AT WHAT COST? THE IMPACT OF STUDENT LOAN DEBT ON HEALTH

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Abstract

Students in the U.S. show an increasing reliance on loans to finance their college education. Yet, studies assessing the effect of student debt on health are limited. This paper extends from the literature by examining the causal relationship between student debt holdings and reported health status through a lifecycle. I use data from the National Longitudinal Survey of Youth 1997 (NLSY97) and employ a two-way fixed effects model. My result shows that student loan debt holdings reduce self-rated health status. It fits in the literature studying the cost and benefit of college education through the lens of long-run health costs.

KEYWORDS: Student Loan Debt, Higher Education, Health
JEL CODES: I10, I22, I23

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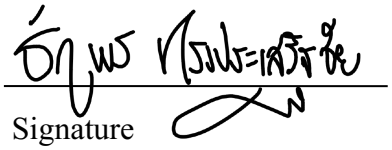

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Introduction

The skyrocketing cost of college education has not stopped Americans from pursuing their bachelor's degrees, on the contrary, it has increased their reliance on student loans. The amount of student loan debt in the U.S. went from $0.76 trillion in 2010 to $1.73 trillion in 2020, totaling over 45.3 million student loan borrowers (Hanson, 2021a). Although a college degree may bring about $1.2 million additional earnings over one's lifetime (Carnevale, Cheah, & Wenzinger, 2021), what is the associated cost in the process of investing in college education? Literature has shown physical and mental health costs associated with personal loan holdings (Kim & Chatterjee, 2019; Walsemann, Gee, & Gentile, 2015). Given that the average length of paying back student loans is 20 years (Hanson, 2021b), what is the long-term health cost of financing for college?

In this paper, I study the impact of student loan debt on health. There are two ways in which student debt can negatively affect health. First, accumulating debt limits available financial resources, making it difficult for individuals to seek medical care when needed. This can have a detrimental impact on their long-term health. Second, student debt can be an overwhelming source of stress which deteriorates the health in the long run. Therefore, I hypothesize that student debt worsens health.

For my analysis, I use data from the National Longitudinal Survey of Youth 1997 (NLSY97), a nationally representative cohort study with 8,984 participants born during the years 1980 through 1984. To study the cost of financing a bachelor's degree through student loans, I limit my dataset to those who have obtained at least a bachelor's degree. I perform a two-way fixed effects method to account for potential endogeneities between

student debt holdings and health status. In particular, the results show a statistically significant association between student debt and poorer self-rated health. My analysis shows an increase of $3,843.2 in student loan debt leads to a deterioration of 0.005 on the scale of self-rated health status from 1-5.

This is consistent with previous literature on debt and health. Sweet et al. (2013) and Clayton, Linare-Zegarra, and Wilson (2015) found negative relationships between household debt and health outcomes. In addition, Walsemann, Gee, and Gentile (2015) found student loans to be associated with poorer psychological functioning.

Following this section, I discuss studies of the impact of student loans on financial and health outcomes. Then, I explain how student loan debt negatively impacts health. I describe my dataset, variables, and how I treat missing values in Data section. Next, I talk about endogeneity issues my model faces and strategies to overcome them in Methodology section. Then, I discuss the results and limitations, and how other researchers can improve on my analysis. Lastly, I present the meaning of my results and its policy implications.

Literature Review

Literature on the impact of student loans has mostly focused on financial and wealth building outcomes, while studies on health outcomes are not as abundant. This literature review first discusses the findings of the broad implications of education debt. Second, I explore results from studies on debt as a determinant of health. Lastly, I state how this research paper contributes to the literature on student loans.

Student Loan and Financial Impact

With the overwhelming rise in college tuition and underwhelming growth of the average household income, financing higher education through student loans have become more and more essential to many American households. The growing number of student borrowers have led many researchers to investigate the impact of education loans on financial outcomes.

First, studies indicate that having education loans negatively impacts and individual's net worth and other wealth accumulation outcomes. Hiltonsmith (2013) found that average student debt of $53,000 led to a lifetime net worth loss of $208,000, using data from the Survey of Consumer Finances. Similarly, a study done by Elliott, Grinstein-Weiss, and Nam (2013) found that the median 2009 values for retirement savings, net worth, and financial assets among households with student debt were all significantly lower than those without such loans.

Second, past literature shows education loans to be negatively related to wage growth over time. Using National Postsecondary Student Aid Study, Minicozzi (2005) showed that a rise in education debt from $5,000 to $10,000 was associated with a drop of 3 percentage points in wage growth over four years.

Lastly, education loans are found to be associated with a decrease in homeownership rates. Since qualifying for a home mortgage relies heavily on an individual's debt-to-income ratio, given that student borrowers are bearing a large amount of loans, many do not qualify for housing loans (Mishory, O'Sullivan, & Invincibles, 2012).

In summary, studies find student loan debt to lower individual's net worth, wage growth, and homeownership rates. The findings suggest that having student loan debt limits available financial resources which can be used towards medical care.

Debt and Health

Research investigating the independent effects of student debt on health outcomes is limited, however, a small body of literature finds a significant association between household debt and health. Clayton, Linare-Zegarra, and Wilson (2015) investigated the relationship between household debt and aggregate health outcomes across 17 European countries. The study used life expectancy at birth and premature mortality as summary measures of health. After controlling for country-level differences such as government expenditure on health care and real GDP per capita, the paper found aggregate household debt to be a significant determinant of aggregate health outcomes across all countries in the study. Long-term household debt was associated with poorer health outcomes. The result was robust; the negative relationship between debt and health outcomes was still present when using alternative health measures (premature mortality indicators such as acute myocardial infarction).

Similarly, Sweet et al. (2013) found significant associations between household financial debt and mental and physical health. Using the National Longitudinal Study of Adolescent Health, the study showed that reporting high financial debt relative to assets was associated with poor health outcomes: higher perceived stress and depression, worse self-rated health, and higher diastolic blood pressure. The association still remained significant after controlling for health insurance, homeownership, prior physical health, and other demographic factors. Cohen et al. (1983) and Reading and Reynolds (2001) explain that debt can result in worsen physical health conditions because of socio-economic hardship and material deprivation.

More recently, an interest in the direct relationship between student loans and health outcomes has emerged. Using data from Panel Study of Income Dynamics, Kim and Chatterjee (2019) illustrated that student debt was not significantly associated with self-rated health but had a negative association with perceived life satisfaction, after controlling for sociodemographic factors. Lastly, Walsemann, Gee, and Gentile (2015) explored the impact of student loan debt and psychological functioning using the NLSY97. The researchers restricted the sample to those who had enrolled in college for at least one semester by 2010. They employed multivariate linear regression to study the association between the cumulative amount of student loans borrowed and psychological functioning in 2010. The authors also used a within-person fixed effects model to adjust for all time-invariant characteristics. Other covariates included educational attainment and income. The research found student loans to be associated with poorer psychological functioning.

My research extends from the literature by examining the impact of student loans on self-reported health status. Self-rated health is a widely used measure of health; many studies have found it to be a good predictor of health outcomes such as mortality, and physical and mental health status (Singh-Manoux, et al., 2006; Jylhä, 2009). In addition, I use a long-panel data from 1997 to 2017, which records information on the long-run health effect that spans through the peak of one's prime working age. The implementation of individual fixed effects further helps isolate the idiosyncratic factors that may bias the causal inference.

Theory

I hypothesize that an increase in student loan debt leads to poorer health outcomes. As discussed in the literature review, student debt limits available financial resources, especially in the form of savings. As individuals with student loans have to allocate a portion of their income towards debt payment, their disposable income decreases, thus, they have limited funds towards health expenditures. Furthermore, when medical costs pose a large burden relative to disposable income, individuals are discouraged to seek medical care when needed, which can worsen their health in the long run. Second, student loan debt can result in overwhelming stress which deteriorates the health in the long run. Traditional stress response theory states that persistent stressors can cause stress-related diseases and illnesses (Schneiderman, Ironson, & Siegel, 2005).

Alternatively, student loan debt may not impact health status. When students do not intend to pay off their student loans, they will not suffer from lower disposable income due to debt repayment, nor will they bear the stress of student loan repayment. Additionally, studies have shown that a college degree provides large lifetime financial returns (Carnevale, Cheah, & Wenzinger, 2021; Oreopoulos & Petronijevic, 2013). If an individual's income increases, then the resources one can allocate between student loan repayment and other necessities will become less restricted. Therefore, the negative impact of student loan holdings can be canceled out by the increase in income.

Data

To examine the effect of student debt on health, I use the National Longitudinal Survey of Youth 1997 (NLSY97), a nationally representative cohort study with 8,984 respondents born during the years 1980 through 1984 and living in the United States at first interview. The NLSY97 sample was selected to represent noninstitutional population of the United States. The survey consists of 19 rounds of interviews that covered a range of topics including education, work experience, health related issues, and financial situations.

To study the cost of financing a bachelor's degree through student loans, I restrict my analysis to individuals who have received at least a bachelor's degree by the end of Round 19. Table 1 provides demographics of all individuals in the dataset and Table 2 summarizes continuous variables used in the analysis.

Of all the participants, 2,530 individuals received a bachelor's degree or higher. Of those who received a bachelor's degree at minimum, 41.8% are male and 58.2% are female. Breaking down the ethnicity of the respondents, 18.1% are Black, 14.3% are Hispanic, 1.0% are mixed race, and the remaining 66.5% are non-Black non-Hispanic.

Table 1: Demographics

No of Waves:	18
No of Individuals:	2,530
Gender	
Female	1,472
Male	1,058
Ethnicity	
Black	459
Hispanic	362
Mixed	26
Non-Black, Non-Hispanic	1,683

Self-rated health. Similar to previous research, I use self-rated health as a measure of health outcomes. Self-rated health is a widely used measure of health, mainly because of its strong relation with health outcomes such as mortality, and physical and mental health status (Singh-Manoux, et al., 2006). In the NLSY97, self-rated health was indexed by a single item, "In general, how is your health?" Responses ranged excellent (1) to poor (5). Higher scores thus indicate worse general health. The average self-rated health is 1.7.

Student Loan Debt. This research's main independent variable is student loan debt. The NLSY97 categorizes student debt into two types: institutional loan and non-institutional loan. Non-institutional sources include debt from relatives or friends. Institutional sources include federal loans. For both types of loans, participants were asked "How much is still owed on these loan(s)?" Respondents were asked the amount still owed term by term. After one term had been reported, each respondent was asked if the amount had changed from the previous term, and if it had not, the information was not recollected. For my analysis, I use the last value reported as the student debt for that

given year. The student debt variable is the sum of institutional loan and non-institutional loan. I use World Bank's US GDP deflator with 2015 based year to adjust student debt values as well as other price variables. Only participants who had started college and participants who reported receiving any type of financial assistance were eligible for loan questions, therefore those who do not meet the criteria were marked as valid skips. I treat all NA values as zero and create a dummy variable to record valid and invalid skips. The latter include participants who refused to answer or did not know the answer. The average student loan is $729.8.

Income. Previous research shows a link between household income and health, supporting that it is necessary to control for its variation in relation to health outcomes. Each year, participants were asked "How much income did you receive from wages, salary, commissions, or tips from all jobs, before deductions for taxes or anything else?". I adjust income values using World Bank's US GDP deflator with 2015 based year. Only participants who had a career were eligible for this question, thus those who did not work were marked as valid skips. Similar to my treatment of student debt, all NA values are treated as zero, a dummy variable is created to categorize invalid and valid skips. The average income is $20,528.6.

Table 2: Descriptive Statistics

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Self-rated health	48,070	1.7	1.0	1.0	1.0	2.0	5.0
Non-institutional student loan	43,010	60.7	965.2	0.0	0.0	0.0	80,400.4
Institutional student loan	45,540	672.4	3,672.9	0.0	0.0	0.0	388,382.3
Total student loan	45,540	729.8	3,843.2	0.0	0.0	1.0	388,382.3
Annual income	48,070	20,528.6	32,803.2	0.0	0.0	33,289.9	306,097.5

Methodology

The regression used in this analysis is a two-way fixed effects model. My regression equation is shown in Equation 1. I introduce time and individual FE to control for variables affecting health not captured in *TotalLoan* or *Income* variables. Time FE controls for variables that change over time and shared by each individual. Individual FE controls for variables that are unique to each individual but do not change over time or change at a constant rate. Example of what individual FE controls are predetermined health conditions, age, sex, and ethnicity. The FE model controls for all time-invariant differences between the individuals, therefore, the estimated coefficients of the FE model cannot be biased because of the omitted time-constant characteristics. There exists another endogeneity issue which will be discussed in Limitations.

$$Health_{it} = TotalLoan_{it} + Income_{it} + dummyIns_{it} + dummyNonIns_{it} + dummyIncome_{it} + TimeFE_t + IndividualFE_i + \varepsilon_{it} \quad \text{Equation 1}$$

where *i* represents each individual and *t* is time. *dummyIns* and *dummyNonIns* are dummy variables created for valid and invalid skips for institutional student loans and non-institutional student loans, respectively. 1 represents an invalid skip, while 0 represents a valid skip or a response.

Results

Table 2: Correlations

	Health	TotalLoan	Income
Health	1.00000000	0.05699893	0.13691872
TotalLoan	0.05699893	1.00000000	-0.05677053
Income	0.13691872	-0.05677053	1.00000000

Before running the regression, I run a pairwise correlation test to check for multicollinearity issues. The results are presented in Table 2. Debt and Income variables have a correlation of -0.057. The value shows a weak correlation between the two variables, meaning that the regression will not suffer from multicollinearity problems.

Table 3: Regression Results

Parameter	Model 1			Model 2		
	Coeff		SE	Coeff		SE
Intercept	1.912	***	-0.006	1.212	***	-0.155
TotalLoan	5.272E-06	***	0.0	1.372E-06	*	0.0
Income	2.224E-07		0.0	5.826E-07	***	0.0
dummyNonInst	-0.887	***	0.028	-0.707	***	0.024
dummyInst	-0.914	***	0.027	-0.958	***	0.022
dummyIncome	-0.053	***	0.014	-0.098	***	0.012
R2	0.316			0.603		
Adjusted R2	0.316			0.578		
Residual Std. Error	0.814			0.539		

Note: Coeff = coefficient, SE = standard error, *p<0.1; **p<0.05; ***p<0.01
Model 1 is a simple OLS regression, while Model 2 has both time and individual fixed effects.

Table 3 presents the results from my OLS regressions with and without fixed effects. 2530 observations are dropped due to missing data. In Model 1, *TotalLoan* variable is statistically significant with p-value less than 0.01. The amount of yearly student loans is positively associated with poorer self-rated health. An increase of

$3,843.2 in student loan debt leads to an increase in 0.02 unit of self-rated health, using the standard deviation. Recall that self-rated health ranges from excellent to poor as the value increases.

After introducing time and individual FE, *TotalLoan* is still statistically significant in Model 2. *TotalLoan* variable is still positively associated with poorer self-rated. An increase of $3,843.2 in student loan debt leads to an increase in 0.005 units of self-rated health, using the standard deviation. This result shows that student debt has less explanatory power when controlled for other variables. If the endogeneity issue exists, it has a positive association with health outcomes.

Income has no significance impact to the self-rated health in Model 1 but its statistical significance increases dramatically in Model 2 with its p-value less than 0.01.

Adjusted R^2 increases significantly from 0.316 in Model 1 to 0.578 in Model 2, indicating that the FE are adding value to the model.

Limitations

I recognize that my model suffers from omitted variable bias. Time and individual FE only control for variables that change over time but identical to all individuals, and variables that are constant, or change at a constant rate, but unique to all individuals. However, my model does not include variables that are unique to individuals but change over time. These variables can be homeownership and health insurance status. Previous literature includes these variables and find a strong relationship between them and health outcomes. Although the NLSY97 asked participants homeownership and health insurance questions, only a small portion of the respondents provided answers. Unlike debt and income variables, I cannot treat missing values of health insurance status as either insured or uninsured, as valid skips can be interpreted into two ways: participants are not eligible for health insurance questions because of their age but are on their parents' health insurance, or participants are not eligible for health insurance questions because of their age and are not on their parents' health insurance. The same applies to homeownership questions.

Another potential econometric issue the model faces is reverse causality. Students with bad health may accumulate more student debt as they are using their savings towards medical bills, therefore, have limited funds to pay for college tuition.

The two econometric problems outlined above can be solved by introducing an instrumental variable (IV), choosing a variable that directly affects student loan but does not impact health. I come up with two IVs:

1) Total student loans of all participants in a given year minus individual loan, multiplied by number of siblings

2) Federal interest rate multiplied by number of siblings

For both IVs, number of siblings is included as it affects the availability of funds parents have for each child's college tuition. The higher the number of siblings, the lower the available funds parents have towards that child's college tuition, this means that the individual will take out more student loan. However, the number of siblings remain constant for almost all participants, making it alone not a suitable IV. Hence the introduction of variables such as total student loans of all participants minus individual loan, and federal interest rate.

The first IV has a significant explanatory power to *TotalLoan* variable, but the second IV has no statistical significance, refer to Appendices A and B for first and second stage regressions. Both IVs are statistically significant to self-rated health, refer to Appendix C. This makes them not suitable IVs. Due to time constraint, I am not able to find an appropriate IV to fix the two econometric problems outlined.

Conclusion

This research provides preliminary evidence that student loans are associated with poorer self-rated health, however, an increase in student loan debt only results in a small rise in poor self-rated health. This association persists after controlling for time-invariant characteristics and time fixed effects. However, as stated in Limitations, this analysis suffers from omitted variable bias, therefore the finding might not be reliable.

In the big picture, my analysis suggests that student loan holdings decrease health status, and households should take this impact into consideration when making the decision whether to attend college. Health is often undervalued and difficult to be accurately expressed in dollar value. However, this finding should not in any way discourage students from low-and middle-income (LMI) families from pursuing a college degree, instead, it suggests better planning and careful consideration of student loans.

Given the benefit of college education, an implication of my study is that policy makers should consider providing alternative financial assistance to students from LMI households, as dependence on student loan debt may be detrimental to their health in the long run. Students can benefit from expanding Pell Grants, need-based financial aid programs, and federal work-study. Alternatively, providing financial education for LMI youth and their families is essential to help them make informed decision whether to attend college, save for college, and better manage student loans if they decide to pursue a college degree.

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Appendix

Appendix

Parameter	First Stage OLS (1) TotalLoan			2SLS (1) Health		
	Coeff		SE	Coeff		SE
Intercept	553.8	***	24.5	1.198	***	0.157
Instrument1	5.685E-05	***	0.0			
Fitted Instrument1				1.93E-05		2.63E-05
Income				5.64E-07	***	1.56E-07
dummyNonInst				-7.08E-01	***	2.37E-02
dummyInst				-9.60E-01	***	2.22E-02
dummyIncome				-9.87E-02	***	1.17E-02

Note: Coeff = coefficient, SE = standard error, *p<0.1; **p<0.05; ***p<0.01

- First Stage OLS (1) is a single OLS regression of TotalLoan on Instrument1.
- Instrument1 = no. of siblings x Total student loans of all participants in a given year minus individual loan
- 2SLS (1) is a regression of Health in Fitted Instrument1, Income, dummyNonInst, dummyInst, dummyIncome, and two-way fixed effects.

Appendix B

Parameter	First Stage OLS (2) TotalLoan			2SLS (2) Health		
	Coeff		SE	Coeff		SE
Intercept	752.952	***	22.712	1.61	***	2.19E-01
Instrument2	4.057		2.581			
Fitted Instrument2				-4.95E-04	**	1.91E-04
Income				5.66E-07	***	1.56E-07
dummyNonInst				-7.05E-01	***	2.37E-02
dummyInst				-9.60E-01	***	2.22E-02
dummyIncome				-9.79E-02	***	1.17E-02

Note: Coeff = coefficient, SE = standard error, *p<0.1; **p<0.05; ***p<0.01

- First Stage OLS (2) is a single OLS regression of TotalLoan on Instrument2.
- Instrument2 = no. of siblings x Federal interest rate
- 2SLS (2) is a regression of Health in Fitted Instrument2, Income, dummyNonInst, dummyInst, dummyIncome, and two-way fixed effects.

Appendix C

Parameter	IV (1) Health			IV (2) Health		
	Coeff		SE	Coeff		SE
Intercept	1.62	***	0.0061	1.682	***	5.60E-03
Instrument1	2.70E-08	***	0.0			
Instrument2				0.008	***	6.41E-04

Note: Coeff = coefficient, SE = standard error, *p<0.1; **p<0.05; ***p<0.01

- IV (1) is a regression of Health on Instrument1
- Instrument1 = no. of siblings x Total student loans of all participants in a given year minus individual loan
- IV (2) is a regression of Health on Instrument2
- Instrument2 = no. of siblings x Federal interest rate