# RACIAL DIFFERENCES IN STUDENT LOAN REPAYMENT: DOES FINANCIAL LITERACY MATTER?

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## ABSTRACT

*This study explores how financial literacy affects differences in student loan repayment behavior across three racial groups. The dataset was drawn from the 2021 Survey of Household Economics and Decisionmaking. Logistic regressions revealed that compared with White student borrowers, Black and Hispanic students were more likely to fall behind on their repayments and less likely to pay off their student loan altogether. However, when controlling for both the main and conditional effect of financial literacy, the coefficients for race became statistically insignificant, suggesting that variation in financial literacy and its effectiveness across different racial groups explain a significant part of racial gap in student loan repayment behavior. Separate analysis for each racial group further confirmed that financial literacy affected student loan repayment behavior differently across races. Specifically, improving financial literacy was found to have the greatest impact on promoting desirable 'paid off loan' behavior among White borrowers, and on preventing 'behind payment' behavior among Black borrowers. This study thus suggests that financial literacy education needs to be customized to match the unique needs of the different racial groups to improve student loan repayment behavior.*

## 1-INTRODUCTION

Student loan debt is a common way to finance a college education. As of July 2022, this debt is spread across 48 million student borrowers to finance their college education. As such, student loan debt surpassed the $1.75 trillion mark (Lending-Tree, 2022)[1], and is second in line to mortgage debt. Not only is this debt the highest it has ever been, but it is borne mostly by those who are economically disadvantaged. For example, studies reveal that student debt disproportionately affects Black and Latino students, who are more likely to borrow and take out larger loans than White students (Houle & Addo, 2019; Grinstein-Weiss, Perantie, Taylor, Guo, & Raghavan, 2016; Kim, Chatterjee, Young, & Moon, 2016; Scott-Clayton & Li, 2016; Jackson

[1]"A LOOK AT THE SHOCKING STUDENT LOAN DEBT STATISTICS FOR 2022", (2022). STUDENT LOAN HERO, INC., BY LENDING TREE (*UPDATED: JULY 29, 2022).*

& Reynolds, 2013). Moreover, Black and Latino student borrowers face challenges in managing and repaying their student loans.

The U.S. Department of Education released data in 2017 revealing that 50 percent of Black borrowers who started college in 2003-04 defaulted on their student loans within 12 years (Miller, 2017). Furthermore, Black bachelor's degree graduates, default at five times the rate of White bachelor's degree graduates (21 percent versus 4 percent) and are more likely to default than White dropouts (21 percent versus 18 percent) (Scott-Clayton, 2018). Recent data from the fall of 2019 indicate that Black borrowers who began college in 2011-12 continued to experience high default rates, with one-third (33.4 percent) of Black borrowers who had entered repayment defaulting on their loans within six years, compared with a 13 percent default rate among their White peers (Miller, 2019). Higher student loan default rates were also found in majority-Black and majority-Hispanic areas, with a default rate of 17.7 percent in majority-Black majority areas, compared with 9.0 percent in majority-White areas (Haughwout, Lee, Scally, & Van der Klaauw, 2019). Using the most recent *Survey of Consumer Finances 2019* dataset, Scott III, Mitchell, & Patten (2022) also found that Black students default more often on student loan debts.

The disproportionate difficulty that minority groups face in repaying student loans has been attributed to their greater tendency to accumulate college debt without ultimately obtaining a degree. Research by Shapiro, Dundar, Huie, Wakhungu, Yuan, & Hwang (2017) revealed that Black students have a six-year graduation rate of 38 percent compared to 63.2 percent for White students and 45.8 percent for Hispanic students. Additionally, Hamilton & Darity (2017) found that Black students are one-third (33.3 percent) less likely to finish college compared to their White counterparts, largely due to financial pressures and the predatory practices of for-profit colleges. For-profit colleges have been referred to as "low-value debt bombs" since 80 percent of Black students enrolled in these institutions drop out within six years with an average of US $40,000 of student loan debt, leading to difficulty repaying loans and higher rates of delinquency and defaults (Hamilton & Darity, 2017). However, even after accounting for differences in degree attainment and other student and family background characteristics, the Black-White difference in default rates remains large and statistically significant (Scott-Clayton, 2018).

Previous research on financial literacy has found that Black and Hispanic groups tend to have lower levels of financial literacy compared to their White counterparts (Lusardi & Mitchell, 2023; Al-Bahrani, Weathers, & Patel, 2019; Hill, Johnson, & Shim, 2017; Alvarado, Chapa, & Kim, 2015; and Lusardi, Mitchell, & Curto, 2010. Additionally, these groups may be less likely to experience favorable financial behavioral change from accumulating financial knowledge (Kim & Chatterjee, 2013; Lown & DeVaney, 2010; Lyons, Palmer, Jayaratne, & Scherpf, 2006). Thus, the variations in the financial literacy and its effectiveness across different racial groups may contribute to the racial disparities in student loan repayment behavior. However, prior studies have not investigated the impact of financial literacy on racial disparities in student loan debt repayment. This study is the first attempt to examine whether controlling for both the main and conditional effect of financial literacy can potentially explain the race gap in student loan debt repayment behavior.

The paper is organized as follows: Section 2 contains the literature review. Section 3 presents an overview of data and methodology. Section 4 presents the empirical results. Section 5 presents the conclusions and recommendations for future research in this area.

## 2-LITERATURE REVIEW ON FINANCIAL LITERACY AND STUDENT LOAN REPAYMENT

Financial literacy is defined as the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being (U.S. Financial Literacy and Education Commission 2007). Huston (2010) developed a conceptual framework that presents financial literacy as a component of human capital that can enhance one's financial well-being by effectuating desirable financial behaviors. Studies have found that individuals with greater financial literacy tend to make better financial decisions and exhibit more favorable financial behavior (Xiao, Porto & Mason, 2020; Lusardi & Mitchell, 2007c). Recent research has also highlighted the importance of financial literacy in student loan repayment behavior. For instance, Zhang & Fan (2022) found that financial capability and financial education factors were positively associated with desirable financial outcomes such as higher loan satisfaction and lower loan delinquency. Hales (2021) revealed that individual with higher financial literacy were less likely to take out a student loan, while those with lower financial literacy were more prone to student loan delinquency.

The positive association between financial literacy and student loan repayment behavior could be attributed to two key factors. Firstly, better financial knowledge enables students to effectively allocate their financial resources, leading to higher returns on savings (Lusardi, Michaud, & Mitchell, 2017). Consistent with the intuition, financial literacy has been found to have positive roles in higher saving returns (Deuflhard, Georgarakos, & Inderst, 2018), greater stock market participation (Van Rooij, Lusardi, & Alessie, 2011b), lower investment fees (Choi, Laibson, and Madrian, 2010), and better investment diversification (Gaudecker, 2015). In essence, individuals with better financial literacy skills are more likely to achieve higher rates of return on their financial assets, thus facilitating greater savings accumulation. This, in turn, enhances their capacity to repay student loans. Secondly, financial literacy plays a crucial role in minimizing errors in loan payment estimation. Research conducted by Artavanis and Karra (2020) examined the relationship between financial literacy and the discrepancy between actual student loan payments and expected payment amounts. Their findings revealed that individuals with lower levels of financial literacy were more prone to underestimating their future loan payments. This underestimation ultimately hindered their ability to repay their student debt, resulting in a higher likelihood of loan default. Overall, financial literacy is associated with improved resource management and enhanced accuracy in loan payment projections. These factors collectively contribute to students' increased repayment capacity and, consequently, a higher likelihood of successful student loan repayment.

Not only does financial literacy have a positive impact on financial behavior in general, but studies have also demonstrated that the beneficial effect of financial literacy on financial behavior differs among various racial groups. Lyons et al. (2006) found that although financial

education programs increased financial knowledge among participants of all races, Black and Hispanic participants were less likely to report positive changes in financial behavior compared to White participants. Similarly, Kim & Chatterjee (2013) found that Black participants were less likely to apply their financial knowledge to their financial decisions compared to White participants. Lown & DeVaney (2010) examined financial behaviors among African American couples in the United States. They found that increased financial knowledge among participants did not necessarily result in positive changes in financial behavior. These studies suggest that the effectiveness of financial literacy's ability to yield better financial decisions is conditional on race, with minority groups exhibiting lower levels of financial behavioral change and application of financial knowledge than their White counterparts.

To account for both the main effect and the conditional effect of financial literacy on student loan repayment, our logistic models for predicting student loan prepayment behavior include financial literacy both as an individual factor and as a part of the interaction term with race. This approach allows our paper to make a two-fold contribution to the literature. First, we aim to determine whether accounting for both the main and conditional effect of financial literacy through race can explain the variation in student loan repayment across different racial groups. Second, we aim to examine how the effectiveness of financial literacy on student loan repayment varies across different racial groups.

## 3-DATA AND METHODOLOGY

### 3.1 Sample and Data

The dataset was derived from the *Survey of Household Economics and Decisionmaking* (SHED) conducted by the Federal Reserve Board during October and November 2021. The Survey gathered information from over 11,000 adults pertaining to credit, savings, education, and student loans. Our sample selection involved three criteria. Firstly, we included respondents who attained a certain education level, specifically some college, a college degree, or a master's degree or higher, since student loans are typically available only for those education levels. Secondly, in order to properly evaluate borrowers' repayment behavior, we only included respondents who had actually taken out student loans. Lastly, we restricted our sample to borrowers who self-identified as White non-Hispanic, Black non-Hispanic, or Hispanic. Our final sample consisted of 3,297 respondents, with 2,517 identified as White non-Hispanic, 422 as Black non-Hispanic, and 358 as Hispanic.

Unlike previous studies that have primarily focused on the racial disparity in default rate, this paper examined both the success and struggles of student loan repayment behavior. Specifically, this study used two binary variables, 'paid off loan' and 'behind payment' to measure repayment behavior. Being behind on payment can indicate either delinquency or default status. Delinquency occurs when a payment is not made by the specific due day, while default status is reached when a loan has gone 270 days or more without payment. Financial literacy was measured by the numbers of financial literacy questions answered correctly by the respondents, ranging from 0 to 3. SHED assesses respondents' financial literacy from three questions on interest compounding, inflation, and risk diversification that have been extensively

used in the literature (e.g. Lusardi & Mitchell, 2007a, 2007c, & 2008; Lusardi et al. 2010; Van Rooij et al., 2011; Artavanis & Karra, 2020). These three questions pertain to concepts that are relevant to individuals' day-to-day financial choices throughout their lives and capture general ideas rather than context-specific details. Over time, these three questions have demonstrated their effectiveness as a measure of individuals' grasp of fundamental financial principles (Lusardi & Mitchell, 2023). Socioeconomic variables that could influence the repayment behavior, including race, age, gender, marital status, highest educational attainment, parents' education, household income, and employment status, were also extracted from the SHED dataset. Table I presents the description of these variables as shown in the survey.

**Table I. Description of Variables as Shown in the 2021 SHED**

| Variables | Code and Description in the SHED |
|---|---|
| **Financial Literacy**: numerical variable<br><br>The number of financial literacy questions answered correctly by the respondents.<br>0 = 0 questions answered correctly<br>1 = 1 question answered correctly<br>2 = 2 questions answered correctly<br>3 = 3 questions answered correctly | The three financial literacy questions are as follows:<br>1. (*FL2*) Do you think that the following statement is true or false: buying a single company's stock usually provides a safer return than a stock mutual fund?<br>2. (*FL5*) Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, or less than $102?<br>3. (*FL4*) Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than today, the same as today, or less than today with the money in this account? |
| **Take Student Loan**: categorical variable<br><br>0 = Never had student loan:<br>Answered No to both question SL1 and SL7<br>1 = Had taken student loan:<br>Answer Yes to either question SL1 or SL7 | (*SL1*): Do you currently have student loan debt or owe any money used to pay for your own education?<br><br>(*SL7*): Did you borrow or take out any loans to pay for your own education that you have since repaid? |
| **Paid Off Loan**: categorical variable<br>0 = No, not paid off<br>1 = Yes, have paid off | (*SL7*): Did you borrow or take out any loans to pay for your own education that you have since repaid? |
| **Behind Payment**: categorical variable<br>0 = No, not behind payment<br>1 = Yes, behind payment | (*SL6*): Are you behind on payments or in collections for one or more of the loans from your own education? |
| **Race**: categorical Variable | (*ppethm*): 1 = White non-Hispanic<br>2 = Black non-Hispanic<br>3 = Other, non-Hispanic<br>4 = Hispanic<br>5 = 2+ Races, non-Hispanic |
| **Age**: numerical variable | (*ppage*) |

| | |
|---|---|
| **Gender**: categorical variable | (*ppgender*): 1=Male<br>2=Female |
| **Marital Status**: categorical variable | (*ppmarit5*): 0 = widowed, divorced, separated, or never married<br>1 = now married |
| **Education**: categorical variable | (*ppeducat*): 1= no high school diploma<br>2 = high school graduate<br>3= some college or associate degree<br>4 = Bachelor's degree<br>5 = Master's degree or higher |
| **Employment Status**: categorical variable | (*ppemploy*):1= working full-time<br>2= working part-time<br>3= not working |
| **Parents Education**: numerical variable<br><br>The average score of the highest level of education completed by mother and father. | (*CH2*): What is the highest level of education that your mother completed?<br>(*CH3*): What is the highest level of education that your father completed?<br>-2 = Don't know<br>1= Less than High School degree<br>2 = high school diploma<br>3= some college but no degree<br>4 = Certificate or technical degree<br>5 = Associate's degree<br>6 = Bachelor's degree<br>7 = Graduate degree |
| **Household Income**: numerical variable | (*ppinc7*): Household Income<br>1= Less than $10,000<br>2 = $10,000 to $24,999<br>3= $25,000 to $49,999<br>4 = $50,000 to $74,999<br>5 = $75,000 to $99,999<br>6 = $100,000 to $149,999<br>7 = $150,000 or more |

Note: The codes for variable are enclosed in brackets. The codebook of 2021 *Survey of Household Economics and Decisionmaking* (SHED) can be found in the Federal Reserve website https://www.federalreserve.gov/consumerscommunities/files/SHED_2021codebook.pdf

### 3.2 Summary Statistics

Table II presents the summary statistics of key numerical variables categorized by race for the sample of 3297 respondents in the study. A close comparison of mean value of household income, financial literacy, and parent education showed that White borrowers had the highest average score on all three measures. Their mean household income score was 5.33, indicating a range from $75,000 to $99,999. Their mean financial literacy score of 2.5 indicated that most White borrowers were able to correctly answer at least two out of three financial literacy questions. Their 'parent education' mean score of white borrowers was 3.8, suggesting the highest average educational attainment for their parents was a certificate or technical degree. Black and Hispanic borrowers scored lower than White borrowers on all three measures. Compared to Blacks, Hispanics scored higher on household income and financial literacy.

However, the parents of Black borrowers have attained higher education levels than those of Hispanics borrowers.

**Table II. Summary Statistics for Key Numerical Variables by Race**
**(For the sample of 3259 respondents used in the study)**

| Variable | *Mean* | *SD* | *n* | Min | Max | *Mdn* |
|---|---|---|---|---|---|---|
| Age | | | | | | |
| White, Non-Hispanic | 47.17 | 15.94 | 2517 | 18.00 | 89.00 | 46.00 |
| Black, Non-Hispanic | 46.41 | 14.93 | 422 | 19.00 | 84.00 | 45.00 |
| Hispanic | 40.50 | 13.70 | 358 | 20.00 | 83.00 | 38.00 |
| Household Income | | | | | | |
| White, Non-Hispanic | 5.33 | 1.59 | 2517 | 1.00 | 7.00 | 6.00 |
| Black, Non-Hispanic | 4.61 | 1.66 | 422 | 1.00 | 7.00 | 5.00 |
| Hispanic | 4.89 | 1.58 | 358 | 1.00 | 7.00 | 5.00 |
| Financial Literacy | | | | | | |
| White, Non-Hispanic | 2.50 | 0.79 | 2517 | 0.00 | 3.00 | 3.00 |
| Black, Non-Hispanic | 2.04 | 1.03 | 422 | 0.00 | 3.00 | 2.00 |
| Hispanic | 2.13 | 0.95 | 358 | 0.00 | 3.00 | 2.00 |
| Parent Education | | | | | | |
| White, Non-Hispanic | 3.80 | 1.91 | 2517 | -2.00 | 7.00 | 4.00 |
| Black, Non-Hispanic | 2.86 | 2.02 | 422 | -2.00 | 7.00 | 2.50 |
| Hispanic | 2.80 | 2.02 | 358 | -2.00 | 7.00 | 2.50 |

Note: See Table 1 for detailed explanation for measurement of each variable.

Table III presents the percentage breakdown of key categorical variables based on race. Consistent with the documented racial disparity in student loan repayment, the data showed that the Black and Hispanic borrowers were more likely to be behind on the repayment compared to the White borrowers and less likely to have paid off the loan altogether. As illustrated in Figure 1, the percentages of borrowers who had paid off the loan were 63.81%, 37.91%, and 40.78% for Whites, Blacks, and Hispanics respectively. Figure 3 illustrated that the percentages of borrowers who were behind on the loan repayment were 3.1%, 7.82%, and 9.78% for Whites, Blacks, and Hispanics respectively.

Figure 2 shows the variations in financial literacy mean values between borrowers who had paid off the loan and those with an outstanding loan balance, broken down by race. Similarly, Figure 4 illustrates the variations in financial literacy mean values between borrowers who had no delinquency or default and those who were behind on the repayment. In both Figures, White borrowers consistently had the highest financial literacy scores across all loan repayment statuses, followed by Hispanics, and then Black borrowers. Additionally, borrowers who displayed desirable repayment behaviors (paid-off loan and no delinquency or default on student loans) had higher financial literacy mean scores across all three racial groups. It is also

evident that Hispanics exhibited the least variation in financial literacy scores between the borrowers with contrasting repayment behaviors, indicating the least effectiveness of financial literacy's ability to yield better student loan repayment behavior in Hispanic group.

**Table III. Percentage Statistics for Key Categorical Variables by Race**
**(For the sample of 3259 respondents used in the study)**

| | Race | | |
|---|---|---|---|
| Variable | White, Non-Hispanic | Black, Non-Hispanic | Hispanic |
| Race | | | |
| White, Non-Hispanic | 2517 (100.00%) | 0 (0.00%) | 0 (0.00%) |
| Black, Non-Hispanic | 0 (0.00%) | 422 (100.00%) | 0 (0.00%) |
| Hispanic | 0 (0.00%) | 0 (0.00%) | 358 (100.00%) |
| Total | 2517 (100.00%) | 422 (100.00%) | 358 (100.00%) |
| Gender | | | |
| Male | 1292 (51.33%) | 175 (41.47%) | 174 (48.60%) |
| Female | 1225 (48.67%) | 247 (58.53%) | 184 (51.40%) |
| Total | 2517 (100.00%) | 422 (100.00%) | 358 (100.00%) |
| Education | | | |
| Some college or Associate's degree | 619 (24.59%) | 152 (36.02%) | 129 (36.03%) |
| Bachelor's degree | 1030 (40.92%) | 142 (33.65%) | 141 (39.39%) |
| Master's degree or higher | 868 (34.49%) | 128 (30.33%) | 88 (24.58%) |
| Total | 2517 (100.00%) | 422 (100.00%) | 358 (100.00%) |
| Employment Status | | | |
| Working full-time | 1582 (62.85%) | 274 (64.93%) | 236 (65.92%) |
| Working part-time | 349 (13.87%) | 50 (11.85%) | 49 (13.69%) |
| Not working | 586 (23.28%) | 98 (23.22%) | 73 (20.39%) |
| Total | 2517 (100.00%) | 422 (100.00%) | 358 (100.00%) |
| Paid off Loan | | | |
| No | 911 (36.19%) | 262 (62.09%) | 212 (59.22%) |
| Yes | 1606 (63.81%) | 160 (37.91%) | 146 (40.78%) |
| Total | 2517 (100.00%) | 422 (100.00%) | 358 (100.00%) |
| Behind Payment | | | |
| No | 2439 (96.90%) | 389 (92.18%) | 323 (90.22%) |
| Yes | 78 (3.10%) | 33 (7.82%) | 35 (9.78%) |
| Total | 2517 (100.00%) | 422 (100.00%) | 358 (100.00%) |

Note: Due to rounding error, percentages may not sum to 100%.
See Table 1 for detailed explanation for measurement of each variable.

**Figure 1. Percentage of Paid-off Status by Race**

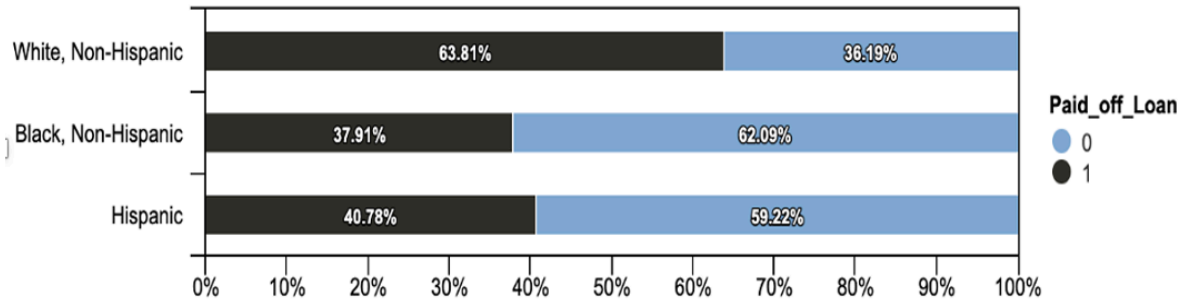
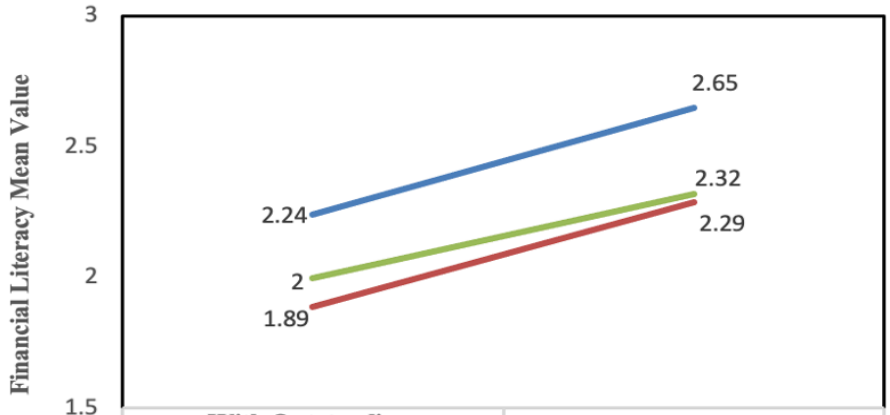



**Figure 2. Comparison of Financial Literacy Mean Values by Paid off Status and Race**




| | With Outstanding Balance | Paid Off Loan |
|---|---|---|
| White, Non-Hispanic | 2.24 | 2.65 |
| Black, Non-Hispanic | 1.89 | 2.29 |
| Hispanic | 2 | 2.32 |

Note: Financial Literacy is measured as the number of financial literacy questions answered correctly by the respondents, ranging from 1 to 3. See Table 1 for detailed description.

**Figure 3. Percentage of Behind Payment Status by Race**

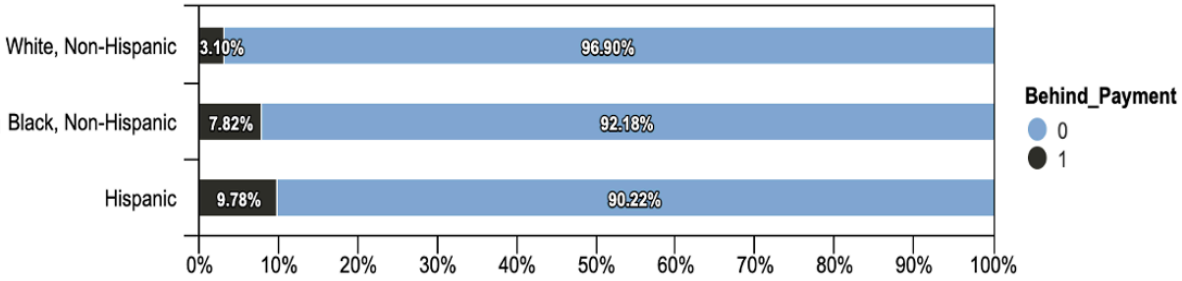
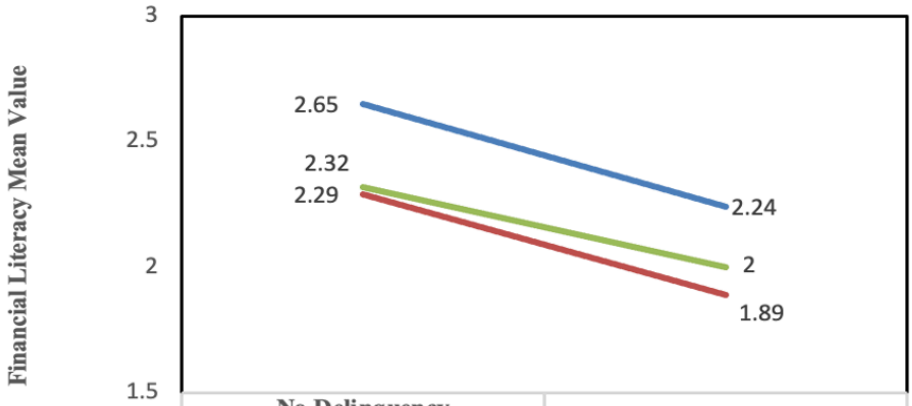



**Figure 4. Comparison of Financial Literacy Mean Values by Behind Payment Status and Race**




| | No Delinquency or Default | Behind Payment |
|---|---|---|
| White, Non-Hispanic | 2.65 | 2.24 |
| Black, Non-Hispanic | 2.29 | 1.89 |
| Hispanic | 2.32 | 2 |

Note: Financial Literacy is measured as the number of financial literacy questions answered correctly by the respondents, ranging from 1 to 3. See Table 1 for detailed description.

### 3.3 Methodology

We performed a series of logistic regressions to assess the impact of financial literacy on the student loan repayment behavior across all racial groups. Firstly, for the base model (Eq.1), we regressed the binary repayment variables against various socioeconomic factors. We then include financial literacy scores and their interaction terms with race in the logistic regression

along with other socioeconomic covariates (Eq.2). The aim was to determine if the inclusion of the main and conditional effect of financial literacy causes the significance of race factor to disappear. Finally, we ran a logistic regression on financial literacy for each racial group separately to further evaluate the variation in the effectiveness of financial literacy on behaviors such as 'paid off loan' and 'behind payment' for the different racial groups (Eq.3).

We controlled for the following socioeconomic variables that could influence repayment behavior: parents' education, family income, employment status, and the highest level of education attained by the borrowers (Oh 2022; Gross et al., 2019; Scott-Clayton & Li, 2016; Addo, Houle, & Simon, 2016; Jackson & Reynolds, 2013). We chose to use White, non-Hispanic group as a reference group because it represents the largest student population and is often used as a reference group in student loan studies (Scott-Clayton & Li, 2016). The logistic regression equations are provided below:

Equation 1:

Logit (Probability of Paid Off Loan or Behind Payment) = $\alpha + \beta 1 \times$ Age$+ \beta 2 \times$ Race $+ \beta 3 \times$ Gender$+ \beta 4 \times$ Marital Status $+ \beta 5 \times$ Education $+ \beta 6 \times$ Employment Status $+ \beta 7 \times$Parent Education $+ \beta 8 \times$ Household Income [Eq.1]

Equation 2:

Logit (Probability of Paid Off Loan or Behind Payment) = $\alpha + \beta 1 \times$ Age$+ \beta 2 \times$ Race $+ \beta 3 \times$ Gender$+ \beta 4 \times$ Marital Status $+ \beta 5 \times$ Education $+ \beta 6 \times$ Employment Status $+ \beta 7 \times$Parent Education $+ \beta 8 \times$ Household Income $+ \beta 9 \times$ Financial Literacy $+ \beta 10 \times$ (Black $\times$ Financial Literacy) $+ \beta 11 \times$ (Hispanic $\times$ Financial Literacy) [Eq.2]

Equation 3:

Logit (Probability of Paid Off Loan or Behind Payment) = $\alpha + \beta 1 \times$ Age $+ \beta 2 \times$ Gender$+ \beta 4 \times$ Marital Status $+ \beta 5 \times$ Education $+ \beta 6 \times$ Employment Status $+ \beta 7 \times$Parent Education $+ \beta 8 \times$ Household Income $+ \beta 9 \times$ Financial Literacy [Eq.3]

## 4-TEST RESULTS

### 4.1 Logistic Regression Results

Table IV presents a comparison of the logistic regression results for predicting 'paid off loan' status. The base model (Eq.1) was compared with the model that includes financial literacy and its interaction terms (Eq.2). The base model showed that being a minority is negatively related to 'paid off loan' status, confirming the existence of racial disparities in student loan repayment. However, when the main and conditional effect of financial literacy was controlled for in Eq.2, the coefficients for Black and Hispanic student borrowers became statistically insignificant. Moreover, financial literacy's main effect was significant with an odds ratio of 1.39, implying that increasing financial literacy by one level would boost the probability of paying off the loan by 39% for the entire sample.

**Table IV. Logistic Regression Results with Age, Race, Gender, Marital Status, Education, Employment Status, Parent Education, Household Income, and Financial Literacy Predicting Paid off Loan for the Entire Sample**

| | Base Model without Financial Literacy (Eq.1) | | | | With Financial Literacy and Interaction Terms (Eq.2) | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *p* | | *OR* | *B* | *p* | | *OR* |
| (Intercept) | -4.35 | < .001 | *** | - | -4.95 | < .001 | *** | - |
| Age | 0.08 | < .001 | *** | 1.09 | 0.08 | < .001 | *** | 1.08 |
| **Black, Non-Hispanic** | **-1.12** | **< .001** | *** | 0.32 | -0.61 | 0.066 | | 0.54 |
| **Hispanic** | **-0.55** | **< .001** | *** | 0.58 | 0.1 | 0.773 | | 1.11 |
| Female | -0.29 | < .001 | *** | 0.75 | -0.2 | 0.031 | * | 0.82 |
| Now married | 0.23 | 0.017 | * | 1.26 | 0.24 | 0.014 | ** | 1.27 |
| Master's degree or higher | -0.49 | < .001 | *** | 0.62 | -0.51 | < .001 | *** | 0.6 |
| Some college or Associate's degree | -0.29 | 0.011 | * | 0.75 | -0.24 | 0.035 | * | 0.79 |
| Working part-time | 0.03 | 0.834 | | 1.03 | 0.01 | 0.938 | | 1.01 |
| Not working | 0.13 | 0.309 | | 1.14 | 0.12 | 0.342 | | 1.13 |
| Parent Education | 0.06 | 0.02 | * | 1.06 | 0.04 | 0.088 | | 1.04 |
| Household Income | 0.23 | < .001 | *** | 1.26 | 0.21 | < .001 | *** | 1.24 |
| **Financial Literacy** | | | | | **0.33** | **< .001** | *** | **1.39** |
| **Black, Non-Hispanic × Financial Literacy** | | | | | -0.2 | 0.14 | | 0.82 |
| **Hispanic × Financial Literacy** | | | | | -0.27 | 0.073 | | 0.76 |
| McFadden R2 | 0.27 | | | | 0.27 | | | |

***significant at 0.001, **significant at 0.01, * significant at 0.05

Logistic Regression Eq.1:

Logit (Probability of Pay Off Loan) = $\alpha + \beta1\times$ Age$+ \beta2 \times$ Race $+ \beta3 \times$ Gender$+ \beta4 \times$ Marital Status $+ \beta5 \times$ Education $+ \beta6 \times$ Employment Status $+ \beta7 \times$Parent Education $+ \beta8 \times$ Household Income

Logistic Regression Eq.2:

Logit (Probability of Pay Off Loan) = $\alpha + \beta1\times$ Age$+ \beta2 \times$ Race $+ \beta3 \times$ Gender$+ \beta4 \times$ Marital Status $+ \beta5 \times$ Education $+ \beta6 \times$ Employment Status $+ \beta7 \times$Parent Education $+ \beta8 \times$ Household Income $+ \beta9 \times$ Financial Literacy $+ \beta10 \times$ (Black $\times$ Financial Literacy) $+ \beta11\times$ (Hispanic $\times$ Financial Literacy)

Table V further confirms the significant racial variation in the effectiveness of financial literacy. Financial literacy had a statistically significant impact on the 'paid off loan' status among White borrowers ($p<0.001$) alone, while no significant impact of financial literacy on 'paid off loan' status was found for either Black or Hispanic student borrowers. These results suggest that improving financial literacy is most effective in encouraging 'paid off loan' behavior among White borrowers.

**Table V. Logistic Regression Results with Age, Race, Gender, Marital Status, Education, Employment Status, Parent Education, Household Income, and Financial Literacy Predicting Paid off Loan by Race**

| | White, Non-Hispanic | | | | Black, Non-Hispanic | | | | Hispanic | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *p* | | *OR* | *B* | *p* | | *OR* | *B* | *p* | | *OR* |
| (Intercept) | -5.43 | < .001 | *** | - | -4.51 | < .001 | *** | - | -3.53 | < .001 | *** | - |
| Age | 0.09 | < .001 | *** | 1.09 | 0.06 | < .001 | *** | 1.06 | 0.06 | < .001 | *** | 1.06 |
| Female | -0.17 | 0.125 | | 0.85 | -0.29 | 0.205 | | 0.75 | -0.31 | 0.228 | | 0.74 |
| Now married | 0.38 | 0.001 | *** | 1.46 | -0.28 | 0.286 | | 0.76 | -0.11 | 0.686 | | 0.9 |
| Master's degree or higher | -0.59 | < .001 | *** | 0.55 | -0.56 | 0.051 | | 0.57 | -0.22 | 0.478 | | 0.8 |
| Some college or Associate's degree | -0.37 | 0.007 | ** | 0.69 | 0.05 | 0.866 | | 1.05 | -0.03 | 0.919 | | 0.97 |
| Working part-time | 0.03 | 0.858 | | 1.03 | 0.13 | 0.722 | | 1.14 | -0.28 | 0.461 | | 0.75 |
| Not working | 0.08 | 0.619 | | 1.08 | 0.22 | 0.471 | | 1.24 | 0.15 | 0.653 | | 1.16 |
| Parent Education | 0.07 | 0.019 | * | 1.07 | -0.03 | 0.62 | | 0.97 | -0.02 | 0.796 | | 0.98 |
| Household Income | 0.22 | < .001 | *** | 1.25 | 0.25 | 0.004 | ** | 1.28 | 0.14 | 0.121 | | 1.15 |
| **Financial Literacy** | **0.31** | **< .001** | *** | **1.36** | 0.22 | 0.079 | | 1.24 | 0.15 | 0.278 | | 1.16 |
| McFadden R2 | 0.29 | | | | 0.17 | | | | 0.13 | | | |

***significant at 0.001, **significant at 0.01, * significant at 0.05

Logistic Regression Eq.3:

Logit (Probability of Pay Off Loan) = $\alpha + \beta 1 \times$ Age + $\beta 2 \times$ Gender+ $\beta 4 \times$ Marital Status + $\beta 5 \times$ Education + $\beta 6 \times$ Employment Status + $\beta 7 \times$Parent Education + $\beta 8 \times$ Household Income + $\beta 9 \times$ Financial Literacy

Table VI presents a comparison of logistic regression results for predicting 'behind payment' status between two models: the base model (Eq.1) and a model that includes financial literacy and its interaction terms (Eq.2). In the base model, being a minority was positively related to 'behind payment' status, indicating racial disparities in student loan repayment. However, controlling for the main and conditional effect of financial literacy in Eq.2 resulted in both Black and Hispanic having insignificant coefficients. The main effect of financial literacy was significant with an odds ratio of 0.76, indicating that increasing financial literacy by one level would reduce the likelihood of falling behind on payments by 24% for the entire sample.

**Table VI. Logistic Regression Results with Age, Race, Gender, Marital Status, Education, Employment Status, Parent Education, Household Income, and Financial Literacy Predicting Behind Payment for the Entire Sample**

| | Base Model without Financial Literacy (Eq.1) | | | | With Financial Literacy and Interaction Terms (Eq.2) | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *p* | | *OR* | *B* | *p* | | *OR* |
| (Intercept) | -1.75 | < .001 | *** | - | -1.4 | 0.008 | ** | - |
| Age | -0.002 | 0.749 | | 1.00 | 0.002 | 0.785 | | 1.00 |
| **Black, Non-Hispanic** | **0.52** | **0.022** | * | 1.69 | 0.55 | 0.203 | | 1.74 |
| **Hispanic** | **0.94** | **< .001** | *** | 2.57 | 0.47 | 0.334 | | 1.60 |
| Female | 0.19 | 0.301 | | 1.21 | 0.11 | 0.546 | | 1.12 |
| Now married | -0.32 | 0.108 | | 0.72 | -0.34 | 0.089 | | 0.71 |
| Master's degree or higher | 0.28 | 0.328 | | 1.32 | 0.28 | 0.314 | | 1.33 |
| Some college or Associate's degree | 1.06 | < .001 | *** | 2.89 | 1.01 | < .001 | *** | 2.74 |
| Working part-time | -0.005 | 0.982 | | 0.99 | 0.03 | 0.911 | | 1.03 |
| Not working | -0.46 | 0.054 | | 0.63 | -0.43 | 0.072 | | 0.65 |
| Parent Education | -0.01 | 0.839 | | 0.99 | 0.007 | 0.879 | | 1.01 |
| Household Income | -0.4 | < .001 | *** | 0.67 | -0.38 | < .001 | *** | 0.68 |
| **Financial Literacy** | | | | | **-0.28** | **0.026** | * | **0.76** |
| Black, Non-Hispanic × Financial Literacy | | | | | -0.08 | 0.712 | | 0.92 |
| Hispanic × Financial Literacy | | | | | 0.24 | 0.276 | | 1.27 |
| McFadden R2 | 0.15 | | | | 0.15 | | | |

***significant at 0.001, **significant at 0.01, * significant at 0.05

Logistic Regression Eq.1:

Logit (Probability of Behind Payment) = $\alpha + \beta1\times$ Age$+ \beta2 \times$ Race $+ \beta3 \times$ Gender$+ \beta4 \times$ Marital Status $+ \beta5 \times$ Education $+ \beta6 \times$ Employment Status $+ \beta7 \times$Parent Education $+ \beta8 \times$ Household Income

Logistic Regression Eq.2:

Logit (Probability of Behind Payment) = $\alpha + \beta1\times$ Age$+ \beta2 \times$ Race $+ \beta3 \times$ Gender$+ \beta4 \times$ Marital Status $+ \beta5 \times$ Education $+ \beta6 \times$ Employment Status $+ \beta7 \times$Parent Education $+ \beta8 \times$ Household Income $+ \beta9 \times$ Financial Literacy $+ \beta10 \times$ (Black × Financial Literacy) $+ \beta11\times$ (Hispanic × Financial Literacy)

Table VII displays the comparison of logit results for each racial group separately. The results showed that financial literacy has a negative relationship with 'behind payment' status in Black borrowers, with an odds ratio of 0.59 indicating we can expect a 41% decrease in the likelihood of falling behind on payments for every one level increase in financial literacy. However, no significant impact of financial literacy on 'behind payment' status was found for either White or Hispanic borrowers. These results suggest that improving financial literacy may be most effective in preventing 'behind payment' behavior among Black borrowers.

**Table VII. Logistic Regression Results with Age, Race, Gender, Marital Status, Education, Employment Status, Parent Education, Household Income, and Financial Literacy Predicting Behind Payment by Race**

| | White, Non-Hispanic | | | Black, Non-Hispanic | | | Hispanic | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *p* | *OR* | *B* | *p* | *OR* | *B* | *p* | *OR* |
| (Intercept) | -1.2 | 0.077 | - | -2.47 | 0.024 * | - | -0.33 | 0.736 | - |
| Age | -0.01 | 0.244 | 0.99 | 0.02 | 0.119 | 1.02 | 0.02 | 0.322 | 1.02 |
| Female | 0.27 | 0.30 | 1.31 | 0.14 | 0.728 | 1.15 | -0.45 | 0.266 | 0.64 |
| Now married | -0.22 | 0.427 | 0.81 | -0.49 | 0.282 | 0.61 | -0.44 | 0.293 | 0.64 |
| Master's degree or higher | 0.92 | 0.022 * | 2.52 | -1.1 | 0.111 | 0.33 | 0.26 | 0.653 | 1.29 |
| Some college or Associate's degree | 1.63 | < .001 *** | 5.09 | 0.46 | 0.342 | 1.58 | 0.52 | 0.226 | 1.69 |
| Working part-time | -0.006 | 0.985 | 0.99 | 0.17 | 0.764 | 1.19 | -0.18 | 0.742 | 0.83 |
| Not working | -0.79 | 0.027 * | 0.45 | 0.39 | 0.39 | 1.48 | -0.53 | 0.288 | 0.59 |
| Parent Education | -0.03 | 0.683 | 0.97 | 0.19 | 0.079 | 1.21 | -0.1 | 0.325 | 0.91 |
| Household Income | -0.48 | < .001 *** | 0.62 | -0.17 | 0.249 | 0.84 | -0.39 | 0.004 ** | 0.68 |
| **Financial Literacy** | -0.16 | 0.242 | 0.86 | **-0.53** | **0.006** ** | **0.59** | -0.13 | 0.499 | 0.87 |
| McFadden R2 | 0.18 | | | 0.12 | | | 0.09 | | |

***significant at 0.001, **significant at 0.01, * significant at 0.05

Logistic Regression Eq.3:

Logit (Probability of Behind Payment) = $\alpha$ + $\beta$1× Age + $\beta$2 × Gender+ $\beta$4 × Marital Status + $\beta$5 × Education + $\beta$6 × Employment Status + $\beta$7 ×Parent Education + $\beta$8 × Household Income + $\beta$9 × Financial Literacy

Additionally, among all the socioeconomic factors controlled for, only household income and some college consistently impacted both the ‘paid off loan’ and ‘behind payment’ status of the entire sample. The higher the household income, the more likely borrowers were to pay off their loans and the less likely they were to fall behind on payments. Some college without degree completion was found to be negatively associated with ‘paid off loan’ status and positively associated with ‘behind payment’ status. These findings were consistent with the existing literature that attributes repayment difficulties of minority students to their higher tendency to accumulate college debt without obtaining a degree (Scott-Clayton, 2018; Hamilton & Darity, 2017; Shapiro et al., 2017).

### 4.2 Wu-Hausman Endogeneity Test

According to Klapper, Lusardi, and Panos (2013), correlations between financial literacy and financial outcomes do not automatically imply causation. To establish a causal link, it is essential to address the potential endogeneity of financial knowledge by conducting an appropriate test. In our study, we conducted a Hausman test (Hausman 1978) to determine if an exogenous source of variation in financial literacy is necessary to assess its causal relationship with loan repayment behavior.

To implement the Hausman test, we need to identify instrumental variables (IVs) that satisfy both the relevance and exogeneity assumptions. After carefully examining the data, we identified "Don't Know" as an instrument as it was correlated with financial literacy (relevance) and appeared to be uncorrelated with the error terms in the loan repayment status estimations (exogeneity). In our dataset, "Don't Know" took a value of 1 if the respondent answered "Don't know" to any of the three financial literacy questions in the SHED survey, and a value of 0 if the respondent did not answer "Don't know" to any of the financial literacy questions.

The Hausman test is conducted by constructing simultaneous equations that include a set of exogenous variables and endogenous variables. In our equations, the exogenous variables consisted of age, race, gender, marital status, education, employment status, parent education, and household income. On the other hand, the endogenous variables were the "Paid off loan" status, the "Behind payment" status, financial literacy, and its interaction terms with race. The Hausman test procedure involved the following steps (Hausman, 1978):

Step 1: Estimate the equation of Financial Literacy with all exogenous variables and the instrument “Don’t Know” as independent variables:

$$\text{Financial Literacy} = \alpha 1 + \alpha 2 \times \textit{Don't Know} + \alpha 3 \times \text{Age} + \alpha 4 \times \text{Race} + \alpha 5 \times \text{Gender} + \alpha 6 \times \text{Marital Status} + \alpha 7 \times \text{Education} + \alpha 8 \times \text{Employment Status} + \alpha 9 \times \text{Parent Education} + \alpha 10 \times \text{Household Income} + \mu 1$$

Step 2: Run the linear probability regression with Paid Off Loan or Behind Payment as the dependent variable and the estimated residuals $\widehat{\mu 1}$ from step 1 as an independent variable along with all other variables:

$$\text{Paid Off Loan or Behind Payment} = \beta 1 + \beta 2 \times \text{Age} + \beta 3 \times \text{Race} + \beta 4 \times \text{Gender} + \beta 5 \times \text{Marital Status} + \beta 6 \times \text{Education} + \beta 7 \times \text{Employment Status} + \beta 8 \times \text{Parent Education} + \beta 9 \times \text{Household Income} + \beta 10 \times \text{Financial Literacy} + \beta 11 \times (\text{Black} \times \text{Financial Literacy}) + \beta 12 \times (\text{Hispanic} \times \text{Financial Literacy}) + \beta 13 \widehat{\mu 1} + \mu 2$$

Step 3: Wu-Hausman endogeneity test hypothesis
Null Hypothesis: $\beta 13 = 0$, Financial Literacy is exogenous.
Alternative Hypothesis: $\beta 13 \neq 0$, Financial Literacy is endogenous.

Based on the diagnostic results presented in Table VIII, the Wu-Hausman test did not provide evidence to reject the null hypothesis of exogeneity. This implies that the need for IV estimation to address endogeneity is not warranted., and the original regression results are considered more accurate and reliable than IV estimates.

**Table VIII. Diagnosis Test on Endogeneity of Financial literacy in Predicting Paid 0ff Loan and Behind Payment**

| | | | Predicting Paid off Loan | | | Predicting Behind Payment | | |
|---|---|---|---|---|---|---|---|---|
| | *df1* | *df2* | Statistics | p-value | | Statistics | p-value | |
| Wu-Hausman | 3 | 3093 | 2.177 | 0.0887 | | 0.786 | 0.5016 | |
| Weak Instrument (Financial Literacy) | 3 | 3096 | 93.854 | <2e-16 | *** | 93.854 | <2e-16 | *** |
| Weak Instrument (Financial Literacy*Black) | 3 | 3096 | 116.568 | <2e-16 | *** | 116.568 | <2e-16 | *** |
| Weak Instrument (Financial Literacy*Hispanic) | 3 | 3096 | 93.743 | <2e-16 | *** | 93.743 | <2e-16 | *** |
| Sargan | 0 | NA | NA | NA | | NA | NA | |

***significant at 0.001, **significant at 0.01, * significant at 0.05

Additionally, the null hypothesis of weak instruments was rejected at p<2e-16, providing robust evidence that “Don’t Know” is a strong instrument that meets the relevance assumption. However, due to the limitation of having only one instrument available in the dataset, we were unable to conduct the Sargan test for instrument exogeneity. The Sargan test requires an overidentified equation, where the number of instruments is greater than the number of suspected endogenous regressors. In our case, with only one instrument, the Sargan test cannot be applied.

Nevertheless, we provided theoretical justification for the instrument exogeneity. Firstly, the "Don't Know" responses to the financial literacy questions can be interpreted as genuine uncertainty or a lack of knowledge about specific financial concepts, rather than a deliberate choice or a direct indicator of behavior. This suggests that individuals may not possess sufficient understanding of certain financial aspects without it being directly related to their loan repayment behavior. Secondly, we observed that the "Don't Know" responses appeared to be random and not systematically influenced by factors such as individual preferences, attitudes, or unobserved characteristics that could affect loan repayment behavior. These theoretical reasons enabled us to treat the "Don't Know" responses as exogenous or unrelated to the error term in estimating loan repayment behavior.

The robustness of our instrument selection and the absence of endogeneity provide substantial support for the validity of our original logistic regression estimates, eliminating the need for instrumental variables (IVs). With these findings, we can confidently assert that the observed associations between financial literacy and loan repayment behavior indicate a genuine causal relationship.

## 5-CONCLUSION

This study sheds light on the significant impact of financial literacy on student loan repayment behavior and how it varies across different racial groups. Overall, the findings indicate that a higher level of financial literacy is associated with a greater likelihood of paying

off student loans and a lower likelihood of falling behind on payments for the overall sample. However, the impact of financial literacy on repayment behavior differs significantly among racial groups. This study reveals that financial literacy is most effective in preventing 'behind payment' behavior among Black student borrowers, while it has the most significant impact on promoting favorable 'paid off loan' behavior among White student borrowers.

The observed asymmetry in the impact of financial literacy on loan repayment behavior among different racial groups can potentially be attributed to variations in their levels of financial literacy. As discussed earlier, financial literacy is associated with both higher returns on financial assets and lower forecasting errors in loan repayments. However, the strength of each association may vary depending on borrowers' levels of financial literacy.

Regarding the positive impact of financial literacy on higher returns and savings, Lusardi et al. (2017) highlighted that investment returns and savings tend to increase at a faster rate for individuals with higher levels of education. Therefore, it can be inferred that individuals with higher financial literacy, such as White borrowers in this case, would benefit the most from the positive effects of financial knowledge on investment returns. As their financial literacy improves, their returns and savings accumulation grow at a faster rate, resulting in a higher ability to repay loans in full and on time. This explains why the impact of financial literacy on the 'paid off loan' status was most pronounced among White student borrowers, who generally exhibited the highest level of financial literacy in comparison to the other racial groups in this study.

On the other hand, we posit that the impact of financial literacy on reducing forecasting errors in loan payments is particularly pronounced among borrowers with lower levels of financial literacy. According to Artavanis and Karra (2020), individuals with low financial literacy are more likely to underestimate their future loan payments compared to those with higher financial literacy. Given that Black borrowers generally exhibit lower levels of financial literacy, they are more prone to underestimate the amount they need to repay, which can result in delinquency and default. As a result, the benefit of financial literacy in minimizing forecasting errors is particularly significant among Black student borrowers. This explains the significant negative relationship observed between financial literacy and the 'behind payment' status for this specific group.

In addition to identifying the significant variation in the impact of financial literacy on student loan repayment behavior among racial groups, our study also reveals that controlling for both the main and conditional effect of financial literacy substantially removes the negative impact of belonging to a minority group on student loan repayment behavior. These findings suggest that the variation of financial literacy and its effectiveness across different racial groups can account for a significant part of the racial gap in student loan repayment.

This study's findings hold significant implications for policymakers and financial literacy education. Financial literacy education can potentially reduce the racial gap in student loan repayment, but for these programs to be effective, they must be customized to meet the unique needs of different racial groups. To achieve this, Cordero, Gil-Izquierdo, & Pedraja-Chaparro (2022) recommend that financial literacy education be delivered by experts and specialists, rather than by non-specialist teachers. Additionally, before designing the program, a proper assessment

of the current level of financial literacy is necessary for customization (Bongini, Iannello, Rinaldi, Zenga, & Antonietti, 2018). It's important to note that the effectiveness of financial literacy education is influenced by a range of complex factors, including cultural values, access to financial resources, and systemic barriers to financial well-being. Therefore, further research should investigate these factors to design financial literacy education programs that can maximize benefits and minimize barriers for each major racial group's unique circumstances and cultural contexts.

Finally, it would be valuable for future research to investigate whether improving financial literacy can also address the gender gap in student loan repayment. Previous studies, such as Saleh, Yu, Leslie, & Seydel (2017), have shown that women may face more challenges in paying off their student debt due to various factors such as industry policies and salary inequities. Despite the availability of extended repayment periods, extended payment options still have negative impact on women compared to men. (Miller, 2017; Saleh et al., 2017). Therefore, it is important to explore whether financial literacy interventions can potentially help mitigate this gender gap in student loan repayment.

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