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Tuition Equity: Adverse effects of tuition policy on engineering students

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Abstract

While there has been much research addressing the equity of college access, the equity of tuition and fees have been less studied. Despite efforts to provide targeted financial aid options, tuition structures may undermine these efforts. Universities often charge different tuition rates based on program major or whether students are in lower or upper divisions. This paper explores whether the policies of block and upper-division tuition create disparities in net tuition costs among university students. By analyzing data from over 30,000 students, this research highlights that engineering students and underrepresented minorities often face higher tuition costs due to these policies for similar coursework and degrees.

This study examines whether these tuition structures adversely affect different student groups, particularly those transferring non-essential credits or are unable to optimize their tuition bill due to external resource constraints. Data from Grand Valley State University were used to assess tuition impact based on Pell Grant eligibility, gender, race, and transfer status, focusing on credit distribution at graduation.

The research addresses the equity of upper-division tuition (higher rate or fee charged for junior/senior students) and block tuition (flat rate is charged for a range of credits). Engineering programs, requiring more credits most undergraduate programs, often incur more upper-division charges and limit students' ability to benefit fully from block tuition discounts, resulting in higher costs. Impartiality measures indicate that upper-division charges and block tuition impact different groups unevenly, with transfer students, students of color, and Pell Grant recipients benefiting least. The findings suggest systemic inequalities that merit further discussion.

Introduction

There has been significant study associated with the equity of access to college and the college admissions process [1] [2] [3]. There are also advocates who are drawing attention to the fact that seemingly neutral policies such as requiring remedial courses and limited credit transfers from associate degree programs can have unintended consequences and contribute to structural racism in higher education [4]. However, there has been less study of policies regarding tuition and fees outside of financial aid and assistance. The work recently done in [5], explores how tuition and fee systems in different countries support or inhibit participation of low-income students. While there are numerous financial aid options in the form of grants and special programs for marginalized communities, this paper seeks to address the question of if the tuition structure itself is working counter to the intent of internal and external financial aid packages.

The growing problem of student debt disproportionately affects marginalized groups [6]. For example, federal Pell Grants are solely based on financial need and can only cover a fraction of total tuition. The maximum Pell Grant award for 2024-25 remains unchanged at $7,395, the same as the previous year [7]. Consequently, changes in fees or tuition structure directly impact Pell Grant recipients, leaving them with more debt compared to their peers. Pell Grant recipients are

predominantly associated with marginalized identities and have consistently been found to have the highest default rates on student loans [8].

Following the work in [9] and [10], we are motivated by the United Nations Sustainable Development Goals (SDG-4) for equity in education and chose to adopt the conceptual framework for equity described in *Handbook on Measuring Equity in Education* (UNESCO 2018) [11].

There are further legal concerns regarding disparate impact of policies in education. Based on U.S. Supreme Court rulings regarding the Civil Rights Act [12] [13] [14] [15], the U.S. Department of Justice uses the following three-part test to determine if an organization receiving federal funds has violated Title VI [16]:

1. **Disparate impact:** Does the adverse effect of the policy or practice fall disproportionately on a race, color, or national origin group? …
2. **Justification:** If so, does the record establish a substantial legitimate justification for the policy or practice? …
3. **Less discriminatory alternative:** Is there an alternative that would achieve the same legitimate objective but with less of a discriminatory effect? …

This paper explores the effects of the upper-division tuition charge and block tuition structure.

Upper-/Lower-Division Tuition

Table 1: Lower-Division and Upper-Division Tuition (per Credit Hour) for Public Michigan Universities [17]

	Lower-Division	*Upper-Division*	*Difference*
Michigan Technological University	$ 682.00	$ 906.00	$ 224.00
Wayne State University	$ 519.46	$ 616.48	$ 97.02
University of Michigan	$ 671.00	$ 761.00	$ 90.00
Oakland University	$ 507.50	$ 587.75	$ 80.25
Michigan State University	$ 528.13	$ 600.50	$ 72.37
Eastern Michigan University	$ 637.35	$ 697.35	$ 60.00
Western Michigan University	$ 603.92	$ 662.58	$ 58.66
Ferris State University	$ 483.00	$ 526.00	$ 43.00
Central Michigan University	$ 458.00	$ 498.00	$ 40.00
Grand Valley State University	$ 614.00	$ 644.00	$ 30.00
Northern Michigan University	$ 517.00	$ 543.50	$ 26.50
University of Michigan-Flint	$ 536.00	$ 542.00	$ 6.00
University of Michigan-Dearborn	$ 606.00	$ 606.00	$ -
Lake Superior State University	$ 582.00	$ 582.00	$ -
Saginaw Valley State University	$ 408.00	$ 408.00	$ -

While it has become common for universities to employ a tuition structure that charges different tuition rates based on major, it is also common in Michigan for universities to charge a different

tuition rate based on whether a student is in the upper division or the lower division of their undergraduate study. Most schools employing this tuition structure consider a student to be in the lower division if they have 59 or fewer semester credits (120 semester credits being the requirement for a standard bachelor's degree), but there are variations in tuition structures and schemes to employ it [18].

Table 1 summarizes the differences in the credit hour tuition rate at several Michigan public universities for the 2022-2023 academic year [18]. University of Michigan – Dearborn recently joined both Lake Superior State University and Saginaw Valley State University as universities that do not participate in an upper-/lower-division tuition structure, but all other public universities in Michigan do to differing degrees. The average differential between lower-division and upper-division rates is $55.19 per credit hour, with Michigan Tech, Wayne State University, and University of Michigan being the top three with differences of $224, $97, and $90 respectively.

Block Tuition

Table 2: Comparison of Tuition (per Credit Hour) and Block Tuition Rates for Public Michigan Universities [17]

	Tuition per Credit	***Block Tuition***	***Block Credit Range***		***% Difference***	
	< min	***In range***	***min***	***max***	***@min***	***@max***
Central Michigan University	$458.00	-	-	-	0.0%	0.0%
Eastern Michigan University	$637.35	$7,600.00	12	16	0.6%	25.5%
Ferris State University	$483.00	-	-	-	0.0%	0.0%
Grand Valley State University	$614.00	$7,314.00	12	15	0.7%	20.6%
Lake Superior State University	$582.00	$6,984.00	12	16	0.0%	25.0%
Michigan State University	$521.75	$7,824.00	12	18	-25.0%	16.7%
Michigan Technological University	$682.00	$9,037.00	12	18	-10.4%	26.4%
Northern Michigan University	$517.00	$6,204.00	12	16	0.0%	25.0%
Oakland University	$507.50	-	-	-	0.0%	0.0%
Saginaw Valley State University	$408.00	-	-	-	0.0%	0.0%
University of Michigan	$671.00*	$8,448.00	12	18	0.0%	32.3%
University of Michigan-Dearborn	$606.00	$7,272.00	12	UNL	0.0%	UNL
University of Michigan-Flint	$536.00	$6,432.00	12	UNL	0.0%	UNL
Wayne State University	$519.46	$6,246.49	12	18	-0.2%	33.2%
Western Michigan University	$603.92	$7,247.00	12	15	0.0%	20.0%
***First credit hour is $1,066.**	**UNL = Unlimited (no published cap)**					

Block tuition, also known as flat-rate tuition, charges a fixed amount for a range of credit hours. For instance, at Grand Valley State University (GVSU) students are charged a flat rate for enrolling in 12-15 credit hours. This rate is equivalent to the cost of 12 credits at the per-credit-hour rate, so a student enrolling in 15 credits would pay for 12 and receive 3 credits for free. Consequently, this

structure provides a tuition discount of up to 20% (paying for 12 out of 15 credits), encouraging full-time enrollment near 15 credits per semester. However, this discount is not accessible to all students and penalizes those who cannot enroll in 15 credits due to time constraints, financial limitations, limited course options, or prerequisite requirements.

Table 2 summarizes the tuition rates for public universities in the State of Michigan [18]. As of the 2023-24 academic year, 11 out of 15 public universities implemented block tuition. Wayne State University adopted block tuition in 2023 to enhance graduation rates [19]. A study found a measurable positive impact on four-year graduation rates, but it lacked information on five- or six-year rates, demographic breakdowns, or an analysis of program equitability.

Methods

Student data from Grand Valley State University (GVSU) were examined to compare both the effective amount of block tuition discount, upper-division tuition charges, and the number of credits earned by graduation for different groups of students who graduated with a 4-year degree. Impartiality measures are presented based on Pell Grant eligibility, gender, race, and transfer status for both engineering degreed graduates and all other majors. The goal of this analysis is to determine if the upper-division and block tuition structures have a disparate impact on the different groups, providing a financial advantage to some demographics over others.

This paper investigates whether these tuition structures adversely affect students from different demographics. We are especially interested in the effects of these tuition schemes on students majoring in engineering; therefore, we performed the analysis twice: first with all students and then with engineering students exclusively. This was done by analyzing student data which included the following information for each student:

- Self-reported as a student of color
- Self-reported gender
- Major program
- Pell Grant eligibility
- Number of transfer credits
- Number of AP/CBE Credits
- Number of changes to degree program at GVSU
- Number of credits attempted at GVSU
    - Separated by level (000, 100, 200, 300, & 400 level)
- Number of credits earned at GVSU
    - Separated by level (000, 100, 200, 300, & 400 level)
- Total credits at graduation
    - Separated by level (000, 100, 200, 300, & 400 level)
- Number of credits attempted at GVSU by semester
    - Credit hours separated by semester

The dataset available includes transcript information on 32,454 students who graduated with a bachelor's degree that requires a minimum of 120 semester credits. We first explored comparing

the tuition paid by students but chose not to use this data because of changing tuition rates over time affecting the results. To avoid this, this analysis utilized the attempted hours by semester and employed the tuition structure of the current year. This eliminates the need to correct for inflation, time-value of money, and changing tuition rates, which impact students differently depending on their rate of academic progress. Additionally, the tuition charged to students in this dataset is also affected by the chosen major, which adds additional charges for certain majors. Our analysis omitted this consideration.

For the upper-division tuition analysis, the goal was to explore the amount of additional tuition charged to students who are in the upper division per credit of upper-division coursework (3xx and 4xx courses). For students at GVSU, the upper-division charge is triggered by having more than 54 earned credits (lower than the more typical 59 credit threshold), which includes transfer, AP (Advanced Placement), and CBE (Credit-by-Examination) credits.

To start, all transfer, AP, and CBE credits were assumed to be in the students' records at the start of the first semester. Then, the history of attempted credits per semester was used to calculate the total of upper-division charges for each student in the dataset using the current tuition structure. For comparison purposes, we propose an alternative upper-division tuition scheme, which was also calculated. This alternative scheme only adds the upper-division charge for credits attempted in 300- and 400-level courses. This alternative scheme is not currently used by any Michigan public university. The average of extra upper-division tuition fees with the current and alternate scheme was calculated for different groups for comparison.

For the block tuition structure, the goal of the analysis was the exploration of the student savings, which amounted to a discount relative to the advertised per credit rate. To start, all transfer, AP, and CBE credits were assumed to be in the students record at the start of the first semester and did not incur a tuition charge and are consequently not considered when calculating the average effective block tuition discount. Then, the history of attempted credits per semester was used to calculate the tuition for each term using the current tuition structure without the upper-division charge. The average of the effective discount percentage was calculated for different groups for comparison.

The analyses were performed for both all students and engineering students exclusively for the following comparison groups:

- Students of color vs. non-students of color
- Male vs. female
- Pell eligible vs. non-Pell eligible
- Transfer vs. non-transfer

Results

Figure 1 shows the average attempted credits by course level for compared groups (male and female were omitted as the difference was not significant). The different groups have significant differences in the number of credits attempted at the institution at the lower-levels but are much more consistent at the upper-levels. This is mostly due to the differences in transfer and AP credit.

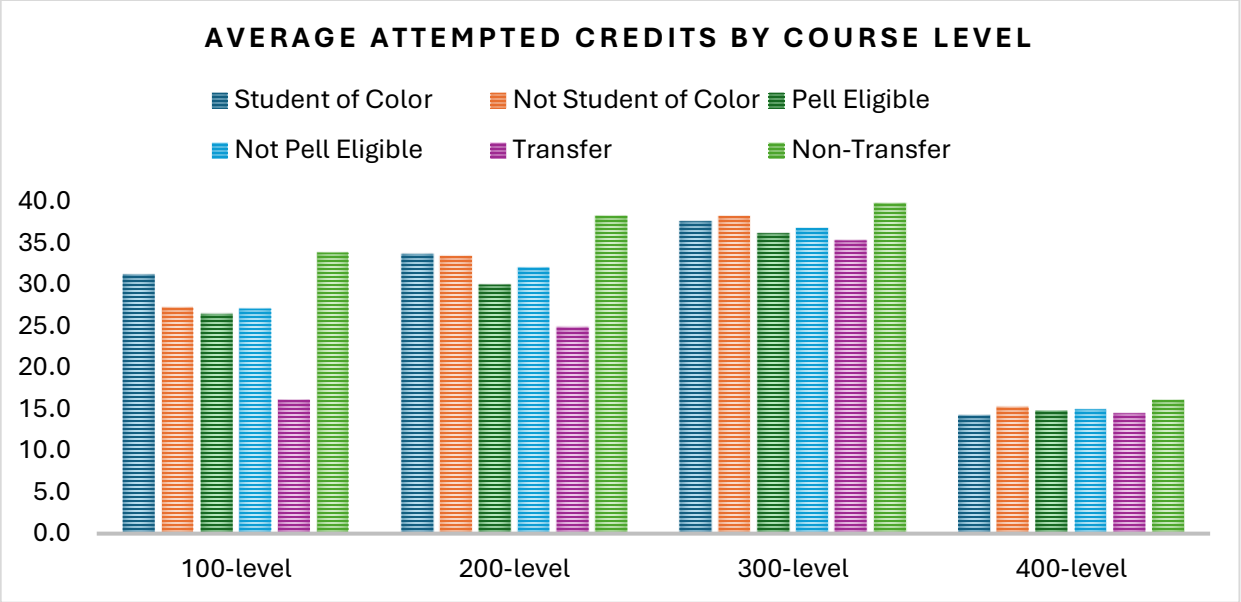

Figure 1: Average attempted credits by course level comparison between groups

Figure 2 shows the average earned credits by level for the different groups and includes all credit from transfer, AP, and CBE. This shows that earned upper-level credits are very similar among the groups, but there are still significant differences in the 100-level. Transfer students have more earned credits, but many of their transfer courses only count toward general credit and do not fulfill degree requirements. There is also a larger number of 100-level credits for students of color and Pell-eligible students as they are more likely to transfer credits or change majors.

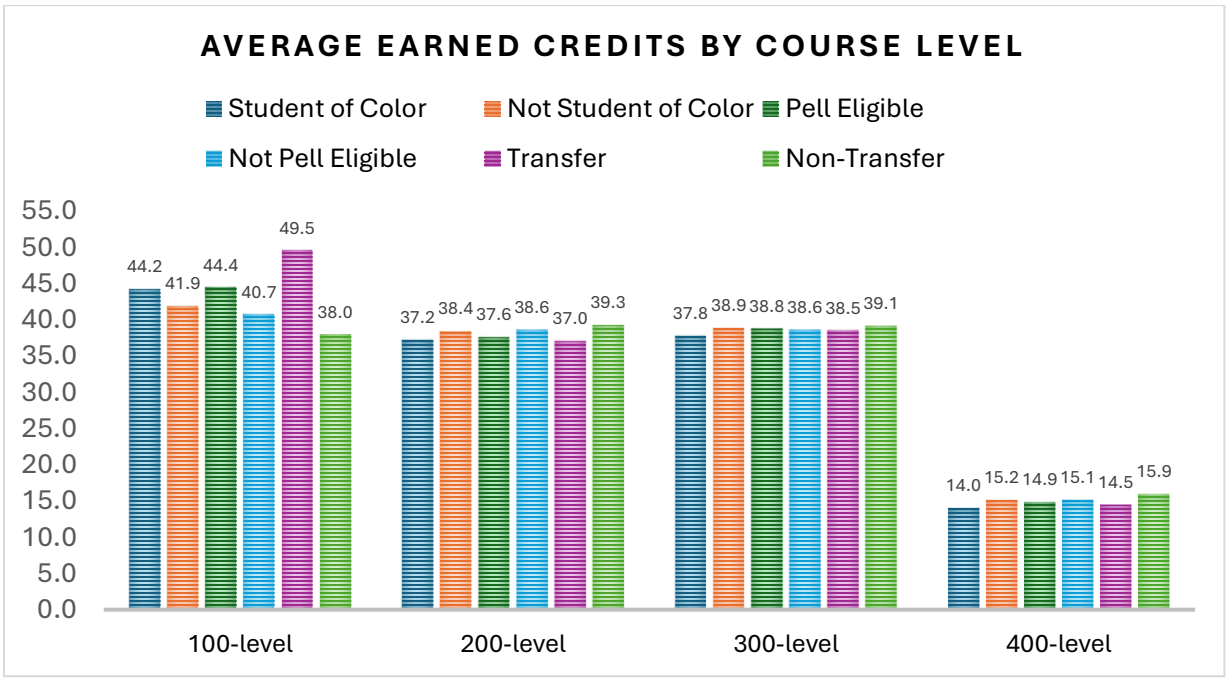

Figure 2: Average earned credits by course level comparison between groups. (Includes all transfer, AP, and CBE credit)

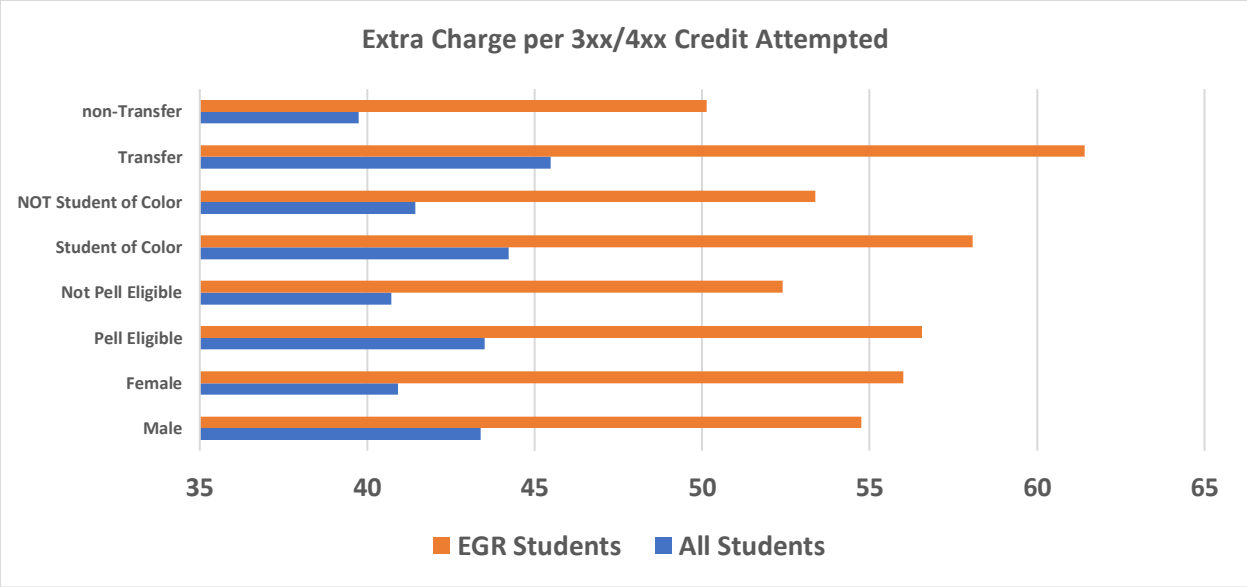

Figure 3: Extra upper-division charges per 3xx and 4xx level credit attempted.

Upper-/Lower-Division Tuition

Figure 3 shows the impartiality measure used to analyze the upper-division tuition charge. This was the calculated total of the upper-division charge by graduation divided by the number of credits attempted at the 300- and 400-level. As could be seen in Figures 1 & 2, students of color, Pell eligible, and transfer students take less upper-level coursework on average; however, the analysis shows that the current upper-division charge is landing heaviest on those who are taking the fewest upper-division courses and are effectively being transferred to students taking courses at the lower division. This is primarily due to transfer credit that does not satisfy degree requirements and repeated coursework. This is especially true for engineering students who have few free elective credits and strict pre-requisites to navigate.

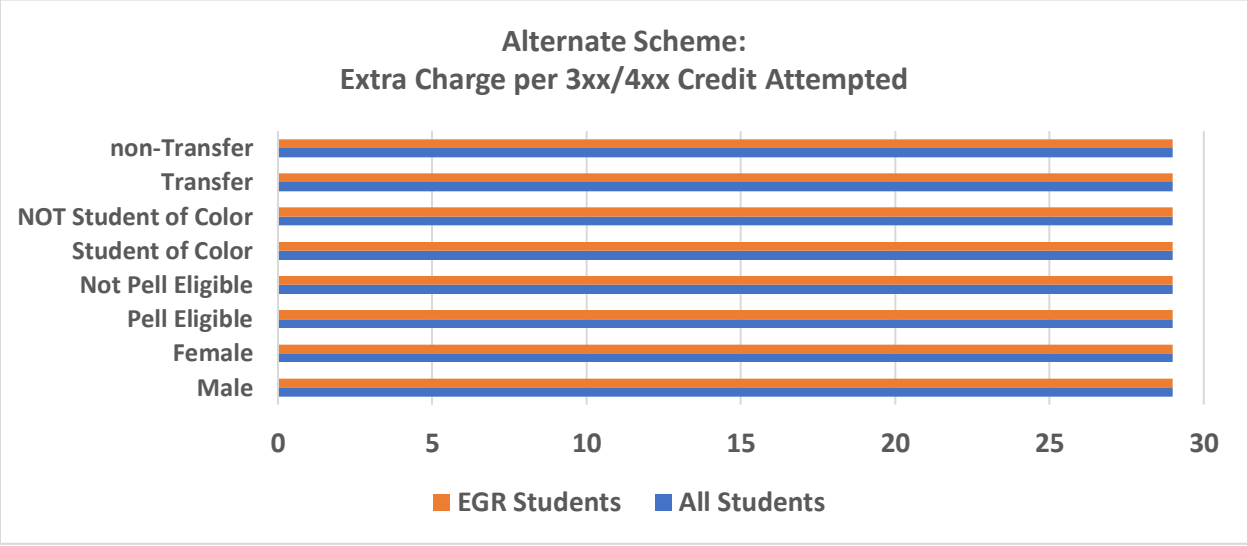

Figure 4: Extra upper-division charges per 3xx and 4xx level credit attempted with alternate scheme.

An alternative scheme would only charge the extra tuition for attempted hours in courses in 300- and 400-level courses. In theory, this scheme would better match tuition to the cost to deliver the course by the institution. Given that it would match our impartiality measure, the metric would be perfectly evened out for all groups as shown in Figure 4.

Block Tuition

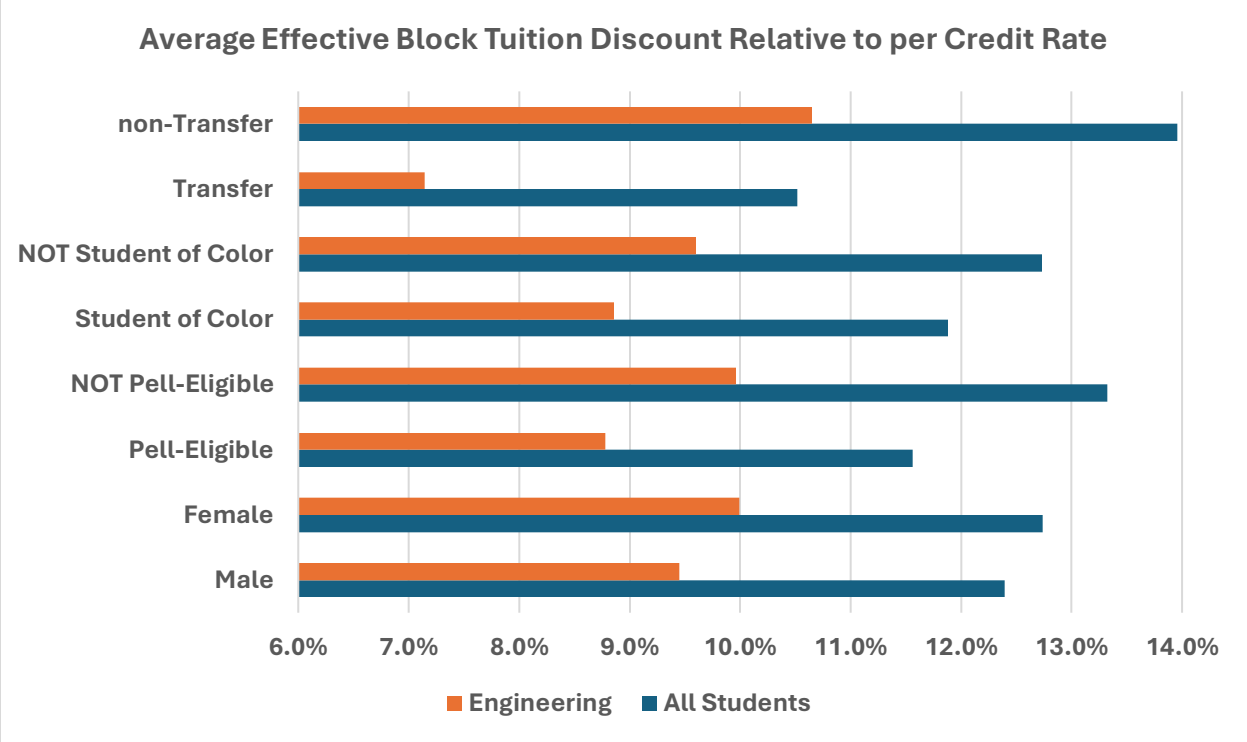

Figure 5: Plot of the impartiality measure (effective discount per credit) resulting from block tuition for engineering students and all students with comparisons between transfer status, race, Pell-eligibility, and gender.

Figure 5 shows a result of the analysis of the effective discount per credit resulting from block tuition for the different groups for all students and engineering students. The average discount enjoyed by engineering students (9%) is significantly below that of all students (13%). Engineering transfer students receive the smallest effective discount of 7.3% compared to the average non-transfer student who receives a discount of 13.9% on average.

Figure 6 shows the comparison of the results in Figures 3 & 5 for engineering students relative to the average for all students and further separates data on students of color into reported race/ethnicity. This clearly shows that engineering students in all categories and demographics are consistently charged more upper-division tuition per 3xx and 4xx credit attempted and benefits significantly less from the block tuition structure relative to non-engineering students.

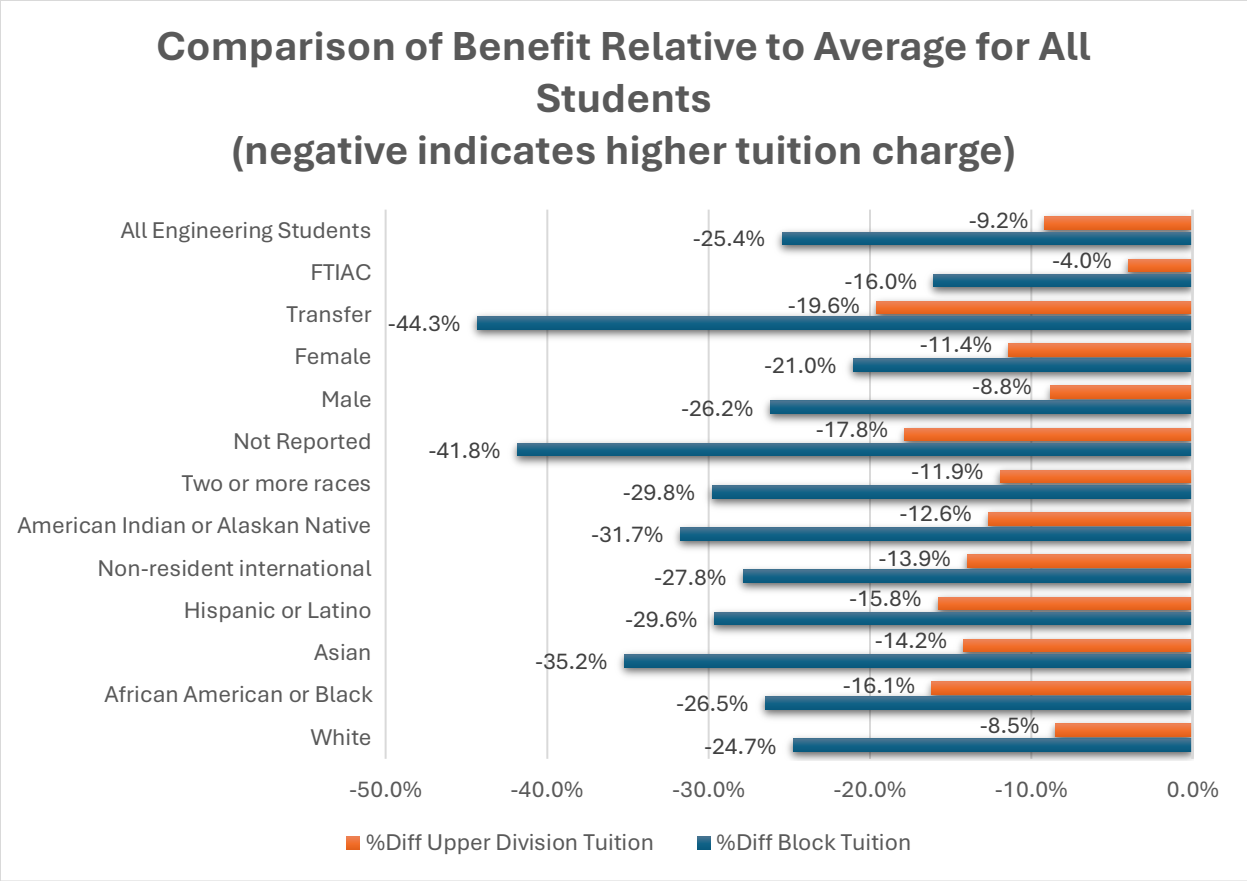

Figure 6: Comparison (% differences) of averages for engineering students in each category relative to the mean for all students.

Discussion and Conclusions

This paper has analyzed the effects of the upper- and lower-division tuition structures along with the block tuition structure on various student groups. The analysis includes dispersion metrics as outlined in [8]. The findings indicate that these structures disproportionately charge higher tuition fees to students of color, Pell-eligible students, and transfer students. This disparate impact is particularly pronounced for students in engineering programs.

Much of the disparate impact from the upper-division charges stems from additional credits not used toward graduation requirements at the lower 100-level, which leads to extra credits being taken after students reach the upper-division status, approximately after completing 59 semester credits. Given that engineering programs often have limited free electives and require more credits than other programs, the issue is exacerbated. This is especially true for students who transfer (often from community colleges) or change majors, resulting in credits that do not satisfy degree requirements.

The rationale for higher upper-division tuition rates is that such courses typically incur higher costs due to smaller class sizes and the need for more specialized faculty and facilities; however, the current structure simply charges less for the first 59 credits and more for all subsequent credits, regardless of the course level or its cost. This is particularly burdensome for students pursuing a

minor, as these courses are charged at the upper-division rate even though they mostly involve lower-level coursework. As found by [5], overcharging certain student groups is likely to discourage their educational participation. The current scheme also discourages students pursuing a minor, double-major, or additional certificates.

The alternative tuition scheme proposed in this paper charges extra only for upper-level (300- and 400-level) courses. Compared to the current scheme, the groups charged the most differ. Data showed that non-minority groups tended to take more upper-level courses yet were charged the least in upper-division tuition, resulting in an undesirable situation where minority groups seem to be subsidizing upper-level coursework for non-minority groups. A tuition scheme based on course level rather than total hours earned would be more equitable.

The case for implementing a block tuition system is to motivate students to take more credits, thereby shortening the time to graduate. Although research has shown this approach to be effective, the same study revealed that most students did not experience financial advantages from the policy [20]. Universities that have recently adopted block tuition are aware of the financial implications of offering such significant tuition discounts and they often couple block tuition with a notable increase in the per-credit tuition rate to maintain revenue neutrality. Students who cannot enroll in the maximum credits allowed under block tuition benefit less, and part-time students see no advantage. When tuition is raised to offset the cost of the discount, students with fewer credit hours end up subsidizing the discount for those with heavier credit loads. This situation disproportionately affects students from marginalized communities, who are often low-income and transfer from community colleges, as they benefit less and end up subsidizing higher-income, non-transfer, white students.

Looking at the three-part test laid out by the U.S. Department of Justice for Title VI in [16], this analysis shows that these policies have a measurable *disparate impact* on students of color. The *justification* for the upper-division tuition policy is to match revenue to the higher expenses of upper-division courses, but there is a clear *less discriminatory alternative*. Meanwhile, the *justification* for the block tuition policy is to encourage higher credit loads and improve graduation rates, but this study should encourage exploration of *less discriminatory alternatives*. While this paper is not intended to serve as legal advice or analysis, this analysis may indicate that these tuition structures may incur some legal liability. These policies are likely to discourage participation of minority and transfer students in higher education and steer students away from degree programs like engineering that are less flexible and require more credits to graduate. Viewed through a framework on equity in education, these policies appear to be inequitable.

References

[1] M. Wanti, R. Wesselink, H. Beimans and P. den Brok, "Determining factors of access and equity in higher education: A systematic review," *Equity in Education & Society*, vol. 1, no. 2, 2022.

[2] V. Tinto, Leaving College: Rethinking the Causes and Cures of Student Attrition, Chicago: The University of Chicago Press, 2012.

[3] G. Whiteford, "Participation in higher education as social inclusion: An occupational perspective," *Journal of Occupational Science, 2017,* vol. 24, no. 1, pp. 54-63, 2017.

[4] A. Logue, "Decreasing Structural Racism in Higher Education," *Inside Higher Ed,* 5 August 2021.

[5] K. Czarnecki, T. Korpi and K. Nelson, "Student support and tuition fee systems in comparative perspective," *Studies in Higher Education,* vol. 46, no. 11, pp. 2152-2166, 2021.

[6] M. Hanson, "Economic Effects of Student Loan Debt," 1 January 2023. [Online]. Available: https://educationdata.org/student-loan-debt-economic-impact. [Accessed 22 March 2023].

[7] Federal Student Aid, "(GEN-24-01) 2024-2025 Federal Pell Grant Maximum and Minimum Award Amounts," US Dept. of Education, 31 January 2024. [Online]. Available: https://fsapartners.ed.gov/knowledge-center/library/dear-colleague-letters/2024-01-31/2024-2025-federal-pell-grant-maximum-and-minimum-award-amounts. [Accessed 22 March 2023].

[8] B. Miller, "Who Are Student Loan Defaulters?," American Progress, 14 December 2017. [Online]. Available: https://www.americanprogress.org/article/student-loan-defaulters/. [Accessed 22 March 2023].

[9] N. Baine and K. Brakora, "Tuition Equity: A Study of the Impact of Upper-/Lower-Division Tuition Rates," in *Proceedings of the 2023 ASEE Annual Conference & Exposition*, Baltimore, MD, 2023.

[10] N. Baine and K. Brakora, "Tuition Equity: A Study of the Disparate Impacts of Block Tuition," in *2024 ASEE Annual Conference & Exposition*, Portland, OR, 2024.

[11] S. Cameron, R. Daga and R. Outhred, "Setting out a conceptual framework for measuring equity in learning," in *Handbook on Measuring Equity in Education*, Montreal, UNESCO Institute for Statistics, 2018, pp. 16-45.

[12] U.S. Supreme Court, "Griggs v. Duke Power Co. 401 U.S. 424," 1971.

[13] U.S. Supreme Court, "Ricci v. DeStefano, 557 U.S. 557," 2009.

[14] Title VII of the Civil Rights Act of 1964, 42 USC42 §2000d, et seq., 1964.

[15] Title VI of the Civil Rights Act of 1964, 42 USC42 §2000d, et seq., 1964.

[16] U.S. Dept. of Justice, "Title VI Legal Manual, Section VII: Proving Discrimination -- Disparate Impact," 3 February 2021. [Online]. Available: https://www.justice.gov/crt/fcs/t6manual7 . [Accessed 22 March 2023].

[17] Michigan Association of State Universities, "Report on Tuition and Fees 2023-2024," Lansing, MI, 2024.

[18] Michigan Association of State Universities, "Report on Tuition and Fees 2022-2023," Lansing, MI, 2023.

[19] Wayne State University, "Flat-Rate Tuition Frequently Asked Questions," August 2023. [Online]. Available: https://wayne.edu/registrar/flat-rate-faq. [Accessed January 2024].

[20] C. Keenan, G. Chhatwal and J. Wang, "A study of the Effects and Policy Implications of Flat Rate Tuition," *International Journal of Research in Education Methodology,* vol. 6, no. 2, pp. 837-849, 2014.

[21] A. Looney, "The student debt burden and its impact on racial justice, borrowers, and the economy," The Brookings Institute, 13 April 2021. [Online]. Available: https://www.brookings.edu/testimonies/the-student-debt-burden-and-its-impact-on-racial-justice-borrowers-and-the-economy/. [Accessed 22 March 2023].

[22] Federal Student Aid, "(GEN-23-02) 2023-2024 Federal Pell Grant Payment and Disbursement Schedules," US Dept. of Education, 26 January 2023. [Online]. Available: https://fsapartners.ed.gov/knowledge-center/library/dear-colleague-letters/2023-01-26/2023-2024-federal-pell-grant-payment-and-disbursement-schedules. [Accessed 22 March 2023].

[23] N. Wong, "New Data Show Recent Graduates Who Received Pell Grants Left School with $6 Billion More in Debt than Their Peers," The Institute for Access & Success, 21 December 2020. [Online]. Available: https://ticas.org/affordability-2/new-data-show-recent-graduates-who-received-pell-grants-left-school-with-6-billion-more-in-debt-than-their-peers/. [Accessed 22 March 2023].

[24] N. Johnson, L. Reidy, M. Droll and R. LeMon, "Program Requirements for Associate's and Bachelor's Degrees: A National Survey," Complete College America, 2012.

[25] N. Baine and K. Brakora, "Tuition Equity: A Study of the Impact of Upper/Lower Division Tuition Rates," in *2023 ASEE Annual Conference & Exposition*, Baltimore, MD, 2023.