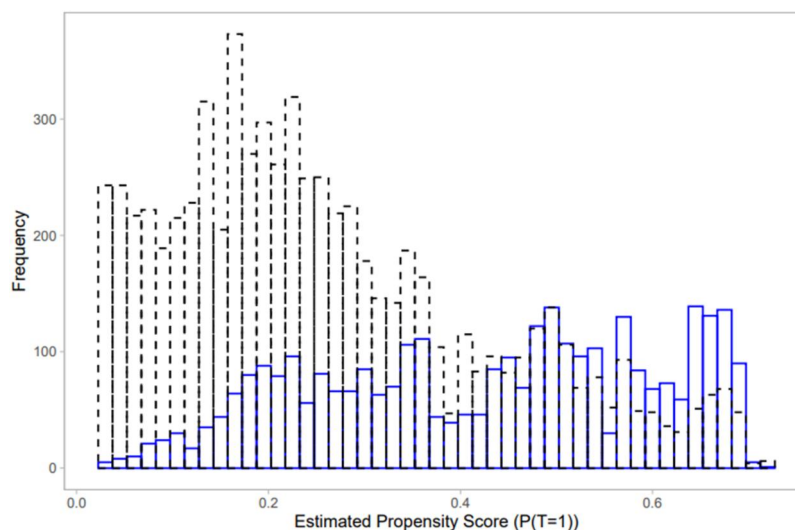


Figure 1. Distribution of estimated propensity scores for treated and control groups. *Note:* The figure displays the distribution of predicted propensity scores for scholarship recipients (treated group) and non-recipients (control group). Propensity scores represent the estimated probability of receiving a scholarship based on observable characteristics. The overlap between the two distributions indicates the presence of common support, which is necessary for implementing Propensity Score Matching and ensuring that treated students are compared with observationally similar non-treated students.

Source: Authors' calculations.

2.4. Identifying assumptions

The PSM matching method remains conditional on two underlying assumptions: The Conditional Independence Assumption¹ (CIA) and the Positivity/Overlap Assumption².

- Conditional Independence Assumption (CIA)

Figure 2 compares the absolute mean differences of covariates (standardized mean differences) between treated and control groups before (unadjusted) and after (adjusted) matching. The red dots (Unadjusted) represent covariate imbalances before matching. Larger distances indicate significant differences in covariates. The blue dots (Adjusted) represent covariate balances after matching. Dots closer to zero indicate successful balancing. The dashed line marks the threshold (commonly 0.1 or 0.25), indicating an acceptable balance. Adjusted covariates falling within this threshold signify successful matching. This graph validates the overlap/positivity assumption, as it ensures comparable distributions of covariates between treatment and control groups.

- Overlap/Positivity

Ensuring covariate balance is crucial for Propensity Score Matching (PSM) validity. Figure 3 compares the distribution of propensity scores between treated and control groups before and after matching.

Before matching, as shown in the unadjusted sample (left panel), the treated and control groups exhibited significant differences in propensity scores, indicating a lack of covariate balance. After

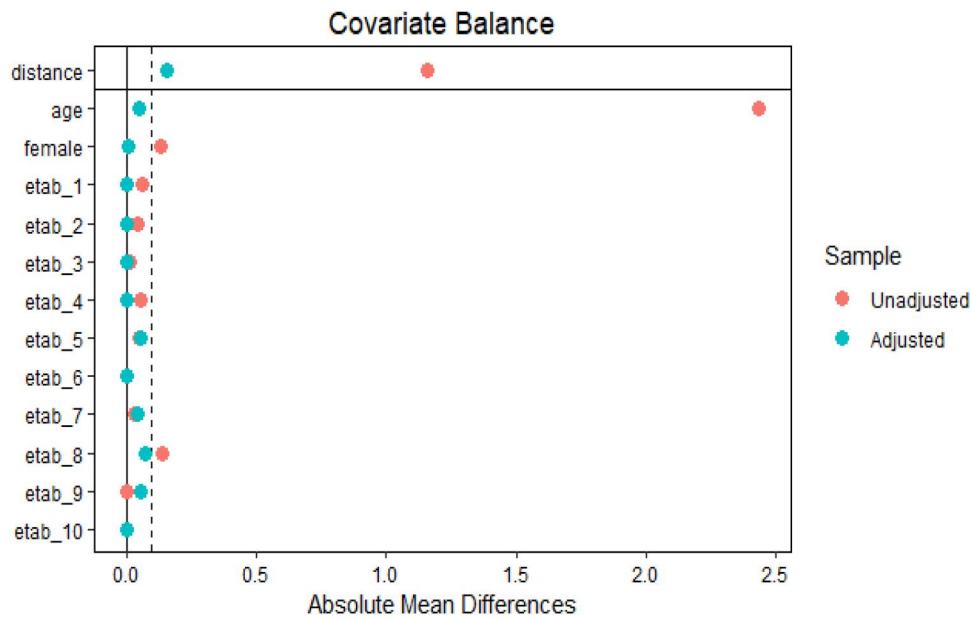


Figure 2. Covariate Balance Before and After Matching. The standardized mean differences of covariates between treated and control groups are shown before (red dots) and after (blue dots) matching. The dashed line represents the acceptable threshold for balance. Post-matching, covariates are closer to zero, indicating improved balance. A covariate is considered balanced if the absolute mean difference is close to zero post-matching. *Source:* Authors’ calculations.

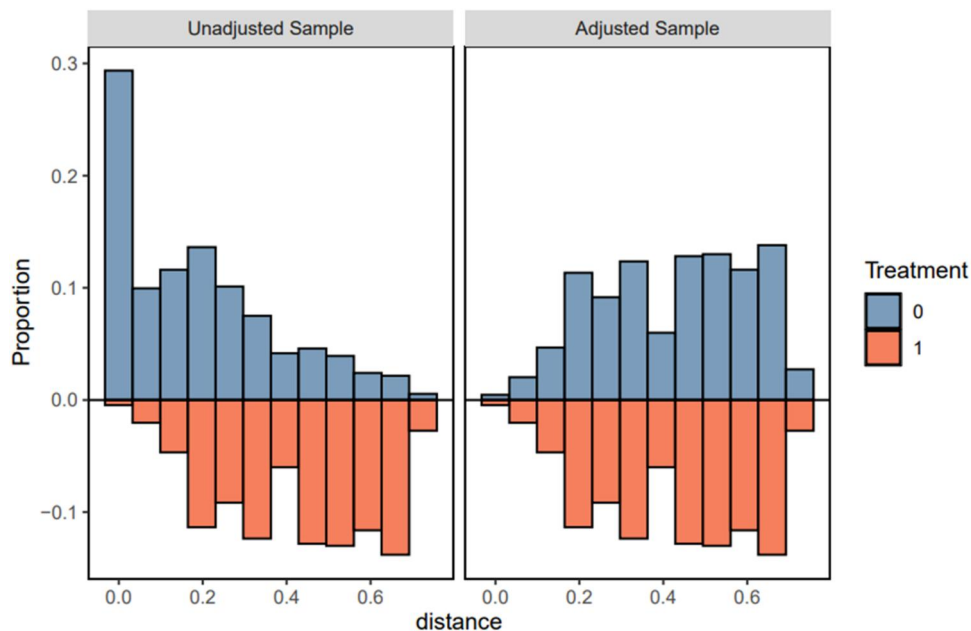


Figure 3. Covariate balance before and after propensity score matching. *Note:* The left panel shows the distributional imbalance in propensity scores between scholarship recipients (treated group) and non-recipients (control group) before matching. The right panel shows the adjusted sample after matching, with the distributions more closely aligned. The improvement in balance indicates that the matching procedure successfully reduces observable differences between treated and control students, improving the credibility of the estimated treatment effects. *Source:* Authors’ calculations.

matching (right panel), the distribution overlap demonstrates that the matching procedure effectively balanced the covariates, thereby reducing selection bias. This balance is a critical assumption for estimating the Average Treatment Effect on the Treated (ATT). By achieving comparable distributions of propensity scores, the PSM approach ensures that any observed outcome differences can be attributed to the treatment rather than pre-treatment differences between groups.

2.5. Matching methodology

To estimate the causal effect of scholarships on educational outcomes, we employ propensity score matching (PSM) as our primary identification strategy (Rosenbaum & Rubin, 1983). PSM addresses the challenge of selection bias by creating a comparison group of non-recipients (controls) who closely resemble scholarship recipients (treated) based on observable characteristics. This methodology allows for a robust comparison of outcomes between these two groups by balancing covariates.

In his study, we use three widely used matching algorithms - Nearest Neighbor Matching, Radius Matching, and Kernel Matching - to ensure the robustness of our findings. Each algorithm has distinct strengths and assumptions, which we briefly describe below:

2.5.1. Nearest neighbor matching

Nearest Neighbor Matching pairs each treated unit with the closest control unit based on propensity scores. This algorithm is interpretable and straightforward, making it a standard choice in matching methods. It ensures a direct comparison between the treated and control groups. For this study, Nearest Neighbor Matching provides a straightforward technique to estimate the impact of scholarships by closely matching treated students with similar untreated peers regarding age, gender, educational institutions, and other covariates. The covariate balance plot 4 demonstrates significant improvement in balance across all covariates after matching. The ATT estimates (Table 4) indicate scholarships' substantial and statistically significant impact on academic mentions and time-to-diploma. Figure 4 shows that Nearest Neighbor Matching effectively balanced the covariates and provided robust ATT estimates. However, it relies heavily on the availability of sufficiently close matches, which could exclude some treated units in cases of poor overlap.

The results suggest that the nearest neighbor matching algorithm has effectively minimized systematic differences between treated and control groups, ensuring a good approximation of the conditional independence assumption (CIA). This enhances the validity of the estimated treatment effect (ATT) by reducing potential bias.

Table 4. Impact of scholarships on time to diploma (ATT results).

Matching algorithm	ATT estimate	SE	<i>p</i> value
Nearest Neighbor Matching	-0.3989	0.0324	0.000
Radius Matching	-0.399	0.032	0.000
Kernel Matching	-0.398	0.032	0.000

Source: Authors' calculations.

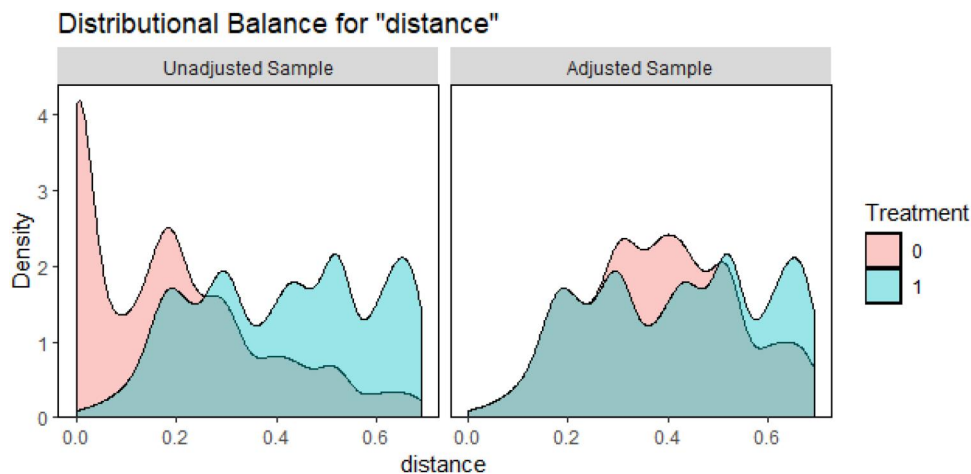


Figure 4. Distributional Balance for Propensity Scores. The plot compares the density of propensity scores between treated (1) and control (0) groups before (unadjusted sample) and after matching (adjusted sample). Matching improves the balance of propensity scores, ensuring sufficient overlap for valid causal inference.

Source: Authors' calculations.

2.5.2. Radius matching

Radius Matching sets a predefined ‘caliper’ or radius around each treated unit and matches control units within this range. It mitigates the risk of poor-quality matches by discarding units outside the caliper. Radius Matching is particularly useful in this study for handling overlapping but diverse distributions of propensity scores, ensuring high-quality matches.

Figure 5 illustrates the propensity score distribution for the treated and control groups before and after adjustment via radius matching. The left panel highlights the initial imbalance in the unadjusted sample, while the right panel demonstrates substantial improvement in balance post-matching. This ensures the overlap assumption is met, enabling a reliable comparison between treated and control units. In the adjusted sample, the treated and control groups exhibit closer alignment in their propensity score distributions, fulfilling the overlap assumption and ensuring treated units have comparable control counterparts. This figure visually validates the effectiveness of radius matching in achieving balance in the propensity score distributions, which is crucial for reliable treatment effect estimation.

2.5.3. Kernel matching

Kernel Matching assigns weights to control units based on their proximity to treated units, ensuring that all control units within the kernel contribute to the ATT estimate. This method leverages the whole data-set and reduces variance. Kernel Matching was chosen for its efficiency in utilizing the entire control sample, particularly in this study where treated and control units may vary widely across propensity scores.

Figure 6 shows the density plot of propensity scores for treated and control groups after Kernel Matching. The overlap between the groups indicates improved balance and comparability, supporting the validity of the matching procedure. The alignment of the curves for treated (green) and control (red) groups suggests that Kernel Matching has improved the balance of covariates between the groups.

This study also employs an ordinal logit model (Williams, 2016) to evaluate the impact of scholarships on student academic performance, measured through ‘mention’ categories: ‘Passable’, ‘Assez bien’, ‘Bien’, and ‘Très bien’. The model is specified in Equation (1), which accounts for the ordinal nature of the dependent variable while adjusting for individual and institutional characteristics. The ordinal nature of this variable necessitates a model that respects its rank order while avoiding the assumptions of equal intervals inherent in linear regression models (McCullagh, 1980).

$$\log \left(\frac{\Pr(Y \leq j)}{\Pr(Y > j)} \right) = \beta_0^j + \beta_1 \text{Scholar} + \beta_2 \text{Age} + \beta_3 \text{Female} + \epsilon_j$$

The ordinal logit model above estimates the log-odds of being in a higher-mention category, adjusting for relevant covariates, including age, gender, and institution type (Long & Freese, 2006).

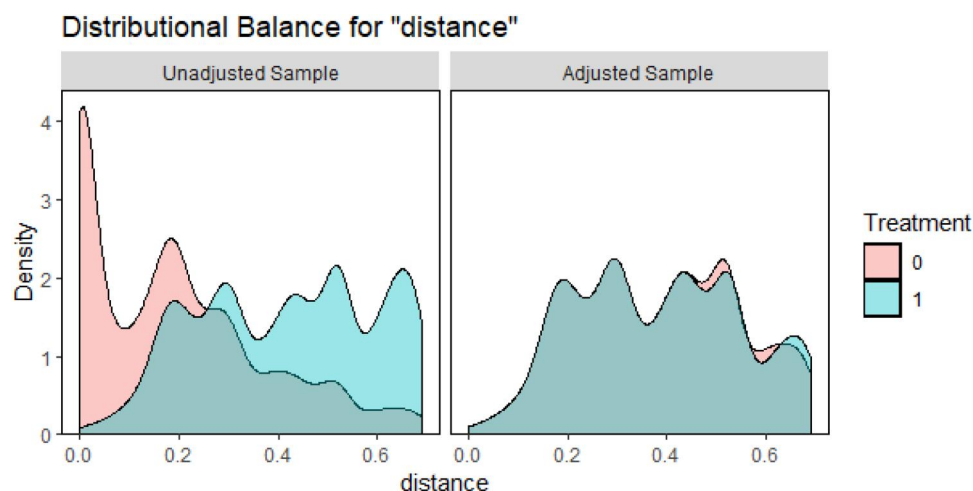


Figure 5. Distributional Balance for Propensity Scores Before and After Adjustment Using Radius Matching.
Source: Authors' calculations.

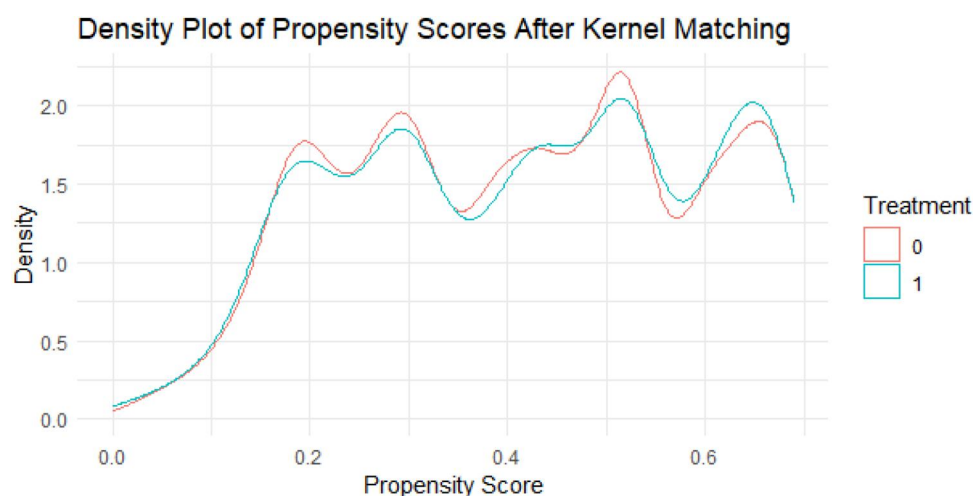


Figure 6. Density Plot of Propensity Scores After Kernel Matching.

Source: Authors' calculations.

Table 5. Ordered logistic regression results: impact of scholarship on mention.

Variable	Coefficient	SE	<i>p</i> value
Scholar	0.229	0.057	0.000
Age	-0.031	0.003	0.000
Female	-0.061	0.052	0.235
Etab	0.249	0.011	0.000

Thresholds (Cutpoints):

Cut1	0.053	0.123
Cut2	0.452	0.123
Cut3	7.132	0.303
Log-Likelihood		-5850.158
Pseudo R2		0.0482
Number of Observations		6,697

Source: Authors' calculations.

3. Results

The results in Table 4 summarize the Average Treatment Effects on the Treated (ATT) for the impact of scholarships on time to diploma across three matching algorithms: Nearest Neighbor Matching, Radius Matching, and Kernel Matching. All three methods yield a consistent and statistically significant ATT estimate of approximately -0.398 . This negative ATT implies that receiving a scholarship reduces the average diploma completion time by about 0.4 years. The consistency of results across all matching algorithms indicates robustness, providing confidence that the observed impact is not sensitive to the specific matching method used.

Table 5 presents the ordered logistic regression results for the impact of scholarships on students' grades (grade levels). The coefficient for the scholarship variable (0.229) is positive and statistically significant, thus indicating that receiving a scholarship increases the likelihood of achieving a higher 'mention'. The negative and significant coefficient for 'age' (0.031) implies that older students are less likely to achieve higher mentions, which could be due to factors like competing responsibilities or reduced academic engagement. The coefficient for gender (0.061) is not statistically significant, suggesting no substantial difference in mentions based on gender. The positive and significant coefficient for 'etab' (0.249) indicates that the type of educational institution (etab) has a substantial effect on achieving higher mentions.

The odds ratios reported in Table 6 provide an interpretable measure of how the explanatory variables affect the likelihood of achieving higher academic distinctions. In an ordered logistic regression, an odds ratio greater than one indicates that the variable increases the probability of belonging to a higher

Table 6. Ordered logistic regression: odds ratios.

Variable	Odds ratio	SE	z	95% CI
Scholar (treatment)	1.257	0.072	4.01	1.124, 1.406
Age	0.969	0.003	-8.59	0.963, 0.976
Female	0.941	0.049	-1.19	0.851, 1.041
Etab	1.283	0.014	21.72	1.254, 1.312

Source: Authors' calculations.

Table 7. Predicted probabilities for mention categories.

Mention	Scholar	Margin	SE	z	95% CI
1	0	0.360	0.007	52.18	0.347, 0.374
1	1	0.313	0.010	32.69	0.293, 0.331
2	0	0.089	0.004	25.20	0.083, 0.096
2	1	0.085	0.003	24.72	0.078, 0.091
3	0	0.548	0.007	75.18	0.534, 0.562
3	1	0.600	0.010	58.14	0.579, 0.620
4	0	0.002	0.0005	3.60	0.0018, 0.0028
4	1	0.002	0.0006	3.59	0.0010, 0.0035

Source: Authors' calculations.

distinction category, while a value below one suggests a lower likelihood of achieving higher distinctions. For instance, the odds ratio of 1.257 for the scholarship variable indicates that students receiving scholarships are approximately 25.7% more likely to obtain a higher academic distinction compared to non-recipients, holding other factors constant.

The odds ratio 0.969 indicates that each additional year of age reduces the odds of achieving a higher mention by approximately 3.1%, consistent with the coefficient's direction in Table 5. The odds ratio of 1.283 confirms that attending a specific type of institution significantly improves the likelihood of achieving higher mentions.

Table 7 presents the predicted probabilities of achieving different 'mention' categories based on the treatment variable (scholarship status) and associated margins. The results indicate that scholarships have the most significant positive impact on obtaining a 'Bien' mention (Category 3), with scholarship recipients being 60% likely to achieve this distinction compared to 54.8% for non-recipients. Furthermore, scholarships reduce the probability of obtaining a 'Passable' mention (Category 1) from 36% to 31.3%, suggesting improved academic outcomes for lower-performing students. The effects on 'Très Bien' (Category 4) remain minimal, with probabilities near 0.2% for both groups, reflecting limited influence at the highest achievement level. These findings highlight the role of scholarships in enhancing academic performance, particularly for middle-tier outcomes.

In summary, the results of this study reveal that scholarships significantly improve academic performance in higher education, particularly by increasing the likelihood of achieving middle-tier academic distinctions and reducing time to graduation. These findings align with evidence from developed countries, such as Dynarski (2003), and developing countries, Dearden et al. (2014), where financial aid has been shown to improve educational attainment, while also echoing the importance of scholarships in resource-constrained contexts, as highlighted by Oosterbeek and van den Broek (2009). The results also underscore the need for targeted scholarship programs to foster equity and excellence, particularly in developing countries.

4. Discussion

This study examines scholarships' impact on higher education academic outcomes using propensity score matching (PSM) techniques. The results reveal that scholarship recipients take less time to graduate, increasing the likelihood of achieving higher academic distinctions, particularly in the 'Good' and 'Very Good' categories. An ATT of -0.398 for time to diploma suggests that scholarship recipients graduate approximately 0.4 years earlier on average than non-recipients. This aligns with findings from similar programs in developing countries where financial aid reduces the time to graduation (Londoño-Vélez et al., 2020). Also, the odds ratio 1.257 for 'mention' indicates that scholarship recipients are 25.7% more

likely to achieve higher academic distinctions than their peers. These results are also consistent with theoretical frameworks, such as Becker's (1975) human capital model, which posits that reducing financial constraints increases educational investment. By alleviating the need for part-time employment, scholarships allow students to focus on their studies, contributing to a shorter time to graduation and better academic performance. Additionally, scholarships may boost motivation and self-esteem, as Oreopoulos and Petronijevic (2019) suggested, enabling students to achieve higher marks.

The reduction in time to diploma aligns with findings from Dynarski (2003), who showed that scholarships reduced dropout rates in the United States³. Similarly, the improvement in mentions echoes findings by Barrera-Osorio et al. (2011), who found that conditional cash transfers enhanced student performance in Colombia. This underscores the broader role of financial aid in improving academic outcomes, particularly in resource-constrained environments. We argue that scholarships in Morocco are crucial in alleviating the financial burdens that students and their families face, particularly those from low-income households. By reducing the need for students to engage in part-time or informal employment to fund their education, scholarships enable them to dedicate more time and energy to their studies. Moreover, financial aid helps mitigate the risk of dropouts by covering essential expenses such as transportation and living costs. This ensures students are better positioned to complete their programs without interruptions, contributing to higher educational attainment and improved long-term outcomes.

These findings underscore the importance of scholarships in improving educational outcomes and reducing inequalities. Policymakers can consider pairing financial aid with academic mentoring programs to maximize their impact (Canaan et al., 2022). An additional issue that merits attention concerns potential gender disparities in scholarship allocation. Ensuring equitable access to financial aid across male and female students may further enhance the role of scholarships in promoting inclusive educational opportunities.

While the present analysis focuses on academic outcomes during university, an important dimension concerns the long-term effects of scholarships on students' labor market trajectories. Financial aid may influence employment prospects, earnings, and career mobility by enabling students to complete their studies more quickly and with stronger academic credentials. In contexts where financial constraints often limit educational persistence, scholarships may also expand access to higher-quality employment opportunities after graduation. Future research could therefore extend this analysis by examining the impact of financial aid on labor market outcomes such as employment rates, wages, and career advancement.

Despite the robustness of the propensity score matching approach, the estimates may still be affected by unobserved confounding factors. Characteristics such as students' intrinsic motivation, parental support, or non-cognitive skills may influence both the likelihood of receiving a scholarship and subsequent academic performance. If these factors are not fully captured by the observable covariates used in the matching procedure, the estimated treatment effects may partly reflect these unobserved differences rather than the causal impact of financial aid alone. While propensity score methods help reduce selection bias based on observable characteristics, they cannot fully eliminate bias arising from unobserved heterogeneity. Future research could address this limitation by incorporating richer background data, applying sensitivity analyses that assess the robustness of the estimates to potential hidden bias, or using alternative research designs such as randomized experiments or quasi-experimental approaches.

Another limitation concerns the availability of background variables that may influence both scholarship receipt and academic performance. In particular, information on students' pre-university academic achievement, household socioeconomic status, or participation in part-time employment during their studies was not available in the dataset used for this analysis. These factors may play an important role in shaping both the likelihood of receiving financial aid and subsequent academic outcomes. If such characteristics affect both scholarship receipt and academic outcomes, the estimated effects may be partially biased. Future research could incorporate richer data on students' socioeconomic background and pre-university performance to further improve the identification of scholarship effects.

In addition, grading standards for academic distinctions may vary across evaluators or institutions, potentially introducing measurement error in the classification of mentions. If grading standards differ systematically across institutions, this variation could affect the observed distribution of mentions and potentially influence the estimated treatment effects. In this study, we partially mitigate this concern by

controlling for institutional characteristics in the matching procedure, which helps ensure that treated and control students are compared within similar institutional contexts. Nevertheless, future research could address this issue more directly by using standardized academic performance indicators or by harmonizing grading scales across institutions.

5. Conclusion

The relationship between financial aid and academic success has been extensively studied, particularly in developed countries, where scholarships have been shown to improve student retention, performance, and time-to-degree completion (Boatman & Long, 2016; Holzer & Baum, 2017; Nguyen et al., 2019). However, empirical evidence from developing contexts, especially in Africa, remains scarce. This study contributes to filling this gap by examining the impact of scholarships on academic success in Morocco. Using a Propensity Score Matching (PSM) approach, we find that scholarships significantly reduce the time to graduation by an average of five months (0.4 years) among treated students. Additionally, scholarships increased the likelihood of obtaining higher grades and achieving academic distinctions.

Our findings align with prior studies, consistently demonstrating that financial aid is critical in increasing student persistence and improving academic performance. For instance, Deming and Dynarski (2009) found that need-based scholarships in the United States led to higher academic engagement and degree attainment. Angrist et al. (2009) provided experimental evidence that financial aid increases course completion rates and final grades. Similarly, a meta-analysis (Leslie & Brinkman, 1988) found that financial aid programs effectively reduce dropout rates and accelerate time to graduation.

Despite the robustness of our findings, several limitations should be acknowledged. First, while the Propensity Score Matching approach helps mitigate selection bias, it does not eliminate concerns regarding unobserved confounders. Variables such as student motivation, parental support, and non-cognitive skills are challenging to control for and may introduce bias into our reported estimates. Second, our study is limited to the Moroccan higher education context; generalizing to other developing countries with different educational and financial structures is challenging. Third, although the analysis documents significant improvements in academic outcomes, it does not examine longer-term labor market effects such as employment probability, earnings, or career progression after graduation.

Building on these findings, future research should consider more rigorous causal designs, such as Regression Discontinuity (RD) or Difference-in-Differences (DiD) approaches, to strengthen causal inference. Additionally, further investigation is needed to assess the heterogeneous effects of scholarships across different student subgroups, including gender, socioeconomic status, and field of study. Beyond academic performance, future studies should also examine the long-term effects of scholarships on the labor market, such as their impact on employment, earnings, and career mobility. A deeper understanding of these mechanisms would provide policymakers with a more comprehensive framework for evaluating the effectiveness of financial aid interventions.

The results of this study have important policy implications for higher education in Morocco and other developing economies. Given that scholarships significantly improve academic performance and reduce time to graduation, policymakers should consider expanding financial aid programs, particularly for students from disadvantaged backgrounds. Furthermore, scholarship programs could be complemented by academic support services, such as tutoring, career counseling, and mentorship programs, to maximize their effectiveness (Canaan et al., 2022; Holzer & Baum, 2017). In addition, integrating financial literacy training into scholarship programs may further enhance their effectiveness. Providing students with guidance on budgeting, financial planning, and managing educational expenses could help them make better use of financial aid and reduce financial stress during their studies. Such complementary interventions may strengthen the impact of scholarships on academic persistence and performance.

Since financial constraints remain a key barrier to higher education completion in many developing countries, evaluating the cost-effectiveness of scholarships relative to other interventions (such as tuition subsidies or performance-based incentives) could help optimize public investment in education.

This study illuminates the role of scholarships in improving academic success and underscores the need for well-designed financial aid policies that enhance both access and efficiency in higher education. Future research and policy efforts should continue to refine these interventions to maximize their impact on student success and economic development.

Notes

1. This assumption suggests that the treatment assignment depends only on observable covariates.
2. This assumption is verified through the overlap in propensity scores between treated and control groups.
3. However, the magnitude of the impact appears larger in this study, potentially reflecting greater financial constraints in the local context.

Author contributions

CRediT: **Zakaria Mansouri**: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing; **Mariem Liouaeddine**: Conceptualization, Methodology, Validation, Writing – original draft, Writing – review & editing.

Disclosure statement

No potential conflict of interest was reported by the authors.

Ethical considerations

This study did not involve the collection of data from human participants. The analysis relies exclusively on anonymized administrative records that contain no personal identifiers (such as names, national identification numbers, or contact details). In accordance with institutional and national guidelines for research using secondary anonymized data, the study did not require review by an Institutional Review Board (IRB) or ethics committee. No procedure in this research involved interaction with individuals, primary data collection, or access to identifiable private information; therefore, informed consent was also not applicable. This approach aligns with international ethical standards for research using de-identified administrative datasets in the social sciences.

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Data availability

The data supporting this study's findings are confidential. Access to the dataset is restricted under the agreement with the corresponding institution, which prohibits public sharing. Researchers interested in replication or further analysis may contact the authors to discuss potential avenues for secure, authorized access in compliance with institutional regulations.

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